use so one must separate the correct theoretical analysis which companies should use (i.e. adjusting for capex, industry cyclicality, etc.) vs. the often employed EBITDA methodology which most companies actually use.

Another consideration driving new fleet expansion, particularly with start-up enterprises, is the growing demand by E&P companies to have new equipment with well trained employees. Over the past year, E&P frustrations regarding the combination of inconsistent service deliverability (i.e. bad equipment, green crews) and a material step-change increase in frac costs became evident as several public E&P's alluded to such challenges as a reason for well completion delays/production issues.

To eliminate this risk, some within the E&P industry are becoming increasingly more insistent regarding the quality of equipment brought to location. We believe the combination of aggressive oil service pricing (notwithstanding our belief frac companies deserve generous pricing) will lead E&P companies to create competition. They do this by providing a term contract which then allows the new enterprise to secure funding. Again, we do not foresee this becoming a major issue in 2018, but it is a risk for 2019. Therefore, if start-up's begin to emerge, which is our view, then the need for industry consolidation becomes even more important.

New Fluid Ends to Drive Frac Margins Higher?

Fluid ends are a major equipment expense for frac companies. There are two types of fluid ends: carbon-based and stainless steel. The carbon-based option is frequently characterized as lower quality, offering a shorter relative life. Frac companies generally claim carbon-based fluid ends last between 300-600 pumping hours. The benefit of these units, however, is a cheaper price with carbon-based fluid ends costing ~$45,000 to $50,000. Stainless steel fluid ends, on the other hand, are higher quality and more durable. Frac companies generally report useful lives in the 1,000 to 1,500 hour range. With higher quality comes higher price as these fluid ends cost anywhere from $65,000 to $90,000 per unit. One mid-size frac player reports its fluid end costs are $68,000/unit.

Frac companies have numerous fluid end providers from which to choose. By our count, we are aware of ~20 fluid end manufacturers, our OEM list is provided in the accompanied slide deck. Given the high cost and frequency of fluid end replacement, designs which extend the life of the asset and yield more uptime can have a profound impact on the financial well being of the frac company. OEMs which are able to develop longer-lived products and do so at an affordable price potentially have the opportunity to gain significant market share. Moreover, if said company is able to offer a price significantly below its competition, it has potential to be a market disruptive force while at the same time, the company provides an opportunity for customers to significantly reduce their R&M expense. This, in turn, could be a savings which may be able to be passed on to the E&P end user, thus a source of well cost savings.

One company, Kerr-Pumps ("Kerr"), introduced a new fluid end design called Frac 1 CONNECT. We initially profiled this product in a note on January 5, 2018 as we see the company's new fluid end design as an interesting development for the frac world. It could also be a potentially disruptive product to Kerr competitors. We'll touch on the latter point momentarily, but before doing so, it is worth understanding the history of the manufacturer and why we take their product innovation seriously.

By way of background, privately-held Kerr was founded in 1946. It is based in Oklahoma and employs ~375 employees, nearly double the number of employees this time last year. The company entered the frac market during the 2013/2014 timeframe and now it is a rapidly growing provider of fluid ends. Kerr does not play in the power end market for frac pumps, but rather seeks to define itself as the premier provider of fluid ends. In fact, the company recently authored an article for Upstream Pumping in the Fall of 2016 which offered a detailed review of the leading causes of fluid end failures. With the permission of Kerr, we briefly list key failure points identified in its research, but we point readers to review that piece independently. What matters is the company studied fluid end failures and then designs its equipment to minimize and/or eliminate such failures. We presume (and hope) other pump and fluid end builders conduct similar studies and make the requisite changes as needed.

As for Kerr's product quality, we admit we are unable to audit the merits of their designs as we are dumb finance guys. That said, it is worth noting that according to Kerr, it recorded unit sales growth in 2015 and again in 2016, despite operating in an industry undergoing a disastrous downturn. This growth (i.e. performance), in our view, does lend credence to the purported quality of the company's products. Therefore, in our view, if such growth is representative to the company's capability, it makes their observations and new product innovations relevant.

With respect to its studies, Kerr identified the following five failures: (1) Fatigue Cracking; (2) Packing Bore Washouts; (3) Suction Seal Bore; (4) Valve Seat Washouts and (5) Discharge Seal Bore. With respect to Fatigue Cracking, this is the most common failure. Fatigue cracking can best be prevented by building a fluid end with high quality stainless steel, a move the U.S. pressure pumping industry began adopting about a number of years ago. But simply moving to stainless steel does not insure a high quality product as not all stainless steel is created equally. Therefore, reputable fluid end builders will source steel which is free of hard spots and delta ferrites (i.e. junk). According to Kerr, traditional carbon-based steel fluid ends last anywhere from 100 to 500 hours, but a fluid end made with superior stainless steel and optimized geometry can last nearly 10x longer. Again, most frac companies claim stainless steel fluid ends last 1,000 to 1,500 hours.

The shift to stainless steel helped address the Fatigue Cracking issue, but stainless steel does not eliminate failures altogether as other wear-and-tear challenges develop with greater hours placed on the fluid end. That's where the other examples of fluid end failures discussed in the Kerr article arise and to address these failures, Kerr designed its fluid end accordingly. We encourage readers to review the Kerr article for a detailed explanation of the key fluid end failures. Again, one would assume other fluid end builders are aware of the failures identified by Kerr and have/ will design their fluid end solutions to address those matters accordingly. Our review of this is not to determine who is the best fluid end builder in the business, but to transition to and highlight Kerr's latest design and opine on the potential implications it may have to the frac industry.

As noted above, Kerr recently introduced a new fluid end, branded Frac 1 CONNECT. This new design eliminates the traditional flange design, a potential, albeit low probability, failure point. In doing so, it is our understanding, the Frac 1 CONNECT design requires a smaller steel forging for the core of the fluid end. Specifically, instead of using a traditional stainless steel forging which typically weighs ~7,000-7,500 pounds, Kerr will instead use the combination of a smaller ~3,500-3,750 pound stainless steel block and a ~1,500-1,750 pound T1 steel plate. The smaller block/plate ultimately is cheaper (i.e. steel is priced on a per/pound basis) and the required machining time necessary to make the fluid end is reduced. Further, there is less steel removed (i.e. waste). Collectively, the combination of less steel purchased, less steel waste due to unnecessary cuttings and less machining time result in a lower manufactured cost. **Importantly, Kerr is passing this savings onto customers as the fluid end is priced just below $50,000. This price compares to the typical stainless steel fluid end which may cost between $65,000 and $90,000**.

Recall, there is one fluid end per frac pump and typically frac fleets employ 18-20 pumps. If the typical industry stainless steel fluid end lasts ~1,000 to 1,500 hours, each pump might potentially use two fluid ends per year. If one assumes the use of a Frac 1 CONNECT fluid end yields $20,000 in savings per fluid end and if one were willing to embrace the possibility that two fluid ends per year per pump are consumed, the total annual savings for a fleet of 20 pumps could range between $800,000 to $1.0M. Let's assume our math is directionally correct and let's extrapolate. For a frac company running ~20+ fleets who standardized on a $50,000 Frac 1 CONNECT fluid end, the potential savings could be in the vicinity of $20-$30M annually. Now, will everyone make a switch? Probably not. Moreover, is it safe to assume other OEMs may try to copy Kerr's design? Sure, but it would seem to us that Kerr has a clear first mover advantage and presumably, the company has secured or will soon secure patents for its product. By the way, if that assumption is correct and the product can't be readily copied, it becomes a risk factor for those that sell fluid ends.

Electric Fleets - A New Competitive Threat

Electric frac fleets are not new to the U.S. market, but the adoption rates have been exceedingly slow. That, however, appears to changing.

We have been following the emergence of this technology for several years. Presently, two companies specialize and operate electric fleet technology in the U.S. onshore market: Evolution Well Services and U.S. Well Services, both of which are private companies. Evolution commenced operations in 2011, completing trial work in the Marcellus, Permian and now the Eagle Ford. U.S. Well Services was formed in 2012 with conventional fleets, but it introduced its Clean Fleet system in 2014 and now, we believe, operates two electric fleets in the U.S.

Several prominent benefits of electric fleet technology include: (i) the elimination of diesel fuel consumption, which reduces operating costs as well as emissions; (ii) reduced well site footprint; and (iii) a quiet footprint thereby minimizing noise pollution. In addition, with labor becoming a growing issue, it is worth considering crew sizes. On this point, one owner claims electric fleets require eleven employees per shift vs. potentially 20+ for a conventional fleet. This allows the company to pay more than its conventional competitors, a nice recruiting tool for potential employees.

Historically, high construction costs, coupled with limited operating experience, prevented rapid construction and adoption of electric technology. According to Evolution, its newbuild fleet costs are now in the mid-$40M range, although we believe first generation electric fleets may have cost much more. When one considers the historical cost of a conventional fleet had been ~$30-$32M, the historical cost differential between electric and conventional was material. Moreover, the concept of electric really developed in late 2014, right as the industry entered the terrible 2015/2016 downturn. We submit market conditions during those two years were not ideal to role out new technology, particularly when the conventional fleets were pricing frac work at break-even EBITDA.

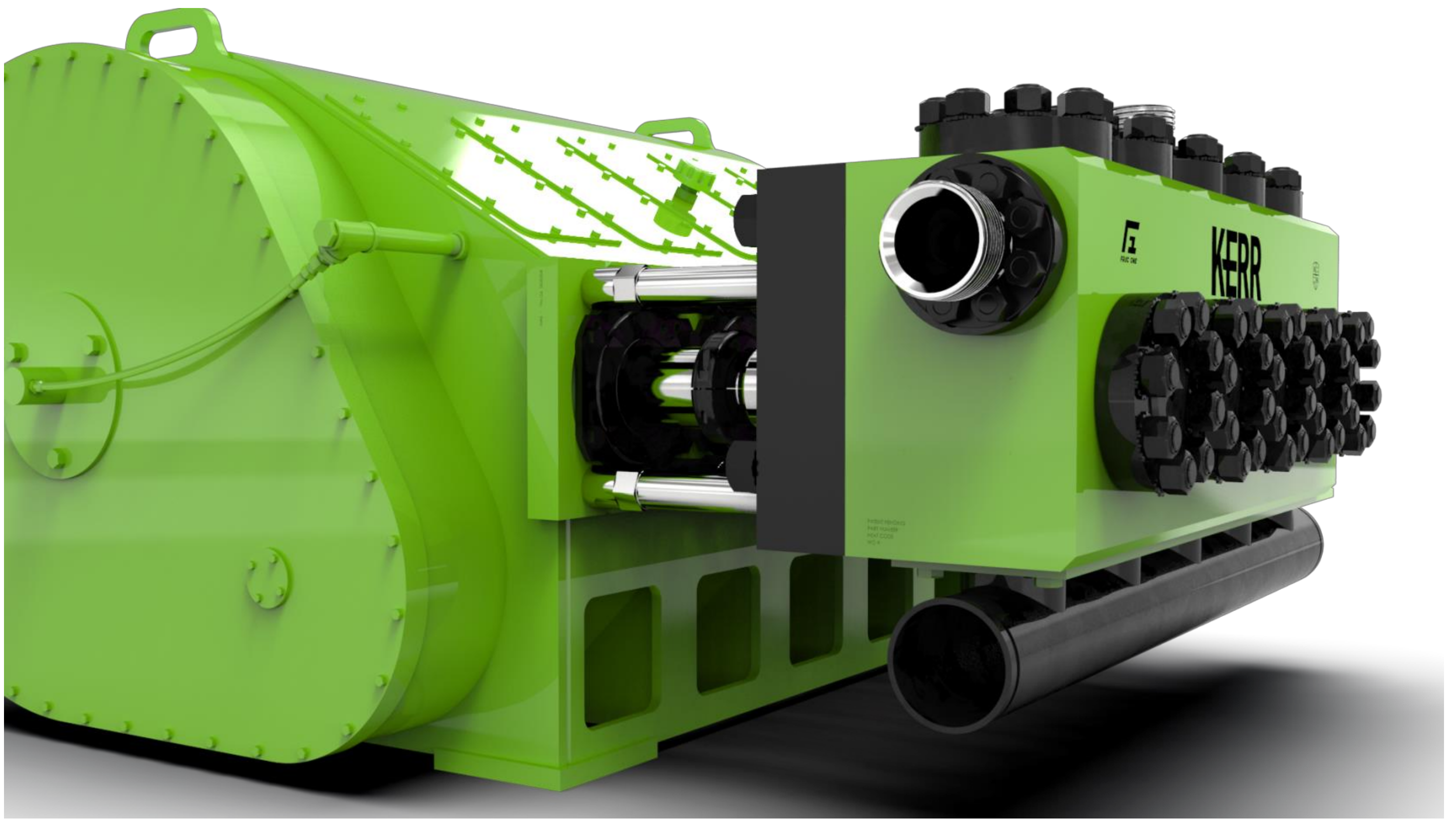
Now, however, the market is changing. Under the new EPA requirements for Tier 4 fleets, the all-in cost of a new frac fleet is closer to $40M (not much different than Evolution's newbuild cost) while the need to reduce well costs is leading E&P's to think outside the box. Examples of E&P willingness to embrace new ideas: (i) greater adoption of in-basin sand; (ii) E&P self-sourcing initiatives; (iii) greater use of internally owned SWD's and water assets; and (iv) elevated interest in understanding new fluid end designs. The next likely path for cost savings could be the adoption of electric frac fleets as diesel costs on the typical well can be significant.

For example, we understand from discussions with frac companies that 80-100 gallons of diesel are consumed per pumping hour. If one assumes a pump operates 10-14 hours/day (we exclude downtime between stages) and if one further assumes a typical well completion is 5-6 days, the implied fuel consumed per fleet could be as much as 100,000 to 150,000 gallons. This assumes 18-20 pumps per fleet. If one then assumes an average diesel price of $2.50/gallon, the implied cost would be nearly $200,000 to $300,000 for the well.

To be fair, electric fleets run on natural gas so an E&P operator would have some cost associated with using gas, particularly from a royalty perspective. In the case of Evolution Well Service, the company has a fuel savings calculator on its website whereby one can input multiple variables to determine potential savings. We sat with a Permian E&P executive who navigated the site with us. Based on its input data, the potential savings for its 2018 completion program if all wells were completed entirely by electric fleets (and assuming the Evolution calculator is implicitly accurate) could exceed $70M from diesel alone (its plan calls for 3-4 frac fleets in 2018). On a per well basis, this company recently incurred nearly diesel charges of $380,000 on a two mile lateral. A second E&P with whom we conferred shared its typical per well diesel cost is in the low $200,000

New Fluid End Design: Frac 1 CONNECT

- The following is the new Kerr Frac 1 CONNECT fluid end. Notice, the design does not have the traditional flange design as seen on all other fluid end designs.



Source: Kerr Pumps

New Fluid End Design: Frac 1 CONNECT

- Installation of Kerr's first Frac 1 CONNECT fluid end. This unit should go to work soon.

Source: Kerr Pumps.

Potential Fluid End Savings??

- Privately held Kerr Pumps recently introduced a new stainless-steel fluid end named Frac 1 CONNECT. The design essentially eliminates the old-style flange design, replacing the flange with a stainless steel plate. Simplistically, the design allows Kerr to build the fluid end using a smaller stainless steel forging. The lack of the flange reduces both machining time and waste. According to Kerr, this results in a materially lower manufacturing cost, thus Kerr is able to pass these savings onto its customers and is offering the fluid end for roughly $50,000 vs. the traditional fluid end which can cost anywhere from $70,000 to $90,000.
- We acknowledge that we have no way to assess the quality of the product, but assuming it is good and broad-based adoption by the frac industry ensues, this could result in material savings to those within our coverage universe. A hypothetical (and simplistic) representation of these per fleet savings opportunities is captured in the table below. The table implicitly assumes the Kerr fluid end has exactly the same life as any other stainless steel fluid end. To the extent the useful life is better, the cost savings could be more material. To put this in perspective, a company running ~20 fleets (i.e. PTEN, PUMP, FRAC, etc.), the implied savings could be nearly $20M per year.

Potential Fluid End Savings Per Frac Fleet

	Industry Average	Kerr-Pump Frac 1 CONNECT	Implied Savings
Fluid End Cost	$70,000	$49,995	$20,005
Fluid End Per Pump	1	1	
Pumps Per Fleet	20	20	
Fluid Ends Per Fleet	20	20	
Annual Fluid End Replacements Per Pump	2	2	
Estimated Fluid Ends/Year Per Fleet	40	40	
Fluid End Expense - Per Fleet	$2,800,000	$1,999,800	$800,200

Source: SCI Estimates, industry contacts.