

## OPEC, Oil Prices, Innovation, Global Impact...

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Thank you, Farah and World Affairs Council, for including me on this esteemed panel. I am also very thankful to all you for giving me your time and I hope to provide you with some insights that will make it all worthwhile.

I joined the oil industry in 1981. The price of West Texas Intermediate was about \$34 per barrel or about \$110 in today's terms.

During the fourth quarter of 1981, economists, banks, oil companies, analysts were forecasting 50% to 200% increase in oil prices; except Hughes Tool Company, whose contrarian opinion was that oil prices would remain flat.

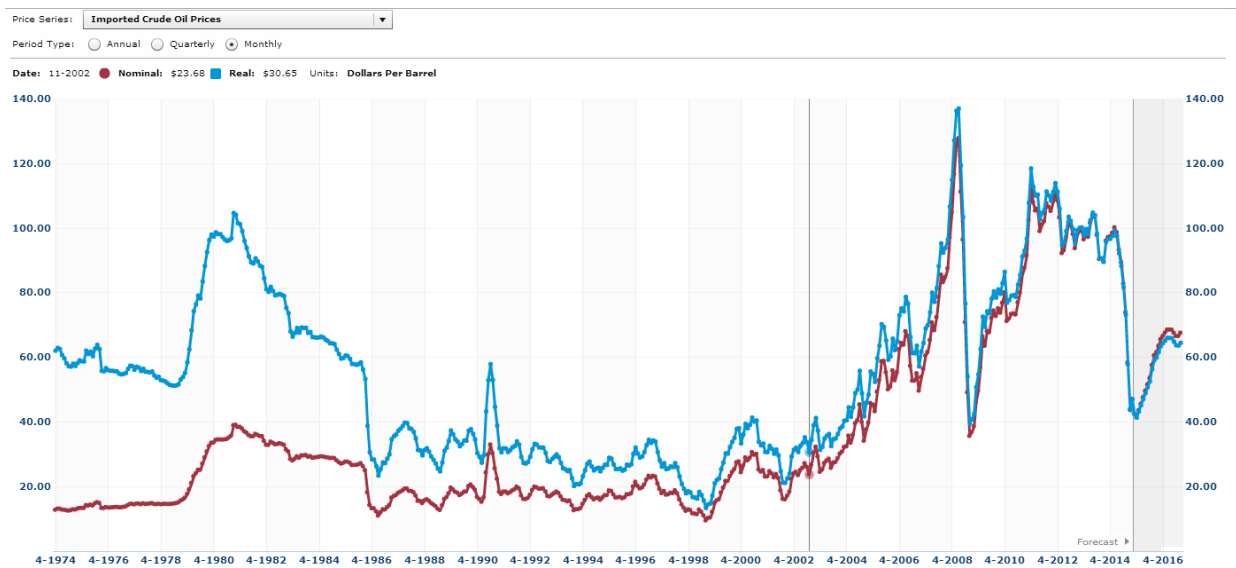
By May 1982, oil prices had dropped to about \$24 per barrel.

Pandemonium broke out. Rig counts dropped and people were laid off. I lost my job too. (A year later, I landed on my feet but that story will come later.)

I was a Business Analyst then and it was my job to analyze various macro- and micro-drivers of the upstream oil and gas business. Oil Price was at the top of the list and since that job loss, I have not taken my eyes off that ball.

Over the last thirty-five years or so, I learned that oil prices that grab headlines and our attention, are short term phenomena.

We pay attention to them when they abruptly change direction. However, when prices reach a predictable steady-state, we walk away to the next best attention-grabber, only to be woken from our slumber by another change in direction.



Source: EIA: Imported Crude Oil Prices, US\$/Barrel; Nominal and Real

I also learned that our collective memories disappear every thirty years or so.

So, I thought I'd share my thoughts about our current situation and where we go from here, drawn from a combination of theory, practice and some pattern recognition.

## The Rest of the Story

There are broad areas that affect oil prices: Borrowing from traditional economics—Demand and Supply; actually, the difference between Demand and Supply. Higher the difference, the lower the price; conversely, lower/tighter the difference, higher the price.

Additionally, we have other factors that affect oil prices, such as the strength of the US Dollar, Government Regulations and other factors *du jour*.

**Global demand** for oil is not going diminish in the next 25 years, when the world population is expected to be about 9 billion (7 Billion today). As the global population grows and more countries seek to fuel their economic growth, the demand for energy grows.

ExxonMobil in its 2015 Energy Industry Outlook estimates that, despite the best of conservation efforts and alternate fuels hitting the market, demand for energy will grow by 36% from 2010 to 2040. For the same period, the outlook suggests that oil demand will grow by 28% and demand for gas will grow by 63%.

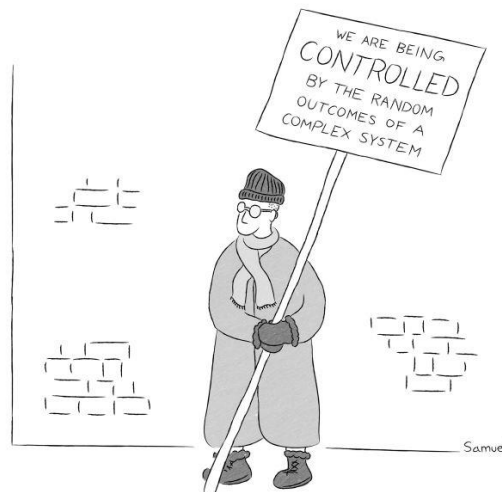
So the good news is that the global economy will grow over the next twenty-five years.

Today's assumption is that the world economic growth will chug along at a steady rate, supported by to lower oil and energy prices.

In reality, the global economy has micro-constituents, some more powerful than others that can cause perturbations in GDP growth.

Similarly, on the **supply** side there are thousands of micro-constituents; some more significant than others. Like demand micro-constituents, they too have inter-relationships and dependencies that are complex at the micro-level but on an aggregate level behave consistently.

Besides the presence of hydrocarbon basin and reservoirs in the earth, the supply-world is driven by different motivations—some by national interests, other by forces of free enterprise, and still others by both. Since energy is crucial to economic growth, suppliers are also driven by power: political, sectarian, territorial, grandeur and others.



Courtesy: The New Yorker

However, amongst all of these, suppliers—countries, private enterprises—with the best balance sheets win.

The marginal producers do well during periods of oil price growth, funded by opportunistic investors. Then, when a correction occurs, in a period of frenzied activity, they try to produce as much cash as possible to reduce the drain from their and their investors' coffers and treasuries.

The smaller free-enterprise supply micro-constituents hang on to their assets as long as they can, until it is unprofitable to produce that next barrel of oil from existing producing wells.

Today, oil prices have to drop to this level to shut in production and reduce supply, if indeed that is the objective behind OPEC's recent supply machinations.

Additionally, these prices have to stay below these levels for a sustained period of time to prevent a quick bounce back from shuttered talent, service and equipment infrastructures.

**Oil demand & supply balance** is like the human body, a system of innumerable micro-constituents that are always in a fine balance.

Except, this industrial body is on a tightrope. A slight variation yields a compensatory variation to regain that balance, except that this reaction can be exaggerated, creating large swings in oil prices, in either direction, high or low.

During these periods of high or low oil prices, innovations are equalizers and stabilizers.

During high price periods, the oil industry invests in and uses technologies that help find and produce from more difficult reservoirs, at the lowest risks in investments, people, property and environment. During price upcycles, the industry invests in technologies that turn previously marginal fields into prolific ones.

During the 1970s, complex and expensive technologies, such as offshore drilling and production became attractive. Protected by the OPEC's umbrella of high oil prices, activity in the Gulf of Mexico and the North Sea took off, leading to an Innovate-Apply-Learn cycles that drove operating prices down.

Likewise in the 2000s, it was the high price of Natural Gas that made exploiting shale gas attractive, despite the associated high costs. Again, it was the Innovate-Apply-Learn cycles that made un conventionals attractive.

The serendipitous discovery of wet, tight gas, where oil could be produced from shales was the unexpected reward. Previously, it was assumed that oil's molecule was too large to be produced through the low porosity and permeability environments of shales.

Three major innovations made the shale revolution possible: Logging-while-Drilling (LWD), without which horizontal formation evaluation and drilling was not possible; 3D Seismic Interpretation and Visualization, without which you couldn't pinpoint, estimate and produce from these reservoirs; and Hydraulic Fracturing or Fracking, without which these formations could not be perforated for production for a sustained periods.

Hydraulic Fracturing has been practiced since the 1960s but for recompleting old wells.

However, LWD and 3D Seismic Interpretation were birthed and commercialized during the 1980s, when the US Rig Count dropped from over 4500 to below 700.

One the pioneers of LWD was Sperry-Sun Drilling Services and I was the first Marketing and Business Development Manager for commercializing that technology.

Why was the technology successful? Because, the demand for oil and gas is insatiable in a growing economy, and oil companies still needed to find and produce hydrocarbons, in this low oil price environment, meeting expectations in financial returns.

Additionally, Sperry-Sun's technology was far superior to existing alternatives: Its formation evaluation tools found hydrocarbons that were overlooked by existing technologies; it contributed to increased safety, borehole integrity and better directional drilling.

These were compelling incremental benefits that far outshone the competition. It always helps to be better in important ways.

Flash forward to a few years later. I was employed by Landmark Graphics Corporation, the pioneer in 3D Seismic Visualization and Interpretation.

Before Landmark, Geoscientists used 2D Seismic data to discover potential reservoirs.

Here is an analogy: 2D Seismic was like taking slices of black and white X-Rays to reconstruct the human body and diagnose anomalies.

Landmarks solution was like an MRI, except much better. It combined the power of the most powerful computing hardware, software and 3D visualization, and brought it to the desktop.

2D X-Rays were replaced by 3D MRIs.

Here too the market drivers were the same—the need to find and produce new hydrocarbons in low oil price environments, with the most promising returns. Again, Landmark was successful because it was far superior to existing alternatives.

Operators' success rates improved significantly, with fewer “dry holes.” Operators drilled fewer wells and placed them accurately to significantly improve their returns, even when oil prices were declining.

Today, we are in another downcycle. The firms that will be successful in today's low oil price environment are the ones that embrace the motto—Absorb the Pain; Position for Gain!

The media makes sure that we hear about the effects of the “Absorb the Pain” tactics. Those are headlines every day, which can be depressing.

However, we don't hear about the firms and technologies that are on the horizon that are “positioned for gain”. These are kept close to the vest but be assured that these are at play. I am optimistic about them.

I came to Houston in July 1978. OPEC in its aggressive wisdom had steadily raised oil prices, Iran was in turmoil, and the world was in deep recession.

I was in an Economics class taught by the brilliant developmental economist, Dr. Thomas DeGregori. Smart man. His classes were a hoot and this engineer learned a lot from him.

Foremost was the statement that went something like this, “We will have a true oil crisis driven by a shortage of supply, when we, collectively, have a shortage of what lies between our ears—in our brains! There's no limit to human ingenuity!”

The past four decades in the oil and gas industry have proven Dr. DeGregori right, over and over, again and again.

Summary:

1. Global demand for oil & gas will grow over the long term.
2. The industry is a complex system on a tightrope, where slight perturbations in demand or supply create price fluctuations.
3. When prices are high innovations that increase production kick in.
4. When prices are low, innovations that reduce cost are attractive.
5. Today, the industry's focus is on absorb the pain.
6. Position for gain is also active but kept under wraps.
7. There are no limits to human ingenuity.

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