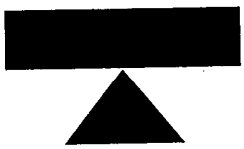
APPENDIX D

Ibbotson Study: "Cost of Capital Analysis for the Energy Production Industry"



Cost of Capital Analysis

for

The Energy Production Industry

Prepared by:
IbbotsonAssociates

25 November 2002

Cost of Capital Analysis for the Energy Production Industry
Prepared by **Ibbotson**Associates
November 21, 2002

Overview

Ibbotson Associates has been contracted to form an after-tax and pre-tax weighted average cost of capital (WACC) estimate for the Energy Production industry. All assumptions and findings for each component of the WACC will also be presented, including the beta, capital structure, and tax rate of the industry. Using the basic capital asset pricing model (CAPM) for determining cost of equity in combination with a cost of debt and a cost of preferred stock computation, the after-tax weighted average cost of capital for the Energy Production industry is 8.56 percent. By applying the CAPM modified for size in deriving a cost of equity estimate, the after-tax WACC is 8.60 percent. These values were calculated with a valuation date as of month-end October 2002. A summary of both after-tax and pre-tax results is presented in Exhibit 1.

Peer Group Selection

For publicly traded companies, inputs to cost of capital models can be estimated from market data. To construct a cost of capital estimate for the Energy Production industry, we must first define the participants. Ibbotson Associates' *Cost of Capital Yearbook* provides cost of capital analysis at the industry level. In this case, our client felt that the industry groupings in our yearbook were not specific enough for their needs and requested analysis on a custom set of companies. This set of companies was delivered to Ibbotson Associates by our client, the American Petroleum Institute, and is presented in Exhibit 5.

Methodology

This methodology section will outline each of the cost of capital components before combining them into a composite weighted average cost of capital. Exhibit 1 presents each component and a summary of results.

Cost of Equity

The cost of equity is equal to the expected rate of return for a firm's equity, including dividends and capital gains or losses. There are several effective methods for computing a firm's cost of equity, including the buildup method, capital asset pricing model ("CAPM"), discounted cash flow ("DCF") method, arbitrage pricing theory, and the Fama-French three factor model. The two most popular methods are the buildup and CAPM models. For this case we will rely primarily on the capital asset pricing model. The CAPM provides an excellent framework for constructing an estimate based on readily available market data.

Capital Asset Pricing Model

We chose the CAPM for the following reasons:

- The CAPM uses only publicly-available data from the market, and a single formula so that the resulting cost of equity estimate is objective, impartial, and reproducible;
- The CAPM relates the return and risk of any stock to that of the market as a whole;
- The CAPM is intuitively appealing in that it says investors demand and receive a risk premium for holding stocks instead of riskless bills or bonds;
- The CAPM has been thoroughly researched and empirically tested, and shown to be effective in estimating the cost of equity; and
- It is a widely used method in the business community (such as in corporate finance and capital budgeting); and in the academic world, where advances in cost of capital theory originate, the CAPM is the prevailing method.

The CAPM cost of equity is computed using the following formula:

$$r_s = R_f + \beta_s \times RP$$

where:

r_s = expected return (or cost of equity) on the stock of company s;
R_f = expected return of the riskless asset;
β_s = the Beta of the stock of company s; and
RP = the expected equity risk premium.

Ibbotson Associates has done substantial work to demonstrate that the CAPM, while adequate in many aspects, fails to fully explain the returns of smaller companies. The adjustment to the CAPM that Ibbotson Associates advocates is in the form of a size premium. For the purpose of this analysis we will provide cost of equity estimates using both the original CAPM and the CAPM modified for size.

The modified CAPM is widely accepted and alters the CAPM formula as follows:

$$k_E = R_f + \beta_s \times RP + SP$$

where:

k_E = cost of equity on the stock of company s;
R_f = expected return of the riskless asset;
β_s = the Beta of the stock of company s;
RP = the expected equity risk premium; and
SP = the expected size premium for company s.

To apply the CAPM and the modified CAPM to our cost of equity estimate for this case, we must obtain each of the parameters from market data. The *SBBI Valuation Edition 2002 Yearbook* provides estimates for the riskless rate, equity risk premium, and size premium. Standard and Poor's Compustat database provides the market data necessary to form the industry beta estimate.

All of the parameters used in this section are stated as of month-end October 2002 so that the after-tax CAPM can be applied as follows:

Standard CAPM

$k_E = 5.08 + (0.58x\ 7.42)$
$k_E = 9.38\%$

Modified CAPM

$k_E = 5.08 + (0.58x\ 7.42) + 0.044$
$k_E = 9.43\%$

Riskless Rate and Equity Risk Premium
The riskless rate of 5.08 percent is the yield on a government bond with approximately 20 years to maturity. The equity risk premium of 7.42 percent is a long-horizon estimate computed as the annual arithmetic total return of stocks (S&P 500) minus the annual arithmetic income return on bonds (20-year government).

Size Premium
For size premium, Ibbotson Associates presents size adjustments for ten different size groupings of publicly-traded companies in the *Stocks, Bonds, Bills, and Inflation (SBBI) Valuation Edition Yearbook.* To find the appropriate size premium, you simply need to take the market capitalization of the firm in question and match it up with a size range presented in the Ibbotson Analysis. This adjustment complements the ability of beta to explain company returns.

To form the industry size premium figure presented in this analysis, we first assigned size premia for each company in the peer group. Then we market value weighted the size premia to form an industry composite size premium. Market value weighting the size premia will reduce the overall magnitude of the adjustment because larger companies are weighted more heavily, but it is our contention that larger companies should have larger impacts on the industry statistics. The size premium for the Energy Production industry is estimated to be 0.044 percent. Exhibit 2 presents individual company size premia data.

To apply the data presented herein to a very small company, it is recommended that the CAPM cost of equity without size adjustment be used as a base. To complete the model, then add the size premium appropriate for the particular subject company. In other words, it may be cleaner to construct the cost of equity from an industry perspective independent of size, and then add the size premium relative to the company being valued. However, in

the absence of a specific subject company, *the best measure for cost of equity of the industry is the CAPM modified for size.*

Beta
Beta is a direct input to the capital asset pricing model (CAPM) when forming a cost of equity estimate and is estimated to be 0.58 for the Energy Production industry. Beta is a measure of a security's sensitivity to the market, also known as its systematic risk. The systematic risk of a security is estimated by regressing the security's returns against the market portfolio's returns. The slope of the regression equation is the beta. The beta estimates calculated in this analysis are based on the capital asset pricing model as developed by Mossin [1966], Lintner [1965], and Sharpe [1964].

In order to calculate a beta for the Energy Production industry, we first constructed a 60-month total return stream for the industry. For each month, the total returns of the peer group companies were weighted by their market capitalization to create a single capitalization-weighted average return stream. Company monthly total returns were obtained from S&P Compustat. Next, we ran a CAPM regression between the monthly total returns of the industry, in excess of the risk-free asset, and the monthly total returns of the stock market in excess of the return on the risk-free asset. The series used as a proxy for the risk-free asset was the returns on the 30 day T-bill, while the proxy for the market was the returns on the Standard & Poor's 500 Index. Total returns for both individual stocks and the market proxy were determined by calculating price appreciation and dividend reinvestment. The regression was run over a 60-month time frame from November 1997 to October 2002.

Cost of Debt

The cost of debt for the Energy Production industry as of month-end October 2002 is estimated to be 6.32 percent. This cost of debt is based on the publicly traded debt of the customized peer group companies. Each of the companies in the peer group that had debt outstanding, and whose debt had been rated by Standard and Poor's, was used in this analysis. The S&P Compustat database was used as the source for long-term debt ratings. Once a debt rating for each company was determined, we assigned the appropriate yield for similar quality corporate bonds presented by Lehman Brothers in their Fixed Income Research for the October update. These yields provide us with approximate cost of debt estimates for each company in the peer group based on the quality of their debt issues. By market value weighting these cost of debt figures we can estimate a cost of debt for the peer group as a whole, and one which we can assign to the Energy Production industry. Exhibit 3 provides individual company cost of debt data.

Cost of Preferred Stock

The cost of preferred stock as of month-end October 2002 is estimated to be 5.90 percent for the Energy Production Industry. The cost of preferred stock was calculated using the publicly traded preferred stock and preferred dividends of the peer group companies. Those companies with less than 10 million in preferred stock were excluded from the analysis, because they did not provide reliable inputs for estimating a cost of preferred stock. The preferred cash dividend amount paid by each firm was divided by the total

value of their preferred stock to arrive at an approximate cost of preferred stock estimate for each company. We market value weighted each estimate to determine a cost of preferred stock for the Energy Production Industry as a whole.

Weighted Average Cost of Capital

The various cost of capitals described throughout this analysis must be combined together to construct an estimate for the firm's overall cost of capital. The weights for each are referred to as the capital structure. In addition to inputs described so far, we also need a tax rate to adjust the cost of debt down to the same tax status as the other components. Since we are concerned with a market derived cost of capital, most of the inputs to this WACC estimate are taken from peer group data. A summary of after-tax and pre-tax weighted average cost of capital results is presented in Exhibit 1.

The weighted average cost of capital formula is:

$$WACC = w_E k_E + w_D k_D(1-t) + w_P k_P$$

where
k_E = the cost of equity;
k_D = is the cost of debt;
k_P = is the cost of preferred stock;
w_E = is the common equity weight in the target capital structure;
w_D = is the debt weight in the target capital structure;
w_P = is the preferred stock weight in the target capital structure; and
t = is the effective tax rate.

The after-tax weighted average cost of capital formula using the parameters explained throughout this analysis is:

$$WACC = (0.8328)(0.0938) + (0.1661)(0.0632)(1-0.296) + (0.0011)(.0509)$$
$$= 8.56\ \%$$

Capital Structure Weights

The most appropriate capital structure for a company is its target structure. This is the capital structure that the company aspires to attain in the future, and is the most appropriate weighting scheme to develop a prospective cost of capital estimate used for discounting future cash flows. Target capital structure can be determined in two ways. One way is to ask the subject company's management what they see as their optimal and therefore target capital structure going forward. This must be compared to their historical structure and adjusted for expected demands in financing to check for reasonableness. If this information is not available, the next best thing is to use the capital structure of the industry. It can be argued that the target capital structure for a given company will be similar to that of its peers.

In this case, as in most, access to management for each of the peer group companies is not realistic given the scope of the assignment. Accordingly, we are not able to attain target capital structure estimates directly from each company. The best alternative is to compute the capital structure for the industry.

The capital structure for the Energy Production industry was determined using the book value of debt, the book value of preferred stock, and the market value of equity of the peer group companies. While it is typically straightforward to measure the market value of equity capital, it is much more difficult to measure the market value of debt and of preferred stock because so little is publicly traded. In most cases, the market value of debt and of preferred stock can be approximated by using book values.

The book value of debt, the book value of preferred stock, and the market value of equity for each company was taken directly from S&P Compustat as of month-end October 2002. Both short- and long-term debt was combined to form the book value of debt. The book value of debt for the peer group of companies was arithmetically summed to arrive at an industry book value of debt. The same summation was used for determining the industry book value of preferred stock, the market value of equity, and total capital. In this case, the Energy Production industry has a capital structure of approximately 16.61 percent debt and 83.28 percent equity and 0.11 percent preferred stock. Exhibit 4 presents individual company book value of debt and market value of equity data.

Tax Rate

The effective tax rate for the Energy Production industry is determined to be 29.6 percent. This rate was derived from the peer group companies effective tax rates for 2001. Individual company tax rate data was obtained from Professor John Graham at Duke University. Traditionally, it has been common practice to use the top statutory marginal tax rate when calculating the WACC for a company. However, according to John Graham, there is substantial variation in tax rates across firms and through time, and it is inaccurate to assume that the majority of U.S. publicly traded firms are subject to the top marginal tax rate. In fact, the majority of U.S. firms can expect to pay less than the statutory rate. Research by Professor Graham provides a way for practitioners to determine more accurate estimates of forward looking tax rates. Using the Graham methodology, we constructed an industry tax rate by taking a market capitalization weighted average of the effective federal tax rate (2001) specific to each company in the industry. Company tax rate data is distributed to the public through Ibbotson Associates' Cost of Capital Center section of their www.ibbotson.com web site. A list of the peer group companies and their effective federal tax rates is presented in Exhibit 5. Note that only federal tax rates were used in this analysis and state taxes were ignored for the scope of this assignment.

Pre-Tax Adjustment

Standard WACC calculations are after-tax values and are used to value a stream of after-tax free cash flow. However, in some instances (usually for regulatory or legal statue reasons) it is necessary to derive a pre-tax estimate. The scope of this assignment

required that we also present our estimates of the WACC so that it can be used to discount before-tax cash flows.

Since there is no completely accurate method to calculate a pre-tax cost of capital rate, we used a simple conversion technique to derive a tax-adjusted WACC. The weighted average cost of capital estimate was divided by 1 minus the tax rate to arrive at a pre-tax WACC of 12.16. The formula is as follows:

$$\begin{aligned} \text{WACC} &= .0856 / (1 - 0.296) \\ &= 12.16\% \end{aligned}$$

In order to fully adjust for taxes, the underlying market data would need to be adjusted at the company level first. This is something that requires heavy analysis and, to our knowledge, has not been done to date by anyone. Therefore, the basic adjustment we make here is based on the best available method.

Summary

Using the standard CAPM to derive a cost of equity estimate, the after-tax weighted average cost of capital for the Energy Production industry as of month-end October 2002 is estimated to be 8.56 percent, while the pre-tax WACC is 12.16 percent. This combines the after-tax cost of equity estimate of 9.38 percent, the cost of debt of 6.32 percent, the cost of preferred stock of 0.11 percent, and the effective tax rate of 29.6 percent together according to a prospective capital structure of 83.28 percent equity, 16.61 percent debt, and 0.11 percent preferred stock.

By applying the modified CAPM method for calculating cost of equity, the weighted average cost of capital is estimated to be 8.60 percent on an after-tax basis and 12.22 percent on a pre-tax basis. This combines the after-tax cost of equity value of 9.43 percent, the cost of debt of 6.32 percent, the cost of preferred stock of 0.11 percent, and the effective tax rate of 29.6 percent together according to a prospective capital structure of 83.28 percent equity, 16.61 percent debt, and 0.11 percent preferred stock.

Cost of Capital Analysis for the Energy Production Industry
- Prepared by **Ibbotson**Associates

Exhibit 1: Industry Weighted Average Cost of Capital - October 2002

WACC	**CAPM**	**CAPM + Size Premium**	**Source**
Post-Tax WACC	8.56%	8.60%	
Pre-Tax WACC	12.16%	12.22%	
Cost of Equity			
Post-Tax Cost of Equity	9.38%	9.43%	
Risk Free Rate	5.08%		Wall Street Journal, November 1, 2002
Equity Risk Premium	7.42%		*SBBI Valuation Edition 2002 Yearbook*
Size Premium	0.044%		*SBBI Valuation Edition 2002 Yearbook*
Industry Beta	0.58		
Cost of Debt	6.32%		Standard & Poor *Compustat*
Cost of Preferred Stock	5.90%		Lehman Brothers *Fixed Income Research* October Update
Tax Rate	29.6%		Professor John Graham - 2001 Company Effective Tax Rates
Capital Structure			
Weight of Debt	16.61%		
Weight of Equity	83.28%		
Weight of Preferred Stock	0.11%		

Exhibit 2: Industry Size Premium - October 2002

Industry Size Premium (%) 0.04

Company Name	Market Value October-02	Portfolio Decile	Size Premium (%)
EXXON MOBIL CORP	227,455,469,000	1	0
BP PLC -ADS	143,771,391,000	1	0
TOTAL FINA ELF S A -ADR	96,421,344,000	1	0
ROYAL DUTCH PETROLEUM -ADR	91,699,227,000	1	0
CHEVRONTEXACO CORP	72,233,773,000	1	0
CONOCOPHILLIPS	32,815,051,000	1	0
DOMINION RESOURCES INC	14,665,392,000	1	0
ANADARKO PETROLEUM CORP	11,068,814,000	2	0.33
OCCIDENTAL PETROLEUM CORP	10,758,663,000	2	0.33
BURLINGTON RESOURCES INC	8,293,560,000	2	0.33
DEVON ENERGY CORP	7,902,796,000	2	0.33
APACHE CORP	7,773,774,000	2	0.33
UNOCAL CORP	6,762,513,000	2	0.33
MARATHON OIL CORP	6,475,154,000	2	0.33
AMERADA HESS CORP	4,577,704,000	3	0.59
KERR-MCGEE CORP	4,366,313,000	3	0.59
EOG RESOURCES INC	4,265,856,000	3	0.59
VALERO ENERGY CORP	3,725,605,000	3	0.59
SUNOCO INC	2,288,104,000	4	0.83
WILLIAMS COS INC	971,044,000	6	1.36
TESORO PETROLEUM CORP	210,625,000	9	2.41
	758,502,172,000		

Cost of Capital Analysis for the Energy Production Industry
- Prepared by **Ibbotson**Associates

Exhibit 3: Cost of Debt - October 2002

Industry Cost of Debt (%) 6.32

Company Name	Domestic LT ICR/S&P	Ratings from Compustat	Lehman Brother's LT Bond Yield - October 2002
EXXON MOBIL CORP	2	AAA	5.84
BP PLC -ADS	4	AA+	6.11
CHEVRONTEXACO CORP	5	AA	6.11
TOTAL FINA ELF S A -ADR	5	AA	6.11
APACHE CORP	9	A-	6.61
CONOCOPHILLIPS	9	A-	6.61
ANADARKO PETROLEUM CORP	10	BBB+	8.14
BURLINGTON RESOURCES INC	10	BBB+	8.14
DOMINION RESOURCES INC	10	BBB+	8.14
EOG RESOURCES INC	10	BBB+	8.14
MARATHON OIL CORP	10	BBB+	8.14
UNOCAL CORP	10	BBB+	8.14
AMERADA HESS CORP	11	BBB	8.14
DEVON ENERGY CORP	11	BBB	8.14
KERR-MCGEE CORP	11	BBB	8.14
OCCIDENTAL PETROLEUM CORP	11	BBB	8.14
SUNOCO INC	11	BBB	8.14
VALERO ENERGY CORP	11	BBB	8.14
TESORO PETROLEUM CORP	15	BB-	11.08
WILLIAMS COS INC	16	B+	13.2

Exhibit 4: Capital Structure Ratios - October 2002

Debt/Total Capital	**16.61%**
Equity/Total Capital	**83.28%**
Pref Stk/Total Capital	**0.11%**
Debt/Market Value of Equity	**19.94%**
Total MV of Equity	758,502.17
Total Book Debt	151,277.81
Total Preferred Stock	964.18
Total Capital	$ 910,744.16

Company Name	Preferred Stock	Total Book Debt	Market Value Mnthly	Total Capital	Book Debt to Tot Capital
AMERADA HESS CORP	0	5,665.00	4,577.70	10,242.70	0.55
ANADARKO PETROLEUM CORP	103	5,050.00	11,068.81	16,221.81	0.31
APACHE CORP	306.594	2,244.36	7,773.77	10,324.73	0.22
BP PLC -ADS	21	21,417.00	143,771.39	165,209.39	0.13
BURLINGTON RESOURCES INC	0	4,337.00	8,293.56	12,630.56	0.34
CHEVRONTEXACO CORP	0	17,418.00	72,233.77	89,651.77	0.19
CONOCOPHILLIPS	0	9,339.00	32,815.05	42,154.05	0.22
DEVON ENERGY CORP	1	6,589.00	7,902.80	14,492.80	0.45
DOMINION RESOURCES INC	384	16,464.00	14,665.39	31,513.39	0.52
EOG RESOURCES INC	147.582	855.97	4,265.86	5,269.41	0.16
EXXON MOBIL CORP	0	10,802.00	227,455.47	238,257.47	0.05
KERR-MCGEE CORP	0	4,574.00	4,366.31	8,940.31	0.51
MARATHON OIL CORP	0	3,647.00	6,475.15	10,122.15	0.36
OCCIDENTAL PETROLEUM CORP	0	4,608.00	10,758.66	15,366.66	0.30
ROYAL DUTCH PETROLEUM -ADR	1	3,492.00	91,699.23	95,192.23	0.04
SUNOCO INC	0	1,444.00	2,288.10	3,732.10	0.39
TESORO PETROLEUM CORP	0	1,146.90	210.625	1,357.53	0.84
TOTAL FINA ELF S A -ADR	0	13,111.17	96,421.34	109,532.52	0.12
UNOCAL CORP	0	3,428.00	6,762.51	10,190.51	0.34
VALERO ENERGY CORP	0	3,683.41	3,725.61	7,409.01	0.50
WILLIAMS COS INC	0	11,962.00	971.044	12,933.04	0.92

Exhibit 5: Peer Group Companies, Industry Tax Rate, Effective Company Tax Rates (2001)

Industry Weighted Average Effective Tax Rate	29.64%

Company	Effective Tax Rates
AMERADA HESS CORP	6.79%
ANADARKO PETROLEUM CORP	35.00%
APACHE CORP	1.38%
BP PLC -ADS	35.04%
BURLINGTON RESOURCES INC	31.78%
CHEVRONTEXACO CORP	35.00%
CONOCOPHILLIPS	35.11%
DEVON ENERGY CORP	33.89%
DOMINION RESOURCES INC	21.26%
EOG RESOURCES INC	35.64%
EXXON MOBIL CORP	35.00%
KERR-MCGEE CORP	4.67%
MARATHON OIL CORP	35.07%
OCCIDENTAL PETROLEUM CORP	35.01%
ROYAL DUTCH PETROLEUM -ADR	1.62%
SUNOCO INC	16.20%
TESORO PETROLEUM CORP	32.63%
TOTAL FINA ELF S A -ADR	35.21%
UNOCAL CORP	3.95%
VALERO ENERGY CORP	34.69%
WILLIAMS COS INC	8.01%

APPENDIX E

Ibbotson Recommendation for Multi-Year Analysis

Cost of Capital Analysis for the Energy Production Industry
Prepared by **Ibbotson**Associates
December 10, 2002

This review pertains to the use of Ibbotson Associates industry cost of capital data in performing industry-level cost of capital analysis for SIC 131 and SIC 291 from 1997 to 2002.

The Ibbotson Associates *Cost of Capital Yearbook* with quarterly supplements provide cost of capital analysis and other financial statistics on over three hundred industries organized by Standard Industrial Classification (SIC) code. The source of data for the Yearbook is *Standard & Poor's Compustat*, which is a provider of company-level financial data.

Ibbotson Associates industry cost of capital analysis can be purchased with data through the end of December, March, June, and September of each year. The *Yearbook* is published once a year with data through March, and the three quarterly supplements are published at the end of each quarter. In the case of the cost of capital analysis being performed by the American Petroleum Institute, which requested year-end historical data, we recommend purchasing March industry cost of capital data for SIC 131 and 291 over the time period 1997 to 2002. We suggest using month-end March data because a large number of companies had not report their book value of debt for the then current year to *S&P Compustat* until after December. In the case of SIC 131 and SIC 291, this greatly skews the estimated industry capital structure ratios. For this reason, we recommend using the March analysis for SIC 131 and SIC 291 from the *Cost of Capital Yearbook* over the time period 1997 to 2002.

Tara McDowell

Ibbotson Associates
Senior Analyst