

# Valuation of Producing Properties for Loan Purposes

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## INTRODUCTION

There are several methods of valuing producing properties and numerous concepts of value, and they all have their purpose. From the standpoint of the lender on oil properties, the primary objective is to judge what might be realized from the sale of the property if it should become necessary to foreclose. For this purpose, the most significant concept of value is the "fair market value"—the price at which the property would be sold by a willing seller to a willing buyer, neither being under any compulsion to buy or to sell, and both being competent and having reasonable knowledge of the facts.<sup>1-4</sup>

The method of valuation generally used by the institution with which the authors are associated is the estimation of the present worth of future profits at that discount rate which it is believed will result in the fair market value. This is often termed the engineering or analytic appraisal method and for several reasons is found most useful in valuing properties submitted as collateral for loan purposes. Most important is to ascertain by our own appraisal that the amount of the loan outstanding at any time could be recovered, if necessary, by foreclosure and sale. Another important factor in judging the goodness of a loan is the ability of the property to generate sufficient net cash income, after all necessary operating, development, and income tax requirements, to amortize the loan within a reasonable time. This is ascertained from a payout schedule which is readily derived by a cut-and-try process from the forecast of net profits used in calculating the value,

as shown in Tables IV and V. In addition, when the purchase of a property is partially financed by a loan, the lender and the buyer are in effect acquiring the property jointly. Prudent lenders will avoid participating in a project where the expenses may become so high that the operator might be unable to meet his obligations. And good bankers should avoid being a party to a transaction at a price so high that the customer later finds he has made an unprofitable purchase.

In the following sections of this paper, the method of valuation generally used by us is described and illustrated by example in Tables II, IV and V, which show the valuation and payout of a loan on the same property under different methods of purchase. The hypothetical property chosen for the examples is based on a typical dissolved gas-drive reservoir in Texas, as described by Muskat.<sup>5</sup> While this paper discusses valuation and loans for the purchase of a producing property, the methods used are equally applicable to all types of loans on oil and gas properties, whether waterflood, gasoline plant, or well-by-well development loans.

## PROPERTY PURCHASED FOR CASH

In valuing a property purchased for cash, as shown in Table II, the future production, the gross revenue, and the costs of doing business are estimated year by year and the resulting annual net cash revenues are discounted, in this case at 8 per cent, compounded annually, to arrive at the total present worth of future net receipts, here considered to approximate the value of the property. The value arrived at, \$3,900,000, is equivalent to 91 cents per net bbl of oil in the ground. There is nothing sacred about the 8 per cent factor used in this case as the rate of discount, but it appears to the authors to result in a reasonable estimate of the fair market value for this type of property, as indicated by sales of similar properties. It may be interesting to note that E. DeGolyer reports that he is "familiar with cases in which the seller and the buyer have arrived at a trading figure which was approximately one-half of the future net revenue discounted at 4 per cent. It is rather surprising more often than not the latter method, *i.e.*, one-half of a 4 per cent discount future net revenue is very close to the future net revenue discounted at 10½ per cent."<sup>6</sup>

If the rate of discount is too low, the resulting answer will be too high and vice versa. For properties that are fully developed, long-lived, and whose reservoir conditions are well known, estimates of reserves and operating conditions can be made with considerable certainty so that the discount factor should be correspondingly low. And conversely where the opposite is true, the factor should be relatively high.

The discount factor used should be that rate of return or yield on the purchase price which is sufficient to induce a producer to risk his funds in the particular project evaluated

Table 1—Comparison of Valuation of a Property Under Various Methods of Financing

Refer to Table	Appraised Value	Discount Rate or Rate of Return	Value Per Barrel	Loan Ratio
2 Purchase for Cash.....	3,900	8	0.91	..
4 Purchase with Loan.....	2,500	4½	....	64
Cash.....	1,400	11½	....	..
Total.....	3,900	8	0.91	..
5 Purchase by Oil Payment....	3,500	5½	....	74
Cash.....	1,200	12¾	....	..
Total.....	4,700	8	1.09	..
Determination of Value by Oil Payment Method				
Value by Tables 2 or 4 above.....	3,900	8		
Present worth of Tax Savings.....	800	8		
Value by Oil Payment Method....	4,700	—8		

Table 2—Valuation and Payout of Property "P" Purchased for Cash

	Actual 1952	Estimated Future							Grand Total	\$ per Net Bbl:
		1953	1954	1955	1956	1957	Total 5 Years	Thereafter		
NUMBER OF PRODUCING WELLS.....	30	33	36	37	37	37	—	31		
NET PRODUCTION:										
Crude Oil Thousand Barrels.....	384	434	460	461	431	396	2,182	2,118	4,300	
Natural Gas Million Cu. Ft.....	307	347	414	461	631	780	2,633	10,634	13,267	
		Thousand Dollars								
GROSS REVENUE:										
Oil @ \$2.66 per Barrel*	1,021	1,154	1,224	1,226	1,146	1,053	5,803	5,634	11,437	
Natural Gas @ 7.5c per Mcf.....	23	26	31	35	47	59	198	798	996	
TOTAL.....	1,044	1,180	1,255	1,261	1,193	1,112	6,001	6,432	12,433	2.89
DEDUCTIONS:										
Operating Expenses.....	75	82	89	93	95	100	459	1,176	1,635	0.38
Prod. and Ad Valorem Taxes.....	62	70	76	76	70	67	359	382	741	0.17
General and Administration Expenses.....	22	24	26	28	30	30	138	300	438	0.10
Intangible Dev. Expenditures.....	300	150	150	50	60	—	410	125	535	0.13
Depletion and Depreciation†.....	297	395	419	419	392	360	1,985	1,927	3,912	0.91
TOTAL.....	756	721	760	666	647	557	3,351	3,910	7,261	1.69
TAXABLE INCOME.....	288	459	495	595	546	555	2,650	2,522	5,172	1.20
Federal Income Tax @ 52%.....	150	239	257	309	284	289	1,378	1,311	2,689	0.63
NET INCOME.....	138	220	238	286	262	266	1,272	1,211	2,483	0.57
Add back: Depletion and Depreciation.....	297	395	419	419	392	360	1,985	1,927	3,912	0.91
SUB-TOTAL.....	435	615	657	705	654	626	3,257	3,138	6,395	1.48
Less: Tangible Dev. Expenditures.....	180	90	90	30	—	—	210	150	360	0.08
NET CASH INCOME.....	255	525	567	675	654	626	3,047	2,988	6,035	1.40
Discount Factor at 8%.....	—	.93	.86	.79	.74	.68	.79	.49	.65	.65
PRESENT WORTH.....	—	488	488	533	484	426	2,419	1,483	3,902	0.91

Notes:  
\* \$2.55 for 35° oil plus \$0.11 for Natural Gas Liquids.  
† 1952 Statutory, thereafter at Cost (\$0.91 per Barrel).

rather than in safer investments offering lower yield. The rate must be commensurate with the physical hazards of producing and the economic uncertainties of future production, prices, expenses, and production control. In principle, it is the same incentive as that recognized in the regulation of public utilities where the reasonable rate of return upon the fair value of the property (the rate base) is held to be that sufficient to induce the investment of capital in establishing, maintaining, and expanding the property. The Federal Power Commission, for example, has been allowing a 6 per cent rate of return on

natural gas pipe line companies. Assuming adequate demand for the transmission service rendered which these pipe line systems generally enjoy, the companies are practically assured of earnings equal to the rate of return allowed. These enterprises are highly rated by investors and by comparison the employment of funds in producing oil and gas properties should generally deserve a rate of return higher than that obtainable in such public utilities investments.

The value sought should be the fair market value of the property as previously described, and if the proper rate of discount is chosen, the answer should approximate this value. Whatever process of valuation is used, the objective is to find what the property would sell for, that is, its fair market value. If the property be purchased at the value found by the engineering appraisal method, the purchase price will be recouped out of net cash proceeds together with a profit on the diminishing balance of the investment, at the same rate of return as the discount rate used in the valuation. This is proved in Table III.

It should be pointed out that provision for estimated income taxes is made in the calculation before discounting estimated future cash income to present worth. The taxes here assumed are computed at the present 52 per cent rate for corporations after allowance for intangible development expense and depletion on cost, which in this case is higher than statutory depletion. Income taxes comprise one of the costs of doing business and must be provided for out of the producing operation. Note that in Table 2 the total future net cash revenues amount to \$6,035,000 after provision for income taxes. Discounting same at 8 per cent results in the valuation of \$3,900,000. Now, if the property be purchased at this price, the purchase price will be paid back, together with 8 per cent per year, on the diminishing balance. The total future income taxes are shown in the table to aggregate

Table 3—Return of Investment with 8% Profit

Year	Net Cash Income	Allocation of Net Cash Income to:		Investment Remaining at Beginning of Year
		Earnings at 8%	Return of Capital	
		Thousand Dollars		
1953.....	525	312	213	3,902
1954.....	567	295	272	3,689
1955.....	675	273	402	3,417
1956.....	654	241	413	3,015
1957.....	626	208	418	2,602
1st 5 years.....	3,047	1,329	1,718	.....
1958.....	570	175	395	2,184
1959.....	450	143	307	1,789
1960.....	385	119	266	1,482
1961.....	368	97	271	1,216
1962.....	294	76	218	945
1963.....	239	58	181	727
1964.....	181	44	137	546
1965.....	133	33	100	400
1966.....	98	24	74	309
1967.....	104*	18	86	235
1968.....	79	11	68	149
1969.....	57	5	52	81
1970.....	30	1	29	29
TOTAL.....	6,035	2,133	3,902	.....

\* No expenditure for pumping equipment required after 1966.

\$2,690,000, so that the net cash revenues *before* provision for taxes amount to \$8,725,000, the present worth of which at 8 per cent is \$5,648,000. Should the property be purchased for this amount, the net future cash proceeds would still be \$6,035,000, but the excess of net cash proceeds over the purchase price would be only \$387,000, or equivalent to a return of approximately 1¼ per cent per annum. Would you buy the property for a yield of 1¼ per cent?

Carrying this reasoning further to show the danger of omitting provision for income taxes, let us assume that the property is purchased by an individual, subject to a 65 per cent tax rate. In this case the present worth of future net cash receipts *before* income taxes would be as before, \$5,648,000. But the income taxes at the 65 per cent rate assumed would be 25 per cent (or \$672,000) higher than at the 52 per cent rate shown in Table II, which would reduce the future net cash receipts after taxes from \$6,035,000 to \$5,363,000 — and the purchaser of the property would never get his money back.

We have observed that the producing properties which often get into difficulties are those whose owners had failed to provide for future income taxes. An oil producer may be so fortunate in successful drilling at an increasing rate that his intangible drilling deductions will preclude income taxes for a number of years. But if such an operator eventually runs out of drilling locations or funds for further development, he may be forced to sell property to meet his taxes or loan obligations.

#### Purchase Financed by Direct Loan

In Table IV is shown an estimate of the future cash flow from the same property, assuming it to be purchased at the

same price, \$3,900,000, comprised of \$1,400,000 in cash and \$2,500,000 obtained by loan. The earnings of the property will be the same as in Table II where it was assumed to be purchased for cash. The income taxes of the operator of the property will be slightly less than in Table II, but the lender will be taxed on the interest received from the operator, so that the sum of the income taxes arising from the operation of the property will be approximately the same. From a practical standpoint, the ownership of the property so financed may be considered as a combined undertaking by the purchaser and the lender since both obtain the return of their capital and profits thereon solely out of the operation of the property. The net cash return from the property is the same as if it were purchased for cash, as in Table II. The 8 per cent return on the property is shown in Table IV to be equivalent to 4½ per cent to the lender and 11½ per cent on the equity funds of the operator.

Comparison of Tables II and IV will show the fallacy of attempting to value property by using a rate of discount equal to the rate of interests that can be obtained on mortgage money. The lender incurs but little risk since his investment is to be repaid first and he may be willing, therefore, to loan at 4 or 5 per cent. But the purchaser, who puts up the balance of the cost of a property, takes practically all the risk and, as shown in Table IV, should be entitled to the 10 or 12 per cent rate of return on his part of the undertaking.

#### Purchase by Use of Oil Payment

An oil payment is a property right to a specified portion of the reserves and production of a property until the proceeds thereof, free and clear of expenses, shall amount to a

Table 4— Valuation and Payout of Property "P" Financed by Direct Loan

	ESTIMATED FUTURE								
	1953	1954	1955	1956	1957	Total 5 Years	Thereafter	Grand Total	\$ per Net Bbl.
<b>NET PRODUCTION:</b>									
Crude Oil Thousand Barrels.....	434	460	461	431	396	2,182	2,118	4,300	
Natural Gas Million Cu. Ft.....	347	414	461	631	780	2,633	10,634	13,267	
	Thousand Dollars								
<b>GROSS REVENUE*</b> .....	1,180	1,255	1,261	1,193	1,112	6,001	6,432	12,433	2.89
<b>DEDUCTIONS:</b>									
Operating Expenses.....	82	89	93	95	100	459	1,176	1,635	0.38
Prod. and Ad Valorem Taxes.....	70	76	76	70	67	359	382	741	0.17
General and Administrative Expenses.....	24	26	28	30	30	138	300	438	0.10
Intangible Dev. Expenditures.....	150	150	50	60	—	410	125	535	0.13
Depletion and Depreciation†.....	395	419	419	392	360	1,985	1,927	3,912	0.91
Interest @ 4½% per annum.....	104	84	63	39	14	304	—	304	0.07
<b>TOTAL</b> .....	825	844	729	686	571	3,655	3,910	7,565	1.76
<b>TAXABLE INCOME</b> .....	355	411	532	507	541	2,346	2,522	4,868	1.13
Federal Income Tax @ 52%.....	185	214	277	264	281	1,221	1,311	2,532	0.59
<b>NET INCOME</b> .....	170	197	255	243	260	1,125	1,211	2,336	0.54
Add back: Depletion and Depreciation.....	395	419	419	392	360	1,985	1,927	3,912	0.91
<b>SUB-TOTAL</b> .....	565	616	674	635	620	3,110	3,138	6,248	1.45
Less: Tangible Dev. Expenditures.....	90	90	30	—	—	210	150	360	0.08
<b>NET CASH INCOME</b> .....	475	526	644	635	620	2,900	2,988	5,888	1.37
Excess over Loan Requirements.....	75	76	144	85	20	400	2,988	3,388	0.79
Discount Factor at 11½%.....	.90	.80	.72	.65	.58	.75	.37	.41	.41
<b>Present Worth</b> .....	68	61	104	55	12	300	1,106	1,406	0.33
<b>LOAN AMORTIZATION SCHEDULE:</b>									
Loan at Beginning of Year.....	2,500	2,100	1,650	1,150	600	—	—	—	—
Less: Principal Payments.....	400	450	500	550	600	2,500	—	2,500	0.58
<b>Loan Balance at End of Year</b> .....	2,100	1,650	1,150	600	—	—	—	—	—
	<b>TOTAL VALUE</b> .....							3,906	0.91

Notes:  
 \* Crude Oil Including Natural Gas Liquids @ \$2.66 per Barrel.  
 † Natural Gas @ 7.5¢ per Mcf.  
 ‡ At Cost (\$0.91 per Barrel).

Table 5 — Valuation and Payout of Property "P" Purchased By Use of Oil Payment

	ESTIMATED FUTURE								
	1953	1954	1955	1956	1957	Total 5 Years	Thereafter	Grand Total	\$ per Net Bbl.
<b>NET PRODUCTION:</b>									
Crude Oil	434	460	461	431	396	2,182	2,118	4,300	
Operator's share	130	138	138	129	132	667	2,118	2,785	
Natural Gas	347	414	461	631	780	2,633	10,634	13,267	
Thousand Dollars									
GROSS REVENUE*	1,180	1,255	1,261	1,193	1,112	6,001	6,432	12,433	2.89
30% to Operator until Oil Payment liquidated	354	376	378	358	370	1,836	6,432	8,268	2.97
<b>DEDUCTIONS OF OPERATOR:</b>									
Operating Expense	82	89	93	95	100	459	1,176	1,635	0.59
Prod. and Ad Valorem Taxes	36	40	40	36	33	185	382	567	0.20
General and Administrative Expenses	24	26	28	30	30	138	300	438	0.16
Intangible Dev. Expenditures	150	150	50	60	—	410	125	535	0.19
Depletion and Depreciation†	56	59	84	69	104	372	2,015	2,387	0.86
<b>TOTAL</b>	<b>348</b>	<b>364</b>	<b>295</b>	<b>290</b>	<b>267</b>	<b>1,564</b>	<b>3,998</b>	<b>5,562</b>	<b>2.00</b>
<b>TAXABLE INCOME</b>									
Federal Income Tax @ 52%	6	12	83	68	103	272	2,434	2,706	0.97
	3	6	43	35	54	141	1,266	1,407	0.51
<b>NET INCOME</b>									
Add back: Depletion and Depreciation	3	6	40	33	49	131	1,168	1,299	0.46
	56	59	84	69	104	372	2,015	2,387	0.86
<b>SUB-TOTAL</b>	<b>59</b>	<b>65</b>	<b>124</b>	<b>102</b>	<b>153</b>	<b>503</b>	<b>3,183</b>	<b>3,686</b>	<b>1.32</b>
Less: Tangible Dev. Expenditures	90	90	30	—	—	210	150	360	0.13
<b>NET CASH INCOME</b>									
Discount Factor at 12¾%	—31	—25	94	102	153	293	3,033	3,326	1.19
	89	79	70	62	55	56	34	36	
<b>PRESENT WORTH</b>									
	—28	—20	66	63	84	165	1,035	1,200	0.28
<b>OIL PAYMENT SCHEDULE:</b>									
70% of Gross Income	826	879	883	835	742			4,165	
Less: 70% of Production Tax	34	36	36	34	34			174	
Interest @ 5½% Per Annum	176	139	99	58	19			491	
<b>NET AVAILABLE FOR OIL PAY. REDUCTION</b>	<b>616</b>	<b>704</b>	<b>748</b>	<b>743</b>	<b>689</b>			<b>3,500</b>	<b>0.81</b>
<b>LOAN AMORTIZATION SCHEDULE:</b>									
Loan Outstanding at Beginning of Year	3,500	2,884	2,180	1,432	689				
Less: Principal Payment	616	704	748	743	689				
Loan Balance at end of Year	2,884	2,180	1,432	689	—0—				
<b>TOTAL VALUE</b>								<b>4,700</b>	<b>1.09</b>

Notes:  
 \* Crude Oil including Natural Gas Liquids @ 2.66 per Barrel; Natural Gas @ 7.5c per Mcf.  
 † 1953-4 at Cost (43c per Barrel), thereafter Statutory.

stipulated sum, plus interest thereon at a stated rate. The residual interest owner is obligated to operate and develop the property without cost to the oil payment owner. The use of an oil payment in the purchase of a property is illustrated in Table V, where it is assumed that the same property as shown in Tables II and IV is purchased for \$1,200,000 cash, subject to an oil payment of \$3,500,000, plus interest at 5½ per cent, payable out of 70 per cent of the production. The oil payment is sold simultaneously to a third party, who borrows the entire cost of his investment, at 4½ per cent, and retains the 1 per cent difference as interest on which he pays income taxes. He pays no taxes on the balance of his receipts which are construed to be the return of his capital investment on which he is allowed cost depletion. The operator of the property retains 30 per cent of the production out of which he pays his operating and development costs and income taxes. The oil payment is generally designed so that the operator's net income will be quite small and his resulting taxes insignificant until the oil payment has been paid off, when the operator will come into full possession of all the production. Thus, the combined income taxes of all the parties, including the operator, the owner of the oil payment, and the lender, are much reduced until the oil payment has been liquidated. Hence if the property be purchased by this procedure, it will be worth more than if purchased for cash or financed by a direct loan. In the examples shown, the total taxes to all parties (including taxes on interest) amount to

\$2,690,000 in Tables II and IV and to \$1,660,000 in Table V, showing a tax savings of \$1,030,000. The present worth of this savings at 8 per cent is \$800,000. Adding this increment to the value of \$3,900,000 found in Table II indicates a value of \$4,700,000 for the same property if purchased by the oil payment procedure, or 20 per cent more than if the property were purchased for cash or by direct loan. It can be shown by mathematics similar to that used in Table III that the purchase price of \$4,700,000 will be returned, plus a yield of 8 per cent on the diminishing balance. And as shown in Table V, the 8 per cent average combined return from the property is equivalent to 4½ per cent to the lender, one per cent to the owner of the oil payment, and 12¾ per cent to the operator. The operator has his income long deferred, takes most of the risk and, as in the case of property bought by direct loan, is entitled to a relatively high rate of return.

**Comparison of the Methods of Financing**

The foregoing treatment of the valuation and payout of the same property under the same assumption of 8 per cent return, but for different methods of financing, as detailed in Tables II, IV and V, is summarized in Table I.

**Ratio of Loan to Value**

From the standpoint of the lender, it is important to have an ample factor of safety between the amount to be loaned and the estimated value of the security. No estimate of

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reserves nor forecast of future earnings can be perfect. There is always the uncertainty of estimating future production, the possibility of fluctuation in the price of oil, and the hazard that the actual costs of operations and future development may overrun the best of estimates.

In financing this property by a direct loan, the ratio of the loan to the estimated value of the property (the loan ratio) in the example shown is 64 per cent. In our experience, a loan ratio of 60 to 70 per cent is ordinarily good practice and a reasonable percentage of the value of the property, depending upon other factors that should be considered. Another test of the safety of a loan is that the estimate of total future production from the property should be at least twice as great as the production required to pay off the loan. In fact, if this last qualification is met, the loan ratio will be within the above range because the present worth of net cash income from the first half of the future production generally approximates this percentage of the total value.

In oil payment financing, the loan ratio is usually higher than for direct loans. The higher the ratio of the oil payment to the value of the property, the greater will be the savings in taxes, all of which savings being available for the repayment of the loan. The savings in taxes increase the total net return from the property, and hence the value of the property. It should be pointed out, however, that the proportion of production allowed the oil payment owner (70 per cent in the example shown in Table V) should be so limited that the remaining production retained by the operator (30 per cent in this case) will be sufficient to provide the latter with ample funds to continue the operation and development of the property. As production declines, the proceeds retained by the operator may approach the cost of operation. During the term of the oil payment, the operator's profits will be quite small and his real inducement is to pay off the oil payment so that he will become entitled to the entire production from the property. The owner of the oil payment must look to the operator to continue operations until the oil payment has been satisfied. The bank financing the oil payment must also depend upon the operator continuing operations, although the bank deals only with the owner of the oil payment and has no recourse to the operator. Hence, from the standpoint of the lender, it is wise and reasonable to require that:

1. The operator, being the owner of the residual, covenant with the oil payment owner to continue operations until the oil payment shall have been paid off.
2. The owner of the oil payment, that is, the borrower from the bank, have assets of consequence in addition to the oil payment, to which the bank may have recourse.

The lender will require that the operator of the property should be capable and reliable, whether a loan be made direct on the property or by the oil payment procedure. But because the loan ratio in the case of an oil payment may be higher than by direct loan, it is good business from the standpoint of the lender on the oil payment to require the above two qualifications and any other conditions which under the particular circumstances of the oil payment loan will assure its safety.

### CONCLUSIONS

So far as the value of a property and the loan ratio thereon can be used as one of the criteria for judging the goodness of a loan, no hard and fast rule can be or should be set up. For properties that are exceedingly long-lived and whose reservoir

conditions are such that great confidence can be placed in the estimate of reserves and operating costs, it is obvious that the loan ratio may be relatively high with equal safety. The same applies to natural gas producing properties with a 20-year take-or-pay sales contract. But where the production of the property is expected to decline rapidly or where the estimate of oil reserves cannot be relied upon with full confidence, the loan ratio should be lower. It all depends upon the particular property and circumstances.

The objective is to avoid unsafe loans. And the real test should *not* be whether the loan and the property can qualify under previously specified ratios—but: Is it a good loan under all the particular circumstances? That takes experience and judgment.

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