Identification of Best Investment Opportunity Using Decline Curve Analysis

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Executive Summary

Our consulting company was hired to determine a particular well, which would be the best investment opportunity for an interested investor. We were given ninety-four different wells, from which we were to pick three similar ones with close/comparable oil and gas production, by the use of a pivot table and a bubble graph. After the three wells were chosen, we used decline curve analysis to forecast the production of each well for the next ten years. Finally, with the use of the "Time value of money" concept and net present value we concluded the best investment would be the Brown, Charles etal"B"#13 well, which is estimated to be worth $381,938 at today's money value.

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Introduction

The ImagiTech consulting company was hired by an interested investor to find a well that would be the best investment opportunity. We were given data from ninety-four different wells. All data was placed into Microsoft Excel from which we did all the graphs and calculations that follow. This data contains information on the location (latitude and longitude), dates of well operations, and numbers on oil (bbl= barrel) and gas (mcf= thousands of cubic feet) productions for those dates. From this data we were to pick three similar wells based on their oil and gas production. The wells that we selected were Brown,J.T.etal"D"#14, Brown,J.T.etal"d"#15, and Brown,Charles etal"B"#13. After the three wells were selected, the oil and gas production was plotted on a scatter plot with respect to time in months. With each of these plots we were able to use decline curve analysis to fit a decline curve to each data set, and forecast production ten years into the future. Tables using the estimated values for oil and gas production were made in order to calculate the net cash flow (NCF) and net present value (NPV) for the three wells. The net present value uses the time value of money concept to compare values of money from different times at today's present value. This concept lets us get the three wells with different production dates "all on the same page" and comparable to each other. After all the NPV's are calculated, they are all added up for their respected well. The well with the highest NPV is the best investment opportunity.

Methodology

1.) The data we were given consisted of a list of an unknown amount of wells, with the well production for various months. Our first step was to find out how many different wells there were. To do this we used an advanced-filter that created a list of all the different well names. From this we were able to determine the number of wells was ninety-four.

2.) Next, with the total number of wells known, we needed to find the total oil and gas productions for each. This was done by creating a pivot table. On the pivot table the rows were the dates of productions, the columns were the well names, and the data were the amounts of oil and gas. The total oil and gas productions for the wells are at the bottom of the page.

3.) Then, to make it easier to compare the totals for production, we needed to make a list of well names, latitude, longitude, and their respective production amount. We used an advanced filter to make the list of well names, latitude, and longitude, just as we did to find out the total number of wells. To get the totals to match up with the corresponding well we copied the values from the pivot table and did a paste special. This allowed us to transpose the values from the pivot table that were horizontal to make them vertical.

4.) Now that we had a list of the well names, latitude, longitude, total oil production, and total gas production, we needed to construct bubble graphs to compare the production values. The wells were graphed with respect to their latitude and longitude. The size of the bubble depended on the well's total production amount, the more it produces the larger the bubble. We changed the values of the axis on our graph in order to zoom in on a specific area so that the data was not so overlapped. This made it easier to determine which bubbles were similar in size.

5.) Our next step was to pick three similar wells based on the bubble graphs for oil and gas. We selected Brown,J.T.etal"D"#14, Brown,J.T.etal"D"#15, and Brown,Charles etal"B"#13 as our three wells. Next, our group inserted three new worksheets, one per well to put the following data: well name, latitude, longitude, date, oil, and gas. To get this particular data for our three wells, we went back to our initial data list and did an auto-filter. This puts scroll down arrows on each different column of data. By clicking on the scroll arrow under the well names, we were able to get all the data for the selected wells.

6.) The next step was to graph our three wells production for oil and gas. In order to graph the data we first had to make a new column that represented time in months as a whole number, instead of the month, day, and year. For example, the first month of production would be represented by a number 1, the second month would be represented by a number 2, and so on. Then, we used xy-scatter plots and graphed the data with respect to time in months as the independent variable and either oil rate (barrels/month) or gas rate (mcf/month) as the dependent variable for each graph. Because some of the graphs had data that was very close and overlapping, we changed the scale of the y axis to logarithmetic. This helped to spread out some of the data points and made the graphs easier to read. To touch up the graphs we put major and minor gridlines on each one.

7.) Now we had to use decline curve analysis to fit a decline curve to our well production graphs that would forecast production for the next ten years. The decline curve analysis equation is $q=q_1(1+Di*b*t)^{-1/b}$, where q=production rate, q_1=initial rate, Di=initial decline, t=time in months, b=decline exponent. We entered the equation on Excel and had to play around with the values of Di, q_1, and b to get the curve to fit. When all the curves fit the data sets on the graphs, we extended the q value for ten years past the last listed production date for each well.

8.) The last step was to construct a table for each graph that calculated the net cash flow and net present value. To calculate the NPV we used this equation, $P=F/((1+i)^n)$, where P= present worth, F=future worth, i=interest rate, n=number of years. The net present value would let us compare values of money from different times at today's present value by use of the time value of money concept. This would put the three wells "on the same page" and comparable to each other even though they are from different dates. To determine the well that was the best investment opportunity we added up all the NPV's for each well. The well with the highest NPV is the best investment. For these calculations we used an operating cost of oil to be $3.00/bbl, gas to be $.50/mcf, a 48% tax, and 10% interest rate. I used the values of $26.40/bbl of oil and $3.00/mcf of gas (explanation in results).

Year	Annual bbls	Annual mcf	$26.40/bbl	$3.00/mcf	Revenue	Operating Cost	48% Tax	NCF	NPV	Total NPV

Annual bbls= (bbl/month)*12

Annual mcf= (mcf/month)*12

Oil Revenue= (Annual bbls)*(26.40)

Gas Revenue= (Annual mcf)*(3.00)

Total Revenue= (Gas Revenue)+(Oil Revenue)

Operating Cost= (Annual bbls)*(3.00)+(Annual mcf)*(.50)

Tax= ((Total Revenue) – (Operating Cost))*(.48)

NCF= (Total Revenue) - (Operating Cost) - (Tax)

NPV= (NCF) / ((1+.1)^n)

Total NPV= sum of all NPV's for each well

Results and Discussions

The following graphs use decline curve analysis to forecast oil and gas production. The tables use these forecasts to calculate the NCF and NPV. For the calculations, the price per barrel of oil came from Berry Petroleum's 2002 and 2003 crude oil prices. I took the prices per month for both years and took the average, which came out to be about $26.40/bbl. For the gas price I used GASearch Pricing Data's numbers for the state of Texas and took the average. The average came out to be about $3.00/mcf. I got the following results using these values for the calculations, with an operating cost of $3.00/barrel, $.50/mcf, and a 48%tax rate. For the first well, BrownJ.T.etal"D"#14, I got the net present value to be $302,343. The BrownJ.Tetal"D"#15 well had an NPV of $293,915. And finally, the Brown,Charles etal"B"#13 well was the best, worth an estimated $381,938. The following graphs use decline curve analysis to forecast oil and gas production. The tables use these forecasts to calculate the NCF and NPV.

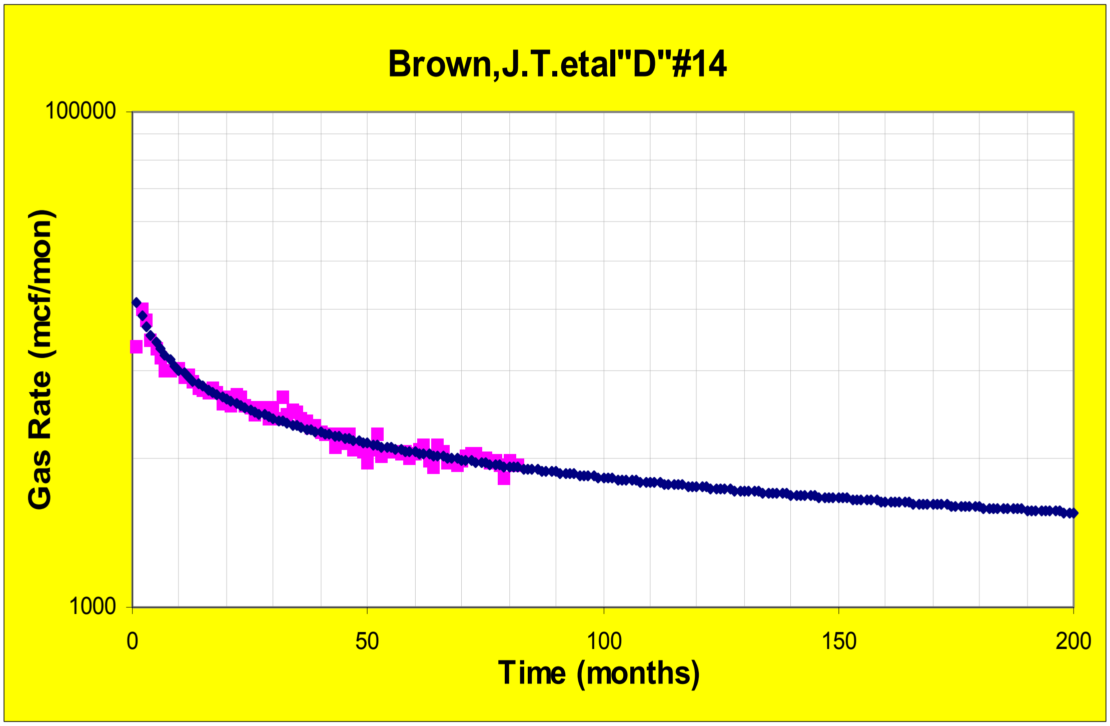

Figure1: Gas production decline curve for Brown,J.T.etal"D"#14

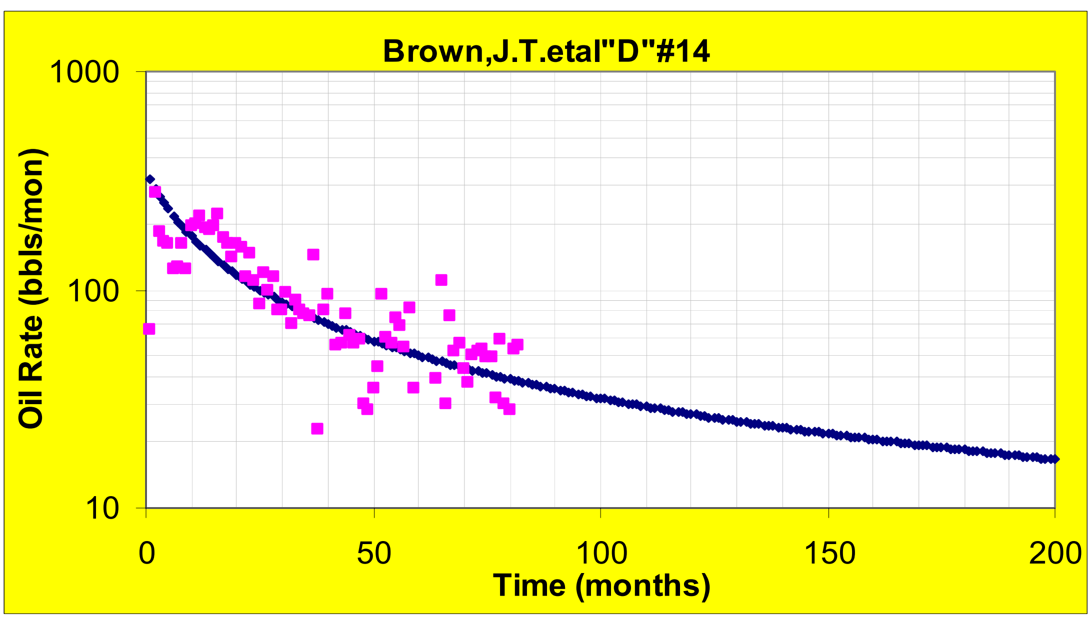

Figure 2: Oil production decline curve for Brown,J.T.etal"D"#14

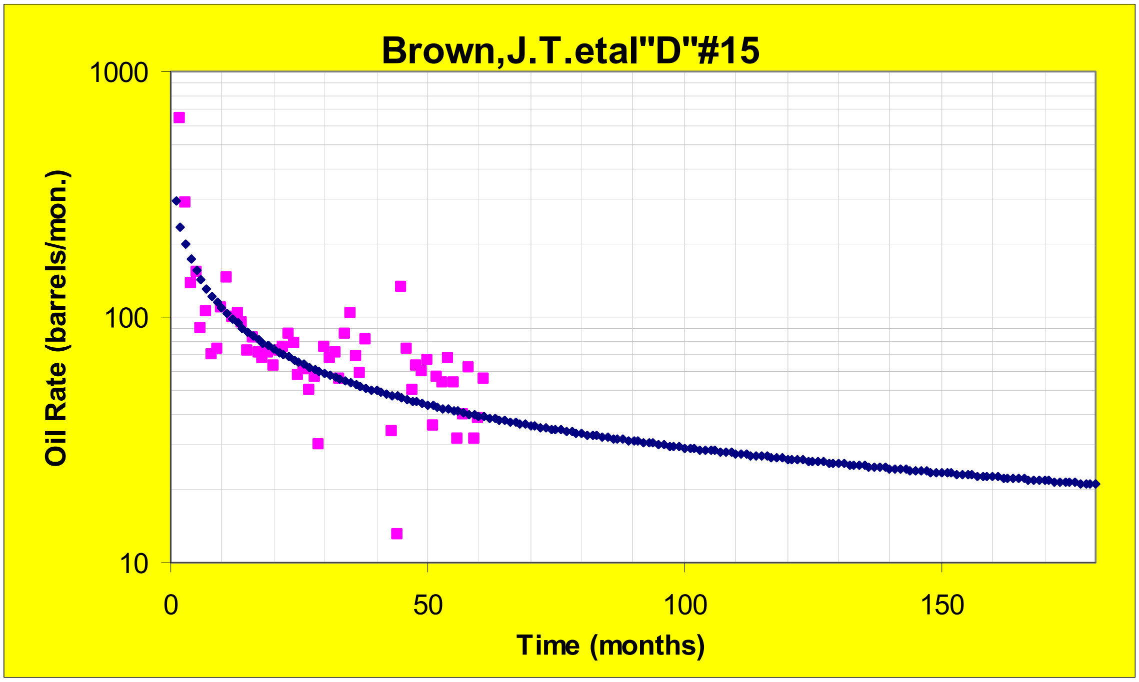

Figure 3: Oil production decline curve for Brown,J.T.etal"D"#15

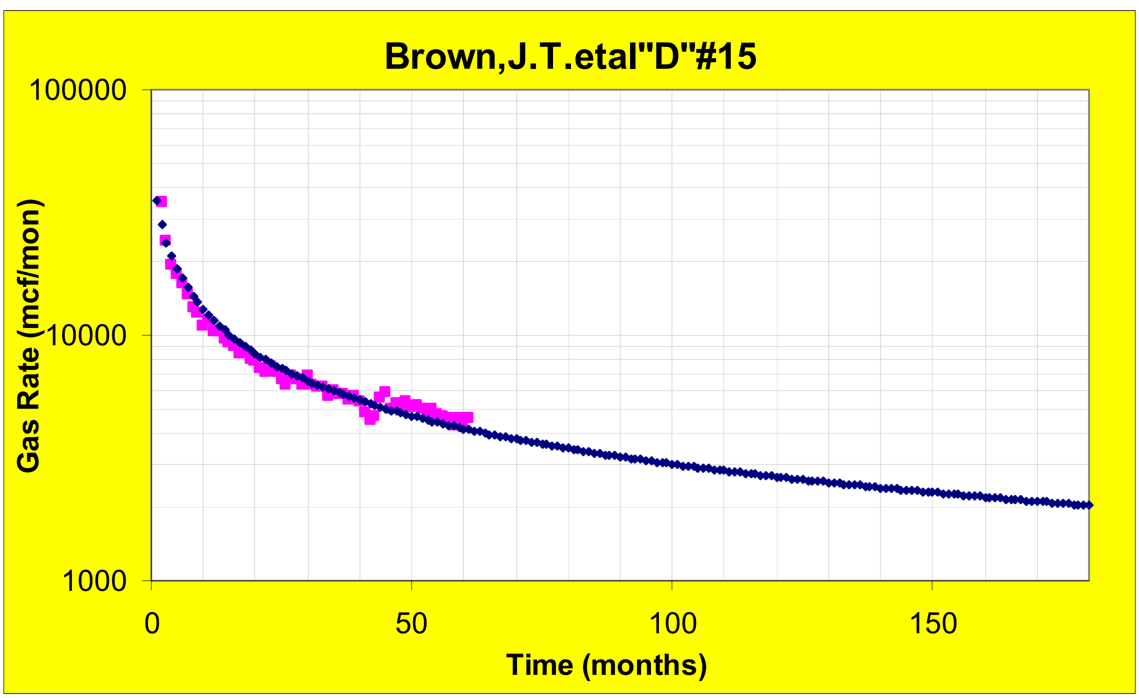

Figure 4: Gas production decline curve for Brown,J.T.etal"D"#15

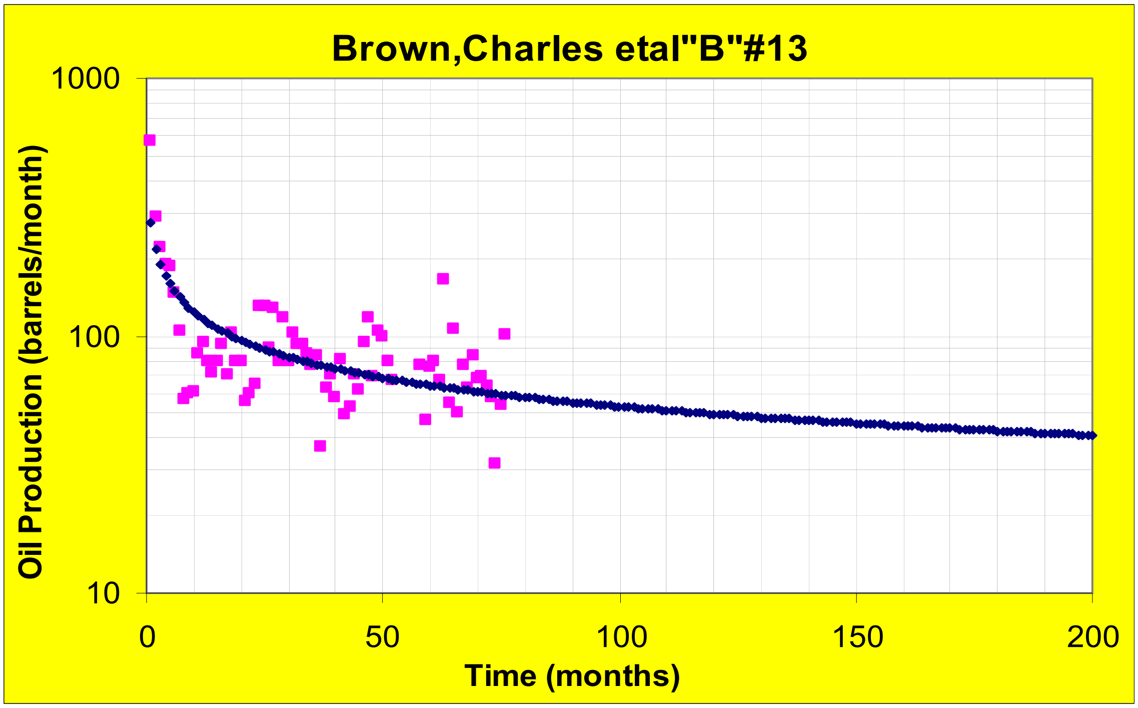

Figure 5: Oil production decline curve for Brown,Charles etal"B"#13

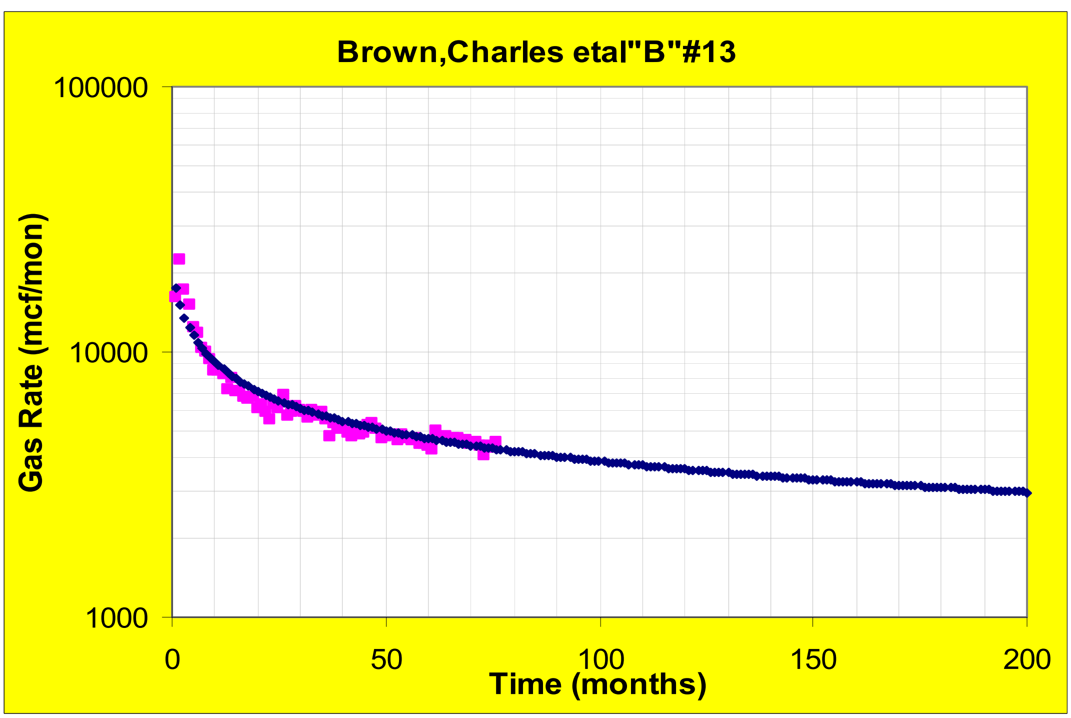

Figure 6: Gas production decline curve for Brown,Charles etal"B"#13

Year	Annual bbls	Annual mcf	$26.40/bbl	$ 3.00/mcf	Revenue	Operating Cost	48% Tax	NCF	NPV	Total NPV
1	408	41196	10771	123588	134359	21822	54018	58519	53199	
2	360	38952	9504	116856	126360	20556	220425	55018	45469	
3	324	37056	8554	111168	119722	19500	48107	52115	39155	
4	300	35424	7920	106272	114192	18612	45878	49702	33947	
5	276	33984	7286	101952	109238	17820	43881	47537	29517	
6	252	32712	6653	98136	104789	17112	42085	45592	25735	
7	240	31584	6336	94752	101088	16512	40596	43980	22569	
8	228	30564	6019	91692	97711	15966	39238	42507	19830	
9	216	29640	5702	88920	94622	15432	38011	41179	17464	
10	204	28932	5386	86796	92182	15078	37010	40094	15458	
										$302,343

Figure 7: Net present value calculations for Brown,J.T.etal"D"#14

Year	Annual bbls	Annual mcf	$26.4/bbl	$3.00/mcf	Revenue	Operating Cost	48% Tax	NCF	NPV	Total NPV
1	420	44052	11088	132156	143244	23286	57580	62378	56707	
2	384	39876	10138	119628	129766	21090	52164	56512	46704	
3	360	36564	9504	109692	119196	19362	47920	51914	39004	
4	336	33864	8870	101592	110462	17940	44411	48111	32860	
5	312	31620	8237	94860	103097	16746	41449	44903	27881	
6	300	29700	7920	89100	97020	15750	39010	42260	23855	
7	288	28056	7603	84168	91771	14892	36902	39977	20515	
8	276	26628	7286	79884	87170	14142	35053	37975	17716	
9	264	25356	6970	76068	83038	13470	33393	36175	15342	
10	252	24240	6653	72720	79373	12876	31919	34578	13331	
										$293,915

Figure 8: Net present value calculations for Brown,J.T.etal"D"#15

Year	Annual bbls	Annual mcf	$26.40/bbl	$3.00/mcf	Revenue	Operating Cost	48% Tax	NCF	NPV	Total NPV
1	672	48792	17741	146376	164117	26412	66098	71606	65096	
2	636	46452	16790	139356	156146	25134	62886	68126	56302	
3	612	44460	16157	133380	149537	24066	60226	65245	49020	
4	588	42744	15527	128232	143759	23136	57899	62724	42841	
5	564	41244	14890	123732	138622	22314	55828	60480	37553	
6	552	39912	14573	119736	134309	21612	54095	58602	33079	
7	540	38724	14256	116172	130428	20982	52534	56912	29205	
8	516	37656	13622	112968	126590	20376	50983	55231	25766	
9	504	36684	13306	110052	123358	19854	49682	53822	22826	
10	492	35796	12989	107388	120377	19374	48481	52522	20250	
										$381,938

Figure 9: Net present value calculations for Brown,Charles etal"B"#13

Conclusions

I picked three wells that were similar in oil and gas productions. Then, I used the decline curve to forecast each well for oil and gas ten years into the future. By using the forecasted production rate values, $26.40/bbl, $3.00/mcf, 48% tax, and operating costs of $.50/mcf and $3.00/barrel, I was able to calculate the net cash flow and net present value for each well. The net present values use the time value of money concept, which allows me to compare dollars from different time periods at today's value. After adding up all the NPV's for the three wells I found that the Brown,Charles etal"B"#13 well had the highest NPV at $381,938. So I would tell the interested investor that the best investment opportunity is the Brown,Charles etal"B"#13 well.