



## Darcy Partners Forum

Houston  
March 8<sup>th</sup> 2017

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Eric Laing, Geoff Steele

“ Without change there is no innovation, creativity, or incentive for improvement. Those who initiate change will have a better opportunity to manage the change that is inevitable. ”

*William Pollard*



**THE PROBLEM:** After initial flush production from a newly fractured well bore, all wells exhibit the same pattern of significant declines in the first 6-24 months.

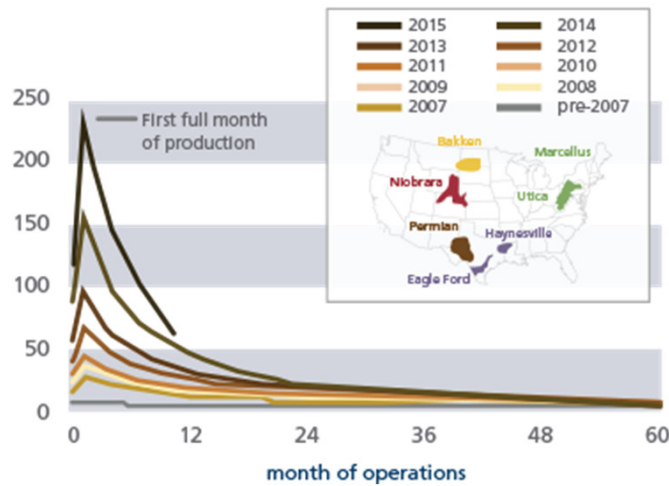


**THE CAUSE:** Frac pressures are multiples of formation pressure- once Frac pressure is dissipated, it is back to natural Delta P to flow fluids along the horizontal section.

# Regional Production Decline Rates

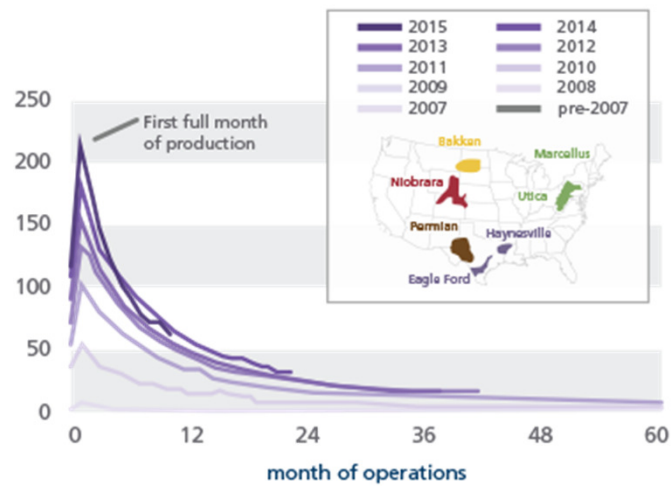
## Permian

Average oil production per well in the Permian region barrels per day



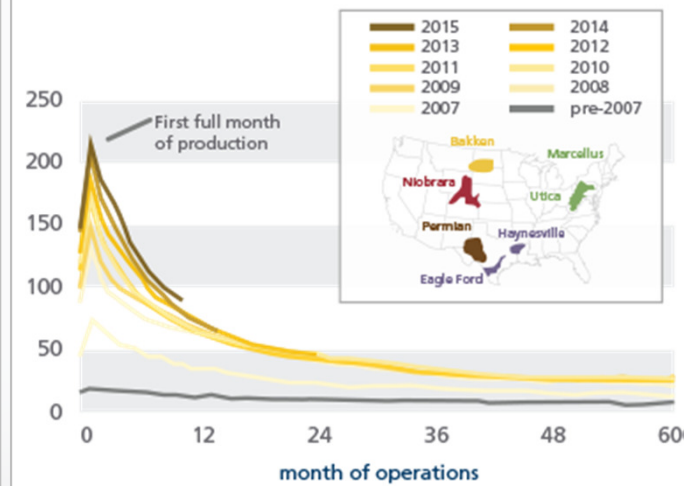
## Eagle Ford

Average oil production per well in the Eagle Ford region barrels per day



## Bakken

Average oil production per well in the Bakken region barrels per day



Production equipment landed in close proximity to perforation intervals

**ENSURES:**

- Regulated drawdown
- Lift equipment longevity and efficiency
- Predictable decline rates
- Prevention of near wellbore liquid loading



Vertical flow is well understood and we can control the regimes as the well ages and flowing pressures decrease.

### **HOWEVER,**

Why do we think that placing an artificial lift system at the heel, or close to the heel, in a horizontal well bore will provide the same, or similar drawdown effect considering:

- Multiple Fracs or perforations from 6,000ft to 18,000ft away
- Varying pressures
- Frictional effects
- Transitional and multi phase flow regimes
- Geometric trajectory {troughs and rises}

## Solution: Divide The Wellbore

Divide the well bore into Vertical and Horizontal flow scenarios that can be controlled.

**Evolutionary** - Patent pending High Angle Rod Pump (Well Specific)

**Revolutionary** - Patented Horizontal Pumping System (Broad Applications)

Multiple pumps placed along the length of the horizontal section allowing positive control of inflow (drawdown) and outflow (discharge)



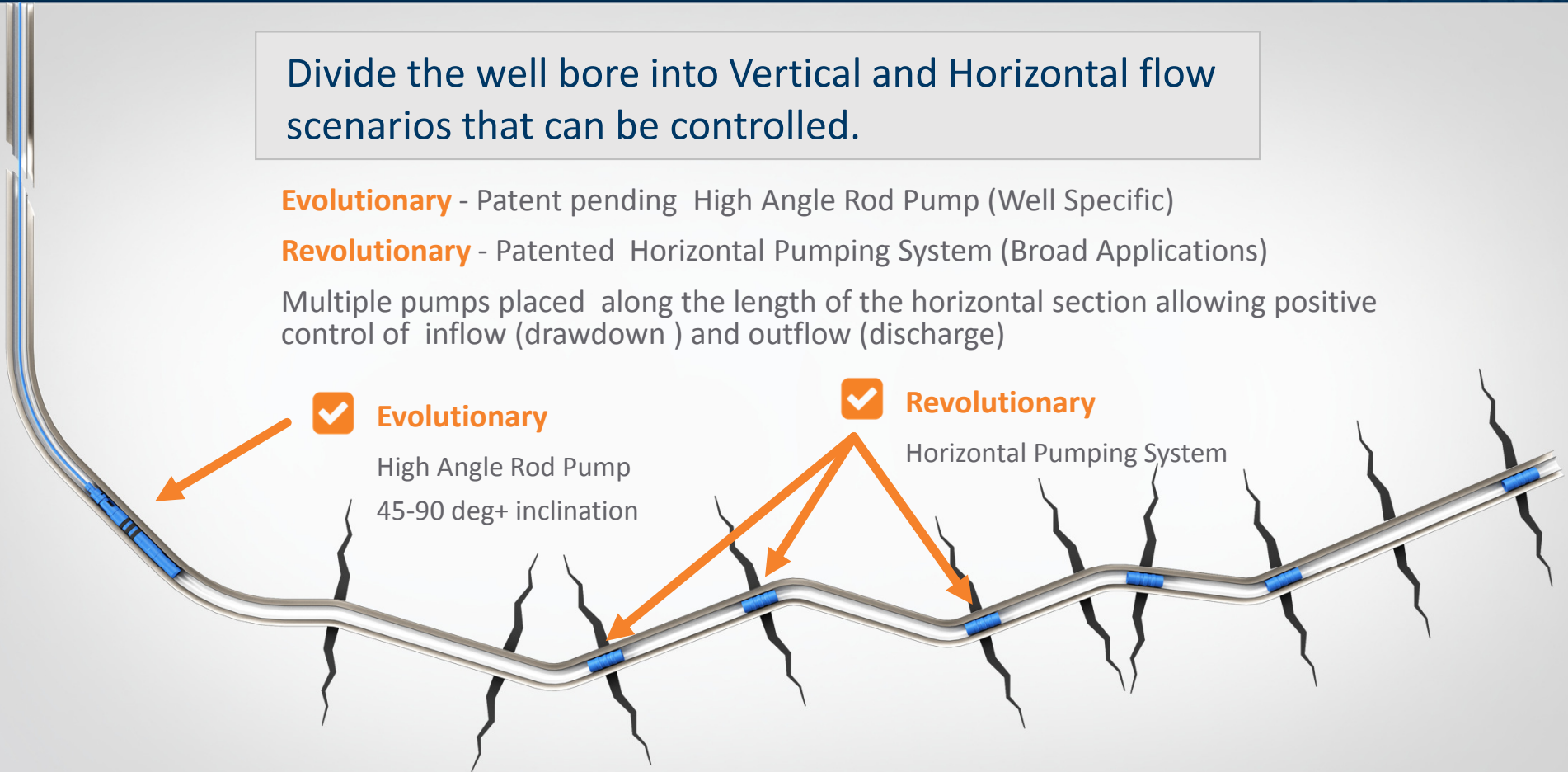
### Evolutionary

High Angle Rod Pump  
45-90 deg+ inclination

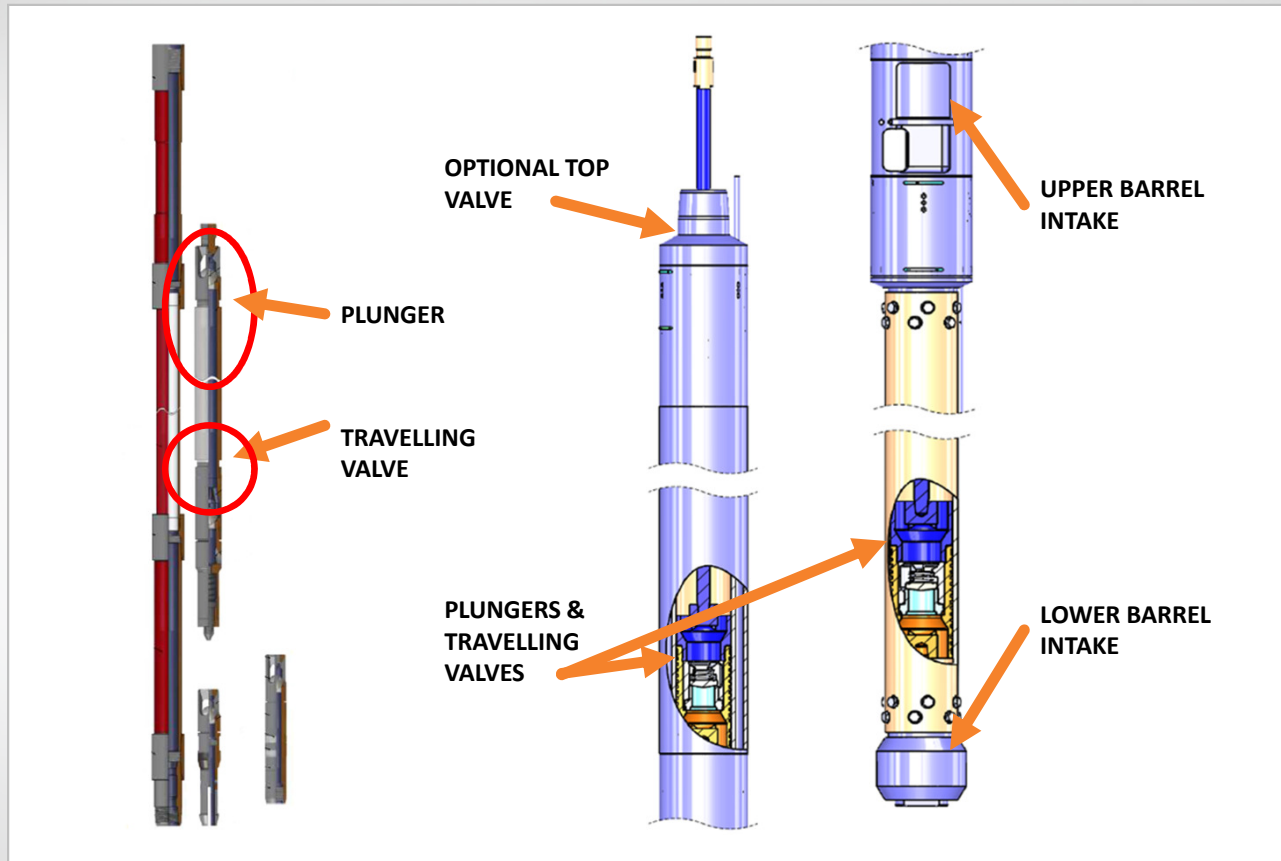


### Revolutionary

Horizontal Pumping System



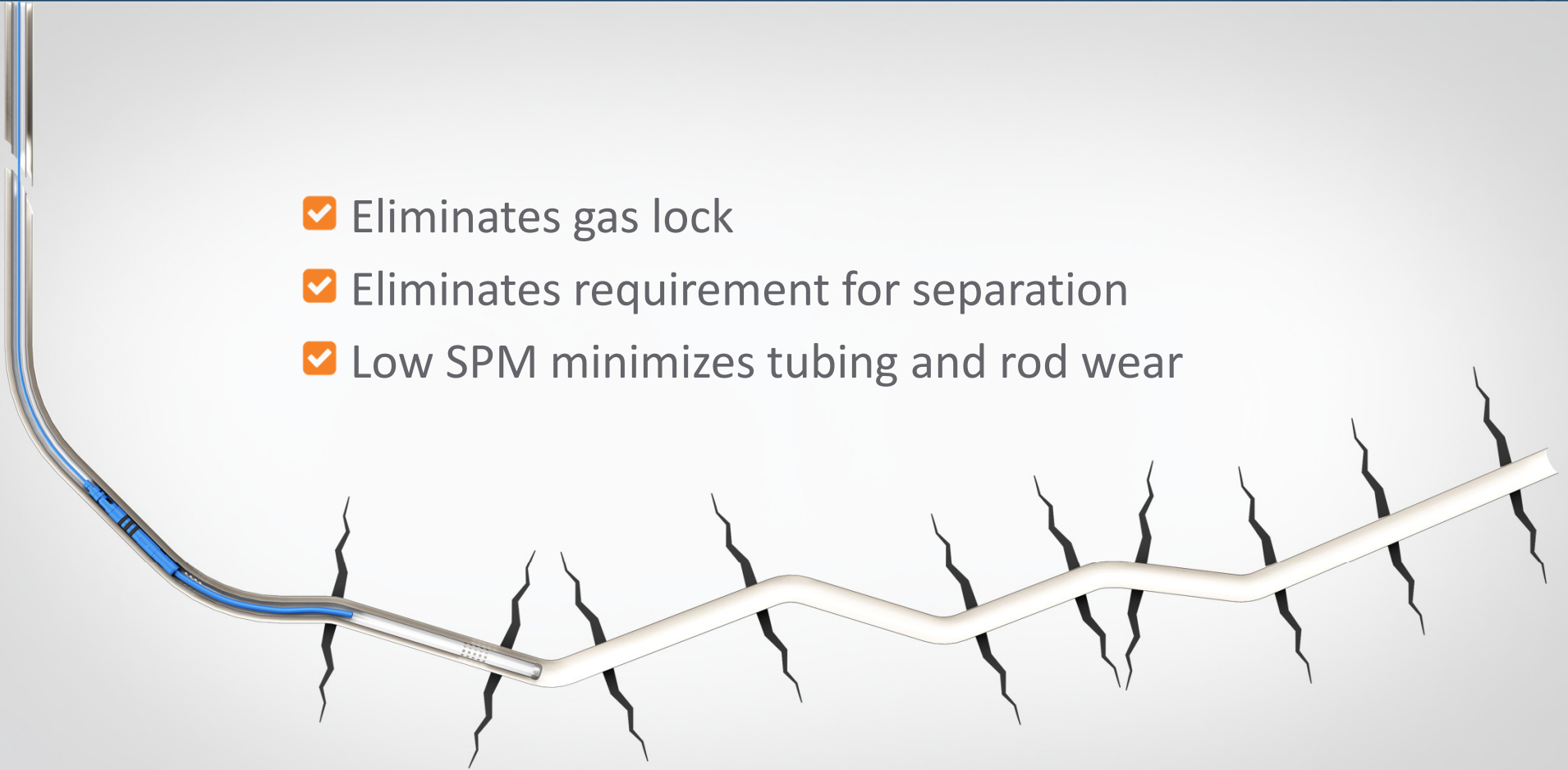
# The RAISE High Angle Rod Pump – An Evolutionary Solution





## The RAISE High Angle Rod Pump – An Evolutionary Solution

- ✓ Eliminates gas lock
- ✓ Eliminates requirement for separation
- ✓ Low SPM minimizes tubing and rod wear



“We are up to ~12 m<sup>3</sup>/d fluid, ~65% BSW, ~10 e3m<sup>3</sup>/d gas. With the 1.5” pump @3.5 spm we are around 70% pump efficiency which is amazing for a high GOR HZ well with no gas separator. I realize that this may be flush as it was down a long time but to put it in perspective the highest rate we ever produced out of this well was 9m<sup>3</sup>/d fluid and 13 e3m<sup>3</sup> gas back in 2014. Current rates on fluid and gas are about double what they averaged over the past year while operating”.

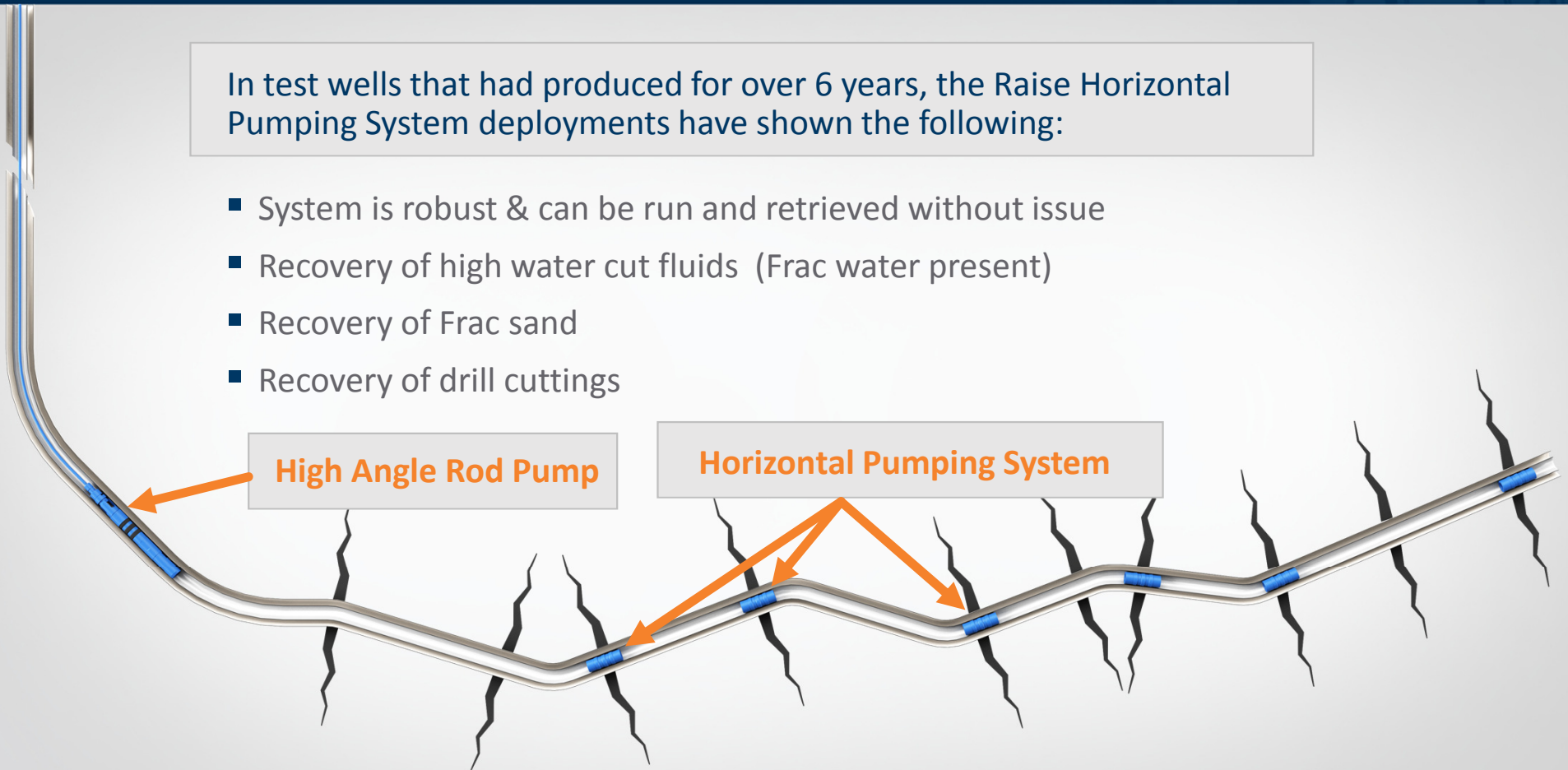


There are no existing vertical pump technologies that completely address the flow issues along the entire horizontal section - material volumes of oil & gas reserves are being left behind.

## The RAISE Horizontal Pumping System – A Revolutionary Solution

In test wells that had produced for over 6 years, the Raise Horizontal Pumping System deployments have shown the following:

- System is robust & can be run and retrieved without issue
- Recovery of high water cut fluids (Frac water present)
- Recovery of Frac sand
- Recovery of drill cuttings



## Multiple Deployments

- Horizontal Pumping System deployed and retrieved in close tolerance wellbores (4 ½ inch mono bore)
- Raise has proven through field testing :
  - Pumps rated up to 5000psi working pressure
  - Reliable Activation
  - Optimum Pump placement
  - Multiphase flow knowledge



- Wells drilled longer and trajectory targeting high porosity areas (pumps evacuate troughs)
- Frac placement at high perm areas
- Larger cased hole size to accommodate production tools
- Life of the well consideration during well planning
- Lift solutions installed at correct stage of drawdown

THANK YOU