The opportunities in Artificial Lifts and The technological advancements

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AL Technology is an ancient piece of engineering

AL Type	Year Invented	
Rod Pumping	1859	The oldest
Gas Lift	1864	
ESP	1927	
PCP	1984	(1990's applied in Oil wells)

… yet there are **seas of challenges** in our day-to-day operations, and subsequent there are **seas of opportunities** in addressing these challenges through **technological advancements**

Why we want New Technologies, our expectations from New Technology

- Increase Efficiency: such as
  - Efficiency gains through optimal motor and pump designs
  - Reduce friction & recirculation (Gas lift)
  - Reduce Fatigue due to moving parts (rods & pistons)
- Increase Reliability: such as
  - Reliability gains through superior design and material selection
  - Hybrids technology (such as ESPCP, replace a weak component to fit the application.
- Reduce the costs
  - Rigless ESP deployment and retrieval technologies.
    - Reduce the overall lifting costs in artificially lifted wells
  - Improve design & material
  - Improve process / workflows, adopting Lean sigma
- Improve Operating range: decline production rate due to natural Pr depletion, unconventional
- Easy of Operating: save time for other add value activities, need of less skilled workers

New Technology should provide solution to our challenges

AL Industry - focus areas to be addressed, *to name few*

- Handle difficult fluid: gas, temp, pressure, sands/solids, scales, viscosity, corrosivity(H2S,CO2,O2)
  - ➢ Gas: Industry has many type of Gas Separators, but we still have gas goes through the pump.
    - Gas separator designs
    - Geometry of pump stages
    - Control systems to handle gas better (fully automation needed)
  - ➢ Sand & scales
    - Check valves, diverters systems, bypass systems
  - ➢ Scales
    - Assess type of scales for right chemical treatment,
  - ➢ Corrosive & abrasive fluids
    - Advanced AL Metallurgy: (Equipment material improvement), e.g
      - Corrosion resistance > Ni resistance
      - Wear resistance > Powder metal
- Addressing well construction type : deviation, lateral lengths/shapes/depths, sizes
  - ➢ Achieving a fully functional well
- Addressing reservoir condition prior to the fluid reach the AL : gas, viscosity, sand, drilling debris
- Rapid changes of Flow conditions (especially in unconventional fields)
- Power quality : harmonics, currents / voltage transients, surges, etc

AL Industry - focus areas to be addressed, *to name few*

- Need more Automation, through the life cycle of the AL
  - Real time automation

Intelligent Control Systems	data acquisition; surface, downhole (drones, advanced gauges)
performance analysis	Pattern Recognition (Exception Based surveillance, diagnosis)
Remote Access & Control	Trouble shooting (failures / issues are repeating, exist huge data set

  - Designs, equipment selection, installation: on going software initiatives. Need maturation & commercialization
  - Failure analysis, feedback improvement loop: need consolidation & add automation in some process/software
- AI & ML : Easy of Surveillance / Diagnosis / Physics based % data driven Failure prediction
  - Automatic anomaly detection & failure prediction on real time surveillance (EBS)
- Increasing Operating ranges in AL equipment :
  - Natural reservoir pressure depletion, challenges on pressure maintenance reservoirs
  - Unconventional wells
- AL deployment methods
  - Rigless : Deployment & retrieval technologies. The uptake to the operators is still low!
    - reducing workover costs and deferred production
  - Improve Conventional AL deployment (Rig / WO Hoist)
    - Inject advanced Automation, such as robotic & drones technology. How about we follow car industry model?

How can we collectively establish/initiate Technology Advancements? We should continue to :

- Participate in Joint Industry Projects (JIPs), Consortiums & Universities / Institutes Research Centers
  - Participate in advancing research in key areas of Artificial Lift technologies, such as EOR, HTHP fields, Difficult fluids, Digital field, etc
  - Participate in cutting edge research driven by industrial needs. Such as :
    - Energy transition in AL
- Be active in worldwide Engineering Networks, such as:
  - Seminar for New Artificial Lift Technology attended by oil & gas companies together with vendors to discuss their latest developments
- Conduct Internal Workshops/Conferences within the Company.
  - Invite service companies (Vendors)
- Be Involved in External Workshops/SPE. (We are here at EuALF!)

Most needed industrial technology advancements can be easily be born in these platforms

AL Challenges – Pushing the limits, to name few

- Pushing the limits of artificial lift technology
  - deeper reservoirs: 3,000 to 4,000 m and beyond.
    - Once they were free-flow, then water cut increase
  - Long laterals
    - AL expected to efficiently drain oil across 4 km length of the lateral hole.
    - Complicates pump setting at horizontal especially at the presence of gas!
  - Slimmer well completions
    - Cost effective initiative from Well Engineers folks!
    - Scab lining well due to corrosion / erosion, increase well life
  - Data acquisition in these wells

- PMM technology
  - Eliminates induction losses
  - Improved Operational Efficiency
  - Reduced Energy Consumption
    - Some companies adopt PMM for this reason, to achieve their NetZero targets
  - Better Performance
  - Multipurpose: PMM-ESP & PMM-PCP (ES-PCP)
  - Enablers in extreme design / well condition well :
    - slim wells (4 ½" mono-bore casing wells)
    - Gassy wells

Success criteria in launching a new technology; best practice

- Implementation
  - The customer must be able to implement it.
  - Need to dedicate a multidisciplinary team to ensure smooth implementation.
  - Need a project management tools to see the implementation through to the end and track milestones along the way.
  - A dedicated New Technology Department with own assigned budget is essential.
- Process :
  - Technology should aim to reduce the number of steps in addressing the challenge.
  - Technology to increase convenience for the customer. Make our lives easier!
    - More opportunities in softwares. Example: Subsurface & surface well modelling; Its about time to have “press a button” well models plots generation
- Customization:
  - Ensure a balance of customization / add on. Avoid losing focus of the original purpose of new technology project
- Expectations
  - Develop a set of KPIs to assess the performance of new technology projects. Examples:
    - Deployment Readiness: Time between trial completion and commercial contract. This is the most critical KPI as it determines how fast a Company benefiting from a successful technology
- Management support / sponsor / frequent engagement
- New Technology champion, some one with the passion. A kind of sell person within the Company!

Struggling implementing New Technologies? Are these sounds familiar?

- Lack of Management support / a sponsor. Budget??
- Fear of failing & shy away: monster with no safety standards / is it even workable!!
  - Example: Dual ESP completion across separate reservoirs with down hole gauges. Turn out to be feasible with a proper procedures.
- Lack of alignment : technologies innovators / service companies sponsor / operators
- Lack of confidence : the benefits, values, lack of sound proposition
  - Need an intelligent / smart sell man/woman to pitch the idea to the organization
- Need people with natural passion : Need champions, not just a position in the hierarchy
  - The late Steve Job had passion!
- Nature of contract model: This on equipment Improvements / re-engineering, often considered to be part of running contract, avoid extra cost.
  - No appetite to attract the vendors to focus on technology advancement
- Continuous changes of user needs, till lost focus of the original idea

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THANK YOU