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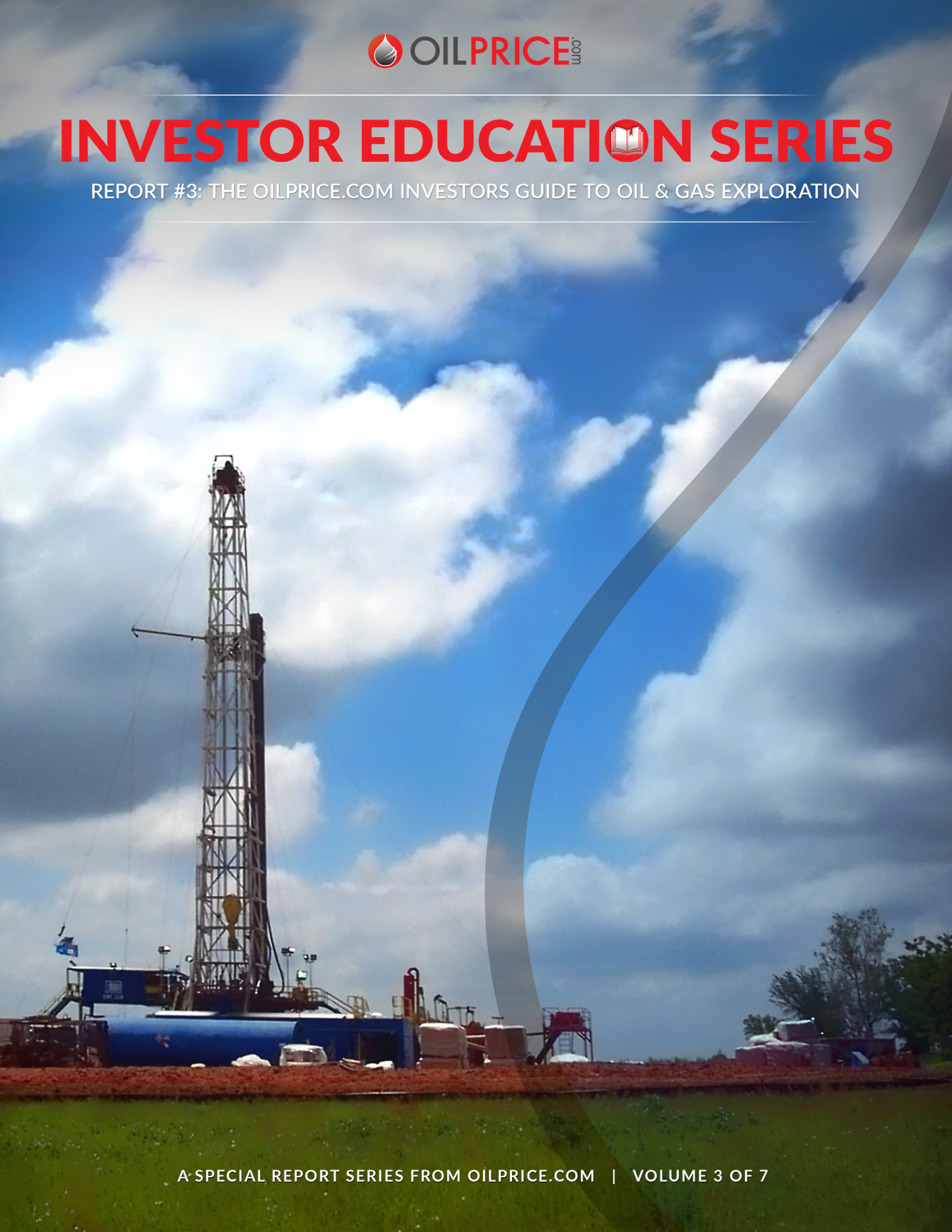
INVESTOR EDUCATION SERIES

REPORT #3: THE OILPRICE.COM INVESTORS GUIDE TO OIL & GAS EXPLORATION



A SPECIAL REPORT SERIES FROM OILPRICE.COM | VOLUME 3 OF 7

The Genesis of Profit, Where the Oil Story Begins.

The Oilprice.com Investor's Guide to Oil & Gas Exploration

Oil and gas exploration is part divination and part science fiction, so if you are thinking of investing in this early phase there is a lot you need to know in order to be able to balance risk with reward.

In no other segment of oil and gas investing is the risk higher. At the same time, in no other segment is the reward as potentially astounding.

In this 20+-page special report, Oilprice.com navigates the new oil and gas investor through the tangible and intangible aspects of exploration:

- **What is exploration?**
- **How geologists 'divine' oil and how today's technological miracles help narrow it down significantly**
- **Not all rocks are equal: What explorers are really looking for**
- **How potential prospects are evaluated**
- **Onshore versus offshore exploration: pros, cons and where to look**
- **Exploration well nuances: Exploratory, wildcat and appraisal wells**
- **The exploration terms that can trip investors up**
- **Weighing risk with reward; when to take the plunge**

Introduction: The Metamorphosis of Exploration

Spindletop gushed forth oil in 1901, ushering in the first Texas oil boom. The exploration story then was very similar to the story today. It was an anxious time for investors, as Gladys City Oil, Gas and Manufacturing Company poured money into drilling a lot of wells that came up dry. They had been lured here by gas seepages and sulfur springs that indicated a high promise of oil beneath the surface. When they finally struck oil, all the money put into exploration was worth it. Spindletop gushed like nothing else before it, making a lot of people rich and turning Texas into the American oil state—a title it retains to this day.

Today, exploration is both easier and more complex—and significant advances in exploration technology have brought the hordes back to Texas once again to see if they can't find more oil under the ground by spying on rock formations under the earth. It is more complicated because the process now relies on mind-boggling seismic imaging technology and massive supercomputers in many cases to compute and analyze the massive amounts of data brought to the surface. It's easier because the new technology can pinpoint a potential drilling site with much more accuracy, saving explorers a lot of money and often avoiding the many dry holes that led up to the Spindletop gusher. The new technology also takes us much deeper underground, and even into the ultra-deep waters offshore, opening up vast new possibilities for discovery and production.

Exploration remains an exciting adventure—but despite the technological advances, it is just as risky as it always has been. The only way to reduce risk is to understand how it all works as much as possible without a degree in petroleum geology.

Going Deeper

Oil and gas exploration is:

- The process of finding viable prospects to drill
- A commitment to spending large amounts of risk capital for an uncertain outcome
- The main avenue of growth for exploration and production companies and the most important way that they can replace depleted reserves
- What turns a small company into a large company
- What can make or break a company overnight

Back to the Beginning: Where the Great Game Starts

Exploration is a game—the game of all games in the oil and gas business.

While the process of exploring for oil and gas deposits below the seabed offshore or beneath the earth's surface onshore is a science for petroleum geologists and geophysicists, for the investor it is perhaps the greatest and riskiest game out there.

There is no cheek behind our definition of exploration as a game. In fact, exploration is the focal point of a number of interactive video games—the best of which has been designed by an actual explorer, Denmark's Maersk.

Quest for Oil is a hands-on simulation, online gaming environment that allows you to explore for oil yourself, size up the competition and figure out what can make or break an exploration venture in real time. It's a brilliant educational tool for investors who are thinking of breaking into the oil and gas industry—and even for those who just need a bit of brushing up. We recommend trying your luck online first. It's also available for Android.

The game of exploration is an ever-changing one in which continually advancing technologies rule the day.

Today, petroleum geologists study the surface of rocks and terrain—as they have always done—but high-tech satellite imaging, gravity meters, magnetometers and seismology help them to find oil and gas faster and more efficiently. Whoever has the most advanced technology, the best intuition, and the best team in place to interpret data will find the sweet spots first.

The trend that has really taken off in the past decade is for junior E&P companies to do the lion's share of onshore exploration. The game in this case is this: Junior companies rush in to a potential sweet spot, explore, strike oil, and then position themselves to be bought out by a larger company. Then the game starts over again, with the larger company producing and the junior moving on to its next exploration target. This has been a great way for new investors to get in on the oil game—and typically a quick money-making scenario. The trick is finding the right junior—and there are hundreds and hundreds of them out there.

Picking a Shore

Searching for oil and gas onshore and offshore are vastly different processes with vastly different price tags,

timeframes, and levels of commitment.

Onshore exploration can range from few hundred meters below ground to up to 6,000 meters beneath the earth's surface. Offshore oil and gas exploration can include shallow water exploration to ultra-deep-water exploration—and everything in between. The deeper you go, the more expensive it is, and the more remote the location, the more that cost compounds—along with potential political risks.

For this reason, the smaller, or junior, companies typically lead onshore exploration these days—hoping to be bought out by a bigger player once they find oil or gas—and offshore is the purview of the larger companies, or the supermajors who can afford the cost.

For onshore exploration, mobile drilling rigs are used to drill into the earth to locate oil and gas reserves. For offshore exploration, a drill ship, jack-up drilling rig, or floating drilling rig is used to locate oil and gas reserves under the seabed.

Offshore

Offshore exploration is not for the faint of heart, and this is a very different type of game even if the technicalities of exploration remain the same as on land. While the sky's the limit now that we are moving into ultra-deepwater exploration, we're talking about massive capital investments, long-term commitments and a very high level of risk coming at you from all over the place.

Consider this: In early 2015, analysts were trying to convince oil and gas explorers in Africa to rethink their capital expenditure on exploration activity and move onshore in the wake of a major drop in oil prices. This is a major facet of the offshore exploration game: Gambling on exactly how long oil prices will remain up or down.

Despite the risks that come with high operational costs, the lure of offshore is strong, and it's never been stronger than it is today. But that lure is really in the ultra-deep waters, not the shallow waters under 1,000 feet. The interest in shallow-water exploration has waned in recent years, largely because after being hugely successful, they've been drilled

Pros of Offshore Exploration

- Higher reward potential, higher profit margins, higher return on investment over a longer period of time
- Massive untapped resources
- Deepwater wells can achieve ultra high output
- Many locations to choose from; shallow water, deep-water, ultra deepwater
- Deepwater and ultra deepwater investments are generally with large, integrated, established companies
- Potentially less vulnerable to a volatile oil market due to long-term project nature, if company is playing it right

Cons of Offshore Exploration

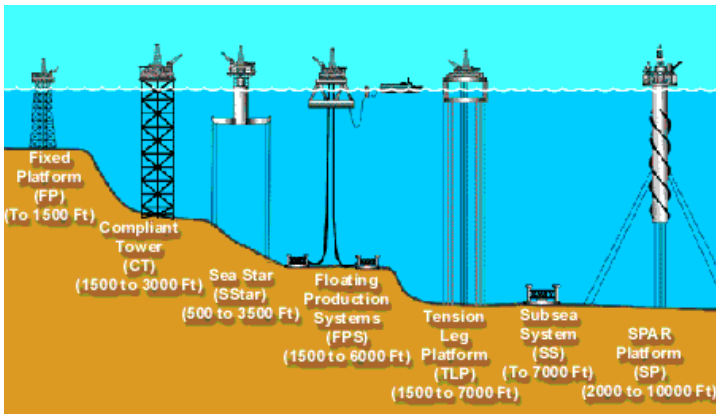
- Very high-risk environment in terms of natural and manmade disasters
- Possible political risks stemming from maritime boundary disputes
- More costly than onshore exploration, requires major capital investment and long-term commitment
- Slower return on investment
- Oil and gas reserves much more difficult to access; even in the event of a discovery, there are fewer guarantees of extraction
- Many oversight and regulatory hurdles
- The deeper the water, the greater the complexities
- Decreased operational flexibility

to their max. The very nature of offshore exploration is about going deeper and deeper.

We can now drill an amazing 35,000 feet in ultra-deep water thanks to technology that didn't exist a decade ago. This is the deepwater oil boom, and it's just getting started.

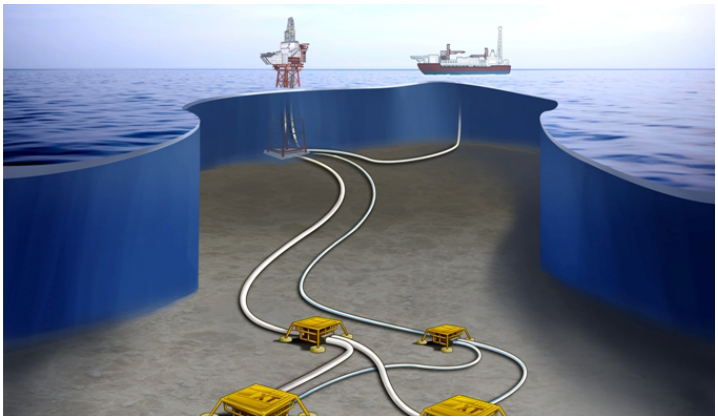
The key to the deepwater oil boom is subsea technology. First, imagine drilling operations that begin around two miles under the water. Then drill another 10,000-20,000 feet under the seabed, through rock and salt formations. This is where the oil is—and no human can get there, but subsea technology can. It's a phenomenal feat for a phenomenal investment.

So, if you're looking for that ultimate, long-term investment and can handle the high risk, welcome to the ultra-deep. This is the final frontier-and it's a huge one.



Subsea production systems are wells located on the sea floor rather than the surface. Petroleum is extracted at the sea floor, and then tied-back to an already existing production platform. The well is drilled by a moveable rig, and the extracted oil and gas is transported by riser or undersea pipeline to a nearby production platform. The real advantage of subsea production systems is that they allow you to use one platform—strategically placed—to service many well areas. And as the cost of offshore production rises, this could represent significant savings.

- Right now, we're looking at a 70%-30% spread for total global onshore and offshore oil and gas production, respectively. Of that 30% of offshore production, subsea oil and gas production represents 9%.
- Subsea production could rival traditional offshore production in less than 15-20 years.
- The market for subsea facilities is expected to grow to $130 billion in 2020 (it was $27 billion in 2011), driven by the increasing trend towards deepwater oil and gas development.
- There are vast opportunities here in a multitude of sub-sectors: subsea technology development and manufacturing, supply, installation, service and maintenance, and exploration and production

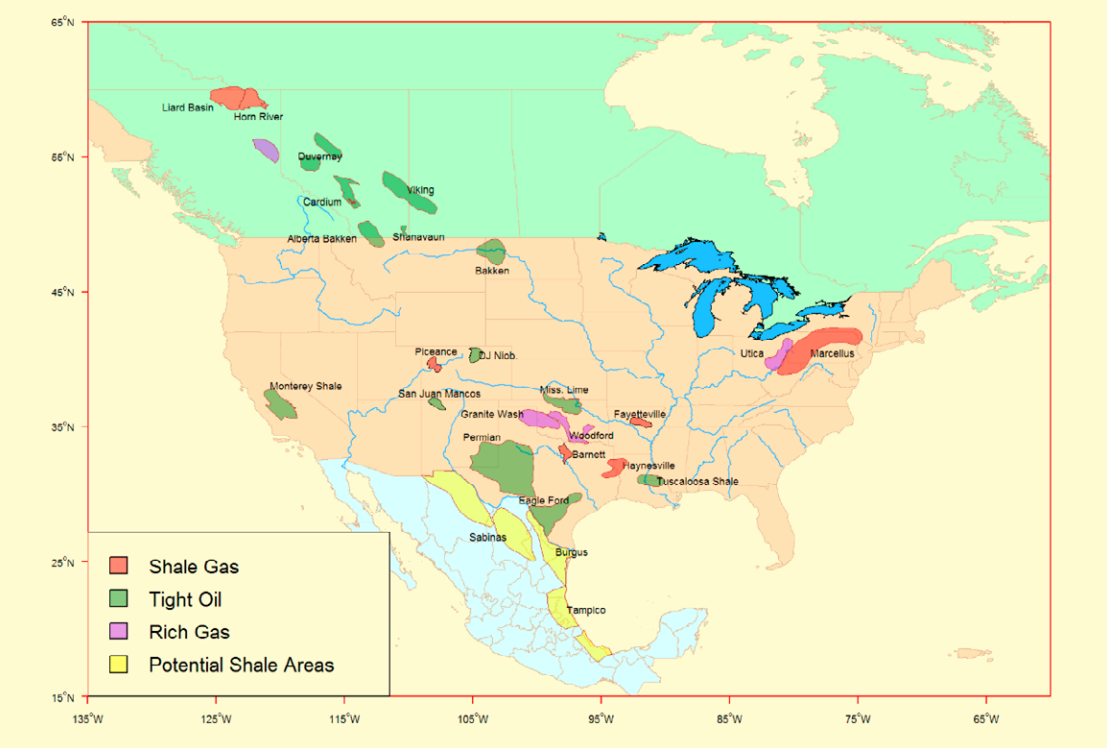


Onshore

If you want something easier, faster and … smaller, onshore is where you need to look.

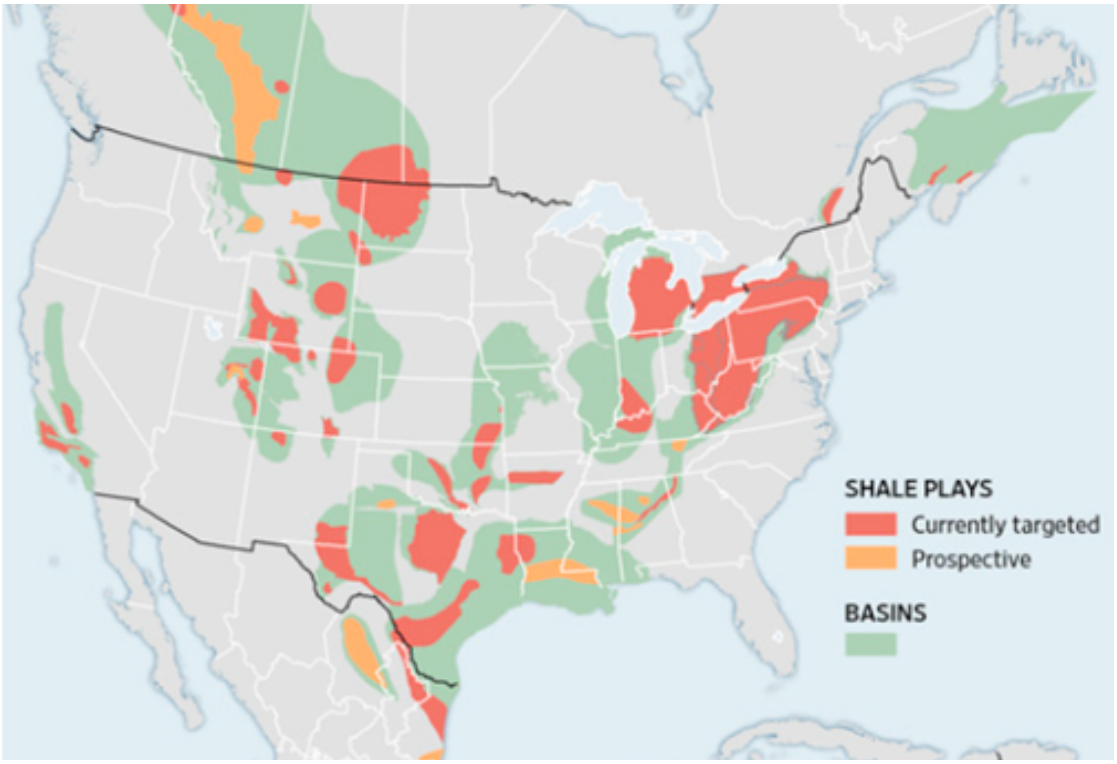
The onshore game is a faster-paced one, and due to the lower capital investment requirements, you can diversify your investment by focusing on various types of plays—conventional and unconventional—and various locations. If oil prices are low and the expense of exploring for and then extracting shale oil cannot be supported, diversifying your portfolio with some conventional exploration may be a safer bet.

Here's where the shale and tight plays are in North America, so watch where your explorer is exploring...



Selected North American tight oil & Shale plays

More specifically, this map shows basins, currently targeted unconventional plays alongside prospective plays:



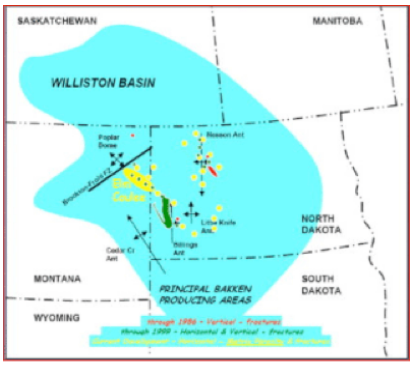
Currently targeted vs prospective unconventional plays

Globally, the unconventional set-up looks like this:

Source: Wood MacKenzie. Resource Potential is a measure of the play if all the accessible and prospective land is drilled up and produced based on a reasonable assumption of well spacing. Country-level estimates only inlude plays covered in Wood MacKenzie's Unconventional Play Service

In terms of conventional plays, there are a number of plays to consider in North America, and this is certainly not an exhaustive list:

- Western Canada, with most conventional output currently coming from the Western Canada Sedimentary basin, which covers most of Alberta, Northeast British Columbia, southern Saskatchewan, and parts of Manitoba and the Northwest Territories.



- The Willison Basin, Saskatchewan's portion, has some junior explorers promising to drill conventional wells for as low as $500,000 (which is extremely attractive when oil prices are low).
- The giant Permian Basin in Texas has always been the conventional oil poster child, and while horizontal drilling and fracking for shale oil and gas is gaining speed, the conventional vertical is still a major player.
- The Green River Basin--which includes the Great Divide, Vermillion and Washakie Basins in Wyoming and the Sand Wash Basin in Colorado—has a number of conventional oil and gas plays. This also includes the conventional Southern and Northern Uinta Basin plays.
- The Niobrara of the Denver-Julesburg Basin

(DJ Basin)—targeting Colorado, Wyoming and Nebraska—varies wildly, with multiple pay zones both conventional and unconventional.

- Paradox Basin, of Southeastern Utah and Southwestern Colorado, is largely known for conventional oil and gas plays.
- Like Niobrara, the San Juan Basin of Colorado and New Mexico offers a mixture of the conventional and unconventional oil and gas.

All About the Rock

Oil is a rather elusive thing. We won't find pools of it waiting for extraction under the surface of the earth. It's all about the rock; and even then, it is not visible to the human eye. So what do we look for in a precious rock?

Pores

- Pores are storage areas for oil—without pores, there can be no oil.
- Pores are invisible to the human eye, and cannot be seen without the aid of a microscope.
- The more pores a rock has, the more oil or gas can be contained within; the more pores, the better.
- Porosity, expressed as a percent, is the volume of rock that contains open space. The porosity of a rock is typically from 5% to 30%.
- High porosity does not necessarily mean there is oil and gas. Sometimes the pores in a rock are filled with water instead

Permeability

Pores and porosity alone are still not enough to determine which rock is the best rock. The pores in the rock must ***also be connected*** to allow for the flow of oil and gas. This connectivity between the pores is called **permeability**.

- Permeability allows oil and gas to flow from the rock
- A rock with low permeability means that oil and gas is more challenged in its flow
- Permeability is measured in millidarcys (thousandths of darcy). Darcy units have dimensional units in length.

Did you know…

More than 90% of original recoverable oil and gas reserves in the world has come from source rocks of six stratigraphic intervals:

- Silurian (9%)
- Upper Devonian-Tournaisian (8%)
- Pennsylvanian-Lower Permian (8%)
- Upper Jurassic (25%)
- Middle Cretaceous (29%)
- Oligocene-Miocene (12.5%)

Conventional Rock

The best rocks—that is, the most porous and permeable rocks—are sandstone and carbonate. These are both rocks associated with conventional oil and gas reservoirs.

Sandstone is a sedimentary rock made up of sand-sized grains of mineral, rock, or organic material, with the addition of a material that binds the grains together. Not only can sandstone serve as an oil and gas collector, but it can also serve as a groundwater aquifer. It can form under sea or land. Think of it as a hard sponge that can hold oil and gas.

Carbonate rocks are another type of sedimentary rock made up of carbonate minerals and classified either as limestone or dolostone. Carbonate can also form under sea or land.

Unconventional Rock

While not all rocks are equal, the shale revolution has made it clear that low-permeability and difficult accessibility doesn't always mean we're out of luck. This is where shale rock—and unconventional oil and gas--comes into play.

Shale is a fine-grained sedimentary rock made up of mud (clay minerals and tiny fragments of other minerals, largely quartz and calcite. In geological terms, shale is a 'mudstone', which is thinly layered.

- Approximately 70% of the earth's surface is covered by shale
- About 55% of all sedimentary rock is shale
- Limestone and sandstone are often found near shale

Black shales contain organic material that is often broken down to form oil or natural gas. When this oil and natural gas has moved through the shale sediment due to low density and becomes trapped in the rock above it (such as sandstone), this gives us our conventional reservoirs. But the oil and gas that remained trapped deeper down within the black shale was inaccessible to us prior to the technological revolution that led to the shale boom. This ushered in the rush to extract oil and gas from unconventional shale plays. The revolution debuted in Texas at the Barnett shale where the first major natural gas field in a shale reservoir rock was developed.

Oil and gas are held in "traps" within the source rock. The traps vary in complexity, from dome-shaped bumps to creases in the rocks or other manifestations.

- A structural trap holds oil and gas due to a deforming of the Earth. In other words, the earth has been bent in some way that that has formed a structural trap holding in the oil and gas.

- A stratifgraphic trap is one that has formed in place when sandstone or limestone has become enclosed in shale, which in turn keeps the oil and gas trapped within.

Now that we know WHAT to look for, we will move on to the other adverbial aspects of exploration: WHERE, HOW, and TO WHAT EXTENT.

Collecting the Clues: The Old-Fashioned Way

In the past, visible surface features provided initial clues to the location of hydrocarbon deposits. Geologists looked for visible indications on the surface that an area contains oil and gas deposits. These visible surface indications include:

Oil and Gas Seeps

These are the most visible signs of oil and gas. Oil and gas seeps are natural springs where liquid and gaseous hydrocarbons leak out of the ground, fed by the natural underground accumulations of oil and natural gas. When it leaks through to the surface of the earth, clear fluid oil turns into asphaltum—a tar-like substance. In this natural transformation process, the lighter components of the oil evaporate and what remains is a heavier oil that is sticky and black and often resembles pavement. Onshore, oil and gas seeps are immediately visible, but once we move offshore, finding them becomes extremely complicated. Combing an entire ocean for oil and gas seeps is not possible, but newer remote sensing technology can help pinpoint potential seeps and targets for exploration.

For underwater seeps, oil flows slowly up through networks of cracks in the seabed, with the lighter components of the oil rising to the water's surface and either evaporating,

CONVENTIONAL & UNCONVENTIONAL WISDOM

- The difference between conventional and unconventional oil and gas is simply a difference between the geological characteristics of the reservoir rock that contains them.

- Unconventional oil and gas includes shale oil and gas, tight oil and gas, and coalbed methane, or coal seam gas. The key difference between conventional and unconventional is the method by which they are extracted and the cost of extraction, with conventional being considerably cheaper and easier to extract.

- Conventional oil and gas is trapped in small, porous zones in natural occurring rock formations such as sandstones and carbonates. For a hundred years, until the advent of directional drilling and hydraulic fracturing that led to the shale boom, exploration and production were all about the conventional plays. The technological revolution made it possible to access commercially viable volumes of tight oil and gas and shale oil and gas. These are resources that are trapped in very low-permeability rock and ultra-compact structures that limit the **ability of the hydrocarbons to migrate upwards.**

- The revolution turned the unconventional into the conventional—but in times of falling oil and gas prices, the conventional again becomes attractive.

becoming caught up in ocean currents, or falling to the seafloor.

Pockmarks

Pockmarks are craters created by escaping oil or gas on the seabed. More specifically, they are caused by gas and liquids erupting and streaming through the sediments, leaving a crater on the floor of the water. This is traditionally a visible sign only offshore; such pockmarks are very rare on land.

> Geologists study rock formations and physical properties of the earth's crust
>
> Geophysicists use scientific and mathematical principles to study the interior of the earth and the oceans, ground, surface water, the atmosphere, and the magnetic, electrical, and gravitational forces

Geologists today no longer have to rely on their own ability to divine oil and gas. Now we have seismic imaging and unbelievable supercomputers—the miracles of modern technology.

If visible surface indications were the Genesis of exploration, new technology is the Revelation. Nonetheless, all exploration starts out with what the geologist can actually see—even if the end game is seismic and one for the geophysicist.

And if they can't see from where they're standing, satellite images and aerial photography are basic tricks of the trade.

- Satellite Images: A geologist will notice certain topographical features on the surface of the earth that will indicate what could lie beneath the surface.
- Using aircraft to measure the gravitational pull over a specific area: Gravitational differences can be indicators of rock density and in turn of the potential for oil and gas to be trapped beneath the surface.

The Technology Behind Today's Exploration

Today, oil and gas exploration is all about geological mapping by way of some very advanced technology that provides key geological data and analyzes that data in order to identify potential source rocks as prospective oil and gas deposits.

While seismic surveying is the primary method of exploring today due to massive advancements in this field, the first step often includes gravity and/or magnetic surveys over areas that are thought to contain hydrocarbons.

- Gravity Surveys: Highly sensitive gravity meters can measure miniscule changes in the earth's gravitational field, and these changes sometimes indicate that oil is flowing.
- Magnetic Surveys: Highly sensitive magnetometers can also measure miniscule changes in the earth's magnetic field, again possibly indicating the flow of oil.

If gravity and/or magnetic surveys detect large-scale features indicative of oil and gas deposits, then more detailed seismic surveys will follow.

Seismology—or seismic surveys—is the process of creating shock waves that are sent through unseen rock layers. When those waves are reflected back to the surface, they tell a story about the oil and gas that may be trapped in the rock. They tell a story because the reflections travel at different speeds and angles depending on the type or density of rock layers. The reflections are then detected through microphones or vibration detectors.

The shock waves can be created by *compressed air guns* for offshore exploration, in which pulses of air are shot into the water. They can also be created by *thumper trucks*, which slam heavy plates into the ground for onshore exploration. Finally, *explosives* are often employed for creating shock waves in both onshore and offshore exploration. Onshore, the explosives are detonated after being drilled into the ground. Offshore, the explosives are thrown overboard. The seismic readings reflected back are then analyzed by seismologists to determine whether they are looking at oil and gas traps.

Seismic imaging advancements help oil and gas explorers drill wells in optimum locations and to extract the maximum for the minimum costs. It has made finding a needle in a haystack a much more scientific endeavor.

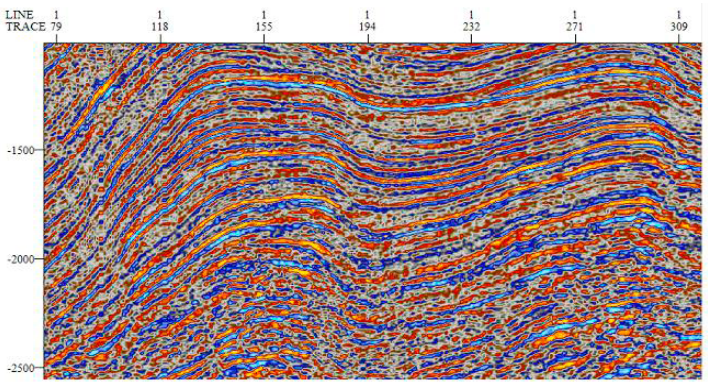
Seismic Rendering

- Geophone: A sensory device placed on the earth's surface to receive the reflected sound waves and translate them into electronic impulses
- Seismograph: The geophones send their translated electronic impulses to a seismograph, which amplifies and records the electrical signal
- Seismogram: The pictures produced by the seismograph—a two-dimensional picture of the subsurface

Seismic imaging, the pictures that come from seismic surveys, have seen significant advances over past decade. Not only do we have normal 2-dimensional seismic images to aid in the hunt for oil and gas, but we now have 3D and even 4D seismic imaging.

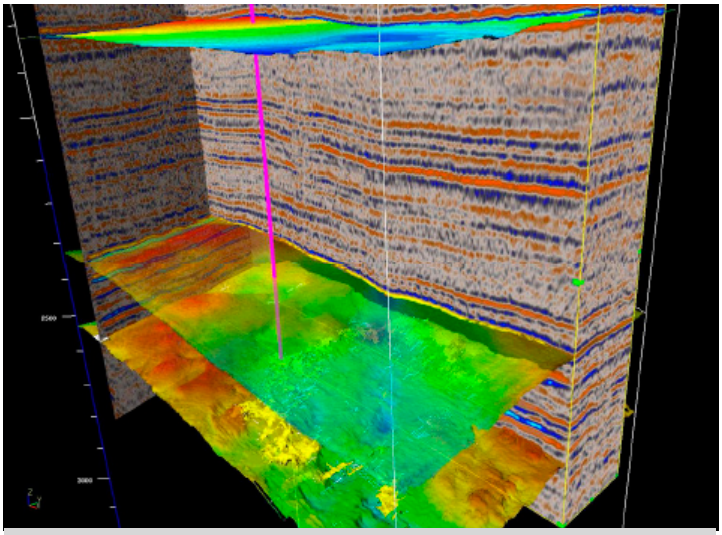
2D Seismic

- Imaging showing width and depth—a single slice of the earth
- Indicates types of rock, their relative depth, and whether an oil trap is present



3D Seismic

- Imaging showing length, width, and depth—in other words, it shows volume
- Data covering a 2-3 square mile area of the earth's surface
- 3D enables exploration data-gathering in areas with extremely deep and complex structures
- Provides more detailed stratigraphic information than 2D
- Is the preferred method today for seismic surveying
- For large companies exploring in ultra-deep waters or pre-salt conditions, 3D seismic imaging has transformed the industry and has almost sidelined 2D seismic over the past decade
- This is one advancement that has formed part of the foundation of the hydrocarbon boom
- Most of the larger, integrated supermajors have their own proprietary seismic imaging technology
- For larger companies who can afford it or who have their own technology at hand, 3D seismic has significantly lowered the costs of exploration and narrowed the time for making new discoveries



As Forbes has noted, this new technology "does for seismic the equivalent of going from 20th century x-rays to 21st century MRI

- It used to take years to process all the data obtained from a 3D seismic image; now sophisticated supercomputers analyze the data in a fraction of the time
- They can be conducted pretty much anywhere
- Obtaining 3D seismic imaging on a single square mile can cost anywhere between $40,000 and $100,000; but while 3D is more expensive, the costs are offset by the reduced drilling risk. Today, there is much less risk of drilling a dry hole thanks to these surveys.

4D Seismic

- This is where it gets really interesting by adding the element of TIME

Seismic Value, Seismic Secrets

Seismic data is extemely valuable. As such it is considered a trade secret, protected from disclosure. It is lecensed, bought and sold by seismic survey companies, brokers and exploratoin companies

- 4D seismic shows a 3D volume at different times in the life of an oil and/or gas field
- Decodes a variable that allows oil and gas companies not only to determine the geological characteristics of a potential source, but also provides insight into how a reservoir is changing LIVE, in real time

The Final Phase: From Seismic Road to Discovery

Once a prospect has been identified through the collection and analysis of seismic data, the next step is to drill an exploration well. This is where exploration finds its conclusion—and where the investor level of anxiety reaches its maximum. This is where you find out whether all the money spent on exploration was worth it.

The term ***exploration well*** can be confusing for both veteran and new investors. It is often used as a generic term to refer to two different varieties of well: wildcat wells and appraisal wells.

This is an extremely important distinction for the investor. An appraisal well may be a secondary well used to further determine the extent of a discovery made by a wildcat well.

Defining the Staging Ground

- Dry hole: A well bore comes up dry; i.e. does not contain commercial hydrocarbons
- Lead: A potential accumulation that remains poorly defined and requires additional data acquisition or analysis before it can be classified as a 'prospect'
- Prospect: A lead which has been evaluated to the extent that it can be considered a viable oil and gas accumulation venue
- Play: An area in which hydrocarbon accumulations or prospects of a given type occur. Basically, a large area of prospects.

- A ***wildcat well*** is the very first well drilled on a new prospect—but one that has been clearly defined in terms of geology as an oil and gas prospect, but which lies outside of known oil and gas fields. (In a subsequent Special Report we will tell you everything you need to know about wildcatting).

- An ***appraisal well*** is a well that is drilled to determine the extent and size of a discovery made through seismic imaging; in other words, to assess the characteristics of a proven hydrocarbon deposit.

Exploration wells can also be:

- A well drilled to find oil or gas in an area that was previously considered unproductive

- A well drilled to find a new reservoir in a known field

- A well drilled to extend the limit of a known oil or gas reservoir

For the purposes of these reports, we are not talking about an exploration well drilled solely for the purpose of gathering additional geological data, and we will refer to this going forward as an "exploratory well".

Maersk Drilling explains its exploration process as follows:

1. Send a mobile drilling platform to the site to obtain a core sample
2. Geologists analyze the core sample for signs of petroleum
3. The exploratory drilling rig will typically drill several temporary wells, each taking a few months to complete
4. A positive find ("a show") is followed by more exploratory wells to verify the quality before taking next step
5. The next step is drilling a much more elaborate production well

Drilling an exploratory well involves sinking a drill string into the ground and injecting mud that allows fragments of rock and samples of gas to be brought to the surface. Boreholes are drilled in multiple locations in order to delineate the potential oil or gas deposit.

Until the exploratory well is drilled, there is really no way of knowing with 100% certainty that there is oil or gas at a specific site under the surface, though seismic imaging will have narrowed it down significantly.

Part II: What Investors Need to Know

Cost, Cost, Cost

Oil exploration is expensive and risky, but it can also be very rewarding. Cost is an area where many investors have difficulty properly weighing decisions. Before you attempt to evaluate the cost of exploration, here are some key things to consider:

- Offshore exploration is significantly more expensive than onshore.

- For deep water exploration, you'd primarily be looking at investing in a large, integrated company for whom the drivers of growth may be difficult to determine.

- An offshore well can cost $30 million to drill, but costs range anywhere from $10 million to $100 million depending on location and depth, with ultra-deep wells often topping $100 million.

- A junior E&P may be able to drill a conventional well for as little as $500,000 in some cases, with the average onshore well running about $4 million.

- Because of the high costs of drilling wells, the companies that spend the most on exploration data—particularly seismic 3D—will ultimately end up the winners because they will have a much better chance of hitting oil with their first well.

- There are advantages and disadvantages—aside from cost—to both onshore and offshore exploration. Onshore drilling is more flexible: If, say, oil and natural gas prices are low, they can just stop new drilling until the market settles down. Offshore is an entirely different story, which further varies between shallow to deep water. Drilling in the deep takes a lot longer, which means long-term contracts that cannot simply be canceled due to fluctuating prices.

Exploration Licenses in the United States

In the United States, most onshore oil and gas rights are owned by private individuals, which means that companies must lease exploration rights from the individual owner. The lease will be based on terms negotiated by both parties—a scenario that is rather unique to the United States. Elsewhere, petroleum resources are owned by governments, in which case companies must negotiate with the government—usually the country's oil ministry—of the country in question to obtain an exploration license.

Exploration Licenses Outside the United States

The first step to exploration outside the United States is to obtain a license from the government in question. This is generally obtained through a licensing round in which bidding is used to pump up the value of the potential prospect. The company or joint venture offering the best term wins. Once a company wins the exploration license, seismic scanning of the subsurface begins, typically using 2D and/or 3D seismic imaging technology. This is complemented by regional geological surveys and additional geological data from neighboring drilling sites. (We'll take you through the ins and outs of international exploration and production in a subsequent special report.)

Geological Cheat Sheet: What to Look for

If you want to bet on an exploration gig, there are five key things you will want to consider in terms of the geology of the prospect in question. If any one of these elements is missing, you will come up dry:

Source Rock

You need source rock. There are no hydrocarbons without source rock. Source rock is what you get when organic-rich rock (oil shale or coal, for instance) undergoes natural high pressure and temperatures over a long period of time, in the process forming hydrocarbons. In other words, source rock is a rock with organic materials that if heated sufficiently will produce hydrocarbons.

A Permeable Reservoir

The source rock will be contained within a reservoir, typically of porous sandstone or limestone. Thus, a reservoir is a subsurface body of rock that has sufficient porosity and permeability to store and transmit fluids. In other words, the reservoir must have a high enough permeability for the oil and gas to flow to the surface.

Migration

The oil and gas must be able migrate out of the source rock and into the reservoir rock, towards the surface. The right geological conditions must exist for this to happen. This means it has to be able to be lured out of the source rock. Either they migrate as oil seeps or they get trapped somewhere along the way.

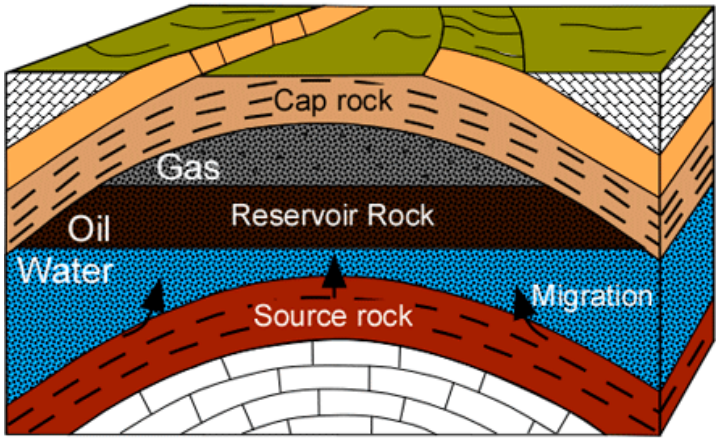
Trap

The oil and gas have to be trapped within a structural or stratigraphic trap, otherwise they can never be pinned down and found or extracted

Cap Rock (Seal)

There must be a layer of cap rock covering the trap. Cap rock is naturally impenetrable for the oil and gas, meaning that it cannot escape the trap.

If any one of these geological conditions is missing, you won't find any oil or gas, and your exploration efforts will fall flat. While no one expects an investor to be an expert geologist, these top 5 geological preconditions give you an idea of what to ask management before you invest.

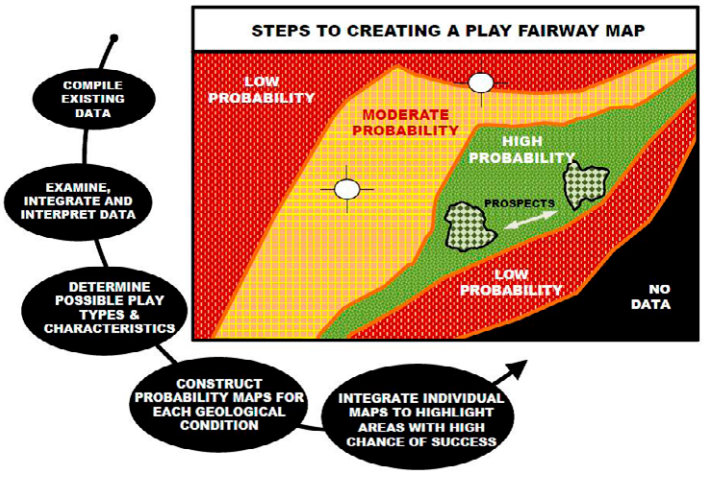


Anticline Trap

Play Fairway Analysis

In the exploration process, ask to see a Play Fairway map, which expresses the level of confidence in the five geological factors using colors.

Green = high confidence / Red = low confidence



Part III: Risk & Reward

- In terms of risk, this is what you need to know before you take the plunge:
- Oil and gas exploration is a high-risk investment
- It requires making decisions under a great deal of uncertainty
- There is no way to know whether oil and/or gas exists without an exploratory well
- Though the exploration prospects may sound exciting, keep in mind that on average, only 1 out of 7 exploration wells is successful
- Even if a company spends $1 million plus on exploration, they may not have the funding the drill production wells and get the oil and gas out of the ground
- Companies can spend millions of dollars to purchase a lease and then to explore and develop it, only to find that it does not contain oil and natural gas in commercial quantities. It is not unusual for a company to spend in excess of $100 million only to drill a dry hole
- In some cases, if exploration is successful there may be lengthy delays in developing and producing a prospect if there is any difficulty in obtaining the necessary permits, environmental studies, or in building the necessary infrastructure

Companies reduce exploration risk by:

- not putting all their investments into a single prospect
- sharing prospects with other companies through multiple joint ventures

- reducing capital expenditures through farm-in agreements, which allow other companies to buy into the joint venture in return for a drilling commitment

- exploring very close to existing, producing oil fields, where infrastructure is already in place in the event of a discovery, thereby reducing costs (this is what the juniors will do, while the supermajors can afford to risk exploration in remote areas and offshore, but for bigger potential rewards)

When To Take the Plunge

You don't have to invest in an oil explorer at the start of the game; you can size up how things are going and with basic knowledge of how it all works now, you can decide when it would be best to invest. Timing is everything; still, no one can tell you when to get in on the game.

1. With junior companies, it usually works like this:

2. The explorer foots the bill to shoot seismic imaging.

3. If that seismic indicates the area could be an oil and gas prospect, the company will start looking for investments to fund the drilling of an exploratory well.

If the exploratory well in turn shows high potential, the modus operandi of a junior company is to look for a bigger company to buy it out. While the bigger company will step into produce, the junior company moves onto another exploration project, as we noted in our previous special report.

There is no simple mathematic equation to help you make the decision about when to jump in on an exploration project. For prospects that turn out to be a great discovery, hindsight will tell you that it was best to get in on the ground floor when they begin shooting seismic. But hindsight is hindsight, and all we have is a gamble. With an industry success rate of only 1 in 7 exploration wells, the safe way to play it is to wait for a company to strike commercial quantities of oil. But by then, it's really too late. The deal time is over.

The road to riches, unfortunately, is the one less taken. For junior explorers, this means finding a new play before it becomes exciting. This is where the money is made, and for the investor, it means putting your money out there long before a discovery is made.

Exploration Management

There are hundreds and hundreds of junior oil and gas explorers out there. They are all competing for the next best play, and they are all trying to find it before the supermajors sniff it out. The only ones who will succeed are those with exceptional management.

As an investor, almost before anything else, you should look at a company's management, individual by individual. Make sure they have a solid track record that shows exploration potential. What you're looking for are individuals who can demonstrate a keen ability to balance risk with reward, a balance-sheet vigilance, and a knack for finding new exploration opportunities that stand out. These will be the kind of people who are intuitive: identifying trends before they are trends.

Without exceptional management, exploration will be a flop regardless of the geology.

Coming up next …

Our next special report will be a guide to DISCOVERY—a road littered with highly nuanced catch phrases meant to throw an investor off track and lure him into the fold without knowing what he's really getting into. When a company announces a discovery, reading between the lines and understanding the terms for what they really mean dictates your bottom line.

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