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Sustainable Investment Spotlight

Sustainable Investment Research, Bank J. Safra Sarasin

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Preliminary end of the shale boom – easy gains are over

- **Unconventional US energy production hits an interim new peak**
- **Long-term drivers for US land-based energy production are intact**
- **A fresh investment cycle is difficult to finance at oil prices around USD 55 per barrel**
- **Simple and low-cost efficiency improvements in the end phase**
- **Optimisation of US shale oil production increases the sustainability risks**

Picture 1: Drilling rig in US North Dakota-shale basin operated by Statoil

Source: Statoil, 05/2015, Photo by Ole Jørgen Bratland

Hydraulic fracturing, or fracking

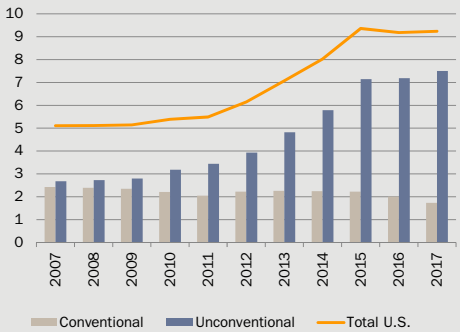
Extracting fossil fuels (oil or gas) from shale formations requires an unconventional approach: hydraulic pressure is applied to create cracks or "fractures" in the rocks. This fracking process also requires the injection of water, silica sand and chemicals into the borehole. This increases the porosity of the rocks and releases any gas or oil they contain.

US production reaches its interim peak

Despite the forward march of renewables, significant milestones have been reached in the United States' production of fossil fuels in 2017. In the first half of the year, US crude output once again exceeded 9.0 million barrels per day for the first time since the seventies, broken down into some 7.5 million barrels of unconventional and 1.5 million barrels of traditional fuels. At the same time, the United States' net oil imports up to the end of September stood at 2.8 million barrels, the lowest level since 1983 (the previous high of 13.4 million barrels occurred as recently as August 2016). This means the USA is on the threshold of energy self-sufficiency, a goal it has been working towards for decades, and one which has both political and economic ramifications. The expansion in production is attributable to one pivotal factor: the virtually unrestricted expansion over several years of unconventional shale oil and gas production on the US mainland.

The greenlight for ramping up production came in 2005, when the US government approved the exploration of shale formations in a number of federal states. Over the past 10 years, production volume has more than doubled. Today, shale oil & gas production accounts for 80% of total US energy output. Around half of this comes from the Permian Basin (Midland and Delaware).

Chart 2: US oil production (million barrels/day) over the past 10 years

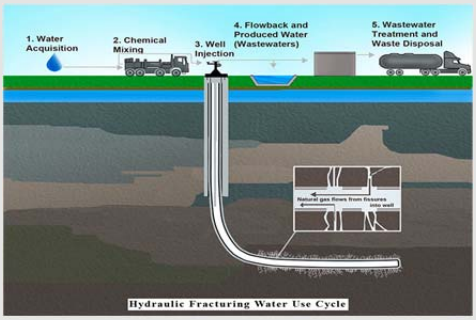


Source:US Energy Information Administration (EIA), 2017

Up to 2014, the rest of the world, and especially the world's major oil exporters (OPEC), kept production flat. Thereafter OPEC embarked on a brief and unsuccessful strategy of expanding production, before eventually cutting it back again at the end of 2016. The USA aggressively exploited this power vacuum among oil-producing countries, increasing its share of global oil production from 4% to a recently estimated 7%.

In the *first phase,* the rig count was increased sharply. In the *second phase*, the output of each drilling rig was boosted mainly by technological breakthroughs in horizontal drilling.

Chart 1: Extracting oil & gas from shale formations

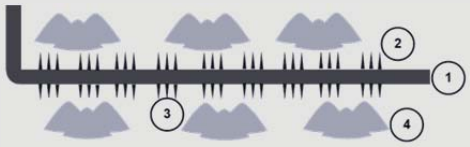


Source: US Environmental Protection Agency, 2017

In a *third phase*, efficiency was further improved by greater drilling intensity for each borehole. The main drivers of the related efficency gains were mainly due to four components illustrated in the Chart 3 below:

1. Longer horizontal wells
2. Higher fracture stage count
3. Tighter cluster spacing
4. Higher sand intensity

Chart 3: Four main technical factors for the US shale boom

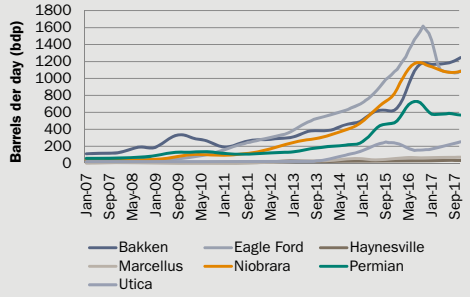


Source: Goldman Sachs, 2017

Growth rates flattening off

The efficiency gains in production from new drilling wells in the biggest US shale-producing regions exhibit a very mixed pattern. In particular, the most productive shale formation in the Permian Basin has seen output stagnate recently (see Chart 4).

Chart 4: Efficiency improvement has peaked in largest US shale regions



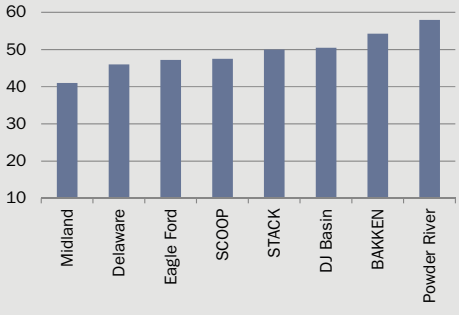
Source: Bank J. Safra Sarasin based on Carnegie, 2017

If the current record numbers of drilled but uncompleted wells (DUCs) are also taken into account, no region has managed to increase its output per rig since July 2017.

Shale producers able to keep prices under control through greater operating flexibility

These increases in production, with a concurrent fall in service costs, have allowed new investments to be made in shale oil and gas production. Another helpful factor was that the resources have been productive for generations, making for a very low exploration risk and with new technology vastly increasing the recoverability. Compared to for example deep sea activities the exploration risk for onshore shale is lower. Furthermore, relative to traditional and other unconventional production techniques, extraction from shale formations is easier to control in the short term: the costs for bringing the well on/off stream are lower, partly because the land owner also owns the natural resources under the ground. Also most of the producers are relatively small and flexible companies that can respond to price changes far more quickly than the bigger oil corporations. An analysis of the seven biggest US shale regions (Delaware and Midland cover the Permian Basin) shows them achieving a positive operating cash flow at just under USD 50 per barrel (see Chart 5). If the prices rebound well above this level, as observed since July 2017 (see next box), it is likely that US shale oil & gas producers will ramp up their production within the next three to six months.

Chart 5: Breakeven threshold for the big US shale basins (in USD/barrel)



Source: Bank J. Safra Sarasin based on BofaML, 2017

The prospect of an increased supply should in turn have a dampening effect on prices. If these fall below USD 40 per barrel, it effectively means US producers are losing money. This should force them to cut back production, which will inevitably push prices up again – assuming no change in the supply volumes of other producers. In contrast, the global energy giants outside of North America often have projects that take several years before new wells come on stream. These generally keep their production volumes unchanged, despite a price fall over the course of this year, and are now not operating on a profitable basis.

It is therefore important for investors in the energy sector to remember that the various regions have different breakeven thresholds as regards the oil price, due to differences in the geological conditions, access and networked infrastructure and proximity to consumers of the end products, etc. (see Chart 5).

Shale oil keeps oil prices in check

The *third phase* of efficiency improvements and the subsequent hike in US production and global oil inventories ultimately resulted in sharp corrections in the oil price towards the end of 2017. Since then, US shale oil production has moved within a band of USD 40 and 60 per barrel. Shortly before the forthcoming OPEC meeting at the end of November 2017, oil prices are trading just above this corridor. OPEC, along with Russia, is expected to agree a nine-month extension to the existing production quota first introduced in January 2017, and already extended in May 2017 until March 2018, i.e. eventually ending in December 2018. This would bring global energy stocks down to their average level over the past five years and regain some control over oil prices thanks to balanced supply and demand. If this scenario materialises, higher oil prices would make non-fossil fuels even more competitive, thereby accentuating the structural change that can be observed in the medium to long term towards renewable energy.

Shale oil boom presents major environmental challenges

The fracking technology that uses a combination of water, silica sand, and different chemicals carries considerable environmental, safety, and health risks. There is a latent risk of groundwater (important for drinking water) becoming contaminated by leaking pipes. Accidents when transporting the wastewater away from the site are another threat. A third, and relatively unexplored, risk is the cumulative effects of numerous boreholes in the same location. All these factors carry a high risk potential when it comes to the operation, costs and revenues associated with the wells. A more in-depth

industry analysis from an environmental, social and governance (ESG) perspective is shown in Chart 6. It forms an integral part of the sustainability analysis performed by Bank J. Safra Sarasin.

Chart 6: ESG materiality matrix for the oil & gas industry

	Operations	Costs	Revenues
Environment			
Carbon Emissions	Continuity	*Opex *Capex	Business Preservation
Biodiversity & Land Use	Continuity	Opex Extraordinary	
Toxic Emissions & Waste	Continuity	Capex Extraordinary	
Social			
Health & Safety	Continuity	Capex Extraordinary	
Governance			
Corruption & Instability		Extraordinary	Business Preservation
Corporate Governance (Board, Pay Practices, Ownership & Control Rights)	Quality	Cost of Capital	

Potential impact on the related value driver: Null or Limited | Medium | High

Opex = Operational Expenditure, Capex = Capital Expenditure

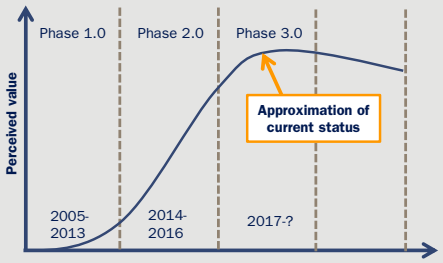
Source: Bank J. Safra Sarasin, 2017

Compared with conventional well drilling, shale oil producers use far more water and produce far greater quantities of toxic waste. In addition, we have discovered that the regulations in the USA contain multiple exemptions and in many cases are therefore not suitable for fully covering all the environmental risks described.

What comes after the boom?

The International Energy Agency (IEA) estimates that US oil production – driven by the output from the shale oil basin – should reach an all-time record of around 10 million barrels per day in 2018. After more than 10 years of unbridled growth, the simple and low-cost advances in production have already been made. The S-curve commonly used in innovation management shows that an extractive technology is constantly hitting its technical performance limits when it comes to further development potential. The steepening of the S-curve describes the improvement in performance created by an additional R&D thrust, in other words the productivity boost from research and development. US shale oil production trends suggest that we are currently in the last boom phase (see Chart 7). Only another massive investment in R&D could trigger a fresh S-curve.

Chart 7: S-curve in the shale oil & gas industry



Source: Bank J. Safra Sarasin based on SocGen, 2017

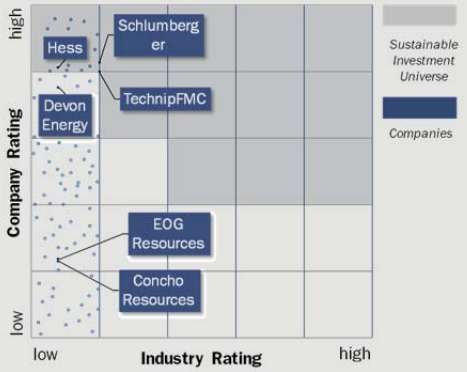
Next production boost requires massive investments and carries major ESG risks

Increasing digitalisation and the use of seismic exploration measurement data (Big Data) is a promising trend. To initiate a new growth cycle, however, the small and often privately-owned US energy companies – many of them highly leveraged compared with their international peers – must substantially step up their investments in new technologies. In this respect, current oil prices (despite the recent rise) are still too low to cover the required investments. Outside financing has been very easy and cheap in the recent past. However, the level of indebtedness is generally already high. Hence, one should not expect capital expenditure to be financed from this side, in particular as the credit conditions on capital markets could deteriorate rapidly at any moment.

Although the breakeven threshold has been lowered thanks to substantial cost savings, and now averages below USD 55 per barrel in the USA, this level only takes into account the maintenance investments. However, this is not enough to offset the decline rate of US shale oil production and the R&D costs for new projects are not included either. In addition, there have recently been signs of reluctance on the part of US shale oil & gas producers to make investments for 2018. If their focus shifts from absolute volume growth to stricter spending discipline with an eye on keeping their shareholders happy, US production is likely to have less growth potential than the market thinks.

Whilst we have identified significant ESG risks for companies involved in shale activities combined with average management initiatives to mitigate them, we still find some high-quality energy companies with good sustainability standards. Even though we currently do not have any shale "pure play" companies in our sustainable investment universe (see Chart 8), there are still investment opportunities linked to this topic.

Chart 8: J. Safra Sarasin Sustainability Matrix® - Energy companies



Source: Bank J. Safra Sarasin, 2017

Some investible companies with above-average ESG credentials compared to their peer group, such as Hess, Schlumberger and TechnipFMC, have some exposure when it comes to unconventional energy sources. Most energy firms in the sustainable investment universe however have no direct link to shale oil/gas resources, such as Woodside, Lundin and OMV. Those should benefit from a relatively abating future exerted influence of the recently strongly growing energy source. Overall and thanks to our investment approach of analysing financial and sustainability factors in an integrated manner, we can offer our clients access to investments in risk-aware companies within the energy sector.

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Sustainability Rating Methodology

The environmental, social and governance (ESG) analysis of companies is based on a proprietary assessment methodology developed by the Sustainable Investment Research Department of BJSS. All ratings are conducted by in-house sustainability analysts. The sustainability rating incorporates two dimensions which are combined in the Sarasin Sustainability-Matrix® :

- Sector Rating: Comparative assessment of industries based upon their impacts on environment and society.
- Company Rating: Comparative assessment of companies within their industry based upon their performance to manage their environmental, social and governance risks and opportunities.

Investment Universe: Only companies with a sufficiently high Company Rating (shaded area) qualify for Bank J. Safra Sarasin sustainability funds.

Key issues

When doing a sustainability rating, the analysts in the Sustainable Investment Research Department assess how well companies manage their main stakeholders' expectations (e.g. employees, suppliers, customers) and how well they manage related general and industry-specific environmental, social and governance risks and opportunities. The company's management quality with respect to ESG risks and opportunities is compared with its industry peers.

Controversial activities (exclusions)

Certain business activities which are not deemed to be compatible with sustainable development (e.g. armaments, nuclear power, tobacco, pornography) can lead to the exclusion of companies from the Bank J. Safra Sarasin sustainable investment universe.

Data sources

The Sustainable Investment Research Department uses a variety of data sources which are publicly available (e.g. company reports, press, internet search) and data/information provided by service providers which are collecting financial, environmental, social, governance and reputational risk data on behalf of the Sustainable Investment Research Department.

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