



# Making Strategic Finance Decisions in a Volatile Oil Market

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The oil and gas (O&G) industry has recently seen incredible volatility in oil prices. Large price swings, especially those due to geopolitical and macroeconomic events, are difficult to predict. As such, O&G modeling faces a challenge not seen in other industries. Financial modeling with unknown inputs is difficult, and answers provided by models may be inaccurate when inputs fall outside of consensus estimates. It is necessary to be able to calculate bottom line impacts on a company given a variety of different assumption changes within a model.

## The Uncertainty of Oil Prices

Due to the uncertain and volatile nature of oil prices, companies and organizations have difficulty making accurate oil price forecasts. The U.S. Energy Information Administration (EIA) is a governmental agency responsible for gathering, analyzing, and distributing energy information to the public. The EIA publishes a monthly report, the Short-Term

Energy Outlook (STEO), which forecasts current and future year oil production, consumption, and price, as well as a variety of other factors. In analyzing historical STEO forecasts, one can examine how close EIA price forecasts were to actual oil prices.

2014 exemplifies the difficulties that the EIA has in forecasting future oil prices — in the 2014 July - October STEO reports, 2015 forecasted oil prices fluctuated between \$102 to \$105. However, in the November and December 2014 STEOs, 2015 price forecasts were slashed to \$83 and \$68, respectively.<sup>1</sup> These changes represent a 33 percent decrease in forecasted oil prices over a two month period. Though the agency took note of strong production and soft demand in the lead-up to the November report, the magnitude of price decline was severely underestimated until that report.

The EIA is not the only governmental agency to have severely underestimated the amount that oil prices would fall. In October 2014, both the World Bank and the IMF issued 2015 forecasts above \$96 a share.<sup>2,3</sup>

1. U.S. Energy Information Administration. "U.S. Energy Information Administration Short-Term Energy Outlook" (various issues). <<http://www.eia.gov/forecasts/steo/outlook.cfm>>
2. World Bank Group. "Commodity Markets Outlook." October, 2014. <[http://www.worldbank.org/content/dam/Worldbank/GEP/GEPcommodities/commodity\\_markets\\_outlook\\_2014\\_october.pdf](http://www.worldbank.org/content/dam/Worldbank/GEP/GEPcommodities/commodity_markets_outlook_2014_october.pdf)>
3. International Monetary Fund. "World Economic Outlook." October, 2014. <<http://www.imf.org/external/pubs/ft/weo/2014/02/pdf/text.pdf>>



Private banks have also made large changes to their forecasts — during the latter half of 2014, Citigroup, Goldman Sachs, and Morgan Stanley cut 2015 price forecasts by an average of 31 percent, and 2016 price forecasts by an average of 14 percent.<sup>4 5 6</sup>

A company relying on these short term forecasts for estimating potential project profitability would likely no longer be able to rely on its analysis. In reality, any O&G company trying to plan projects with unstable oil price assumptions faces a large challenge. Decisions to undertake or forgo a project during periods of oil price swings can easily lead to a loss of profit or failure to commence a profitable project. Additionally, if enough money is lost, funding sources may need to be utilized and performance targets may not be met.

While 2014 exemplifies the difficulty of accurate forecasting, severe overestimates and underestimates are not unique to 2014 alone. Figure 1 is a chart of historical real (adjusted for inflation) prices of oil and various historical EIA forecasts. Each red line is representative of the future annual EIA oil price forecast made in the prior year. Generally, oil forecasts are heavily influenced by the price of oil at the time the forecast was made; forecasts rarely predict large price volatility. The one year forward forecasts shown in Figure 1 were off by an average of 41 percent.

Dramatic swings in oil have become much more common over the last 15 years, with price movements of 20 percent in the span of several

months a common occurrence. As these swings become more regular, oil price forecasts will more regularly be inaccurate.

Geopolitical and macroeconomic events have heavily influenced oil prices in the past and it may be irresponsible to assume that they will no longer do so. Many of these events are impossible to predict. While military conflict and cyclical growth and recession will occur again, the timing and severity of these events is difficult to foresee. Some events that may possibly occur in the future include:

- Further unrest in the Middle East and continuing economic difficulties in Former Soviet Union countries will disrupt near-record production levels, leading to a lack of supply and an increase in price. Both Russia and Iraq are currently producing oil at levels not seen since the 1980's; political unrest could threaten these production levels.
- Military conflict in Libya is resolved and fiscal problems in Iran cause the government to back

4. Angela MacDonald-Smith, "Citi Slashes Profit Forecasts for Oil Producers," Sidney Morning Herald, January 8, 2015. <<http://www.smh.com.au/business/mining-and-resources/citi-slashes-profit-forecasts-for-oil-producers-20150108-12jyv2.html>>

5. Aaron Sheldrick, "Goldman Slash 2015 Oil Price Forecast as Glut Grows," Reuters, October 27, 2014. <<http://www.reuters.com/article/2014/10/27/oil-forecast-goldmanidUSL4N05M08A20141027>>

6. Katy Barnato, "Oil Prices Tumble Further after Morgan Stanley Cuts Forecast," CNBC, December 8, 2014. <<http://www.cnbc.com/id/102247766>>

down from nuclear ambitions, resulting in the lifting of oil sanctions. Libya is likely producing between 130,000 - 350,000 barrels per day (b/d), well below the 1.6 million barrels per day (mb/d) produced while Muammar Gaddafi was in power.<sup>7</sup> As a result of Western imposed sanctions, Iran is estimated to be exporting around 1.1 mb/d, more than a 50 percent decrease from the 2.5 mb/d exported before sanctions were imposed.<sup>8</sup> If oil production in either country returned to historic levels, global oil supply would be materially increased.

- A combination of increased U.S. oil regulation and sustained downward pressure on oil prices from OPEC forces U.S. defaults, resulting in diminished production. In fact, this seems a quite likely scenario as the Obama administration has committed to increased oil regulation by the end of term, and many sources reporting Saudi Arabia appears committed to keeping production high in order to gain market share.

While global events have always caused swings in oil prices, the last decade has seen more volatile oil prices than historically. Many economists have speculated that this volatility level is the new norm. Reasons the price of oil may be more structurally volatile now than previously before include:

- Consumption growth is now driven through emerging economies, which have more volatile growth than mature economies. While the period of 1985 to 2005 saw steady consumption growth of roughly 450,000 b/d annually by OECD countries, consumption growth has been steadily decreasing since. According to the EIA, consumption declined so rapidly after 2005 that oil consumption actually declined between 2000 and 2010, compared to a 40 percent consumption growth in non-OECD countries.<sup>9</sup> Less stable political situations, less defined economic policies, and more variable GDP growth are all factors that make oil demand from emerging economies more difficult to forecast than that of advanced economies.

- Technological advancements continue to improve methods of oil production, making future supply more difficult to forecast. Tight oil well development, for example, has rapidly increased oil production within the United States. In 2012, according to a Harvard University Discussion paper, at least 4,000 new tight oil wells were developed in the U.S. alone, compared to less than 4,000 wells of any kind globally outside the U.S.<sup>10</sup> U.S. tight oil production has grown to nearly 4 percent of total global oil production in 2014, while in 2011 U.S. tight oil accounted for just 1 percent of global supply.<sup>11</sup>

## Necessary Modeling Components

Understanding that oil prices will swing in unexpected directions outlines the difficulty that O&G companies have in financial planning. Creating a financial model that can incorporate unpredictable inputs is a difficult process that requires both upfront thought and capable professionals. The best method for mitigating this unpredictability is by relying on experienced personnel to build and use models that are dynamic, as the ability for models to quickly and accurately respond to changes in baseline assumptions is essential.

While every company is unique, all financial professional and executives share the need to distribute common outputs to investors, lenders, governmental agencies, other stakeholders, and internally. At a minimum, a model should have the ability to forecast.

7. Ayman al-Warfalli. "Libyan Oil Output Shrinks More as Oil Tanks Blaze." Reuters. December 29, 2014. <<http://www.reuters.com/article/2014/12/29/libya-security-oilidUSL6N0UD15Z20141229>>

8. Indira Lakshmanan & Anthony Dipaola. "Growing Iran Oil Exports Challenge U.S. Nuclear Sanctions." Bloomberg. June 12, 2014. <<http://www.bloomberg.com/news/2014-06-12/growing-iran-oil-exports-challenge-u-s-nuclear-sanctions.html>>

9. U.S. Energy Information Administration. "Demand: OECD." <<http://www.eia.gov/finance/markets/demand-oecd.cfm>>

10. Leonardo Maugeri. "The Shale Oil Boom: A U.S. Phenomenon." Harvard Kennedy School. June, 2013. <<http://belfercenter.ksg.harvard.edu/files/draft-2.pdf>>

11. U.S. Energy Information Administration. "Tight Oil Production Pushes U.S. Crude Supply to Over 10 percent of World Total." March 26, 2014. <<http://www.eia.gov/todayinenergy/detail.cfm?id=15571>>

- **Earnings Per Share (EPS).** As one of the most, if not the most, important variables to investors, a model should be able to examine how possible company decisions impact EPS.
- **Cash Flow.** While cash flow is important for all companies, it has become especially necessary for O&G companies to have accurate cash flow projections. American O&G companies have increased debt loads by 55 percent since 2010, creating large debt payments that need to be serviced.<sup>12</sup> Because cash flow can be used to service debt payments, make capital expenditures, or for other strategic initiatives, it is important to have visibility into how a company's cash flow will change if inputs into the model change.
- **Credit Ratings.** O&G companies have heavily relied on debt to finance new projects. Yields on bonds have started soaring over recent months, with Bloomberg reporting \$27 billion of investment-grade energy debt now being treated as junk.<sup>13</sup> While rating agencies respond slower than the markets, it is almost certain that some bond issuances will be downgraded in the wake of the recent oil decline. As companies experience these lower ratings, they will no longer be able to receive the cash they once were for bond issuances, impacting the amount and size of new projects.
- **Financial Ratios.** Both internal and external stakeholders have uses for different financial ratios. A financial model should have the ability to forecast how each of these ratios changes given a decision made by the company.

Companies need to be able to forecast each of the preceding model outputs for distribution and planning purposes. Creating a dynamic model that is able to incorporate the aforementioned price volatility gives financial professionals the ability to forecast each of these outputs. However, models must include the relationships that make them dynamic.

Bottom line company financials are inevitably influenced by strategic decisions; it is the underlying goal of financial models to provide insight on how

the company's overall financial position changes if a specific strategic decision is made.

And while this may not be difficult with a static external environment, O&G companies cannot rely upon oil price forecasts to derive reliable revenue estimates. Keeping that in mind, strategic decisions a company may utilize and are necessary to analyze include:

- **Project Initiation and CapEx.** With well development being the largest cost for O&G companies, it is important to have a firm grasp on what oil price makes a given well or field have a positive net present value (NPV). As roughly 90 percent of project costs occur after final investment decision (FID), finance departments need to calculate the profitability levels of wells in the future given base, best, and worst case scenarios, well before FID occurs.<sup>14</sup> However, tradeoffs between current and future profitability need to be taken into account as well. Any decision to delay or forgo a current project due to negative profits at current price levels leads to decreased production in the future, with a potential loss in market share and future profits.
- **Leverage.** As O&G companies have become increasingly levered, default risk and service costs have risen drastically. Debt issuances are necessary for investment in exploration and development in order to maintain asset bases, yet several companies have overextended themselves; one O&G producer has already declared bankruptcy in early 2015.<sup>15</sup>
- **Financing Considerations.** Future debt issuances may be limited to maintain compliance with

12. Erin Ailworth, Russel Gold, and Timothy Puko. "Deep Debt Keeps Oil Firms Pumping." Wall Street Journal. January 6, 2015. <[http://www.wsj.com/articles/deep-debt-keeps-oil-firmspumping-1420594436?mod=WSJ\\_hpp\\_LEFTTopStories](http://www.wsj.com/articles/deep-debt-keeps-oil-firmspumping-1420594436?mod=WSJ_hpp_LEFTTopStories)>

13. Sridhar Natarajan. "Oil Plunge Leaves \$27 Billion of Energy Bonds Junk Priced." Bloomberg. January 8, 2015. <<http://www.bloomberg.com/news/articles/2015-01-08/oil-plunge-leaves-27-billion-of-energy-bonds-junk-priced>>

14. Jeannette Lee. "Final Investment Decision: the Big Breakthrough." Alaska Natural Gas Transportation Projects. April 8, 2014. <<http://www.arcticgas.gov/final-investmentdecision-big-breakthrough>>

15. Terry Wade. "Tiny Texas Oil and Gas Producer Files for Bankruptcy Protection." Reuters. January 7, 2015. <<http://www.reuters.com/article/2015/01/08/wbhbkrptcyidUSL1N0UN01Z20150108>>

current debt covenants, and current issues may not raise as much capital as previous issues in an environment of declining yields. FP&A and Treasury teams have the need to comprehensively understand each facet of a new debt issuance in order to assist with raising funds for CapEx.

- **M&A Activity.** Deteriorating balance sheets provide an opportunity for strong companies to acquire weaker competitors. While making acquisitions may seem difficult and a nonpriority in a down-market, it could allow O&G companies to make strategic plays that broadly strengthen the underlying business. Finance departments and corporate development teams need to be able to quickly and effectively analyze the effects that possible acquisitions have on key metrics.

## Creating Dynamic Models

Calculating model outputs with both fluctuating model inputs and a variety of possible strategic initiatives requires specific model functionality. Because of the many unknowns that O&G companies face, models need to be more dynamic than those of traditional companies. Methods for making models dynamic include:

- **Scenario Analysis.** Scenario creation is the most important tool for making a model dynamic. Finance teams have insight into how the aforementioned outputs change in a variety of situations. However, while many finance teams perform base, best, and worst case oil price scenarios for the company, few have the ability to combine multiple scenarios to examine how a multitude of changes to a model impact the business. For example, models should be built so that it is both feasible and efficient to examine how a potential debt issuance affects service costs and capital structure given regulation changes and either best or worst case oil prices. Scenario combinations shed light on what different situations could occur that threaten the core business. Careful planning for a multitude of possible downsides hedges company risk.

- **Sensitivity Analysis.** Similar to scenarios, sensitivity analysis shows how outputs change given changes to base numbers. However, sensitivity analysis is stronger in analyzing the exposure of outputs to a given variable. For example, a company can calculate by what percentage Earnings Before Interest, Taxes, Depreciation and Amortization (EBITDA) will change at a range of oil price changes. For a company looking to mitigate risk by reducing the correlation between EBITDA and oil prices, more oil futures could be purchased or the amounts of oil futures sold when prices decline could be increased. Sensitivity analysis can be incredibly effective when combined with scenario usage. For example, a business could examine how sensitive revenue is to oil prices five years from today given a sustained environment of low oil prices and a policy of cashing in a high percentage of hedges. If the sensitivity analysis shows that revenue is too highly correlated with oil prices for that given scenario, the amount of hedges the company owns could be increased, or the company could implement a policy of cashing in fewer hedges, creating lower profits now for the benefit of lower exposure to prices in the future.

- **Monte Carlo Simulations.** While similar to “what-if” scenarios, Monte Carlo simulations allow for non-equal probability assignment to different outcomes. Instead of looking at a range of possible revenues between worst and best case oil price scenarios, Monte Carlo simulations use probability distributions to create tighter ranges of possible outcomes. Monte Carlo simulations are useful when probabilities of different scenarios occurring are not uniform

One very practical application of Monte Carlo simulations is in estimating oil prices. If, for example, production, consumption, and inventory supplies are selected as the three main risk factors to oil prices, probability distributions can be assigned to each risk factor and iterations of the Monte Carlo simulation run repeatedly. A different use of a Monte Carlo simulation could be used for project assessment, where the three main risk factors are production, OpEx, and CapEx.



Finance departments could run iterations of this simulation to determine likelihoods of barrel production and cost per barrel, and use these numbers to assess both profitability and risk under different scenarios.

- **Optimization Capabilities.** Optimization tools in a model help financial teams find solutions to practical questions. If the office of the CFO is deciding on amounts of CapEx to maximize profit for a range of future years, a model should be able to calculate the optimal investment. For O&G companies, optimization requires the use of multiple unknown variables and constraints.

Because of this, optimization is most suited to be run in conjunction with Monte Carlo simulations. Consider a more comprehensive example where a company has a range of possible projects to undertake, all with different possible returns and variances. The company has a limited amount of capital to use, and is looking for the combination of projects that can minimize capital spent and maximize returns, given minimum acceptable return standard deviations. By first using Monte Carlo simulations to determine estimates of possible returns and associated variances, optimizations can then be run that determine the projects that should be selected for investment.

- **Integration with Other Systems.** While not a forecasting tool, integration with other systems is essential in any financial model. It is important to recognize that financial models have limitations and they are not suited for many common O&G processes. Many estimates that are used in financial models come from petroleum engineers and economists who do not work with financial forecasting. These people use their own systems to obtain the most accurate estimates relating to their job functions, and it is their model outputs that serve as primary starting points in many financial models. To accurately and rapidly respond to changes in estimates, financial models need to be integrated with the source systems that non-financial personnel use.

## Conclusion

O&G companies face a unique challenge of having their main good sell at volatile and unknown prices. It is difficult to make strategic decisions in the face of this uncertainty. By making models dynamic, understanding the effects of various scenario combinations, and minimizing situations that present unacceptable downside risks, companies can realize benefits in an unstable market.

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