Through Tubing Conveyed ESP

Effective Pump Swap
Maximizing Production and Well Uptime

John Algerøy

Europe and Africa Region Manager

SPE International
Aberdeen Section

EuALF 2018 European Artifical Lift Forum

AccessESP

Retrievable ESP History and Evolution

Excessive Sand Production – Short ESP Run Lives

Development of Retrievable Pump System:

280 Successful rigless workovers (94.6% success); but…

100 rig workovers due to other ESP failures and cleanouts

Operator launched fully retrievable ESP system development:

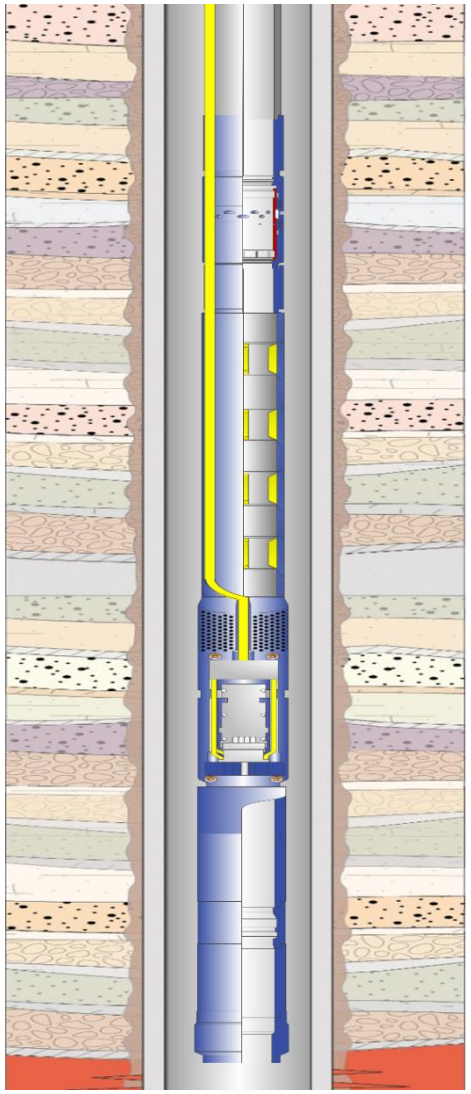
- 4.5” tubing, 7” casing
- Full bore access when ESP removed
- Slickline deployable (.125”) without killing well
- Compatible with existing surface equipment (VSDs)
- Conventional SCSSV, completion hardware

Same as TTCESP with one additional SL run:

- Motor + protectors + gauge
- Required Wet connect and PMM motor

Field test began, 2009

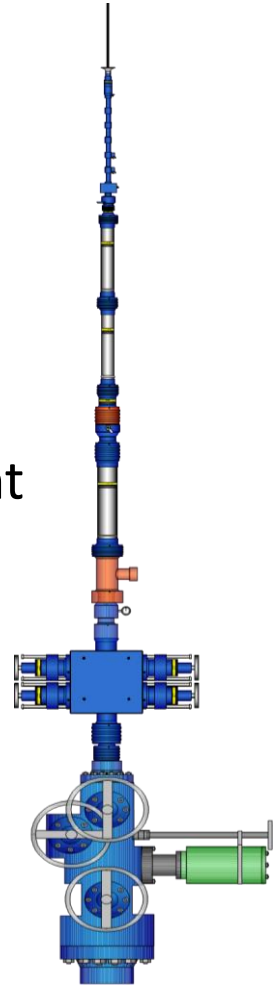
Commercial system, 2014



Deployment Comparison – Operations

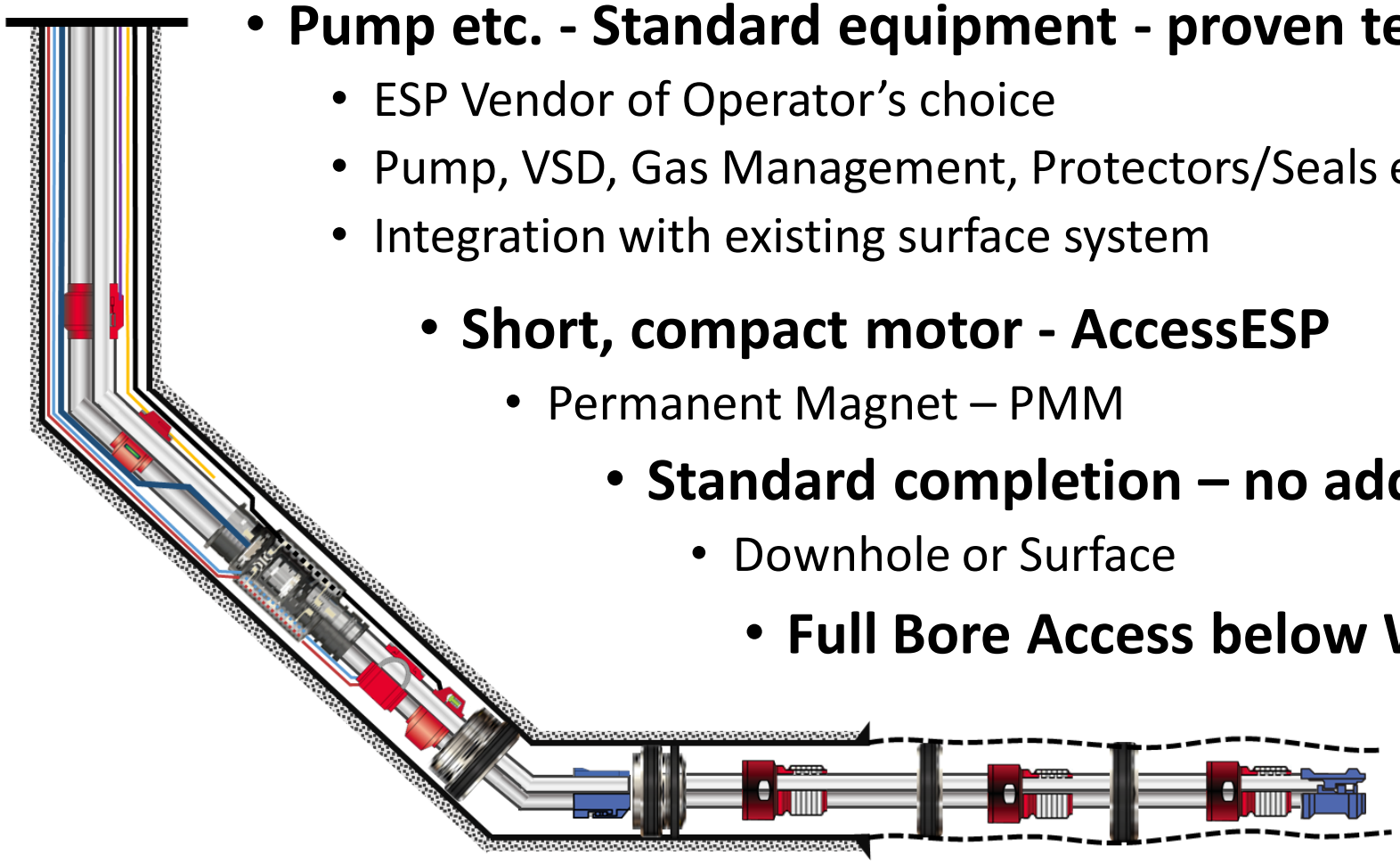
Slickline vs. Traditional ESP

- Live intervention
  - Standard slickline operation,
  - Tractor or CT in high deviated wells
  - Deployment bar when limited lifting heights
  - No kill fluids, no reservoir damage, no additional lift on start-up
- Flexible system replacement
  - Pump only or entire retrievable system
- Full bore through tubing
  - Plugging, re-perforating, logging etc.
- No Rig or HWU required
  - Short mobilization and deployment time
  - Minimized production impact and deferred oil



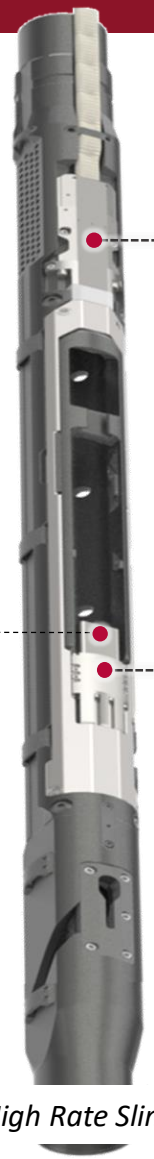
Deployment Comparison – Technology

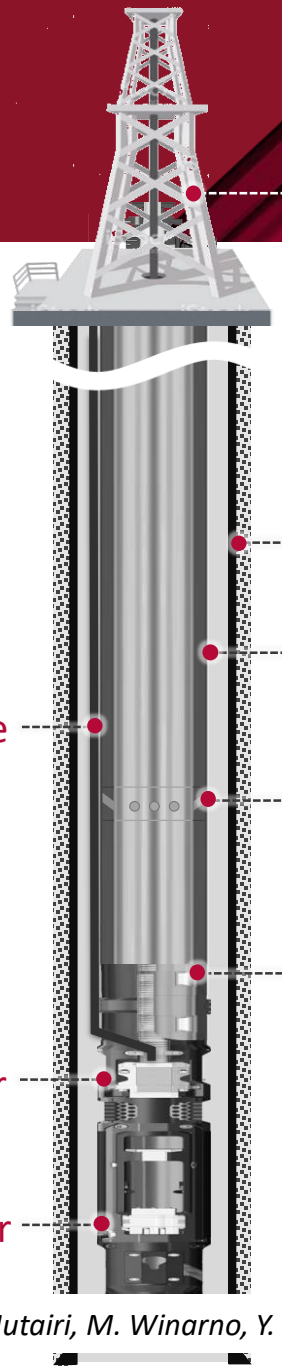
Slickline vs. Traditional ESP



- **Pump etc. - Standard equipment - proven technology**
  - ESP Vendor of Operator's choice
  - Pump, VSD, Gas Management, Protectors/Seals etc.
  - Integration with existing surface system
    - **Short, compact motor - AccessESP**
      - Permanent Magnet – PMM
        - **Standard completion – no additional equipment required**
          - Downhole or Surface
            - **Full Bore Access below Wet-Connect**

Tubing Deployed Permanent Connector

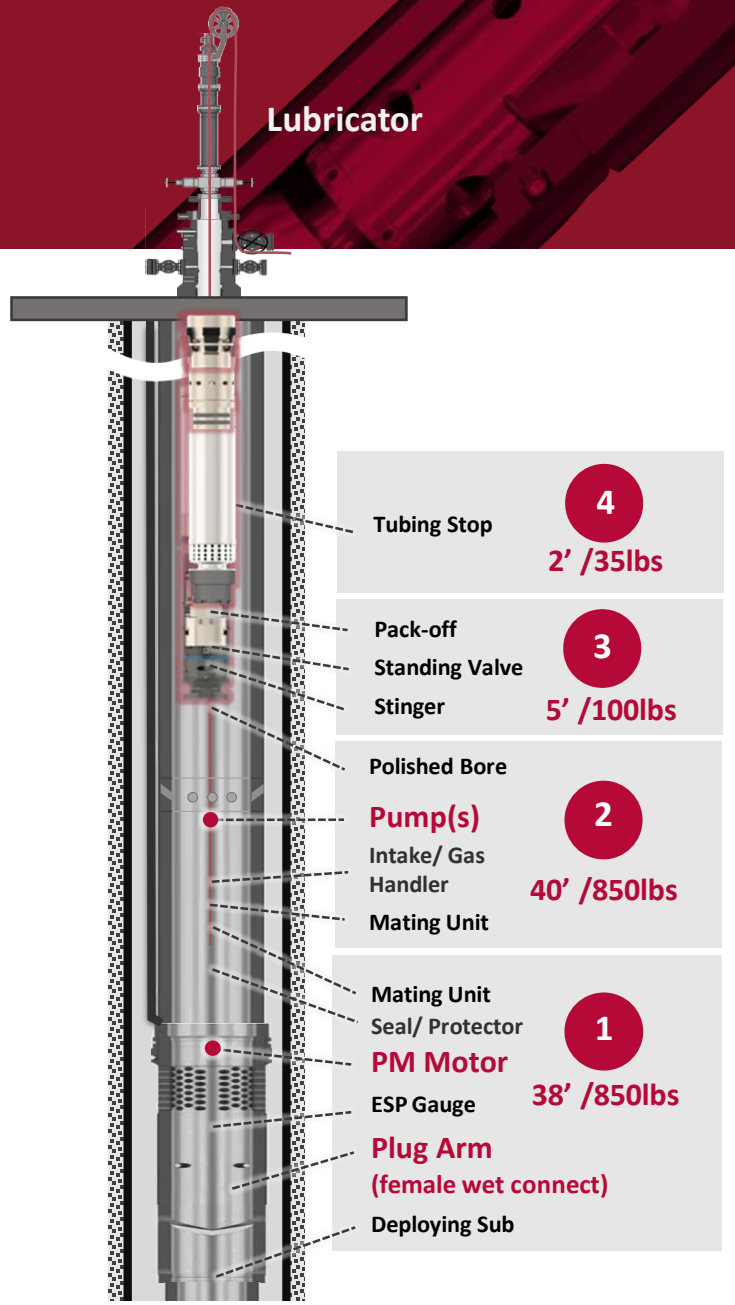




SPE-188175-MS “The First Slickline Deployed, High Rate Slim Design ESP in the Middle East”; M. Rafie, M. Qahtani, K. Mutairi, M. Winarno, Y. Windiarto, A. Assal

Slickline Retrievable Deployment

Retrievable System (ESP) installed in four runs



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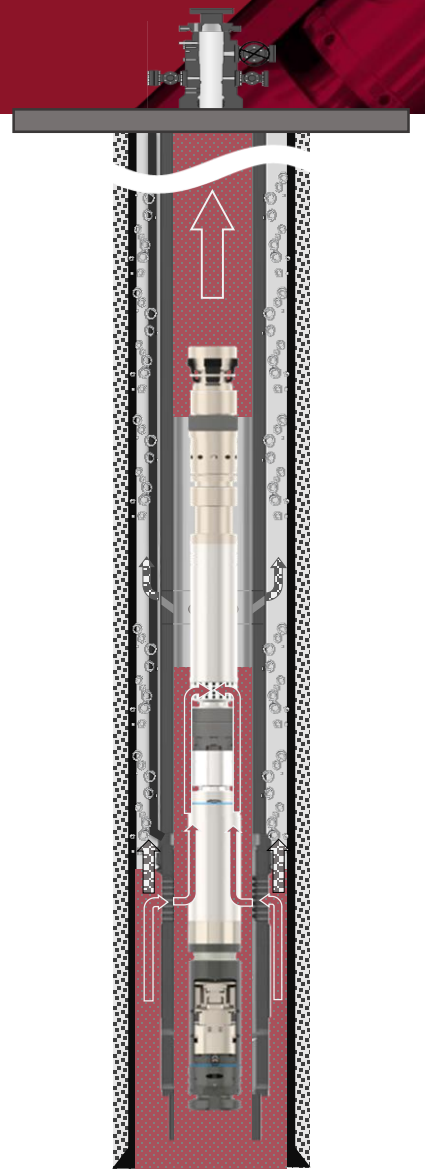
Production Startup

- Prepare VSD and start Motor
- Produced fluid cools the motor and enters the pump intake
- Tubing Pack-off isolates pump Intake/discharge to prevent recirculation
- Gas management
  - Natural gas separation at fluid intake
  - Additional gas vent below pack-off
- Shrouded System available
  - No HC in Annulus



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Case Study

Alaska – Pump Only Replacement

Objective

To replace only the pump (not the motor) in a well.

Challenge

The wells in Alaska are exposed to excessive sand production, causing pump wear and subsequent reduced production and short run lives.

Cost Savings

$6.7M
$4.9M
$3.1M
$1.3M

February 2014
Initial rig installation of AccessESP system

October 2015
Pump worn, swapped prior to failure, resized to better match changed production characteristics

December 2016
Pump worn, swapped prior to failure, resized to better match production. Motor and wet connect **not pulled**, pump only operation (one slickline run)

October 2017
Pump worn, swapped prior to failure, motor and wet connect **not pulled**, pump only operation (one slickline run)

April 2018
Pump worn, swapped prior to failure, motor and wet connect **not pulled**, pump only operation (one slickline run)

Case Study

High Deviated Well – Extreme Sand Production

Objective

To clean out a well to restore production to previous level.

Challenge

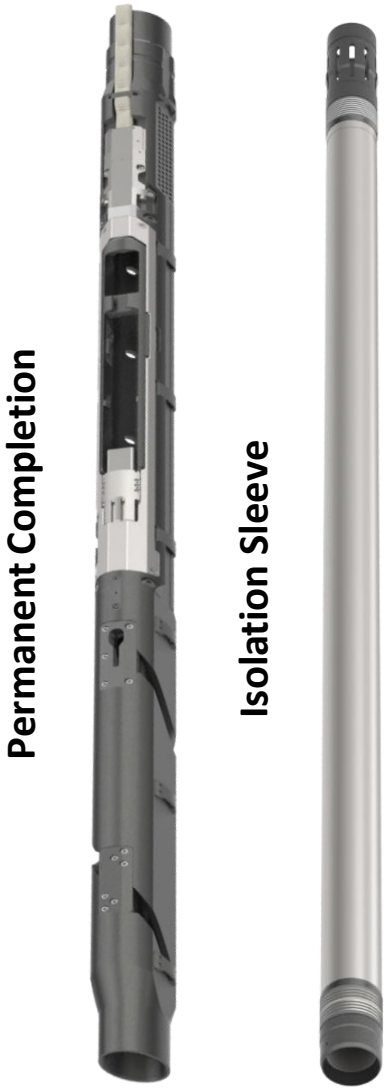
Sand accumulated to 2000 ft above the Pump. The retrievable system must be removed, the well cleaned and the retrievable system replaced, all without killing the well.

Solution

Due to high deviation, Coiled Tubing and Slickline was used to remove the sand and the Retrievable System.
Isolation Sleeve across wet-connect enabling clean-up to the producing zone.
Retrieve the Isolation Sleeve and reinstalled the Retrievable System.

Result

The well-clean was successfully performed in a live well and production restored to previous level. Minimized disruption to oil production and HSE risks.



Case Study

West Africa Offshore Installation

Objective

Install an alternatively deployed ESP to reduce future ESP replacement costs by using a retrievable ESP system.

Challenge

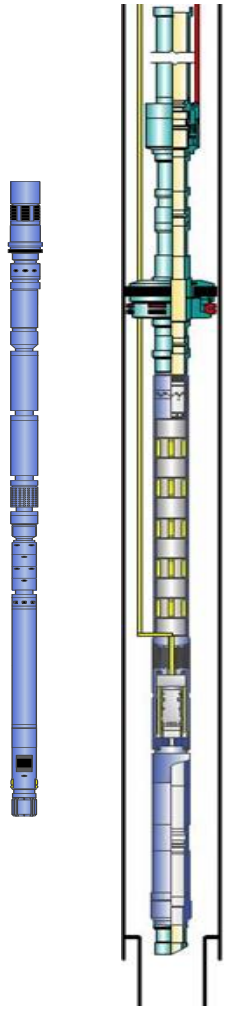
Unknown reservoir capacity of the well, therefore needed cost-effective method to replace the ESP, if required.

Solution

The productivity of the well was found to be much higher than expected, and the 190hp retrievable ESP system was replaced with a 250hp system using slickline, in days rather than months for a conventional ESP.

Result

The new retrievable ESP system achieved the required drawdown and target production rate.



SPE- 185160: "Live Well Deployment of Retrievable ESP Systems, Case Histories"; G. Nutter, D. Malone, J. Patterson

Field Case: SPE-188175 - Saudi Aramco

- Conclusions with regards to SLESP Evaluation:
  - Installed and operated 180 days during evaluation
  - ESP pulled and reinstalled successfully three times using standard slickline, in full compliance with rigorous well control guidelines;
  - ESP can be replaced in four days, including mobilization;
  - Intervention cost savings up to 70% compared to conventional ESP;
  - Additional SL ESP benefits:
    - No modifications to wellhead;
    - No need to kill well to remove/install ESP;
    - Compatible with existing Variable Speed Drives;
    - No need to strip-out and hook up flow line when replacing ESP;
    - Compatible with pumps, drives, gas handlers, VSD, cables from all major ESP suppliers

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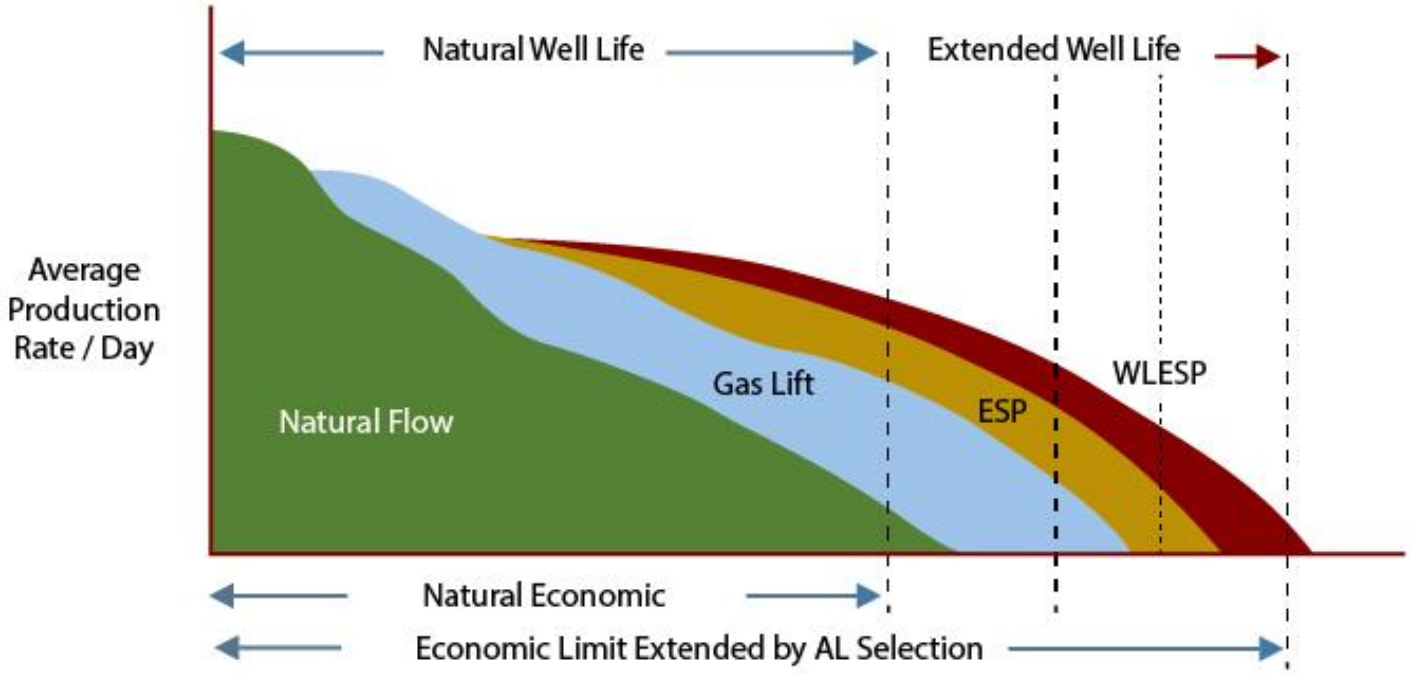
Conclusions

Retrievable ESP Systems

- Increase production
- Extend the economic life
- Increase recovery
- Increase field valuation
- Limit disruption to operations



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Thank You!

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Europe and Africa Region Manager

John.Algeroy@accessesp.com

+1 832 657 6297

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