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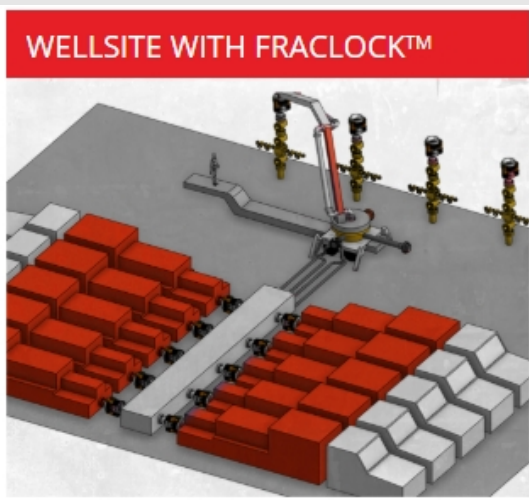
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3. [Halliburton's ProdigyAB Technology](#)



## The Next Revolution in Frac – FHE's FracLock

With the rapid pace of change underway in the U.S. hydraulic fracturing space, we want to highlight an emerging technology that we expect to revolutionize the way that operations are executed at the well pad. Look at your typical U.S. shale pressure pumping setup and you'll find numerous pieces of heavy equipment and the potential for workplace injuries given the number of moving parts. The fact that U.S. shale is entering "manufacturing mode" means that speed and low-costs are of the essence for not only oilfield service providers but also their customers. The product we're highlighting today is called FracLock and it is manufactured and sold by FHE, a scrappy capital equipment provider that introduced another revolutionary product to the market last year called RigLock (which we profiled [here](#)). **FracLock is a wellhead connection system that reduces frac velocity by 20% and could potentially increase the number of stages per day by 50% while reducing the number of employees and equipment needed.** While we highlight that FracLock's market adoption is still in the early innings, the advantages it provides is likely to take off with a number of pressure pumpers as their customers continue to push the envelope in terms of wringing out costs. Having a cutting-edge solution in the realm of hydraulic fracturing is what's needed to garner the kind of competitive edge that will allow pricing to increase (or at the very least remain firm) in a space that has grappled with supply issues. It's not just us that's proclaiming this, look at the following commentary from Antero Resources' most recent 8-K: ***"The Company provided further information about its plan to target an additional 10% well cost reduction by 2020 through service cost deflation, self-sourcing of sand and completion logistics, operational efficiencies and new produced water cost-savings initiatives. Assuming the Company operates in 2020 at D&C activity levels similar to its 2019 plan and achieves the targeted cost savings, the Company would expect 2020 D&C capital expenditures to be 10% lower than 2019 levels.*** Simply put, E&Ps want to use technology that lowers their overall cost of production.

**Quick Background on FHE.** With offices in Colorado, Texas, Ohio and Abu Dhabi, FHE is a privately-owned provider of production and well-completion equipment used on the wellsite which includes pressure control systems, grease injection systems, lubricator trailers, and of course RigLock, in addition to other products. Last year we surmised that RigLock could be "the next best completion technology" of 2018 as adoption gained momentum across key hotbed basins. The reason we focused on RigLock was that our channel checks in the field revealed that the product was quickly gaining favor amongst what we believed to be preeminent companies operating in the pressure pumping space such as Schlumberger, Liberty Oilfield Services, ProPetro, and Keane Group. Simply put, RigLock is a remote-operated wellhead add-on that allows for the quick connect/disconnect of crucial pressure control equipment during perforation and stimulation operations. We forecasted that RigLock had the potential to drive \$4-5M in incremental EBITDA per spread annually based on its ability to yield an incremental frac stage per day. PUMP had this to say last year about the technology, **"PUMP rolled out RigLock in late '17/early '18 and the five (out of nineteen) crews running it "love it" for the ease-of-use benefits. Part of the adoption is customer-driven, while PUMP has turned several other E&Ps onto the system. PUMP reiterates the 20-30 minute/swap savings and more consistent pressure tests as the basis for the incremental 'stage or two' per day."** FracLock is providing another piece to the completions puzzle.

## You Had My Curiosity But Now You Have My Attention. Just What is FracLock?

Figure 1: FHE's FracLock



Source: FHE

With FracLock, a pressure pumping crew no longer needs to hammer all the connections between the flow wire, zipper manifolds, and wellheads.

**What does it do?** What FracLock offers is a high performance wellhead connection that allows the frac fluid to be pumped at a much higher rate than the typical, incumbent offering. At the same time, FracLock's design results in less damage to the flow iron used to transport frac fluid from the blender and missile down to the wellbore. The end-result is less service intensity and lower repair and maintenance costs. **Figure 1** to the left shows the design of the wellhead.

**So what?** The strongest feature of this FracLock design is that the path the frac fluid takes into the wellbore is optimized to the point that frac fluid velocity is reduced by 20% (yielding less wear-and-tear) while the amount of fluid pumped can still be maintained at 130 barrels per minute (assuming 15k/psi). This compares to what we believe to be an industry average of 90-100 bpm.

**Anything else?** Indeed. FracLock can also come with a robotic (or in this context, "articulated") arm, called the FracScorpion, that's operated remotely (like a crane) by an employee that sits away from the chaos of the well pad. FHE's engineers created a process that when used in conjunction with the FracScorpion, the end-result is a method to quickly and accurately connect the well fluid from the pressure pumping manifolds and flowlines to the FracLock wellhead connector. **Figure 2** below shows a schematic of the FracScorpion utilizing the FracLock wellhead connector.

**How does it work?** To really understand how FracLock would work in the field, we suggest checking out this quick video: [FracLock Articulated Arm on a Zipper Pad Demo](#). That said, the benefits are obvious when you compare the streamlined setup that FracLock brings to the table with the incumbent solution that requires a lot of time, attention and expensive equipment.

Figure 2: Bringing "Order to Chaos" at The Well Pad



Source: FHE, Evercore ISI Research

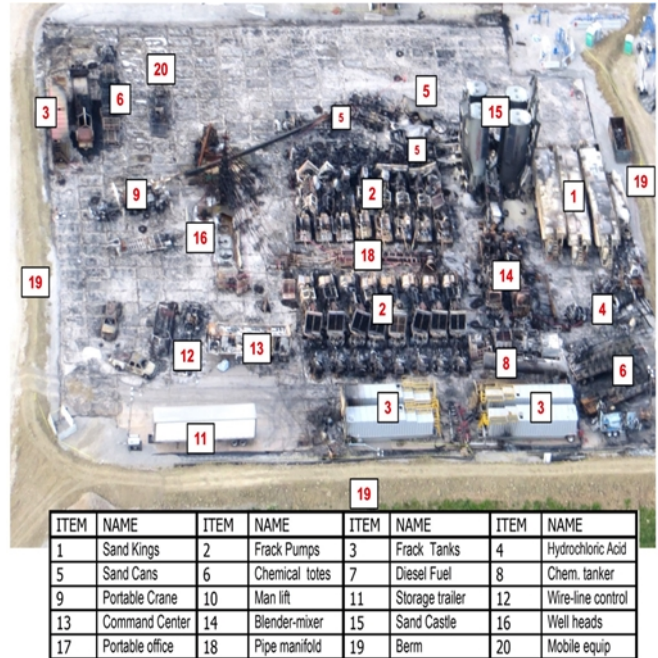
**Why does this matter?** Ultimately, E&P customers want to produce at the lowest cost per barrel and no doubt that the recent downturn has prompted this resilient and creative group to optimize how wells are drilled and completed in order to drive down costs. One well-documented example of a completion innovation is the **zipper frac** – which has unlocked a myriad of operational/geological efficiency gains in the era of Mega-Completions. Pad manufacturing/'cube development' are other aliases by which this broader trend is known although it has not come without its own set of problems. To drive home the point, we refer to **Figures 3** and **4** on the next page which represents the typical setup of a hydraulic fracturing wellsite in most U.S. shale basins. That's a lot of capital invested into "frac iron" which can run the gamut of the red zipper manifolds at the center of **Figure 3** to the blue and red connecting flowlines and the large, blue wellheads sticking out of the ground. Imagine if a solution emerged that would not only reduce the amount of equipment and people operating in the "hot zone" of the well pad, but would also result in a more efficient process (i.e. more well stages completed per day) while reducing the frequency of injuries and costly, non-productive time (NPT). For context, approximately six days a month are spent on "rig up / rig down" time for a typical pressure pumping job, half of which will be used to assemble and hammer together all the various pieces of frac iron. Further, roughly 1/3<sup>rd</sup> of all employee injuries reported to OSHA that occur during the hydraulic fracturing process happen throughout this rig up / rig down window. With FracLock, a pressure pumping crew can start fracturing within 30 minutes after FracLock is setup on the well pad versus the 2-3 day window needed to setup and test all the frac iron and related equipment.

Figure 3: A Typical Frac / Pressure Pumping Setup



Source: FHE

Figure 4: FracLock Connects #18 and #16



Source: FracTracker

**Opportunities to Improve Are Abundant**

**1** Frac crews spend six days per month on rig up / rig down time, half of which is used to put together all the frac iron

**2** On average, 10 hours of NPT per month is the result of leaks occurring throughout the 600-800 pieces of frac iron

**3** 1/3<sup>rd</sup> of OSHA-recordable injuries on pressure pumping jobs occur during rig up / rig down

**4** Traditional frac iron has a useful life of 18-24 months (at a cost of \$1-\$1.2M) due to wear and tear

Source: Infill Thinking

**No More “Dumb” Iron and Sledgehammers.** As Figures 3 and 4 above demonstrate clearly, the well pad of your typical U.S. frac site is very involved. There are pressure pumps, manifolds, flowlines, employees, storage silos, electric units, portable cranes, diesel engines, etc., all within the confines of a couple acres of property. Risks to workers are high given that there are thousands of pounds of heavy machinery that is being pushed to perform at very high velocities. That’s not even considering the dangers posed from the highly-pressurized oil and gas sitting underground that requires expensive equipment and constant attention. What FracLock intends to do is minimize the amount of equipment on site which will reduce the likelihood of accidents while at the same time substantially increasing productivity. We also underscore that FracLock’s lower impact on flow lines (the red connecting tubes in Figure 3) allows them to have estimated lifespans of roughly 12 months, double the lifecycle for equipment used by incumbent solutions. Further, a pressure pumper would no longer need the large, redundant zipper manifolds as FracLock can hook right into the missile that transfers the blended frac fluid to the wellbore that’s being fractured.

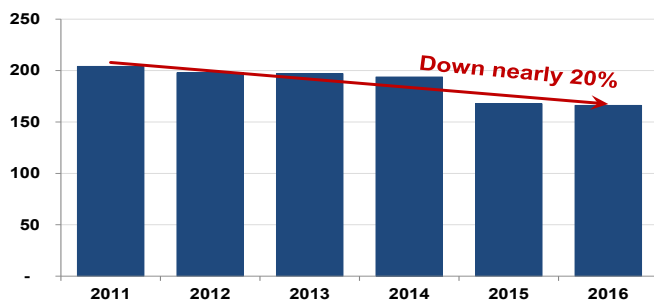
Figure 5: FracLock Benefits

Incumbent Solution	FracLock
1. Frequent injury occurs due to the amount of equipment on site	1. Less equipment results in less labor and reduced workplace injuries
2. All frac iron (manifolds, flow lines, wellheads) needs to be tested every 3-6 months resulting in significant NPT	2. The articulated arm (crane) reduces opex and NPT while de-cluttering the well pad
3. The amount of flow line piping requires crews to arrive at least two days early in order to setup	3. Less equipment also yields lower maintenance and inspection costs

Source: FHE, Evercore ISI Research

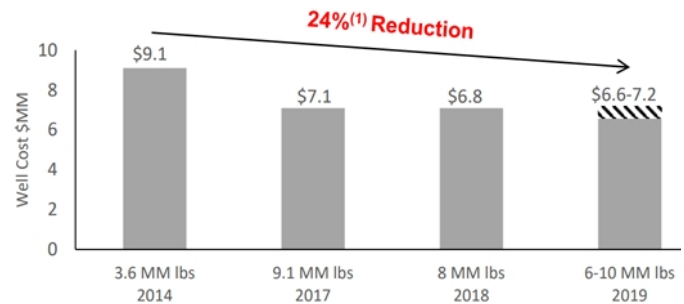
**Who's Down With NPT? Nobody.** Nonproductive time (NPT) is a metric that's tracked by E&P customers but even further scrutinized by OFS providers. According to our E&P colleagues and contacts in the field, contracts these days are setup in a way that downtime on the well pad (i.e., unplanned hours where systems are not being operated or services being provided) are charged back to the oilfield service company based on terms specified in the contract. Another way to punish providers for NPT is that E&P customers will only end up paying for operational hours on the wellsite. Naturally, NPT is critical for OFS companies because it can detract from the bottom-line and if there is too much of it then the E&P operator will be prompted to replace their provider. We point you to **Figures 6 and 7** that show the reduction in U.S. onshore drilling and completion costs over the past years and why NPT can be such a big deal. There is little doubt that the reduction in costs to drill, develop and complete wells both in the U.S. and abroad has been due to the supply/demand mismatch between a plethora OFS providers and reduced E&P budgets since the 2014 peak. Even then, what has also driven well costs lower has been the more efficient operations taking place at the well pad. With service providers starting to push back on price reductions in some cases, it's reasonable to assume that E&Ps will be focused on generating savings from improved operations than squeezing an already beleaguered supplier base. **This is where FracLock (and also where RigLock) have been able to or are expected to provide substantial value.**

**Figure 6: IHS Markit Onshore Cost Index**



Source: IHS Markit, Evercore ISI Research

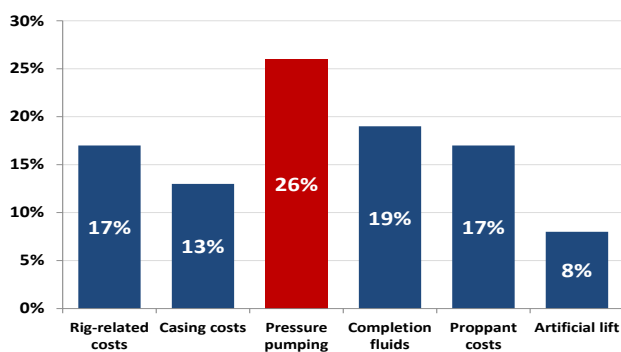
**Figure 7: Whiting Petroleum Average Well Costs**



Source: Company data, Evercore ISI Research

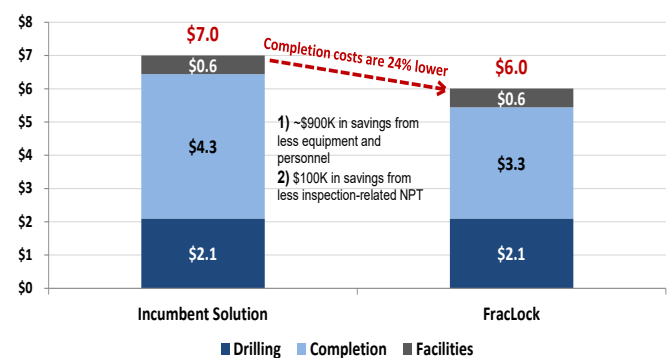
**Breaking it All Down.** We roughly estimate that using the FracLock technology can result in well completion costs that are at least 24% lower than incumbent solutions being used today. Assuming that the typical well costs \$7M to build, usage of FracLock will yield 50% less equipment and personnel on the well pad, driving overall well costs lower by 13%. Additionally, given the lower service intensity from FracLock's optimized frac fluid velocity and reduction in equipment, we assume that NPT related to inspecting and servicing flowlines will fall from four weeks per year to just one week, resulting in incremental savings of 1% of the overall cost of the well. As **Figure 8** shows, nearly 26% of the total costs of a U.S. shale basin well will go towards pressure pumping. Inarguably it's the largest component of costs and why it has become a battleground in terms of pressure pumping providers trying to find ways to differentiate themselves vis-à-vis the employment of cost-saving measures and increased efficiencies. **We believe FracLock does both.**

**Figure 8: Typical Cost % for a U.S. Shale Well**



Source: Evercore ISI Research

**Figure 9: Implied Costs Per Well Using FracLock**

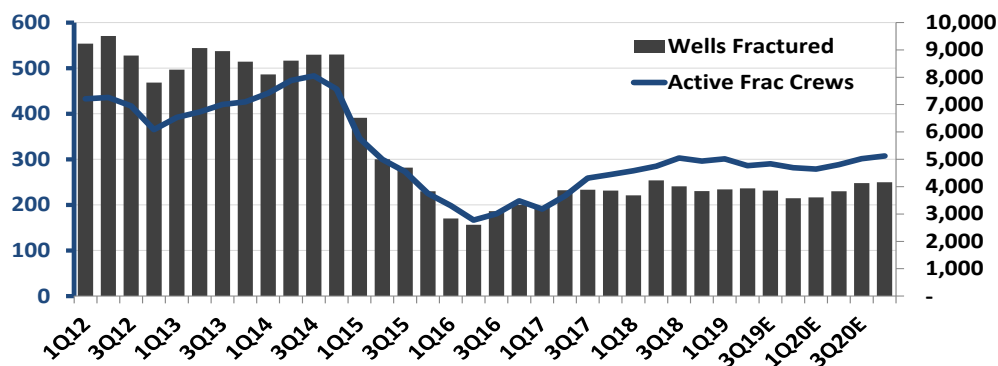


Source: Evercore ISI Research

**Will FracLock Take Over the Market Overnight?** The short answer is no although it's important to size-up the addressable market and also to consider the company's manufacturing capacity. Our conversations with FHE revealed that the company's vision is to have one FracLock system serving an 8-well pad that would travel with the frac fleet as it moves from job to job. Further, for 2020 the company intends to quadruple manufacturing following the product's initial rollout in 2019. Naturally, we try to surmise the implied adoption rate assuming that all units are purchased by available frac crews. Currently, we project that there are 540 available frac crews in the U.S. shale basins with approximately 286 of those active (or 53%). We expect the average number of active frac crews to modestly rise in 2020 to 290. This results in an adoption rate of 25% assuming that 75 FracLock systems are utilized. However, several conversations that FHE has had with pressure pumpers validate the rationale that customers would likely procure at least one FracLock per crew (if not more to ensure coverage during maintenance / repair periods). **It's reasonable to believe that demand for FracLock units will outweigh supply in 2020.**

At the macro level, we estimate that the number of wells fractured in the U.S. will rise 3% YoY in 2020 which supports the outlook for FracLock in terms of having a solid market to sell into. Further, FHE is backed by holding company Basin Holdings, a sponsor that we believe could underwrite incremental roofline expansion should demand for FracLock surprise to the upside. However, we temper optimism in U.S. onshore by highlighting that 2019 drilling and completion activity will likely underwhelm given the recent reticence of E&P customers to outspend their cash flows while capital expenditures have been front-loaded in 1Q19, implying that budget exhaustion will rear its ugly head as soon as 3Q19, a notion that management teams and investors have only begun to begrudgingly admit as 1Q19 earnings season came to a close. Pressure pumping utilization has improved in the second quarter as expected as operators moved past the slow start to the year due to weather and delays as operators revised budgets. Recent concerns around global growth expectations have weighed on oil prices, which in turn may limit the willingness of privates to increase activity levels in the second half.

**Figure 10: Projected U.S. Wells Fractured and Active Frac Crews**



Source: IHS Markit, Evercore ISI Research

**Change is Constant in the Oil Patch.** The energy industry has had a strong history of innovation, a lot of which has been driven by the boom / bust nature of activity levels and the subsequent demand for lower-cost solutions. Historically the offshore drilling sector has driven the step-change in technological advances given the complexity demanded by producing oil and gas from heavy seas while change was slow in land-based conventional drilling plays given their lower unit economics. Things have changed tremendously in the past 5 and 10 years with innovations in unconventional development now happening onshore with operators and service providers alike driving efficiencies and shifting into "manufacturing and development" mode. Still, adoption takes time although any inkling of a reduction to the total cost of production will make adoption occur much faster than predicted, **a scenario that we believe to be plausible in the case of FracLock.** Support from key E&Ps will likely enact a "network effect" where an uptick in customers will continue to improve the perceived value of FracLock's benefits as nobody wants to be considered as behind-the-curve in terms of adopting leading-edge production techniques. A good example of this is when ProPetro announced its revised agreement to upsize its order of electric frac fleets from AFGlobal while indicating that they will serve the operations of XTO Energy and Diamondback Energy, two key customers and well-regarded shale producers. This will likely propel demand for e-fracs higher as E&Ps demand use of a more optimal well completion solution, a plausible scenario for FracLock as customers realize its potential.

**TIMESTAMP****(Article 3(1)e and Article 7 of MAR)**

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Hold	319	41	Hold	169	53
Sell	39	5	Sell	16	41
Coverage Suspended	22	3	Coverage Suspended	17	77
Rating Suspended	8	1	Rating Suspended	2	25

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