Compagnie Pétrolière et Gazière, INC.

REQUEST FOR PROPOSAL
RFP #: SR – S1.H2

TITLE: OIL AND GAS EXPLORATION AND PRODUCTION – PHASE 2
CLOSING DATE AND TIME: FEBRUARY 23. 2024 @ 5:00 PM

Oil & Gas Exploration and Production – Phase 2: SR – S1.H2

Background and Purpose

By responding to this Request for Proposal (RFP), the Proposer agrees that s/he has read and understood all documents within this RFP package.

Submission Details

Responders to this RFP should supply:

- A business report up to 3 pages (not including cover page or table of contents), including any supporting plots and tables.
- The commented code used to produce the results.

The report should address **all points described in the "Objective" section** below.

The report should be returned in the following way:

- Electronic - Moodle submission on AA503 website.

Objective

Compagnie Pétrolière et Gazière, INC. (hereafter the "Company"), acting by and through its department of *Price Analysis* is seeking proposals for analytics services. The scope of services includes the following:

- Simulate the following two distributions using the information provided in the project RFP under Phase 2 (also listed below):
    - Cost of a single dry well.
    - Net Present Value of a single wet well.
- Use your results from the previous RFP to simulate drilling costs.

"Year 0" Expenses:

In addition to the drilling costs in Phase 1, there are additional Year 0 (2024) expenses that occur **before** oil production begins. These expenses are:

1. *Seismic and Lease Costs*. To develop their proposal, our team will need to purchase seismic data to choose the optimum well location, and to purchase the right to drill on much of the land near the well. The cost of these items depends on the number of wells in the project. Uncertain assumptions include leased acres **per well**, which are Normally distributed with a mean of 600 and a standard deviation of 50 acres per well (lower number of wells means lower number of acres to buy); the price per acre is $960[1]. The number of seismic sections **per well** is Normally distributed with a mean of 3 sections and a standard deviation of 0.35 per well (lower number of wells means lower number of sections to purchase data on); the seismic costs per section are $43,000[2].
2. *Completion Costs*. If it is determined that there is oil present in the reservoir (**and we have not drilled a dry hole**), engineers must prepare the well to produce oil at the optimum sustainable rates. For this particular well, we hypothesize that his cost is Normally distributed with a mean of $390,000 and a standard deviation of $50,000.

3. *Professional Overhead*. The project team annual costs in salary and benefits per well depends on the time that the project team spends on the well. We believe the salary and benefit cost is best represented by a triangular distribution, with a most likely cost as $215,000, with a minimum of $172,000 and a maximum of $279,500. This will remain constant across the lifetime of a well, but would potentially be different for different wells. These costs are incurred during Year 0 as well for drilling, but stop after Year 0 if the well is dry.

Production Risk:

A multi-year stream of oil can be characterized as an initial oil production rate (measured in barrels of oil per day, BOPD), followed by a decline in production rates as the natural reservoir energy and volumes are depleted over time. Our hypothetical production stream is described with two parameters:

1. IP. The initial production rate tested from the drilled well. This is the rate the oil is produced at Year 1.
2. Decline Rate. A declining production rate that describes the annual decrease in production from the beginning of the year to the end of the same year. To simplify the problem, we will assume each well has the same decline rate for every year of its life, but this could be different across wells.

Production rates in BOPD for our model are calculated by:

$$Rate_{Year\ End} = (1 - Decline\ Rate) \times Rate_{Year\ Begin}$$

Yearly production volumes in barrels of oil are approximated as:

$$Oil_{Volume\ Year} = 365 \times \frac{(Rate_{Year\ Begin} + Rate_{Year\ End})}{2}$$

Previous research has shown that:

- The IP's follow a Lognormal distribution with a mean of 420 BOPD and a standard deviation of 120 BOPD. (HINT: You might need to look up the relationship between a Lognormal and Normal distribution depending on the software you use. The underlying Normal distribution for this Lognormal has a mean of 6 and standard deviation of 0.28.)
- The rate of decline is Uniformly distributed between 15 and 32 percent.
- We incorporate an additional constraint in the production model; we have imposed a **correlation coefficient of 0.64 between the IP and the decline rate** assumptions that are drawn from their respective distributions during each trial of the simulation.

Revenue Risk:

Revenues from the model flow from the sale of the oil production. There are two assumptions in our model that represent risks in our prospect:

- Oil prices have shown substantial volatility over the last years (reference). For example, the price of a barrel of crude oil was $30.38 in 2000, $56.64 in 2005, and around $100 in 2013. Given this variability, it is really hard to make forecasts by looking into historical performance, future prices, etc. In these cases, it is better to use the long-term forecasts provided by an organization such as the World Bank of EIA. These forecasts run up to 2050 and apart from the expected value, they provide the best and worst cases as well. This data can be found in the worksheet "Price Projections" in the Excel file "Analysis_Data.xlsx". Use the information there to build distributions for the next 15 years (2024, 2025, etc.) of the project. **Given that you have a worst-case scenario, best-case scenario, and typical value, what distribution should you use?**

- Net revenue Interest. Oil companies must purchase leases from mineral interest holders. Along with paying cash to retain the drilling and production rights to a property for a specified time period, the lessee also generally retains some percentage of the oil revenue produced in the form of a royalty. The percentage that the producing company retains after paying all royalties is the net revenue interest (NRI). Our model represents a typical West Texas scenario with an assumed NRI distributed Normally with a mean of 75% and a standard deviation of 2%. This calculation is done per well for the entire life of the well.

Note: **The annual revenues before the royalty payments are simply (Oil Price X Annual Production).** These annual revenues are then multiplied by the assumed NRI to reflect dilution of revenues from royalty payments to lessees.

Operating Expenses:

1. Operating Costs. Companies must pay for manpower and hardware involved in the production process. These expenses are generally described as a dollar amount per barrel. A reasonable West Texas cost would be Normally distributed with a mean of $2.25 per barrel with a standard deviation of $0.30 per barrel. The expenses would be the same for every well in a given year, but could change from year to year with the distribution above.
2. Severance Taxes. State taxes levied on produced oil and gas are assumed to be a constant value of 4.6% of revenue. Taxes are applied after the NRI.

The operating expenses are subtracted from the gross sales to arrive at net sales.

Net Present Value Calculation:

The final section of the model sums all revenues and expenses for each year (starting at Year 0), discounted at the weighted average cost of capital (WACC – which we assume for this model is 10 percent per year), and summed across years to compute the forecast of NPV for the project. The formulation used is the following:

$$NPV = -Initial\ Costs + \frac{FNR_{Year\ 1}}{1 + WACC} + \frac{FNR_{Year\ 2}}{(1 + WACC)^2} + \cdots + \frac{FNR_{Year\ 15}}{(1 + WACC)^{15}}$$

FNR is the final net revenues during the specified year.

Data Provided

The following set of data is provided for the proposal:

- The data set **ANALYSIS_DATA** contains the following two sets of information:
    - Estimated drilling costs for Crude Oil, Natural Gas, and Dry Wells. These costs are collected from 1960 – 2007. The geometric annual change on these costs has been calculated.
    - Oil price projections from 2025 – 2050. There are estimates of the high, low, and actual price of oil (reference price).