



Oil and Gas Exploration and Production

Blue team 12

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Executive Summary

The purpose of this report is to assess the net present value (NPV) of investing in a 15-year Oil and Gas Exploration Project starting in 2019, and to recommend Compagnie Pétrolière et Gazière company whether to make this investment. After considering drilling risk, dry-hole risk, production risk, and price risk and running 100,000 simulations, the median NPV of this project is \$195.78 million (Figure 1). There is 5% chance that the project will earn less than \$85.96 million. We are 95% confident that this 5% value at risk ranges from \$79.94 million to \$93.05 million. If this worst 5% scenario happens, the estimated return on average ranges from \$60.06 million to \$73.67 million. There is only 0.012% chance that this project loses money. At this time we recommend the company to invest in this project since the expected return is high and the probability of losing money is extremely low.

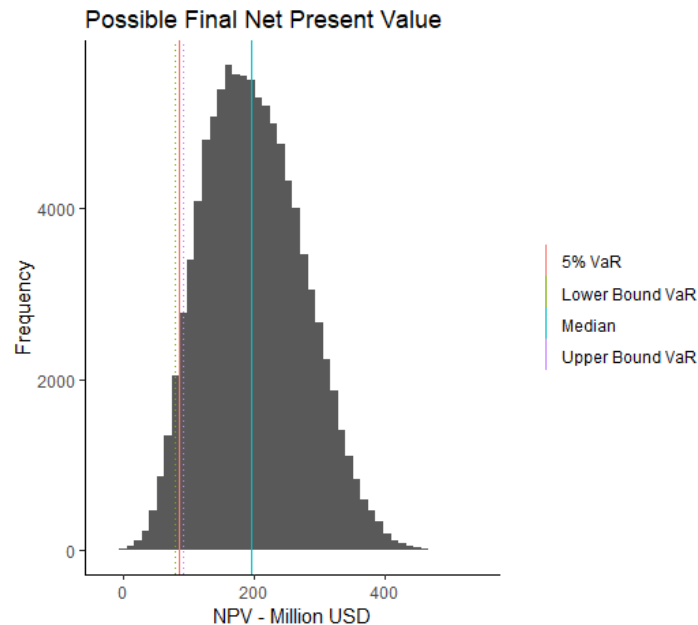


Figure 1.

Analysis

There are four risks involved to calculate the net present value (NPV) of this investment: drilling risk, dry-hole risk, production risk, and pricing risk. We have run 100,000 simulations which take these four risks into consideration in order to calculate the NPV of this investment.

Drilling cost was estimated using historical drilling costs for crude oil, natural gas, and dry wells from 1960 to 2007. With this data, the arithmetic return was calculated for each year. Years prior to 1991 were discarded due to changes in the drilling industry and 2007 was discarded as it was an outlier. The historical data from 1991 to 2006 was used to create a kernel density estimate to predict years 2006 to 2012. We believe using a kernel density estimate is a more conservative way to predict future drilling costs since its distribution has a larger range. For years 2012 to 2015 a triangle distribution was created with an average of -9.17% return, a maximum return of -22%, and a minimum return of -7% was used. For years 2015 to 2018 a triangle distribution was created with an average of 5% return, a maximum return of 6% and a minimum return of 2% was used. After running 100,000 simulations, the median cost per well drilled was \$3.48 million and 95% of wells cost \$6.89 million or less.

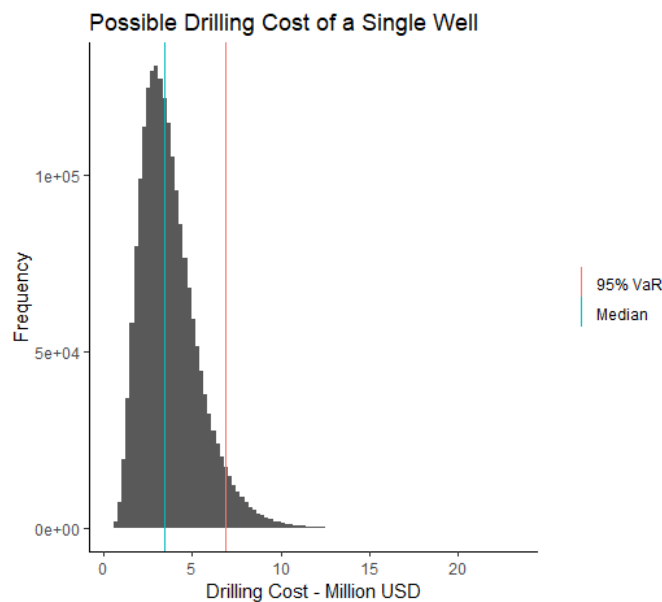


Figure 2.

The largest risk for the Compagnie Pétrolière et Gazière company is drilling a dry well as this event costs millions of dollars. The factors that go into a potential dry hole are as follows: hydrocarbons presence, structure, reservoir, and seal. The distribution for hydrocarbons presence and reservoir follows a truncated normal distribution with centers at 99% and 80% and standard deviations of 5% and 10% respectively. A dry well is either no hydrocarbons presence or no reservoir. The expected number of wells drilled followed a uniform distribution between 10 and 30 wells. The expected proportion of producing wells was determined with simulation that used a binomial distribution with the expected number of drilled wells and probability of a producing

well. Based on the 100,000 simulation, the median of the proportion of producing wells was 76.47% with a 95% chance that the proportion of wet wells would be more than 58% (Figure 3).

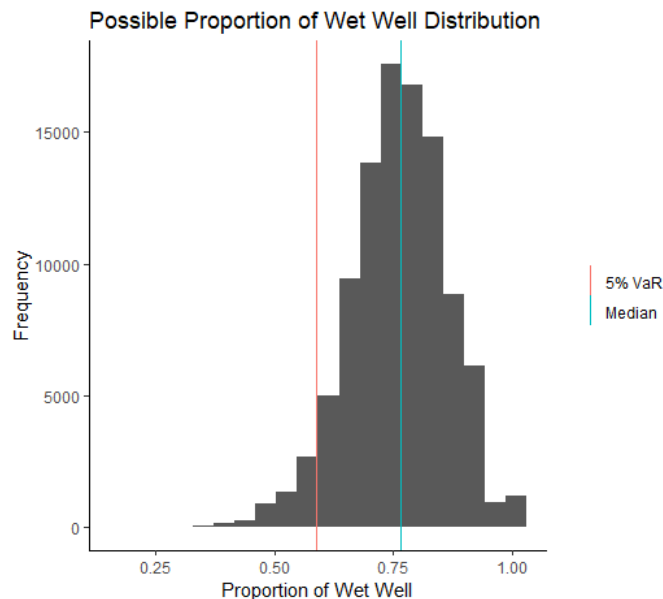


Figure 3.

Production and pricing risk were involved to determine the potential cost of a dry hole and to calculate the NPV of a wet well. Each well site incurs initial costs before oil extraction, regardless of having oil (a “wet” well) or not (a “dry” well). These initial costs encompass leasing land, seismic measurement, drilling, and professional overhead. If the well is determined to be wet, project engineers must set up the infrastructure needed to optimally extract oil. Oil production of a wet well was estimated in barrels per day, drawn from a lognormal distribution with a mean of 420 barrels per day and a standard deviation of 120 barrels. Production rate was expected to decrease annually at a constant rate, drawn uniformly from 15% to 32%. We assumed that production rate and the rate of decline were correlated with a coefficient of 0.64. As the production rate increases or decreases, the rate of decline tends to also increase or decrease respectively.

The volatility of oil price, net revenue interest and tax were considered to calculate a wet well’s revenue. We used the data from the World Bank from EIA as our predicted oil price, and the production volumes were based on our simulation. The net revenue interest (NRI) followed a normal distribution with a mean of 75% and a standard deviation of 2%. Our final revenue was NRI subtracting tax, which is 4.6% of the revenue.

Based on 100,000 simulation (Figure 4 and Figure 5), the median of the NPV of a single wet well was \$13.99 million. There was 95% chance that the project could make more than \$5.89 million from a wet well. There was only 0.2% chance that we lose money from a wet well. In terms of dry wells, the median cost of a dry well was \$4.4 million. There was a 5% chance we lost more than \$7.82 million on a single dry well.

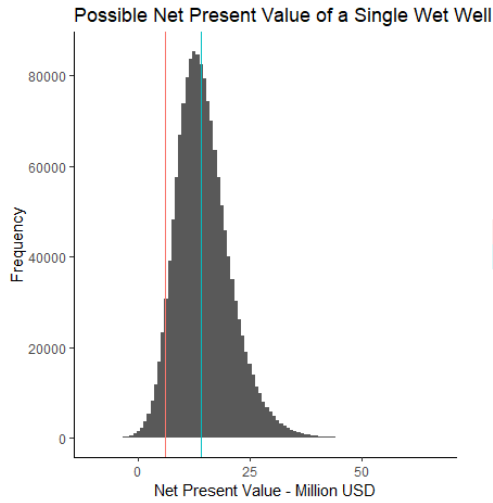


Figure 4.

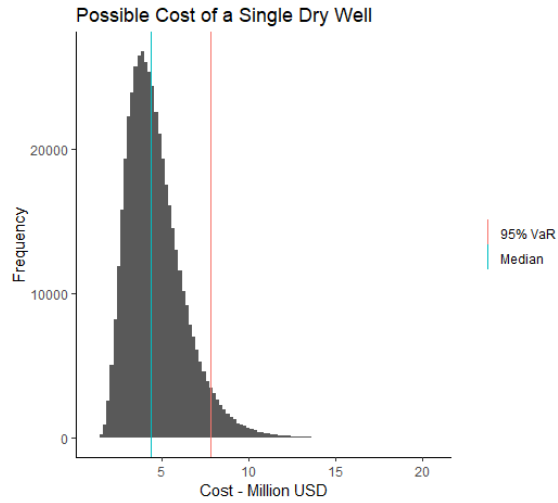


Figure 5.

The final NPV of this investment was calculated as the net revenue of all the wet wells minus the expenses on all the dry wells, and the output distribution can be seen in Figure 1. From the NPV distribution (Figure 1), we sub-sampled 1000 of the 100,000 simulations a total of 1000 times to calculate the expected 5% value at risk (VaR) and the expected shortfall (ES). The distributions of VaR and ES and their confidence interval are shown in Figure 6 and Figure 7. The estimated range of VaR with 95% confidence interval was from \$79.94 million to \$93.05 million with a mean of \$85.96 million. The estimated range of ES with 95% confidence interval was from \$60.06 million to \$73.67 million with the estimated ES of \$66.58 million. Moreover, there was 0.012% chance that the project loses money.

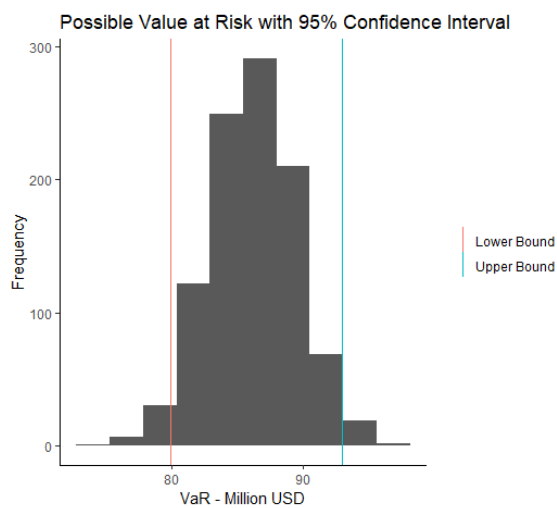


Figure 6.

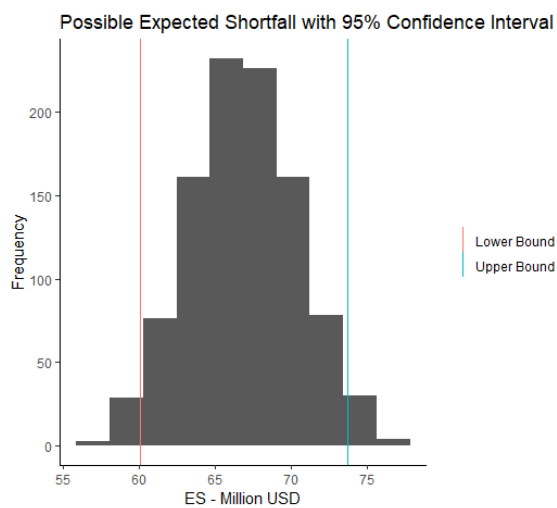


Figure 7.

Conclusion

Based on our analysis, we recommend the company to invest in this project because this project will yield a net present value of at least \$195.78 million in half of the possible outcomes. We believe it to be a robust investment with the potential for a substantial return. Moving forward, we would recommend an analysis to determine yearly return and the breakeven point on this investment. This will allow Compagnie Pétrolière et Gazière company to determine the opportunity cost of this investment compared with other potential investments.