



PROFITING FROM SHALE IN FIVE PHASES

By Jamie Webster, Paul Goydan, and Eric Oudenot

EVER SINCE THE US unlocked the resource in the 2000s, shale oil has remade the global oil market. Politicians and pundits alike have praised shale oil as the pathway to North American energy independence, and its production methods (such as hydraulic fracturing) have revolutionized oil and gas recovery and generated record quantities of oil more quickly than ever before. Yet certain predictions—forecasts of how fast shale reserves would grow, the potential extent of shale’s decline in a price downturn, and when and how shale developments would become profitable long term—have by and large missed the mark, and the shale story remains a bit of an enigma.

Part of the problem is that analyses using analogs from traditional oil and gas plays (groups of oil fields in the same region) show how the shale segment would behave under different price and supply and demand scenarios. But what those analyses ignore is how significantly shale development differs from typical oil development efforts. Such errors in assessment have

been costly in several ways. Think how an accurate analysis of shale oil production growth would have provided better and more useful forecasts of the 2014-2015 decline in oil prices. Similarly, a clearer picture of how the energy sector would respond under stress could have offered valuable perspective about how long the price downturn would last. Perhaps worst of all, those and other results of flawed analyses have hindered both energy producers and oil and gas services companies in making smart business decisions regarding their involvement in the shale sector.

Fortunately, it isn’t too late to improve the methods used to evaluate the sector. Traditional linear thinking and assessments are not the right approach. Too often they rely on rules of thumb that originated from conventional oil, which have very little in common with shale efforts, particularly in terms of cost, how the efforts unfold, and the choices companies need to make to succeed. In addition, such linear projections assume that the future will look like the past—and in the shale world, that is unlikely.

To avoid these drawbacks and come up with a useful way to evaluate the shale market and projects, we have instead utilized a systems thinking approach that focuses on how US shale responds to internal and external forces peculiar to its unconventional characteristics. From this, we have identified five signposts, or phases, that appear to indicate pivotal shifts in the evolution of the shale market and in how projects are affected by, for instance, changes in exploration and development costs and in oil prices. These five signposts could prove key to better forecasting. Think of the phases as a blueprint for action—to help companies determine where their play resides in the overall evolution of the industry and the strategies that offer success in the current phase and prepare companies to thrive in the next phase. In each phase, there are pitfalls that could sidetrack revenue and earnings growth. By having an idea of what can go wrong, companies can avoid these sand traps.

Strategic Phases

For consistent and sustainably strong performance in the shale sector, companies should view development through the lens of how a shale project progresses from initial drilling through the eventual decline of production growth. Companies might not always move from one phase to another consecutively, but rather back and forth between phases as

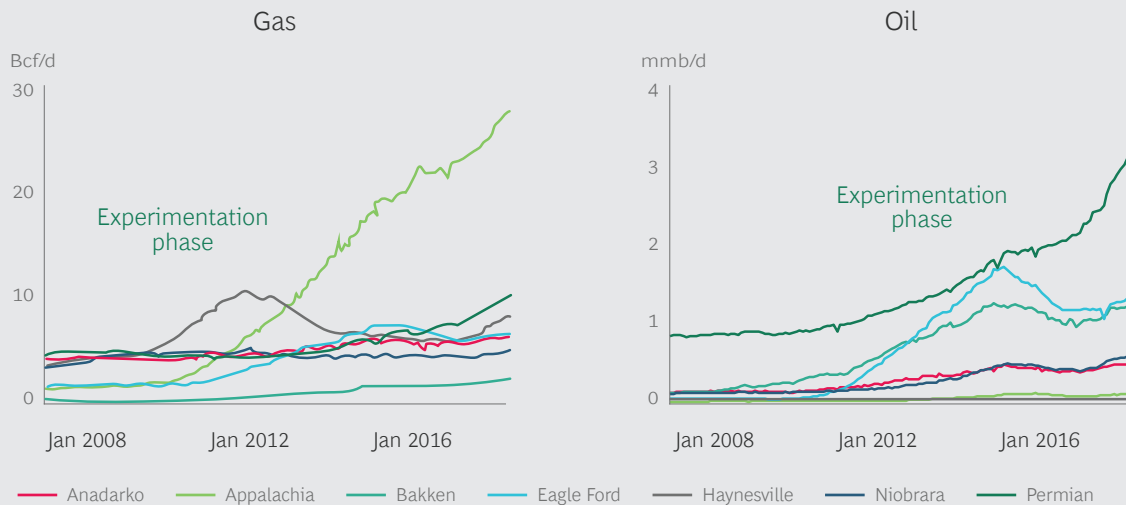
market conditions shift. Therefore each phase should be considered for its unique value as the basis for strategic options at different times in the project's evolution.

PHASE ONE: EXPERIMENTATION

In this first phase, companies are aware of the potential of specific plays but are not yet certain where the best producing acreage is located. Since little to no development has yet occurred on the properties, land acquisition and leasing costs are relatively low. Successful companies stock up on as much promising acreage as they can and engage in somewhat indiscriminate drilling—sometimes just to hold the lease—but little actual shale production. In this stage, being nimble is critical—that is, outpacing competitors in buying up land with the most potential and juggling numerous properties in a variety of locations for maximum future payoff.

To illustrate how swiftly conditions can change—and hence the importance of maintaining a flexible posture during this stage—consider the 30-fold increase in Texas's Permian land costs from late 2011 until the high-water mark in 2018, when an acre went for \$75,000. During this time, combined gas and oil production in the Permian basin tripled, improving the area's position from a high top-ten producer globally to number four. (See Exhibit 1.)

EXHIBIT 1 | In the Experimentation Phase, Production Is Flat Except for Outliers



Source: BCG analysis.

Note: bcf/d = billion cubic feet per day; mmb/d = million barrels per day.

During this experimentation phase, access to capital is essential to finance real estate and project equipment purchases as well as to hire workers for the numerous development efforts. The number of workers needed at this stage is quite high relative to that required during actual production, because many companies are not skilled at integrating efficiency measures during the initial “blank slate” periods of development. Moreover, even when companies incorporate lean procedures, identifying the most valuable shale plays on a large plot of land requires substantial drilling.

PHASE TWO: BOOM

The second phase is marked by a period of rapid growth across the entire development parcel. While the “sweet spots”—shale areas that are as much as ten times as productive as sites on the periphery—may provide the bulk of production, in this phase there is also significant activity on the periphery.

This phase is propelled primarily by high oil prices, which result in better economic outlooks and positive returns at drilling sites. The improved financial performance serves as an accelerant, motivating companies to experiment widely (particularly in marginal areas that could still be unlocked) to increase shale production and take ad-

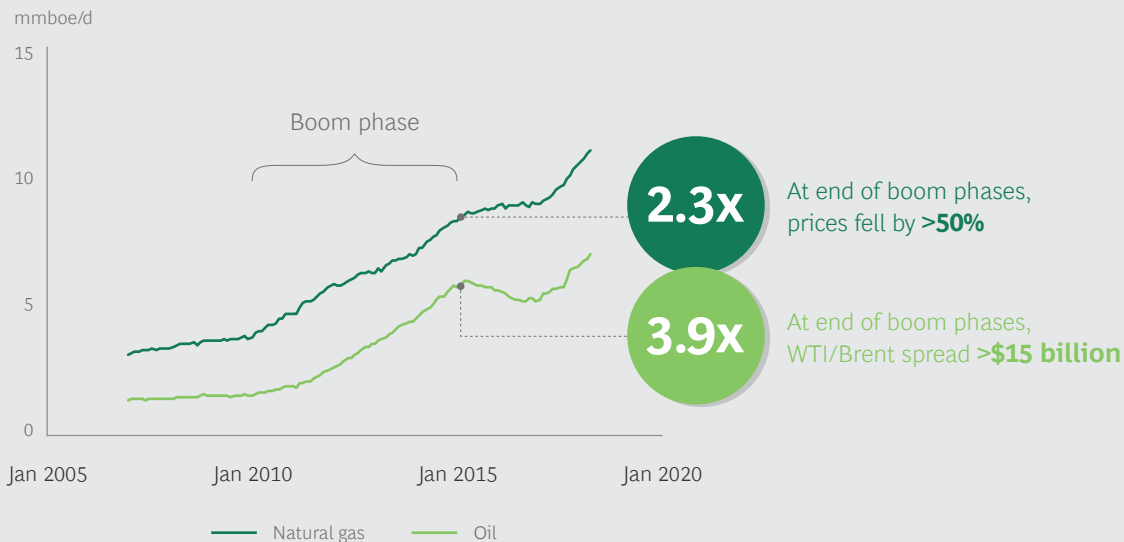
vantage of the booming market. The expanded development activity leads to escalating costs, but elevated oil prices can support them.

This stage’s sharp production growth sometimes results in intermittent constraints, such as equipment shortages, insufficient management expertise, or overloaded pipelines that create a backlog of oil waiting to be removed from the site. These problems might compel some companies to slow the pace of drilling or well completions. But unless they become serious enough to tip the region into the “stress” phase, output growth generally continues.

Industrywide, shale oil and gas enjoyed a boom phase from late 2010 until the price declines of October 2014. During that time, shale gas production increased 2.3 times and oil production rose nearly four times. (See Exhibit 2.) Today an oil price recovery has reignited a boom phase for the Permian basin, where most of the activity is now, but other areas are growing at a much slower rate.

Companies have no power to increase oil prices, the primary trigger for a boom phase, but they can take steps to benefit from the upside of the boom and to continue benefit-

EXHIBIT 2 | During the Boom Phase, Prices Increase and Growth Accelerates



Source: BCG analysis.
 Note: mmboe/d = million barrels of oil equivalents per day.

ting even after the next “stress” phase kicks in. For example they can, first, reduce costs as much as possible to elevate margins, in part by focusing on innovation to improve productivity; second, maintain best-in-class logistics to ensure limited price spreads to the benchmark price; and third, concentrate on core, resource-rich and profitable plays, while trading out of less-promising acreage on the periphery.

PHASE THREE: STRESS

When oil and gas prices inevitably fall after a boom period, in part because of overproduction and excess supply, shale producers’ margins often turn negative. In turn, shale producers sharply cut back on drilling and capital spending and lay off employees, while focusing on efficiency and innovation to increase their wells’ production and do more with fewer workers.

The period following the oil price declines of late 2014 illustrates how the shale sector responds during a stress phase. In the wake of falling prices, US companies reduced drilling by 75%. Meanwhile, day rates for rigs fell by 25% and the workforce declined by 10%. The remaining development work, therefore, was far less expensive to keep alive than it had been before. Moreover, during the boom phase companies had learned where the most productive areas were in specific plays. And these sweet spots, which included sites with the potential for the highest initial production rates and estimated ultimate recovery (EUR), continued to see plenty of action after the stress phase began.

But what stood out most during this period were the gains in productivity, transforming shale from a largely high-cost resource to a low-cost producer as breakeven expenses fell sharply. The new techniques and strategies included much longer laterals, or horizontal drilling programs, with so-called “super-laterals” extending 18,000 feet. Fracking activities also became more targeted and larger, with companies sharply increasing the amount of proppant used to keep the fractures open. Such breakthroughs meant that rig productivity (a measure of average production per de-

ployed rig) more than doubled since the price fall. A single rig operating today can do the work of 2.6 rigs in October 2014.

Apart from the operating changes that mark the post-2014 period, many producers became more active in hedging programs, helped along by a surfeit of available capital to finance these financial instruments and the sustained contango (future prices were higher than spot prices) in the West Texas Intermediate market structure. Many of the hedges were designed around puts, which would give companies some relief if price declines worsened. Those strategies allow companies to keep investing in promising sites or even just meet payroll as prices dip during a stress phase.

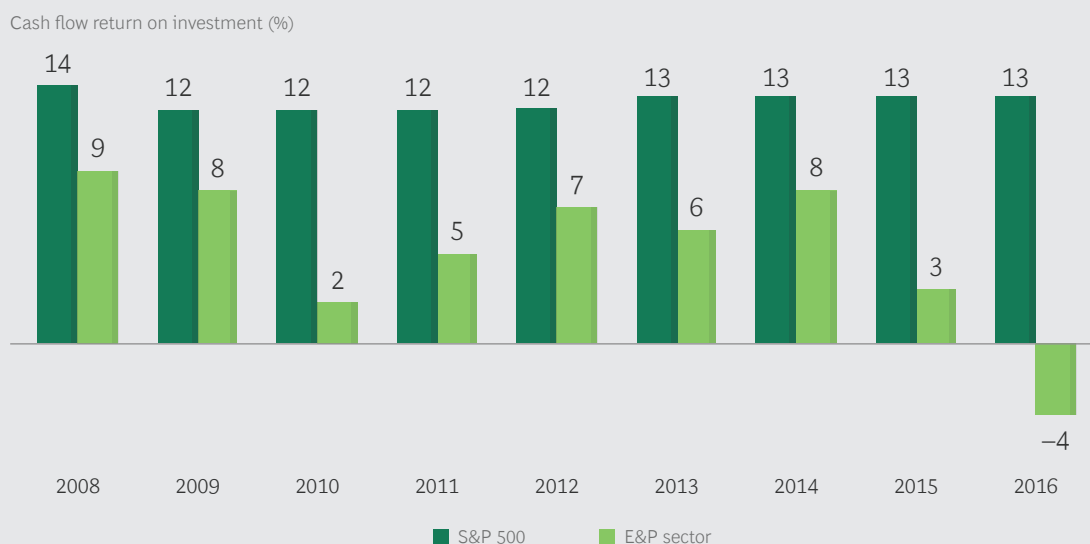
PHASE FOUR: RECOVERY

As shale production costs drop and well-drilling declines during the stress stage, the breakeven level falls and profitability for individual sites becomes easier to achieve. Companies then move into a recovery phase, a period of expanding operations and growth that is also usually stimulated by a rebound in oil and gas prices in response to the reduced output.

This is when the shale industry also deals more substantively with the issue of profitability. The term “profit” in the industry has multiple meanings, but in this case we are referring specifically to the return of capital to investors. Traditionally, during the experimentation, boom, and sometimes the recovery phases, shale companies reinvest their net earnings plus an additional amount in expanding existing sites or acquiring new ones. Particularly during the recovery phase, this tactic tests the patience of investors, anxious for returns on their money and frustrated with constantly escalating investments in the business. In other words, by focusing too intently (and not coherently) on growth, especially when energy prices are on the rise, oil and gas producers downplay the long-term importance of protecting free cash flow. (See Exhibit 3.)

As investors get more jittery, calls for strategic changes intensify and often the

EXHIBIT 3 | Energy Companies' Focus on Growth Came at the Expense of Generating Free Cash Flow



Source: Bloomberg.

Note: Average cash flow return on investment for a group of 10 large US E&P companies.

compensation plans for CEOs and top management are altered; instead of purely rewarding growth, new agreements are crafted that provide bonuses for profits available to investors, separate from new capital expenditures. But these types of agreements are usually temporary. Profitability concerns, when they are even raised, are generally confined to the recovery stage and often ignored by investors during the earlier phases, when capital discipline to invest less than net profits is equally important though taken less seriously.

Indeed, viewed broadly, the shale sector is bedeviled by a “profitability paradox” resulting from its investment appetite, which ultimately threatens the equilibrium of the industry and sustainable, stable growth. Under the weight of this paradox, when shale companies restrict the amount earmarked for capital budgets, which in turn reduces output and increases oil prices, they become anxious to take advantage of the escalated demand and, hence, expand production markedly. But when investors then complain about too much money targeting more and bigger shale plays, production growth slows and oil prices rise again—and the investment boom occurs once more. In other words, repeatedly, improved profits are the precursor to anemic returns on investment.

To break the back of the profitability paradox, the shale sector would have to demonstrate capital discipline throughout all of its phases. If that occurred, the result would likely be a slower but more steadily growing shale industry, able to both capture productivity gains to increase the amount of available funds for investments and to incubate new plays in a stepwise, coherent fashion. Returns on investment would be balanced against the need to expand revenue streams in an orderly way.

However, by not confronting directly the dangers of the profitability paradox, we expect that the shale sector will continue to be dominated by large companies, with substantial production and holdings—and antsy investors—and by smaller start-up companies funded at levels higher than their net revenues. These conditions only impel productivity gains and increase inefficiency as the need for financial rigor almost always takes a back seat to finding new ways to earn money—even if it costs more to make less.

While the recovery stage is marked by generally improving conditions, many companies will still be limping from the cost cuts and loss of talent during the stress phase. As a result, M&A activity is commonplace. Companies that have been financially

prudent and are in relatively healthy shape after the downturn—that is, they have balance sheets that can weather above-ground constraints, such as insufficient pipeline capacity or the need to recruit experienced workers quickly—may be in an ideal position to acquire weaker rivals. Moreover, with many companies reeling, this phase could present opportunities for outside companies to enter the sector.

PHASE FIVE: MAXIMIZING GAINS

To survive and escape the boom and bust cycle that characterizes the shale sector, the best option for companies is to solidify gains with continuous innovation. Over time, companies that can adopt new digital tools and equipment into their daily workflow will see their performance eclipse their less aggressively creative rivals.

For instance, by adopting new IoT technologies such as sensors placed on discovery and drilling equipment linked to data and analysis tools in the cloud, shale producers can meld huge amounts of historical and real-time field data. From these pools of information, a picture of the most fruitful shale sites and how to best access them emerges—and can form the basis of a drilling plan for semiautonomous or autonomous robotics rigs. The result: less downtime, faster time to production, lower production costs, and higher productivity.

And that's just a small window into how technological advances can change profitability scenarios in the shale sector. Companies can derive similar benefits using drones to fly in grid patterns over potential reserve fields to create site maps and 3D models for self-navigating equipment or rapid, real-time distribution to project management anywhere in the world. Or blockchain programs—which can instantly and securely connect disparate communications networks while outwitting potential cyberhackers—can speed up global shale oil and gas transactions or manage supply chain inventory, ensuring that the location and delivery schedules for materials are transparent to every node in the system and eliminating production slowdowns. Another possibility: with 3D printing, com-

panies can instantly manufacture onsite small parts and components so equipment malfunctions do not hinder well output.

Few oil and gas companies today, however, are comfortable with linking technology directly to their operations to take full advantage of this stage. A recent paper by the World Economic Forum quoted survey findings that 72% of CEOs in global corporations struggle to recruit the best digital talent. Part of the problem is that few energy organizations have instituted a corporate culture that allows and encourages persistent innovation to take advantage of rapidly advancing technologies.

Focus On Your Unique Situation

In assessing how to put the five phases framework to use in the particular circumstances that your business faces, consider that each stage is propelled by a key factor that itself should be strategically addressed as well. The first factor is price, which affects boom and recovery. Shale companies cannot control prices, but building scenarios to respond to higher or lower prices—for instance, by using the insights from the five phases—can offer ways to navigate around them.

The second factor, activity, affects all phases but is the prime driver in the first phase (experimentation) and the final phase (maximizing gains). It touches on the business's capabilities, assets, and corporate culture, all critical areas the company must attend to as it evolves through the phases. Success sometimes requires transforming these core facets of the business, a difficult decision if prior behavior drove even a modicum of success. But changing conditions in the shale sector from phase to phase and other external factors point to the need for companies to reevaluate all aspects of the business.

The third factor, cost, is most prominent in the stress phase, when prices are low and breaking even is difficult unless expenses are under control. Shale companies have shown that they can control costs—at least for a time. But after leaving the stress

phase, few companies sustain the discipline to avoid rising outlays.

Going Forward

The shale industry does not move in lock-step through any of the five phases we have outlined. Some plays are mired in the recovery stage while the active Permian basin has moved into the boom phase, even as it contends with rising above-ground constraints.

Oil and gas prices are largely edging up. But at the same time, companies are predictably drilling more to try to grab some of the additional revenue entering the market. As a result, after two years of declines, shale costs are increasing. In particular, high-quality, latest generation rigs are at a premium and interest rates on capital for

expansion are rising. So far, wages have remained flat—up only 2.7% since 2016—but that will unlikely last as the number of available skilled workers continues to dwindle in a strong economy.

FOR THE MANY shale companies in the recovery phase today, it is imperative to plan for the future by adopting a digital strategy that allows them to overcome the profitability paradox. With efficiency and output gains propelled by innovation, as well as access to real-time information and data banks, shale companies can avoid chasing revenue ad hoc and instead invest in only the most productive plays when prices are both high and low. For the shale industry, that is a phase worth going through.

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