

# OVERCOMING OFFSHORE PRODUCTION CHALLENGES – WHAT ARE YOUR PRODUCTION OBJECTIVES?

By FourPhase



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## **FourPhase's view on production challenges for offshore operations – market overview**

The revenues in the North Sea are declining due to lower output and falling oil prices while the fixed costs are rising due to the need for increasing maintenance work on older platforms. A recent assessment by Oil and Gas UK showed that UK production has more than halved since 2004 while the cost of producing the average barrel of oil in UK waters rose by 62% between 2011 and last year (2014). While 50 fields in 2013 produced oil and gas for less than £10 per barrel, 19 fields had operating costs above £30 per barrel. These are the common challenges for North Sea and other regions. With these challenges present the oil and gas industry must focus on working smarter and more efficiently. There has never been a greater need to apply new technology and implement innovative solutions in order to reduce operational costs.

E&P (exploration and production) companies are increasingly turning to EOR (enhanced oil recovery) techniques to increase overall production from about 30 to 60 percent depending on the capacity of the reservoirs.

According to SPE 70% of oil fields produce sand, or other types of sediments, giving solids removal technology a major role to play in materially reducing costs and improving production efficiency in solids producing wells.

Implementing next generation technology that addresses the challenge of solids in both mature and new fields can turn the management of solids into an improved production performance. A new approach to sand management strategy can highly reduce, and in some cases eliminate the needs for costly intervention operations in addition to providing uninterrupted and increased production possibilities.

The FourPhase EOR technology removes solids at the surface. This enables operators to increase the flow rate from producing wells while at the same time staying within the ASR (acceptable sand rate) criteria. This results in increased oil recovery at a lower cost per barrel making the technology even more relevant since the oil price is not something operators can directly affect – increased production rates can compensate in loss of revenue while oil price decreases.

## ***Continuous production - challenges, solutions and opportunities***



- **Operate at maximized well flow**
- **Meet production objectives**

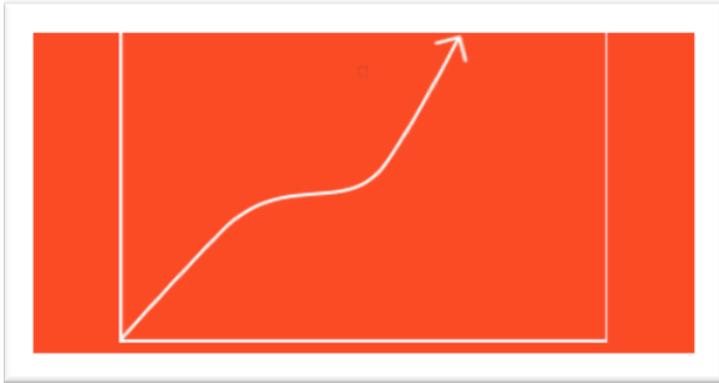
In addition to the number of aging wells globally there is also an increasing number of HPHT (high pressure, high temperature) wells being drilled and produced. Both aging wells and HPHT wells have significant challenges related to solids control while at the same time maintaining optimal well flow.

Next generation solids removal technology plays a major role in materially reducing costs and improving production efficiency in solids producing wells. An integrated continuous production system can majorly improve production performance. Integrated solids management solutions can significantly increase production and reduce production cost per barrel while highly reducing the need for coil tubing (CT) interventions and eliminating down-time caused by production halts.

Implementing a top side continuous solids removal system and maintaining solids free flow enables operators to optimize production by:

- Operating at maximized flow rate below ASR see illustration below
- Optimizing well performance
- Reducing well down time
- Increasing ultimate recovery
- Reducing cost per barrel
- Extending the life of the well, protecting the reservoir, the wellbore and process equipment from solids build-up and long-term erosional damage:
- Reducing need for CT and HWO (hydraulic workover – snubbing) sand clean-out
- More time for alternative CT operations
- Reducing POB (people on board)
- Reducing need for maintenance

## ***Increasing production - challenges, solutions and opportunities***



- **Increasing production while reducing production cost per barrel using an integrated solids management system.**
- **Increase production while sand is held below the ASR level.**
- **Key numbers from Gullfaks C (data provided by Statoil).**

Solids removal is essential to mitigate erosional damage of surface process hardware.

Using an integrated top side solids management system enables production increase from existing wells without exceeding acceptable sand rate (ASR) level and while keeping top side process integrity intact.

A deliberate sand removal strategy contributes majorly to enhancing production performance of underperforming wells and provides the following advantages:

- Less jetting work for operators
- Reduced solids problems in process plant
- No downtime – improved NPT (non-productive time)
- Longer productivity and improved economics
- Beneficial HSE – reduced need for heavy lifting operations

## Case Study

### Interventionless Kickstart & Sand Cleanout – Gullfaks C, Statoil

#### Challenge

Production of C-19 and C-03 came to a halt in September/October 2014 and was shut in due to high sand production.

#### Solution

- DualFlow 5K - a production enhancement system that allows continuous production by active solids handling.
- In order to achieve solids removal from wellbores located on both north and south test manifolds a X-flow™ choke manifold solution is used.

#### Result

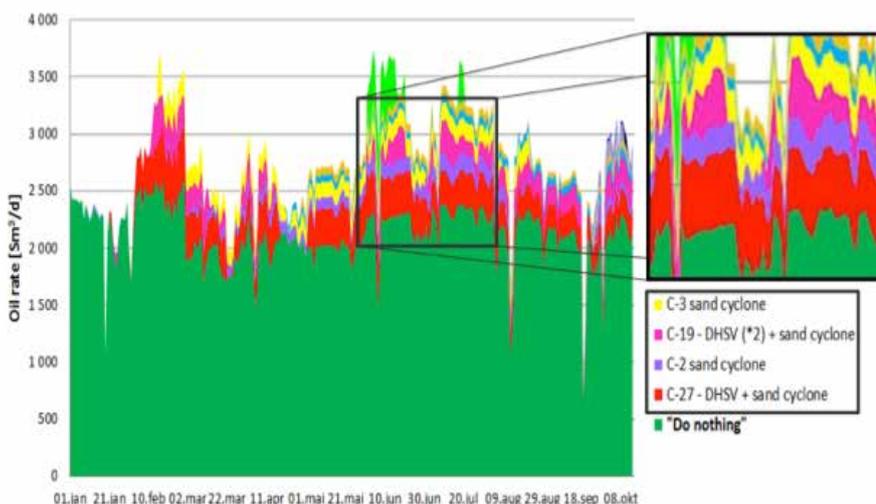
- FourPhase removed 300 kg of solids during latest cleanout operation on C-19. Over the past two years a total of 15 000 kg of solids have been removed from C-19 alone.
- FourPhase removed 2700 kg of solids during the kick start phase of operation.
- Eliminated the need for expensive coiled tubing operation to clean out wellbores (approx. 20-30 MNOK).

#### DualFlow hydrocyclone

The leading solids removal solution on the market.

The DualFlow 5K PSI unit uses next generation hydrocyclone technology that was developed and engineered by FourPhase and is the leading solids removal solution on the market. The DualFlow is used in surface applications where solids might be present during production or intervention cleanup applications.

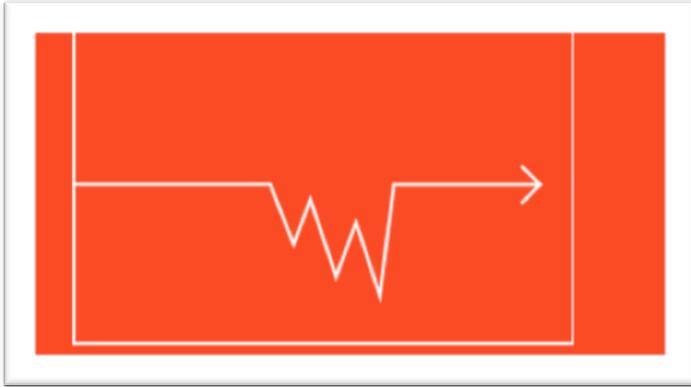
The graph below illustrates the increase in production using a cyclone solids removal system compared with the original “green” production profile.



Production increase using Continuous production system

\* The Illustration above shows increase in production on Gullfaks C while using Continuous production system provided by FourPhase. The illustration is taken from the presentation 'Optimization of well performance by use of a semi-permanent dynamic desander' by Asle Sandven/Ted Brueren MSc. Statoil, presented at SPE SMN European Sand Management Forum 26-27 March 2014.

## ***Restoring production - challenges, solutions and opportunities***



- **Restoring production without coil tubing interventions with use of next generation cyclone technology.**
- **Highly reducing the need for coil tubing interventions while maintaining continuous production.**

Next generation cyclone technology can now be effectively used to kick-start operations where otherwise CT/snubbing operations are required. The FourPhase equipment is suitable for solids removal in a flow back system to protect the production facilities and saving the customer a lot of time and cost.

When carrying out a CT/Snubbing operation normally an amount of 1 to 3 tonnes of solids is cleaned out from a well. In addition, there would be deferred production on the respective wells due to planning and waiting for CT equipment to be mobilized.

FourPhase's Solids removal system increases the performance of underperforming or shut-in wells and can reinstates performance with interventionless clean-up. The system can also be used for well clean-up for CT/HWO, fracking, P&A (plug and abandonment) and startup of new field operations.

Value added for the customer:

- Cost and time efficient operation compared to CT
- Reduced well down time
- Increases recoverable reserves



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FourPhase is revolutionizing the way produced solids are managed in order to help our clients deliver a step change increase in production, while reducing cost per barrel.

FourPhase's enhanced solids management technology improves production efficiency by enabling continuous production, at maximum flow rates, while maintaining topside process equipment integrity.

Our purpose is to embrace the management of the fourth phase as fundamental to improving production efficiency and performance. With extensive experience and unique know-how of both designing and operating solids control equipment, FourPhase is emerging as the preferred supplier of continuous production and solids removal systems.

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[info@offsnet.com](mailto:info@offsnet.com)



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