Freshman Engineering Design Project 1

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Executive Summary

This report's purpose is to recommend one of the three gas and oil wells (BP, Shell, or Halliburton) for you, the buyer, to invest in. This recommendation has been determined by organizing and analyzing data, using curve analysis, and using various equations to predict which well will have the greatest net present value in three years. From the results of the data, I highly recommend that you invest in the BP well, because the data predicts that it's the best investment for the next three years.

Introduction

I work for Eers^2 Consulting Company, and I was hired in order to predict which oil and gas well would be the best investment for the next three years. BP, Shell, and Halliburton were the three assigned wells. At the beginning of this task, I was given the data for the three wells. The data came from the Madina Data Set and consisted of the API number of the well, the month of production, the amount of oil production (BBls), the amount of gas production (MCF), and the GOR, however the data was only somewhat organized. Therefore in order to make an accurate prediction of which well to recommend, I started organizing my data by separating each of the three wells onto three separate sheets in Microsoft Excel. Then, I could begin the process of determining which well would be the best investment.

Methodology

Initially to predict the greatest net present value in the next three years, as I stated previously, I began organizing the data by separating each well onto three sheets in Microsoft excel. Then I graphed the data by making logarithmic scatter plots. I plotted time (in months) versus oil production (in BBls) for the three oil wells. Then for the three gas wells, I plotted time (in months) versus gas production (in MCF). After I organized the data onto graphs and was able to make a general observation, I began predicting the future production. In order to do so I used the logarithmic equation: $q = qi (1+bDit) ^ (-1/b)$, whereas q is the production, qi is the initial rate, Di is the initial decline, t is time, and b is the decline exponent. I used a logarithmic curve due to the fact that oil and gas production, when graphed, produce a logarithmic curve. To make this equation fit the points plotted, I changed the values of gi, Di, and b. The values were changed very easily because of the versatility of Microsoft Excel. Therefore once I was able to determine the values of qi, Di, and b, I could use this equation to predict the future well production. By using Microsoft Excel, I simply dragged the values for time (t) down for the next 36 months in order to predict the future production (q values). Basically, the logarithmic curve that I just created was extended to predict the production of gas and oil.

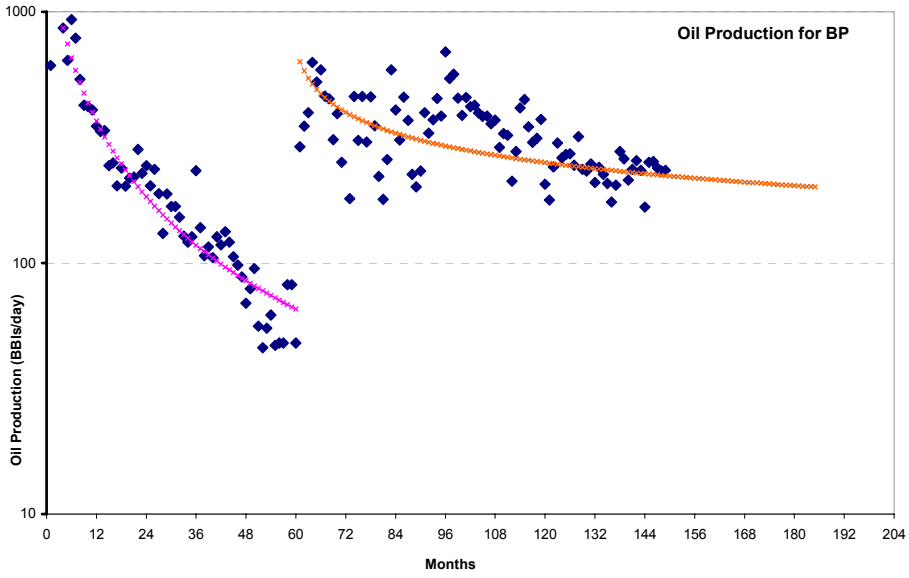
After I determined the predicted future production, I was able to begin determining the net cash flow. First, I determined the revenue by multiplying the q value and the predicted oil price for each coming year. (The explanation of how I derived the gas and oil prices is attached at the end of the report.) To determine the direct cost, I multiplied the revenue and direct cost (Direct operating cost is $4.35 for oil and $0.65 for gas for the next three years). Then I calculated the tax by subtracting the cost from the revenue and multiplying by the tax rate or

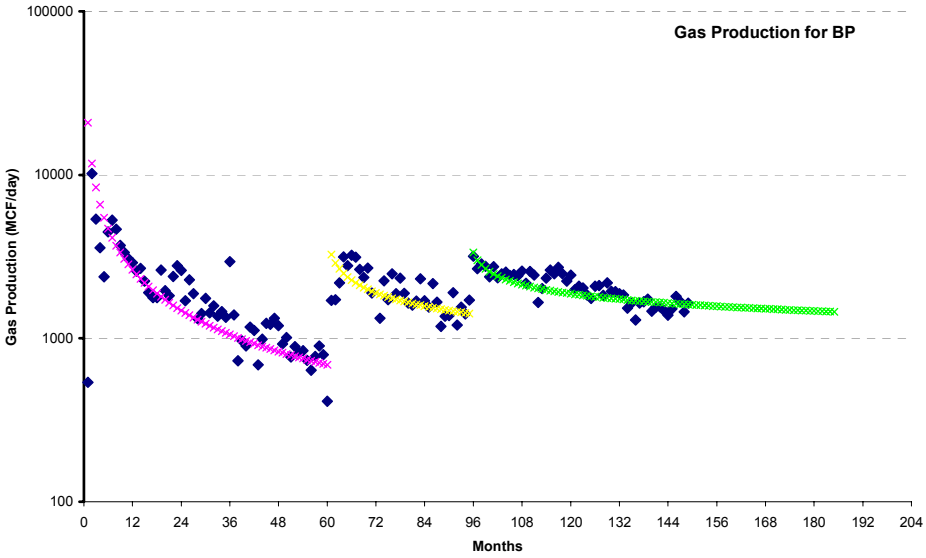
48%. After calculating the tax, I subtracted the direct cost and the tax from the revenue in order to calculate the net cash flow.

Then, I had to determine what the net present value would be as the value of time progressed. To do so, I used the equation: $P = F/(1+i)^n$, whereas P represents present value or present lump sum, F represents the future lump sum (which I previously calculated as the net cash flow), i represents the monthly interest rate, and n represent the number of months. I calculated the present value twice using 0.90% and 0.70% as my monthly interest rates in order to see how the change of interest affected the present values. Finally, to calculate the net present value, I simply added all the present values together for the thirty-six months.

Results and Discussion

First I graphed the three wells, plotting the time versus the production. Then by using the logarithmic equation for gas and oil production, I found a curve that fit the points. The following graphs are for the BP well. The first graph plots oil production (BBls) versus the number of months, and the second graph plots gas production (MCF) versus the number of months.

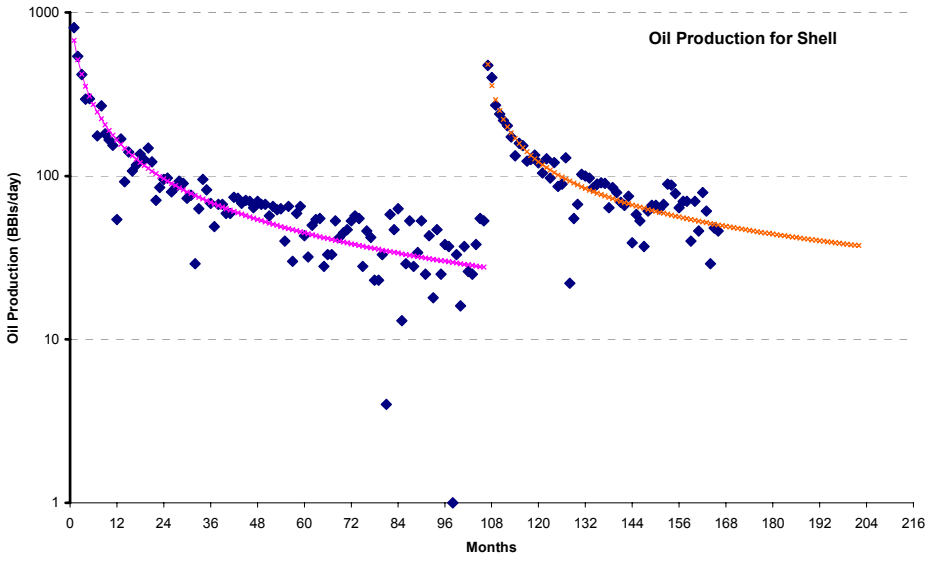


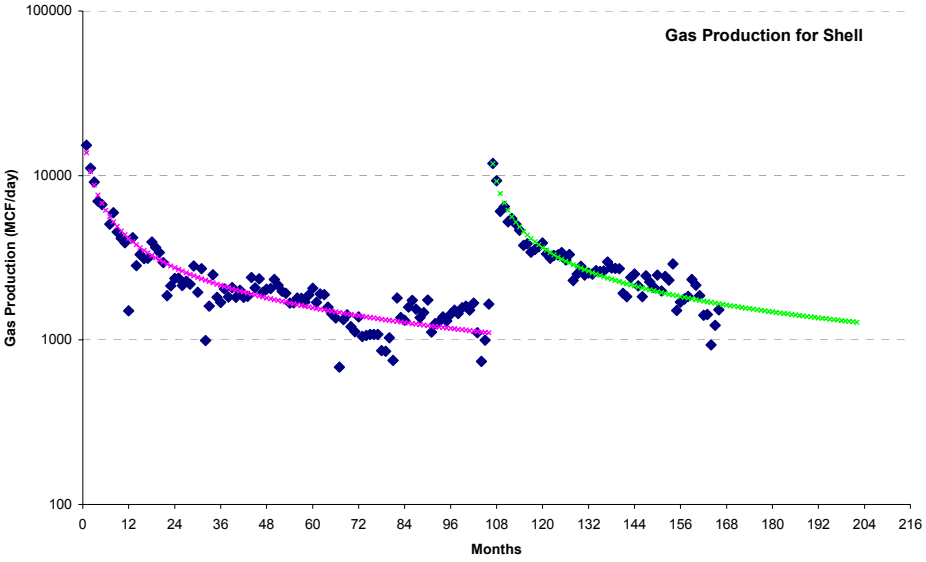


In determining which well will produce the most oil or gas in the future, you should only analyze the last logarithmic curve of the data. As you can see from the two previous graphs, the BP well's final curves for both oil and gas prove the wells very productive nature for the future months to come. As the graph is stretched into the next 36 months, it is obvious that the well maintains steady production.

Now to further prove why the BP well is the best investment, I will show the graphs of the other two well's data to compare all three wells.

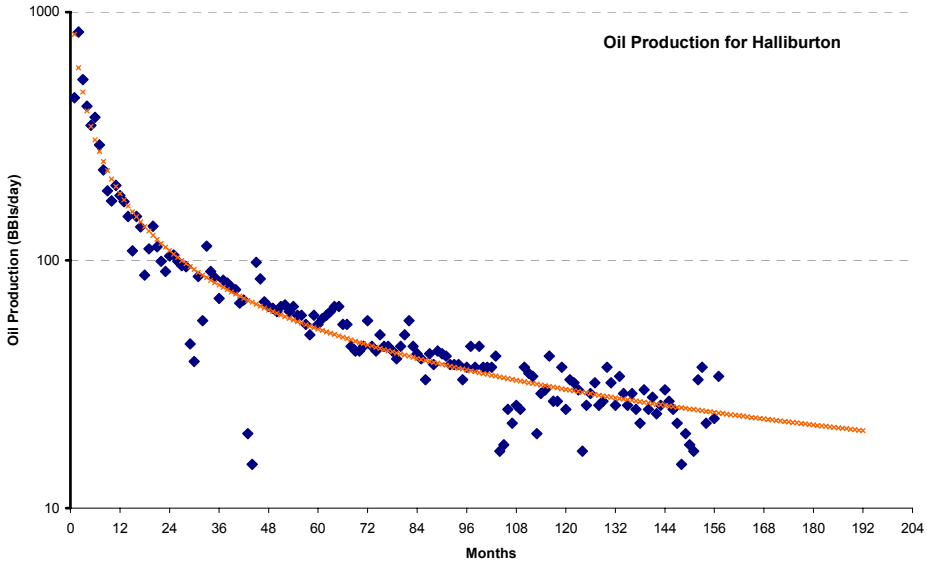
The following two graphs are from the Shell well. The graph of oil production is first, and the graph of gas production follows.

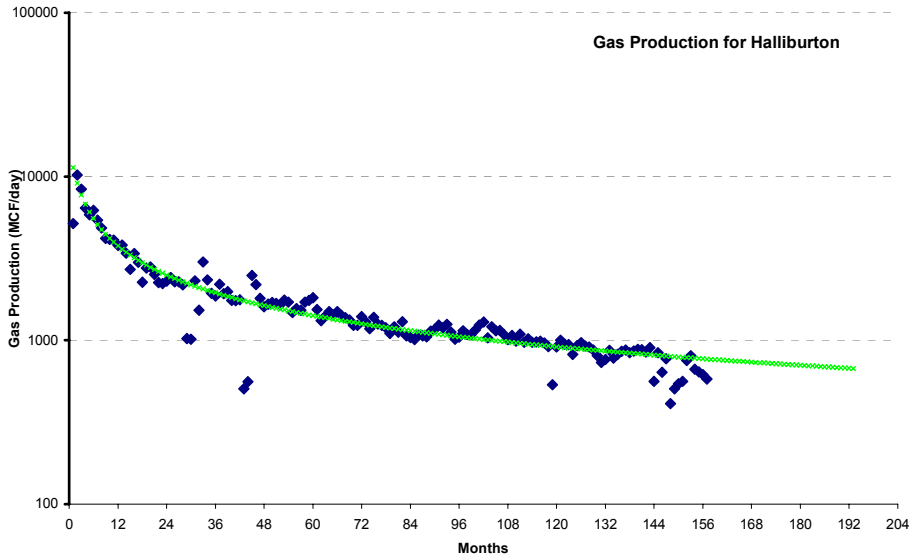




As you can see, the Shell well's second curves, unlike the BP's curves, are constantly sloping downward in the upcoming months, which means that the future oil production will constantly decline. Therefore, this well would not be a wise investment.

The Halliburton is the final well that I would like to compare to the other two wells. The first graph shown is the oil production and the second graph shown is the gas production.





The Halliburton's curve also clearly shows that its production is constantly declining. If you consider servicing this well, it possibly may be a good long-term investment; however, this would be expensive and the outcome is really unknown. Therefore, I still conclude that the BP well is a better investment for the next three years.

The next charts compare the predicted amount of oil produced and the predicted amount of gas produced by each of the three wells.

BP								
Month	BBls	MCF	Month	BBls	MCF	Month	BBls	MCF
1	221.93	1603.90	13	213.60	1542.23	25	206.45	1492.51
2	221.18	1598.18	14	212.97	1537.69	26	205.90	1488.78
3	220.44	1592.57	15	212.34	1533.23	27	205.35	1485.10
4	219.72	1587.08	16	211.72	1528.85	28	204.81	1481.48
5	219.00	1581.70	17	211.10	1524.55	29	204.28	1477.91
6	218.29	1576.42	18	210.50	1520.31	30	203.75	1474.39
7	217.60	1571.26	19	209.90	1516.15	31	203.23	1470.92
8	216.91	1566.19	20	209.31	1512.05	32	202.71	1467.50
9	216.23	1561.21	21	208.72	1508.02	33	202.20	1464.13
10	215.56	1556.34	22	208.15	1504.05	34	201.70	1460.80
11	214.90	1551.55	23	207.58	1500.14	35	201.20	1457.51
12	214.25	1546.85	24	207.01	1496.30	36	200.70	1454.28

Shell								
Month	BBls	MCF	Month	BBls	MCF	Month	BBls	MCF
1	49.64	1646.04	13	44.42	1491.5	25	40.42	1371.7
2	49.14	1631.43	14	44.04	1480.4	26	40.12	1362.9
3	48.66	1617.17	15	43.68	1469.5	27	39.84	1354.3
4	48.19	1603.26	16	43.32	1458.8	28	39.56	1345.8
5	47.73	1589.67	17	42.97	1448.4	29	39.28	1337.4
6	47.28	1576.41	18	42.63	1438.1	30	39.01	1329.2
7	46.84	1563.45	19	42.29	1428.1	31	38.74	1321.2
8	46.41	1550.78	20	41.97	1418.3	32	38.48	1313.2
9	45.99	1538.40	21	41.64	1408.6	33	38.22	1305.4
10	45.59	1526.29	22	41.33	1399.1	34	37.97	1297.8
11	45.19	1514.44	23	41.02	1389.8	35	37.72	1290.2
12	44.80	1502.84	24	40.71	1380.7	36	37.48	1282.8

Halliburton								
Month	BBls	MCF	Month	BBls	MCF	Month	BBls	MCF
1	24.08	765.67	13	22.69	730.65	25	21.46	699.44
2	23.96	762.58	14	22.58	727.91	26	21.37	696.99
3	23.84	759.53	15	22.48	725.20	27	21.27	694.56
4	23.72	756.51	16	22.37	722.51	28	21.18	692.16
5	23.60	753.52	17	22.26	719.85	29	21.09	689.77
6	23.48	750.56	18	22.16	717.22	30	21.00	687.41
7	23.36	747.63	19	22.06	714.61	31	20.90	685.07
8	23.25	744.73	20	21.96	712.02	32	20.81	682.74
9	23.13	741.86	21	21.86	709.46	33	20.73	680.44
10	23.02	739.02	22	21.76	706.92	34	20.64	678.16
11	22.91	736.2	23	21.66	704.4	35	20.55	675.89
12	22.80	733.41	24	21.56	701.91	36	20.46	673.65

The previous three tables clearly illustrate the difference in the oil production and gas production of the three different wells. The BP well produces the most oil and gas, then the Shell well, and finally the Halliburton produces the least amount of oil and gas.

As I continued to do the many calculations, my main goal was to calculate the net present value of each well. In order to explain exactly how I came up with the net present value, I would like to show one of the exact charts containing all of the information that lead up to the present value.

BP OIL							
Month	BBls	Revenue	Direct Cost	Tax	Net Cash	PV	PV (2)
1	221.93	$8,877.04	$965.38	$3,797.60	$4,114.06	$4,077.37	$4,085.47
2	221.18	$8,847.18	$962.13	$3,784.82	$4,100.22	$4,027.40	$4,043.42
3	220.44	$8,817.73	$958.93	$3,772.22	$4,086.58	$3,978.20	$4,001.95
4	219.72	$8,788.69	$955.77	$3,759.80	$4,073.12	$3,929.73	$3,961.04
5	219.00	$8,760.05	$952.66	$3,747.55	$4,059.84	$3,881.98	$3,920.68
6	218.29	$8,731.79	$949.58	$3,735.46	$4,046.75	$3,834.95	$3,880.87
7	217.60	$8,703.92	$946.55	$3,723.54	$4,033.83	$3,788.61	$3,841.59
8	216.91	$8,676.41	$943.56	$3,711.77	$4,021.08	$3,742.95	$3,802.83
9	216.23	$8,649.27	$940.61	$3,700.16	$4,008.50	$3,697.96	$3,764.58
10	215.56	$8,622.48	$937.69	$3,688.69	$3,996.09	$3,653.62	$3,726.83
11	214.90	$8,596.03	$934.82	$3,677.38	$3,983.83	$3,609.92	$3,689.58
12	214.25	$8,569.92	$931.98	$3,666.21	$3,971.73	$3,566.86	$3,652.80

The previous data is from the oil production of the BP well for the future twelve months. This is how I set up each well in order to calculate the net present value. I calculated the present value (PV) twice in order to compare how the monthly interest affected the present value (I used 0.9% as the monthly interest for the first present value and 0.7% as the monthly interest for the second). I performed all the calculations using Microsoft Excel and organized the results in a series of charts. In order to calculate the net present value, I added the values in the present value columns. This chart only contains the predicted production for the next twelve months, whereas the actual net present value was derived from adding the values of all thirty-six present values.

The following chart compares the net present values for the BP, Shell, and Halliburton gas and oil wells.

Oil Wells	NPV 0.90%	NPV 0.70%
BP	$104,688.92	$108,077.61
Shell	$21,543.58	$22,217.34
Halliburton	$11,063.68	$11,417.62

Gas Wells	NPV 0.90%	NPV 0.70%
BP	$64,824.88	$67,023.47
Shell	$61,902.22	$63,942.93
Halliburton	$30,587.53	$35,401.63

As you can clearly see, the BP well has a much larger NPV (net present value) than that of the other two wells. This is the main basis to why I predict this well to be the best investment.

Conclusions

At the beginning of this project, my main objective was to determine or predict which of the three wells would be the best investment for the next three years. I started with a great amount of data and began making the data easier to comprehend. I organized the data by graphing it. Then I used the many tools of Microsoft Excel in order to predict the net present value of each well. I also used a variety of other skills such as data analysis, curve analysis, and applying the equations in order to predict which well would be the best investment.

I believe another objective of this project was to learn how to use Microsoft Excel. I believe that I have greatly improved in using this program. This is the first time I have ever attempted to use it, and now I find myself already relying on it to do other assignments (even things as easy as averaging my grades).

Finally after analyzing the three wells and their data, I have come to the conclusion that the BP well is the best investment for the next three years. From the graphs and charts, it is clear that it has been producing a steady amount of oil and will continue to do so in the future. I also believe that it is the safest investment because of its steady production. Therefore, I would invest my hard earned money on the BP well.

How future oil and gas prices were determined

I chose my predicted oil and gas price predictions as follows. For oil (in $/BBls), I predicted $40.00 for year 1, $35.00 for year 2, and $30.00 for year 3, and for gas (in $/MCF), I predicted $3.50 for year 1, $3.20 for year 2, and $3.00 for year 3. I chose these numbers for the following reasons. First, the American Public Gas Association stated that gas would be around $3.12 for the coming season. However, I took into account that this price will possibly increase because of the great chance of a shortcoming war. The American Public Gas Association also stated that the price of oil would be climbing past $30/barrel. They quoted that prices will be increasing "as the fears of a looming war with Iraq intensify." Therefore, I also determined that the oil price will be much higher than expected for the coming year. However as the war comes to an end, the prices will continually decrease until they somewhat level off once again. I also based my prediction on a chart made by PVM Energy Group that plotted the price of oil during the past twelve years. I noticed that right before 1991 (which was when the Persian Gulf War took place) prices quickly jumped from about $15 to $40 a barrel, then as the war started to decline, prices went back down and somewhat leveled off. Consequently, that is how I determined my predicted prices for gas and oil.