3rd EUROPEAN CONFERENCE ON GAS WELL DELIQUIFICATION

NEW DEVELOPMENTS IN OFFSHORE DELIQUIFICATION SOLUTIONS

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Market Size (excluding Russia and China)

- 775,000 active gas wells globally
- North America - 499,000 - 1.3% offshore
- Europe – 22,000 - 49% offshore
- Globally 38,000 offshore gas wells (5% of global gas wells)
- 90% of gas wells suffer from liquid loading issues
- 43,000 new gas wells drilled annually

* Data above obtained from Spears, IHS Energy, BP Statistical Review
Tail End Gas

- Mature fields
  - Existing infrastructure
  - Small pockets of gas
  - Deliquification
  - Economics of the solution?

Solution requires addition of “energy” i.e. Artificial Lift!!
Economics

- Workover well
  - install full scale artificial lift/water removal
    - High Capex, low producer = Poor Economics

- Thru Tubing (Retrofit) solution
  - no workover requirement
    - Lower Capex = Improved Economics
Thru Tubing Artificial Lift

- **Downhole**
  - Safety Valve Issues - Thru tubing makes TRSCSSV redundant
  - Dimensional challenges

- **Surface**
  - Wellhead modifications - Umbilical through tree valves??
Flapper Safety Valve - Sliding Sleeve Safety Valve

Annular Flow

TRSSSV unable to Close/Function

Umbilical
Opening up new opportunities

**Capillary string**
- Wells with a requirement for a DHSV.

**Gas lift**
- Insert gas lift GWD system with a DHSV.

**Insert Plunger lift**
- Take plunger to wellhead in well with DHSV.

*Insert DHSV is an “enabling technology”*
Possible configurations

“Dual string” design

- Exists for capillary string applications
- Uses existing proven DHSV
- Injection via upper string or through TRSSV line
Possible configurations

“Concentric string” design 1 - flapper

- Exists for coil tubing gas lift
- Uses single flapper for barrier
- Gas injection via central conduit
Possible configurations

“Concentric string” design 2 - sleeve

- Exists for capillary, CT gas lift, PCP applications
- Large flow area
- Valve independent of type of penetration
- Animation
Velocity String/ Plunger Lift

- Insert velocity String using ball valve
- Install plunger when well depletes further
- Continuous bore through the valve

Ball Valve Closed

Ball Valve Open
Balance Pump

- Low volume reciprocating pump
- Operated by two hydraulic lines
  - Oil filled – applied pressure line
  - Water filled – hydrostatic return line
- Adjustable to volume and depth requirements
- Utilises field proven rod pump valve technology
- Ideal for deliquification applications
1) Pressure applied to Oil line forces piston to travel upwards, forcing fluid up the water line and sucking more water into pump.

2) Gravity causes the lower ball to drop on seat trapping fluid above lower ball.

3) Remove hydraulic pressure and hydrostatic in water line causes the piston to drop allowing fluid to pass through the travelling valve, filling void above upper ball.

4) Gravity causes the upper ball to drop, trapping fluid above upper ball.
Surface Issues

- Topside and the wellhead
  - Do we need to remove the tree?
  - Modify or replace the tree
  - Insert spool and position of flow lines
  - Power requirements
  - Gas/N$_2$ requirements
Solutions

- **Topside - wellhead**
  - Capillary string ➤ *hot tapping*
  - ESP and gauge applications ➤ Insert Spool
  - PCP ➤ Insert Spool/Top Mounted

- **Alternative…**
  - Add extra wing valve to create “horizontal tree”. Two barriers in the flow.
Solutions > Hot Tapping

- Tap into Tubing Hanger profile through tie down bolt
  - No well intervention
  - Existing Technology – North Sea track record
  - Drill hole from ¼” up to 40” Diameter, up to 50ft deep
  - Can be performed up to 1500psi and 700F
    - no production shut down
  - Double barrier seal
Solutions > Spool Piece

- Through Tubing ESPs
  - TTESP from The Artificial Lift Company

- Gauge Applications
  - Fibre Optic and electrical feed-through connectors

- Y-block
  - Stream flow
Solutions > PCP

- PCP Topside Equipment
  - Zero leak stuffing box.
  - Top Drive
  - Rod Lock BOP
  - Modify tree to “horizontal tree”.
Solutions > “Horizontal Tree”

- Modify Tree
  - Lock open UMV and LMV
- To maintain two barriers;
  - Add wing valves
  - Modify flow line
Conclusions

- Several safety valve solutions commercially available
- All existing artificial lift methods can be utilised
- Several new low cost artificial lift solutions under development
- Low cost technical solutions available for Wellhead obstacles
- Technical advances have enabled existing on-shore solutions to be commercially viable in the off-shore environment

Thank you for your attention – Any Questions?