



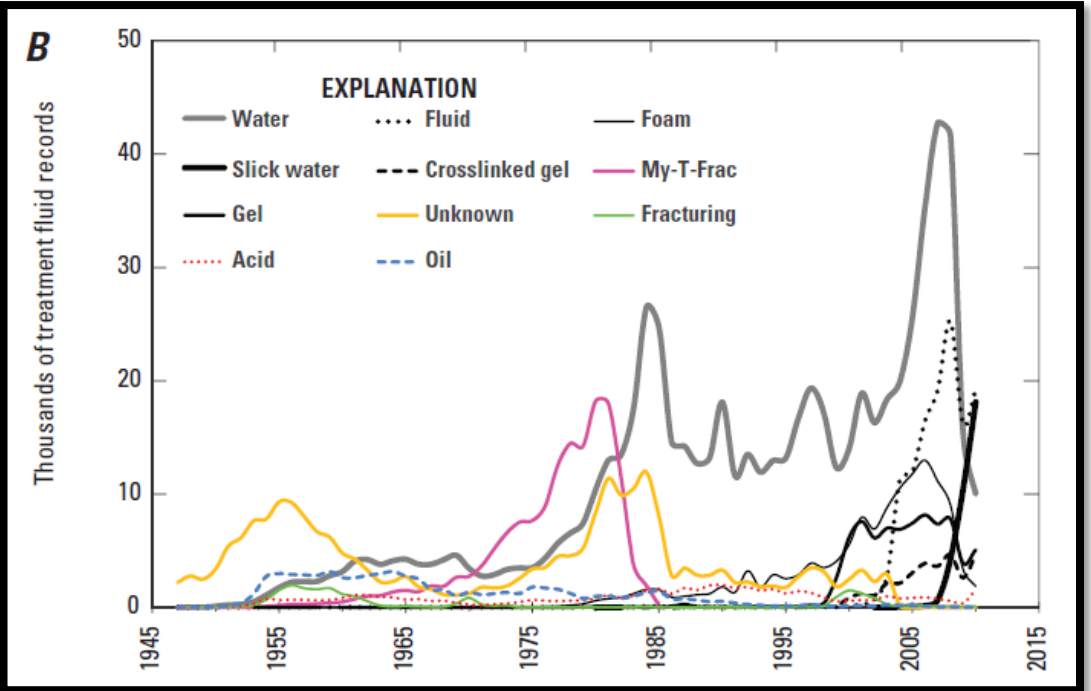
VorTeq™

Liberty Technology Solution



Some Things Change, Some Things Stay the Same...

Pumps Haven't Changed that Much, but the Type of Work They Do Has...



USGS Scientific Investigations Study 2014-5131

Equipment Evolution Lags Frac Design Evolution

Tremendous Development in Frac Design Has Come with a Price

- Low viscosity fluids w/ proppant
- High pumping rates
- High treating pressures

lead to

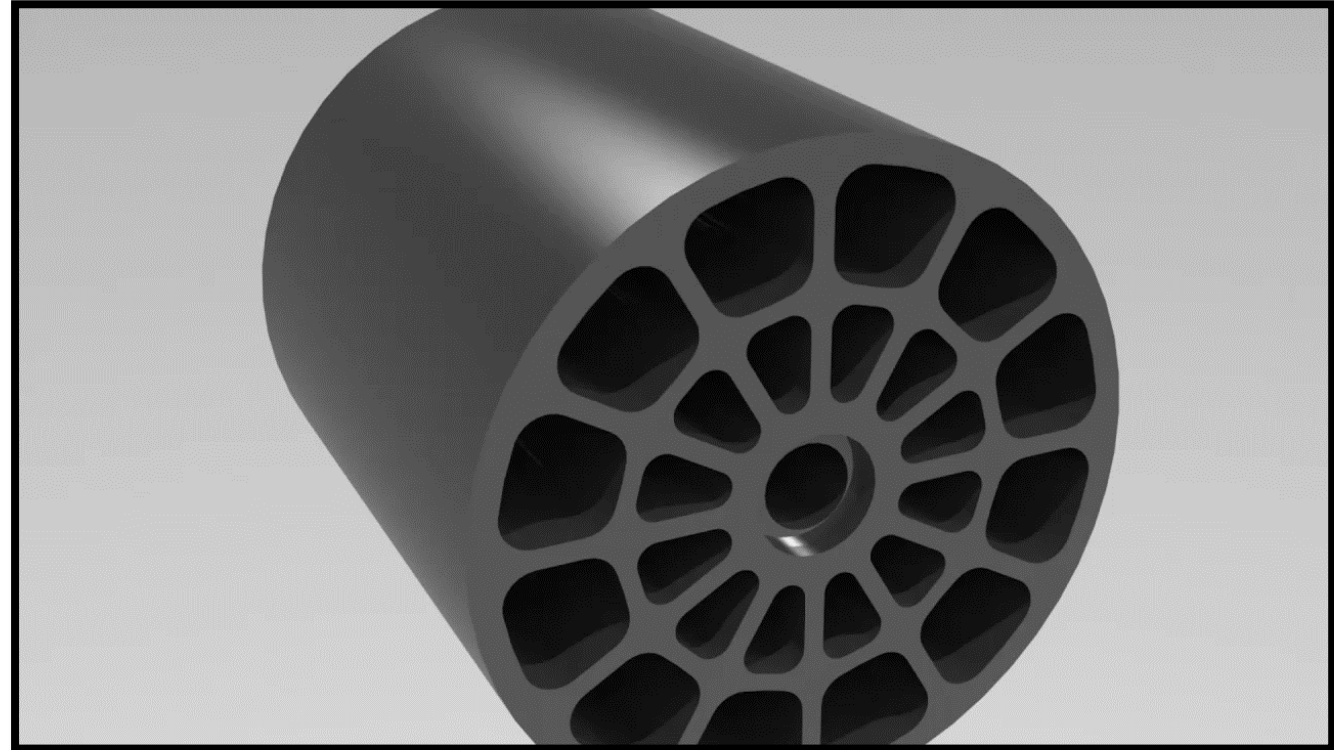
- Wear/erosion of various pump components
- Increased R&M costs
- Reduced efficiency in fracturing operations



A Possible Solution from an Unlikely Place

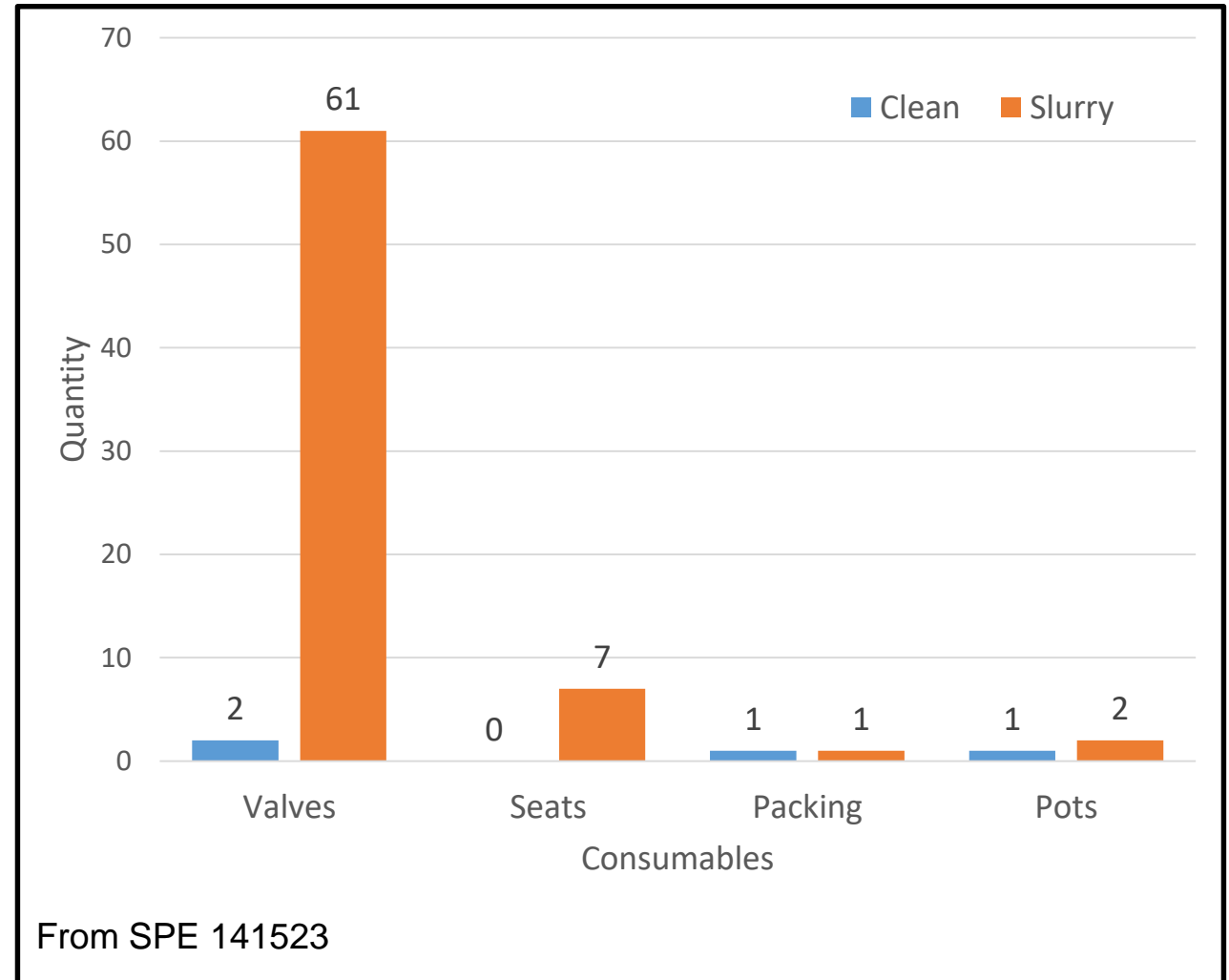
The Isobaric Pressure Exchanger (PX) from Energy Recovery

- Pressure transfer from one fluid stream to another via positive displacement
- Bearing support in the form of a hydrodynamic film between the rotor and the sleeve/endcaps
- Manufactured from tungsten carbide
 - Abrasion resistant
 - Structural integrity
 - High stiffness



Anticipated Benefits

- Reduction in R&M costs, and specifically consumable parts
- Less NPT = Increased efficiency
- Less redundant equipment on location
- Improved safety conditions
- Opportunity to use high pressure multi-stage centrifugal pumps





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