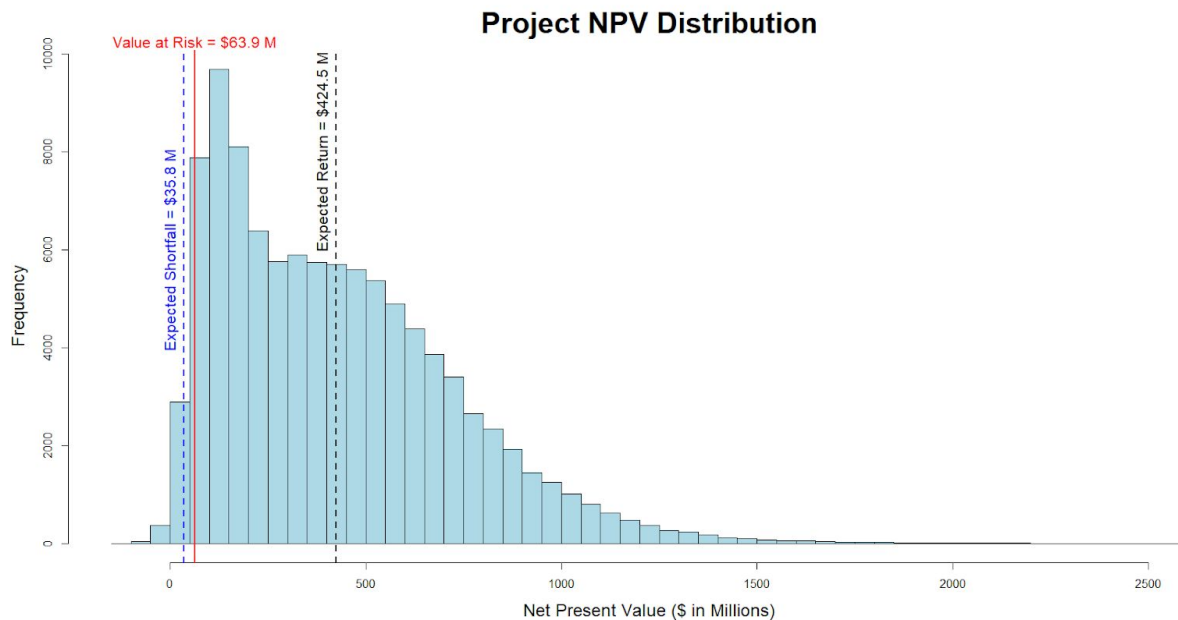# Oil & Gas Exploration:
Final Project

Simulation & Risk
Dr. Aric LaBarr

Orange Team 2
Qing Feng, Andrew Moolenaar, Carlos Chávez, Julie Huang, Bill Jenista

Executive Summary

Per RFP SR-F3.P for Compagnie Pétrolière et Gazière, INC (the "Company"), we estimated the distribution of the Net Present Value (NPV) of all wells from 2019 to 2034, along with the expected return as well as measures of risk. According to our analysis, the simulations of the NPV is right-skewed, with an expected return of $424.5 million. There is a 5% chance that the Company will earn less than $63.9 million in 15 years (5% Value at Risk) and the expected NPV of all wells in the worst 5% of the cases is $35.8 million (5% Expected Shortfall). Additionally, there is only a 0.4% chance that the investment will lose money. With this forecast, we recommend the Company invest in this oil project.

Project NPV Distribution

Background

In the previous phases of the Oil and Gas Exploration RFT by the Company, we estimated the distributions of the drilling costs for an average well, the distribution of the costs of a dry well, the possible NPV for a producing well, and the distribution of the proportion of drilled wells that produce oil or natural gas. In this phase, we combined all the pieces and focused on the distribution of the NPV of the entire project. Per request, the number of wells was randomly determined from a uniform distribution between 10 and 30 wells.

Analysis & Results

To calculate the NPV of all wells from 2019 to 2034, we first obtained the distribution of the proportion of wells that would produce oil. Second, we calculated the drilling cost per well. Third, we simulated applicable fiscal quantities from 2019 to 2034 for dry wells and producing wells: for dry wells, we used our Phase 1 estimation for drilling costs for 2019 as well as information about seismic sections, estimated leased acres, and the cost of professional overhead for Year 0; for producing wells, not only did we determine the initial expense at Year 0 and yearly expenses, such as professional overhead and operating expense, but we also calculated the oil production, oil price, net revenue interest, and tax to estimate the net revenues for each year. With all the expenses and the sum of net revenues, discounted at the weighted average cost of capital, we lastly estimated the NPV for all wet wells from 2019 to 2034.

Using this information from all of the previously submitted phases, we ran a Monte-Carlo simulation 100,000 times which produced a right-skewed distribution (Figure 1), which indicates a greater chance of positive NPV. With a right-skewed NPV distribution, most of the variation is in the positive end of the distribution. This simulation had a median Net Present Value of $376.2 million and an average NPV of $424.5 million. While this number is important and seems that we should invest, it is also important to consider the worst-case scenario. First, we found that the 5% Value at Risk (VaR) is $63.9 million. This means that we are 95% certain that we will not earn less than this amount. While VaR gives us some understanding of the worst possible scenarios, it does not tell us the full story. Expected Shortfall fills in some of those gaps. Within our 5% VaR, we got an Expected Shortfall of $35.8 million. This means that of the worst 5% of possible cases, we still average a gain of $35.8 million. These values and their 95% confidence limits can be seen in Table 1.

	Lower 95% Confidence Interval	Predicted Value	Upper 95% Confidence Interval
Expected Return	$407.4 million	$424.5 million	$443.2 million
Value at Risk	$54.9 million	$63.9 million	$73.1 million
Expected Shortfall	$26.9 million	$35.8 million	$46.4 million

Table 1: Risk Measures for NPV

Figue 1: Project NPV Distribution
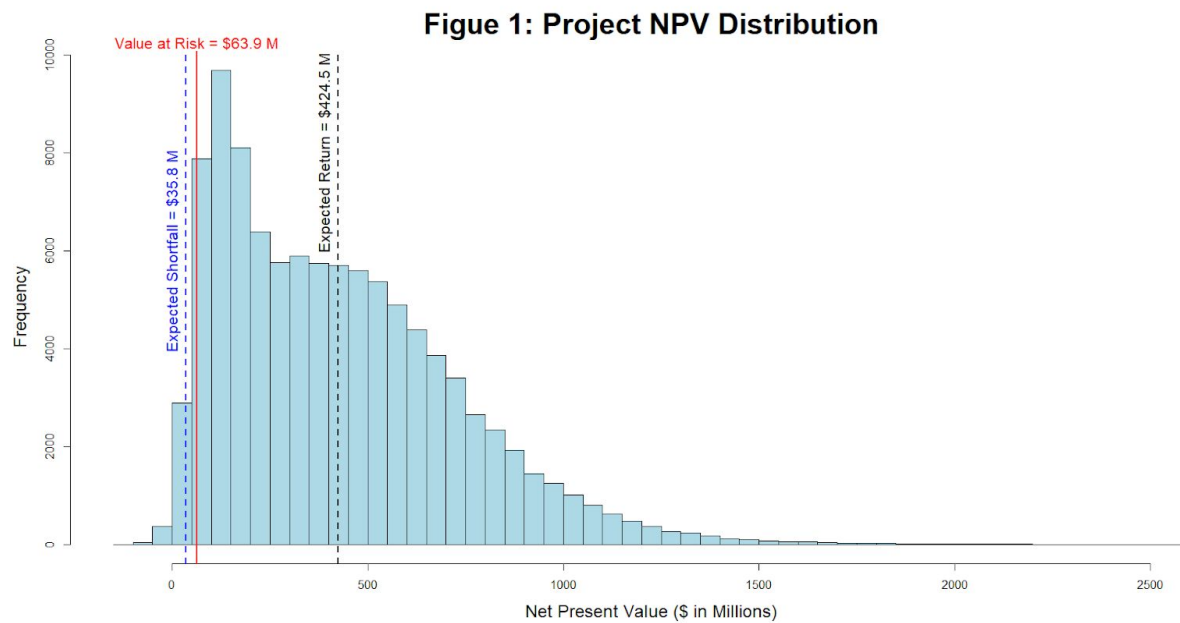
Recommendations and Conclusions

Based on the expected Net Present Value, the 5% Value at Risk, and the Expected Shortfall that were calculated through our simulation, our team recommends that the Company go forward with the investment into this project. We included all available risk factors into our simulation including the possibilities of drilling into a dry or wet well and all the costs associated with the project, and found that there is only a 0.4% chance that we will see a loss in this investment. While we did see a few rare occasions of a loss, the worst being a loss of $130 million, this was a very rare occurrence. With 95% confidence, we can say that you will earn at least $63.9 million, and we expect that you will make $424.5 million on average. Thus, we recommend investing in this oil drilling project.

Appendix

The distribution in Figure 1 appears to be a combination of two overlapping distributions. We believe the "tall skinny" distribution is the project NPVs when the proportion of wet wells is less than one and the "short fat" distribution is the project NPVs when the proportion is equal to one.