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VALCON 2021

Chesapeake Case Study

Sponsored by AlixPartners, LLP

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Chesapeake Energy

VALCON 2021

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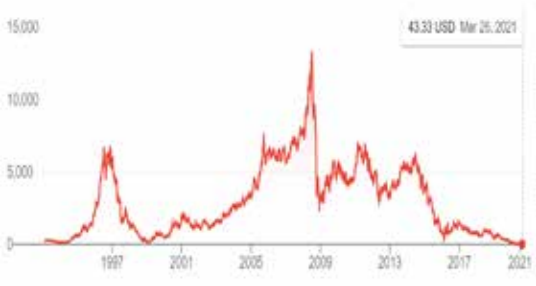
Chesapeake Energy is one of the largest domestic upstream oil and gas companies and has a colorful history

History of Chesapeake Energy Company

- Founded in 1989 by Aubrey McClendon and Tom Ward with $50K in capital
- Focused on developing natural gas reserves
- IPO in 1993 at a value of $25M
- In early 2000's, began applying horizontal drilling and hydraulic fracturing technologies to "tight" gas formations – previously thought uneconomic
- Became the 2nd largest producer of natural gas in the US. $36B market capitalization at its peak
- In its quest for growth, the company spent nearly $18B in capex in 2008 alone – and became highly leveraged
- When natural gas prices collapsed, CHK was forced to sell assets; replace its founder and focus on deleveraging its balance sheet
- In early 2019, the company shifted gears toward oil and acquired Wildhorse Resources for $4B
- When oil prices collapsed in May 2020 (due to both a Covid-driven demand collapse and an OPEC+ production quota dispute, CHK pursued a CH11 filing

Chesapeake Energy's Equity Price ($/share)



Source: CHK website; Wikipedia, Reuters, Yahoo Finance

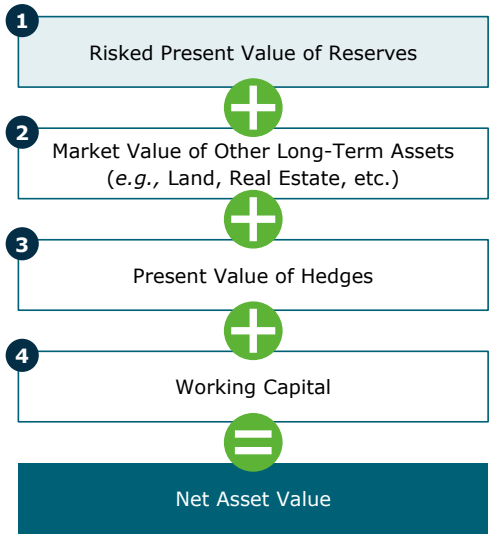
Net Asset Value (NAV) is a widely accepted approach to valuing upstream oil & gas company assets

Detailed on pages 4&5

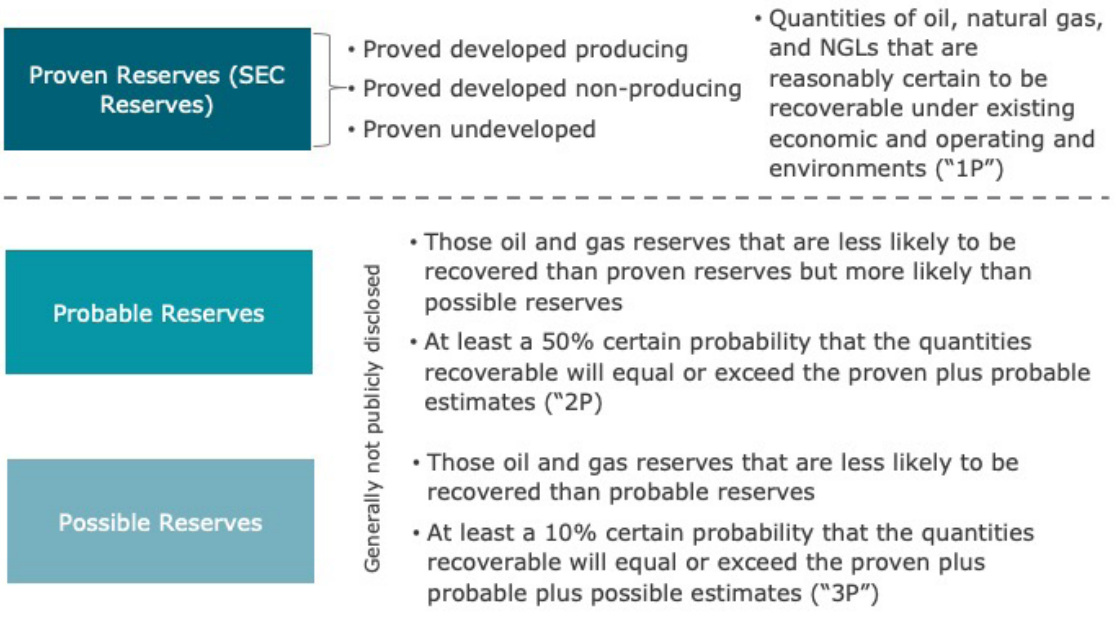
Net Asset Value (NAV) Approach Overview:

- NAV approach is based on the theory that the value of an E&P company is based on cash flows stemming from its existing reserves
- NAV is basically a comprehensive DCF analysis which takes into consideration specific information on reserves
- But NAV flips the traditional DCF on its head in that it no longer assumes perpetual growth
- Instead, NAV approach assumes that the company adds nothing to its assets and that it produces 100% of its reserves until it runs out of natural resources completely
- Similarly, NAV leaves out items like corporate income taxes, overhead and SG&A because company is valued on an asset-level

Net Asset Value (NAV) Components:



The NAV approach factors in oil and gas reserve categories with different levels of technical and economic certainty



Source: Society of Petroleum Engineers, SEC

1 Net asset valuation links drilling and production parameters with price and cost assumptions to estimate future cash flows

Debtor/UCC difference drivers

Technical assumptions related to developing known reserves

- Development program
  - Field development approach
  - Well design and spacing
  - Development pace and sequence
  - Non-operated development plan
- Well performance
  - Existing well production forecasting
  - Type curve assumptions for new wells
  - Gathering & takeaway constraints
  - Process yield and shrinkage

Economic assumptions

- Commodity pricing
  - Oil and gas forward curves
  - Long-term price inflation
  - Location and quality price differentials
- Capital expenditures
  - Facilities and pad construction
  - Well drilling and completion
- Lease bonuses and royalties
- Severance and ad valorem taxes
- Operating costs
  - Gathering and transportation
  - Lease operating expense
  - Workovers and recompletions
  - Plugging and abandonment

Risk and valuation assumptions

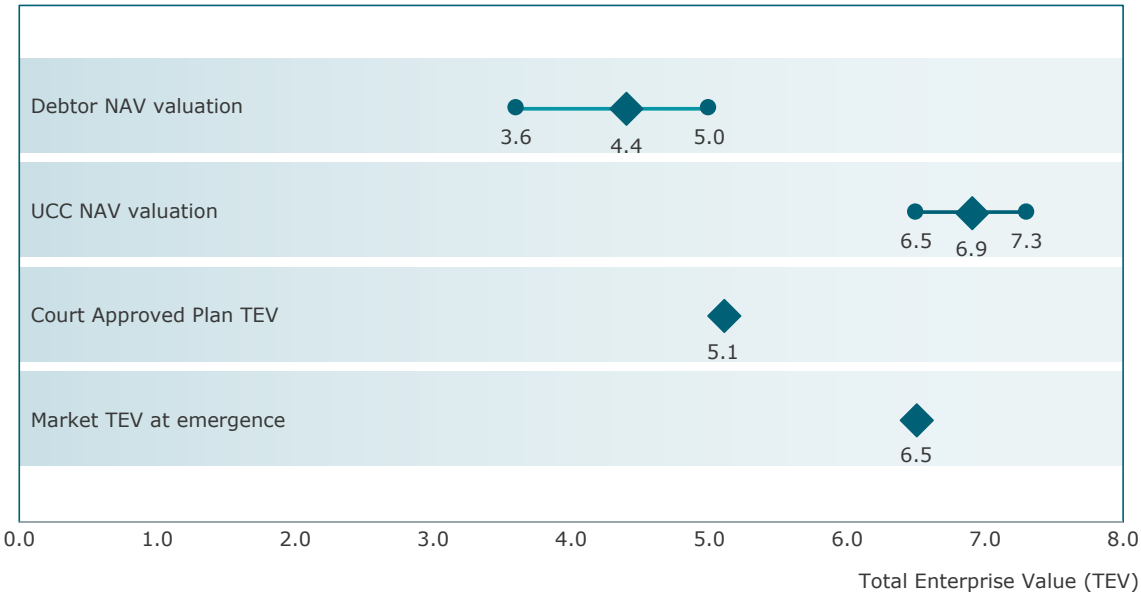
- Discount rate
  - Company WACC
  - Industry standard 10% discount rate
  - Risk-adjusted discount rates
- Risk adjustments applied to reserve quantities
  - Reserve categories
  - Acreage/resource quality
  - Current pricing environment
  - Regional infrastructure issues
  - Outlook/health of operators

There are three primary drivers of differences in the NAVs concluded by the Debtor's and UCC's advisors

	Description	Debtor	UCC
Commodity Pricing	• Future prices of oil and gas that are applied to projected production volumes to estimate future revenues	• 5-year NYMEX strip, with flat (nominal) prices thereafter	• 2-year NYMEX strip, with 2.0% inflation factor thereafter
Discount Rate	• Discount rate applied to future projected cashflows from company's reserves to calculate their present value	• 10% discount rate (oil & gas industry Standard)	• Estimated post-emergence WACC of 8.5%
Risk Adjustment Factors (RAFs)	• Multipliers applied to present values of reserves by category to account for additional risk associated with unproven, undeveloped, and/or non-producing reserves	• RAFs based on most recent survey by Society of Petroleum Evaluation Engineers (SPEE)	• Estimated RAFs based on advisors' industry experience and review of Chesapeake's assets

While court-approved TEV was higher than Debtor's estimate, it fell ~$1.4B short of Chesapeake's market value at emergence

Summary valuation ranges determined by Debtor, UCC, Court and Market



Source: Public Access to Court Electronic Records (PACER); Yahoo Finance

The NAV approach factors in oil and gas reserve categories with different levels of technical and economic certainty

Proven Reserves (SEC Reserves)

- Proved developed producing
- Proved developed non-producing
- Proven undeveloped

- Quantities of oil, natural gas, and NGLs that are reasonably certain to be recoverable under existing economic and operating and environments ("1P")

Generally not publicly disclosed

Probable Reserves

- Those oil and gas reserves that are less likely to be recovered than proven reserves but more likely than possible reserves
- At least a 50% certain probability that the quantities recoverable will equal or exceed the proven plus probable estimates ("2P)

Possible Reserves

- Those oil and gas reserves that are less likely to be recovered than probable reserves
- At least a 10% certain probability that the quantities recoverable will equal or exceed the proven plus probable plus possible estimates ("3P")

Source: Society of Petroleum Engineers, SEC

CASE STUDY: Chesapeake Energy

VALCON 2021

May 2021

Professor Israel Shaked
The Michel-Shaked Group & Boston University

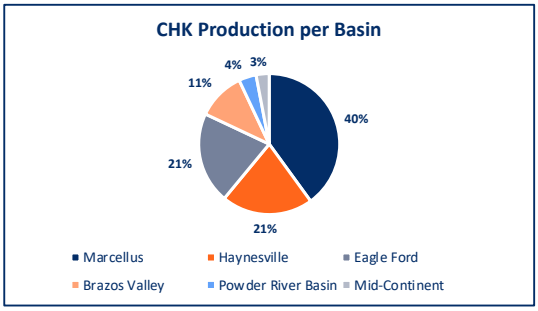
THE MICHEL-SHAKED GROUP
www.michel-shaked.com

Case Study: Chesapeake Energy Background

Chapter 11 Bankruptcy

CHESAPEAKE ENERGY

- Chesapeake Energy Corporation is an Exploration and Production company that engages in the acquisition, exploration, and development of properties in the production of oil and natural gas (30% oil, 70% natural gas).
- Chesapeake filed for chapter 11 bankruptcy on June 28, 2020 in the US Bankruptcy Court in the Southern District of Texas.
- Chesapeake emerged from bankruptcy, with the acceptance of management's restructuring plan, on February 9, 2021.



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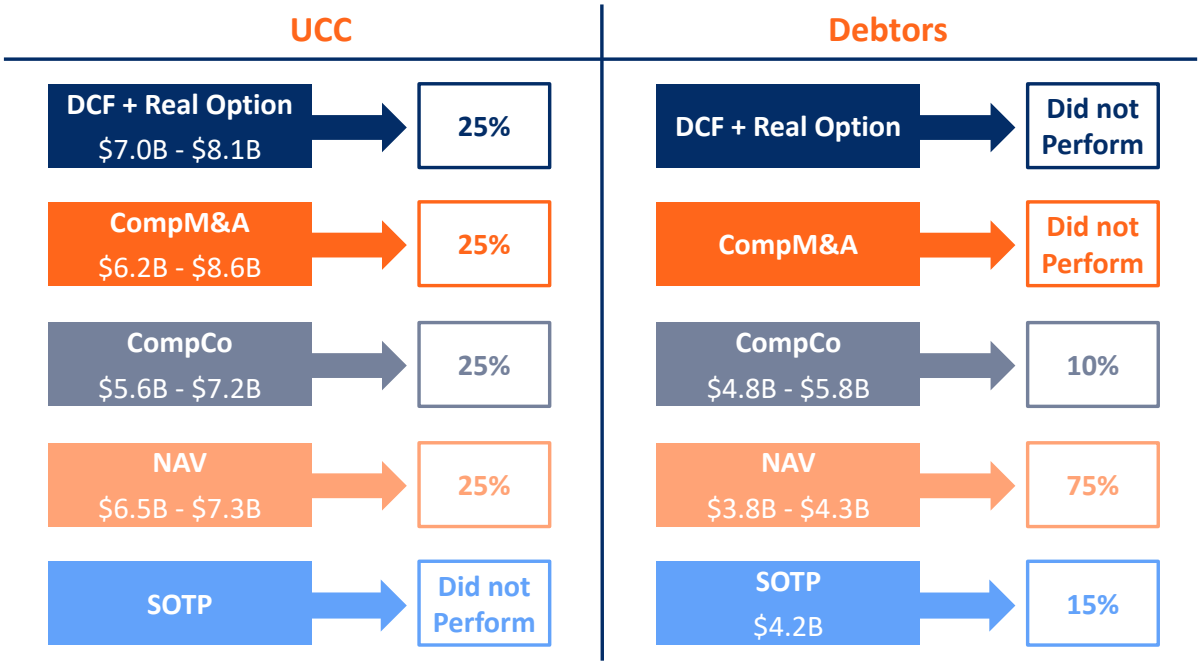
Unsecured Creditors Committee (UCC) vs Debtors Valuation Summary

Valuation Methodologies and Weightings



Valuation Methodologies Used in Recent Corporate Transactions

- The table below summarizes the valuation methodologies performed by at least one financial advisor in recent transactions within the E&P Industry.

	Valuation Method Performed by at least One Financial Advisor in a Transaction			
Target	NAV	CompCo	CompM&A	DCF
Parsley Energy	X	X	X	X
Concho Resources	-	X	X	X
WPX Energy	X	X	-	X
Montage Resources	X	X	X	-
Noble Energy	-	X	X	X
Carrizo	X	X	-	X
Amplify Energy	X	X	X	X
Anadarko	-	X	X	X
Rosetta Resources	X	X	X	-
LRR Energy	X	X	X	X
QR Energy	X	X	X	X
Forest Oil	X	X	-	-
	9/12	12/12	9/12	9/12

Valuation Methodologies and COVID-19

- When a valuation is performed during COVID-19, the demand, pricing, and future outlook of the E&P industry is reflecting the impact of COVID-19:
  - **CompCo:** applies the **current** enterprise value of each peer company in the calculation of multiples and EBITDAX estimates for the peer companies as well as CHK.
  - **CompM&A:** selects **current** precedent transactions that are available in this consolidating industry.
  - **DCF:** relies on **current** management projections.
    - Pre-COVID data may be used to calculate Beta to avoid double-counting the effects of COVID-19.

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Comparable Company Analysis

Most Commonly Performed Valuation Method by E&P Financial Advisors

UCC	Debtors
CompCo $5.6B - $7.2B → 25%	CompCo $4.8B - $5.8B → 10%
Multiples selected based on peer group medians from benchmarking analysis.	**Range of multiples with peer median as maximum.**
• UCC Peer Group:	• Debtor Peer Group:
➢ Comstock Resources	➢ Comstock Resources
➢ EQT Corporation	➢ EQT Corporation
➢ Marathon Oil	➢ Marathon Oil
➢ Range Resources	➢ Range Resources
➢ Cabot Oil and Gas	➢ Magnolia Oil and Gas
➢ Murphy Oil	➢ Antero Resources
	➢ Ovintiv
	➢ Southwestern Energy
	➢ Devon Energy

Transactions also used in Debtors' SOTP Analysis

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Comparable Transaction Analysis

Valuation Methodology Used by a Large Majority of E&P Financial Advisors

UCC

CompM&A $6.2B - $8.6B → **25%**

Multiples selected based on peer group medians from benchmarking analysis.

- Comparable Transaction Target Companies:
  - Montage Resources *(closed 11/13/20)*
  - Nobel Energy *(closed 10/05/20)*
  - Concho Resources *(pending as of valuation date)*
  - Parsley Energy *(pending as of valuation date)*
  - WPX Energy *(pending as of valuation date)*

**Note: all transactions announced in the last two quarters of 2020*

Debtors

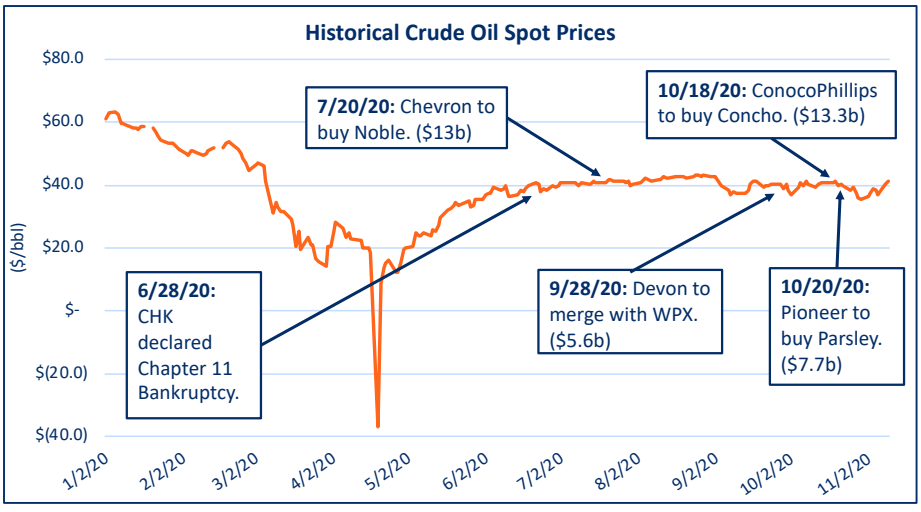
CompM&A → **Did not Perform**

- Debtors only performed a CompM&A analysis as part of their Sum-of-the-Parts analysis for each basin rather than for CHK as a whole.

Comparable Transaction Analysis

E&P Consolidation in 2020 – Rare to Have Large Volume of Recent Transactions

- 2020 has seen a wave of consolidation in the E&P sector that provides **timely** transaction data for purposes of valuing CHK.



Comparable Transaction Analysis

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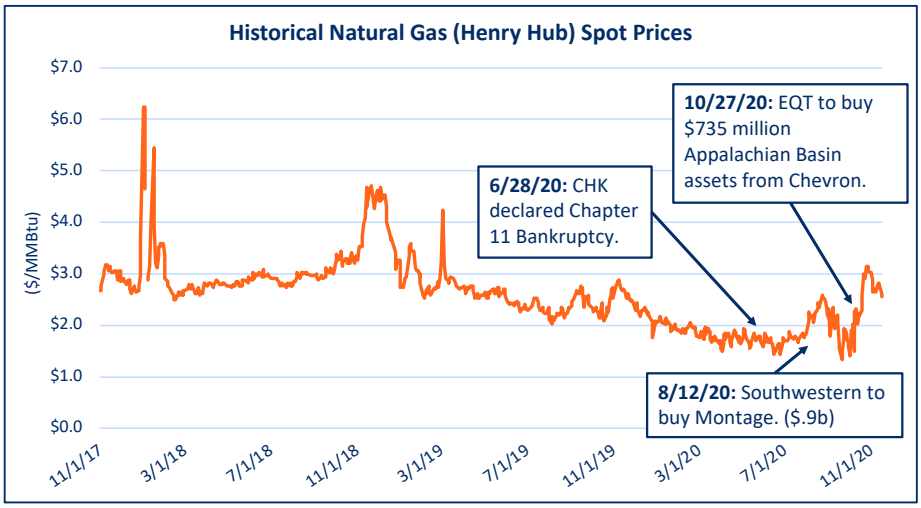

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NYMEX Strip Pricing

Pricing Assumption - Most Significant Input for DCF and NAV Analyses

UCC

DCF + Real Option $7.0B - $8.1B	25%
NAV $6.5B - $7.3B	25%

- **2-Year** NYMEX Strip Pricing, increased by 2% inflation annually thereafter
  - Historically high correlation between oil and gas prices and inflation
  - Nominal discount rates, such as WACC, should be paired with cash flows adjusted for inflation
  - Lack of trading data beyond two years

Debtors

DCF + Real Option	Did not Perform
NAV $3.8B - $4.3B	75%

- **5-Year** NYMEX Strip Pricing, kept flat thereafter
  - Most commonly used pricing assumption for Exploration & Production valuation

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NYMEX Strip Pricing

NYMEX 5-Year Strip Pricing is Most Commonly Used in Recent Chapter 11 Bankruptcies

Company (Debtor)	Financial Advisor / Banker	Commodity Pricing During Forecast Period
Recent Chapter 11s		
Lonestar Resources	Intrepid	5 Year Strip
Oasis Petroleum	TPH / Perella W.	5 Year Strip
California Resources	Perella Weinberg	5 Year Strip
Chisholm Oil and Gas	Evercore	5 Year Strip
Chaparral Energy	Intrepid	5 Year Strip
EP Energy	Evercore	5 Year Strip
Denbury Resources	Evercore	5 Year Strip
Ultra Petroleum	Centerview Partners	5 Year Strip
Rosehill Resources	Jefferies	5 Year Strip
Unit Corporation[1]	Evercore	2 Year Strip[2]
Whiting Petroleum	Moelis & Co.	5 Year Strip
Select Opportune Engagements		
Chaparral Energy	Opportune	5 Year Strip
Rosehill Resources	Opportune	5 Year Strip
Unit Corporation[1]	Opportune	2 Year Strip[2]
Elk Petroleum	Opportune	5 Year Strip, 2% Escalation
Vanguard Natural Resources	Opportune	5 Year Strip
Gastar	Opportune	5 Year Strip
Fieldwood Energy	Opportune	5 Year Strip

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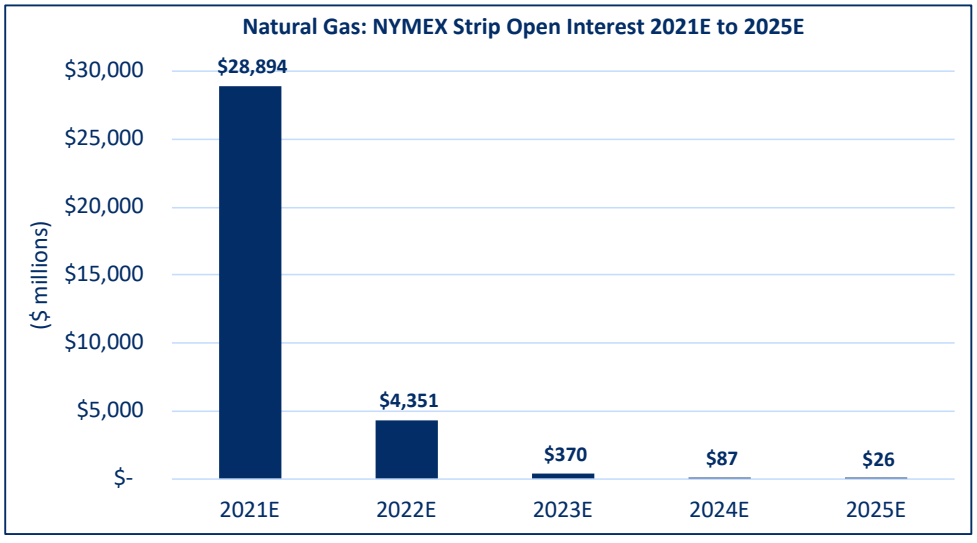
NYMEX Strip Pricing

NYMEX Strip Open Interest Data Indicates Minimal Data After Year 2



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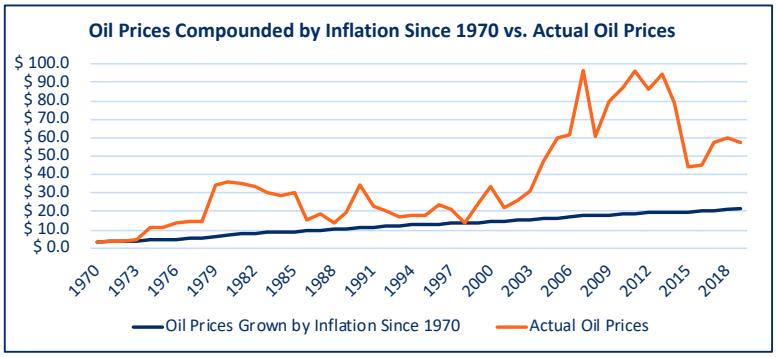
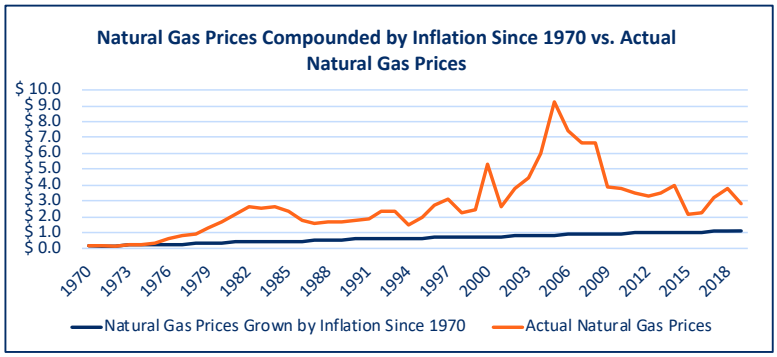
NYMEX Strip Pricing

Historically Oil and Gas Prices Were Statistically Significantly Correlated with Inflation

The actual oil and gas prices from 1970 to 2020 were generally significantly higher than the oil and gas prices compounded by inflation since 1970.





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Discounted Cash Flow Analysis

Extended DCF Includes Traditional DCF Analysis + Real Option Valuation

UCC

DCF + Real Option $7.0B - $8.1B → **25%**

- UCC performed a traditional DCF analysis (in addition to an NAV analysis) with an extended real option valuation component
  - 2-Year NYMEX Strip Pricing, increased by 2% inflation annually thereafter
  - Calculated a WACC of 8.5%
  - The real option valuation captures the value of additional available locations not represented in the projected cash flows

Debtors

DCF → **Did not Perform**

- Debtors chose to perform an NAV analysis rather than a traditional DCF analysis
  - Debtors cite the NAV methodology as a variation of a traditional DCF methodology in the Exploration & Production industry
  - 5-Year NYMEX Strip Pricing, kept flat thereafter
  - Used a 10% industry standard WACC for the NAV discount rate

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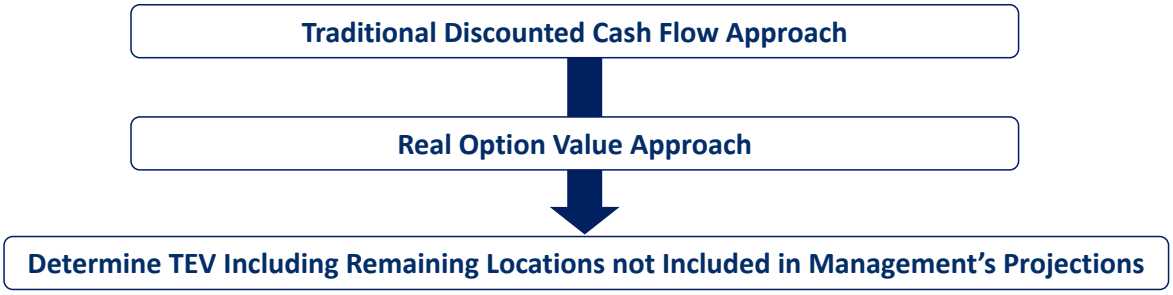
Extended Discounted Cash Flow Analysis

Extended DCF Valuation Definition

- "E&P companies are valued for their reserves. These reserves have both DCF and real option components. The market value of the vast majority of E&P companies is greater than can be accounted for through DCF means, implying that the market pays for real option value as well."[1]



(1) McCormack, John, Gordon Sick. "Valuing PUD Reserves: A Practical Application of Real Option Techniques." Journal of Applied Corporate Finance, Vol. 13, No. 4, Winter 2001. Emphasis added.

Extended Discounted Cash Flow Analysis

Oil & Gas Reserves have DCF and Real Option Components

- "Unfortunately, **DCF techniques systematically undervalue undeveloped reserves**… **Real option models address these shortcomings.** Though more complex than traditional DCF analysis**, real option models provide a far more complete picture of not only reserve values but also the drivers of that value.**"[1]

(1) McCormack, John., Stern Stewart & Co., Gordon Sick. "Valuing PUD Reserves: A Practical Application of Real Option Techniques." Journal of Applied Corporate Finance, Vol. 13, No. 4, Winter 2001. Emphasis added.

Real Option Value Approach

Literature Supporting Real Option Valuation Analysis

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Real Option Value Approach

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Real Option Value Approach

Sample of Energy Companies That Have Utilized Real Option Valuation

Real Option Value Approach

Real Option – An Illustration Using a Hypothetical Example

- The following table presents **two areas**, **Area 1** with a single well that is currently $10 in-the-money, and **Area 2** with a well that is also $10 in-the-money and another well that is currently out-of-the-money:

Current Commodity Prices					
Area 1	PV of Reserves		Extraction Cost		Value
Well 1	$	100	$	(90)	$ 10

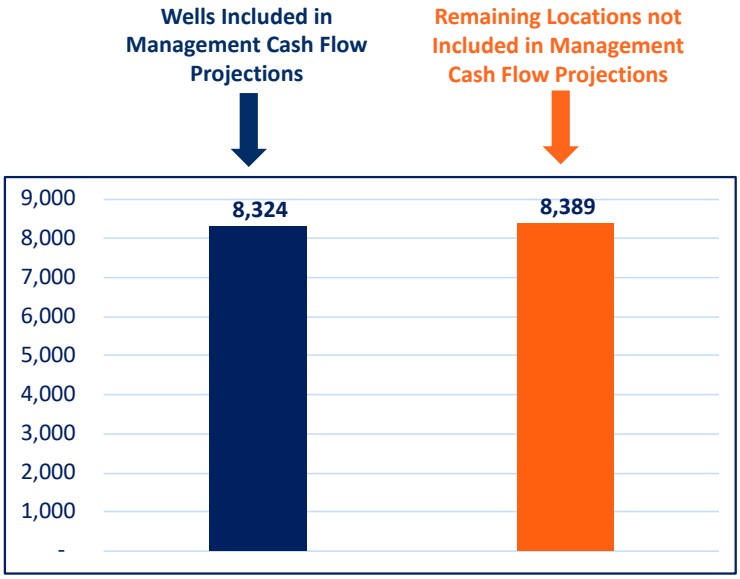
Area 2	PV of Reserves		Extraction Cost		Value
Well 1	$	100	$	(90)	$ 10
Well 2	$	100	$	(105)	$ -

Currently Out of the Money

The traditional DCF valuation methodology suggests that both areas are worth the same. However, economic rational dictates that Area 2 is more valuable.

Real Option Value Approach

Wells Included in Management Projections vs Remaining Locations



Economic Rational dictates that the value of the option to drill the 8,389 remaining locations should be added to the value derived by applying the traditional DCF methodology.

Real Option Value Approach

Reserve categories of the 8,389 Remaining Locations

- The 8,389 remaining locations are spread across 5 of CHK's basins and fall under 107 different type curves.
- Within the same type curve, reserves (potential wells) are categorized into Proved Undeveloped (PUD), Probable and Possible.

Basin	# of Type Curves	Remaining Locations			All Remaining Locations
		Proved Und.	Probable	Possible	
Appalachian	9	4	38	256	297
Brazos Valley	23	497	132	2,469	3,097
Gulf Coast	16	148	230	304	682
Rockies	33	90	959	1,961	3,010
South Texas	26	240	-	1,063	1,303
All Basins	**107**	**979**	**1,359**	**6,052**	**8,389**

Real Option Value Approach

Stock Call Option vs. Real Option – Applying the Real Option Approach to E&P Companies

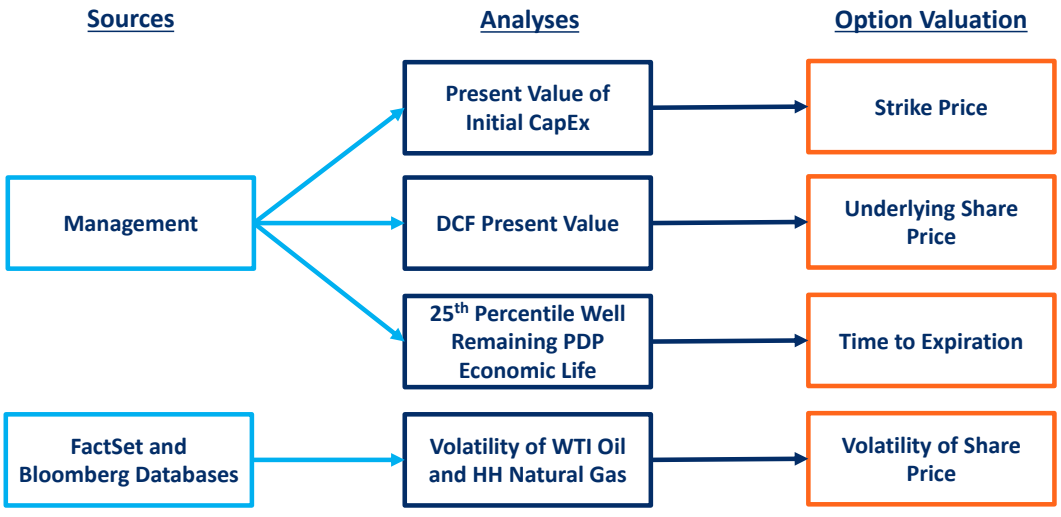
- The real option valuation methodology is analogous to the financial stock call option valuation methodology as can be observed in the following table:

#	Stock Call Option Terminology	Real Option (undeveloped reserves) Terminology
1)	Strike price	Capital Exp. needed to develop reserve
2)	Underlying share price	DCF value of reserve when developed
3)	Time to expiration	Time remaining on mineral lease
4)	Volatility of share price	Volatility of developed reserve value
5)	Time value of money (Treasury rate)	Time value of money (Treasury rate)
	The value of a Call option on shares of stock	The value of a Proven Undeveloped Reserve (PUD)[1]

The same methodology can also be applied to valuing both probable and possible reserves.

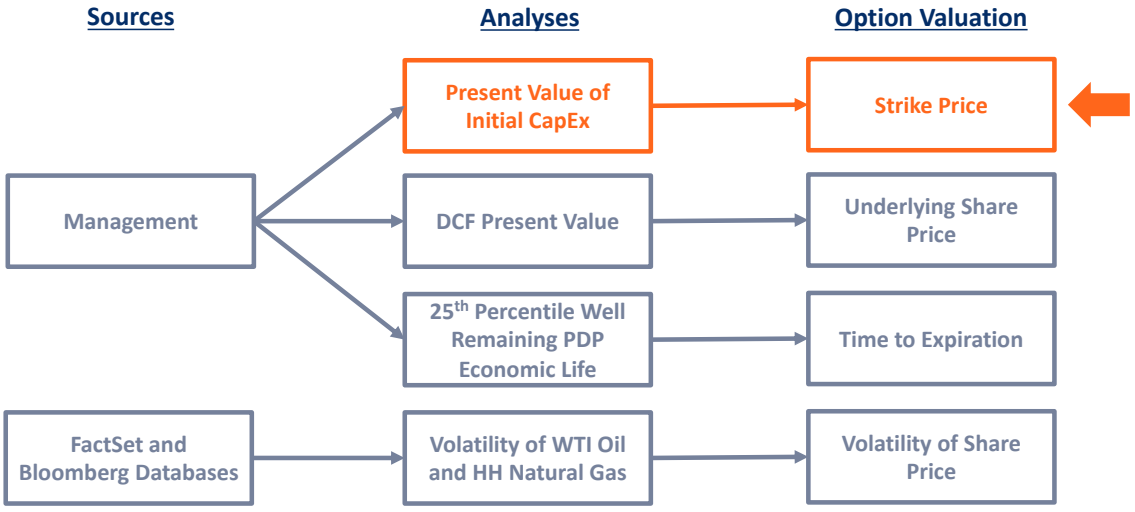
Real Option Value Approach

Option Valuation Road Map



Real Option Value Approach

Option Valuation Road Map



Real Option Value Approach

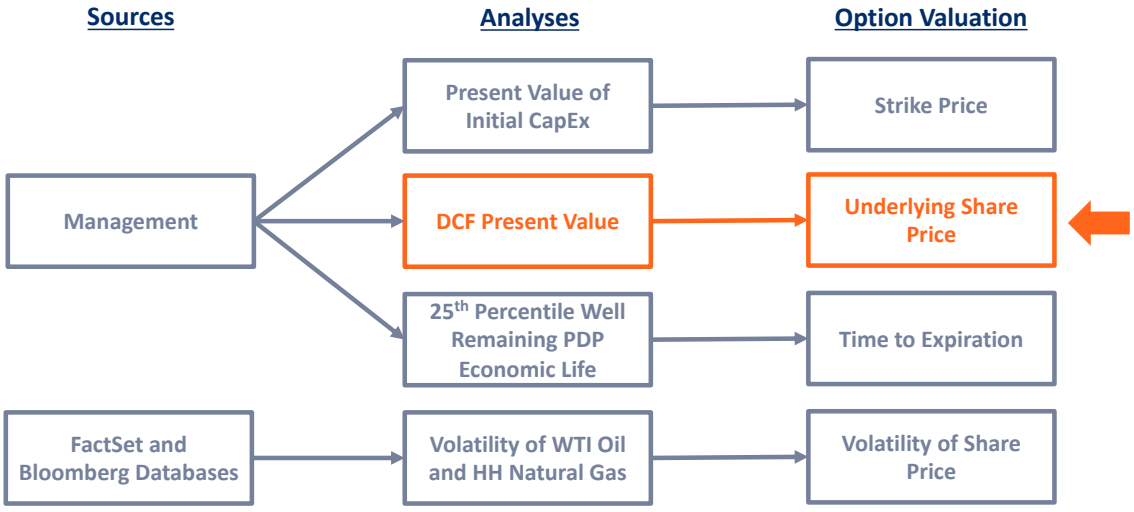
Present Value of Capital Expenditure needed to develop reserve (= Strike price)

- For each type curve, a present value of initial capital expenditures was calculated and applied as a strike price in the option valuation model. Strike price calculations of a specific type curve (NAN OP Tier 2 Granville) are presented in the table below:

($ 000s) Capital Investments	Timing	Amount	Timing in Months	Discounted Amount
Pre-Drill	Immediate investment	$ 63	0	$ 63
Drill	Immediate investment	1,135	0	1,135
Completion	Drill Time - Completion Time	2,102	2	2,074
TIL	Drill Time	268	4	261
			Strike Price	**$ 3,533**

Real Option Value Approach

Option Valuation Road Map



Real Option Value Approach

DCF PV of reserve when developed

- Perform a DCF in order to assess the current value of a typical well within that type curve. The detailed calculation of a specific type curve (NAN OP Tier 2 Granville) is presented in the following table:

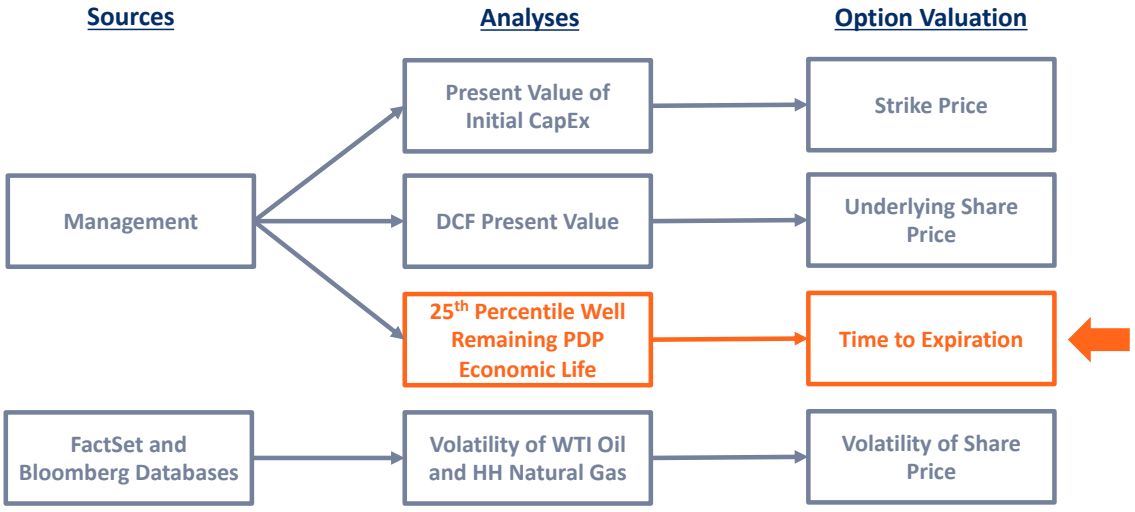
($000s)		Tax Shield					
Years	Cash Flows	Initial CapEx	Maint. CapEx	Taxable Base	Taxes @ 24%	Cash Flows After Tax	Discounted Cash Flows
1	$ 1,211	$ 1,211	$ -	$ -	$ -	$ 1,211	$ 1,147
2	1,212	970	-	242	58	1,154[1]	1,021[2]
3	695	556	-	139	33	662	540
4	423	338	-	85	20	403	303
5	321	256	-	64	15	305	211
6	248	198	-	50	12	236	151
7	212	38	-	174	42	170	100
8	170	-	5	165	40	131	71
9	146	-	-	146	35	111	56
10	125	-	-	125	30	95	44
11	107	-	-	107	26	81	35
12	95	-	-	95	23	72	28
13	85	-	-	85	20	65	23
...							

Cash Flows PV	Sal. + Plugg. PV	DCF PV
$ 3,822	$ (2)	$ 3,820

(1) $1,154 was derived by subtracting the taxes of $58 in year two from the cash flow of $1,212 in year two.
(2) $1,021 was derived by discounting the year two cash flow after tax of $1,154 back to the present @ 8.50 % WACC (using the mid-year discounting convention).

Real Option Value Approach

Option Valuation Road Map



Real Option Value Approach

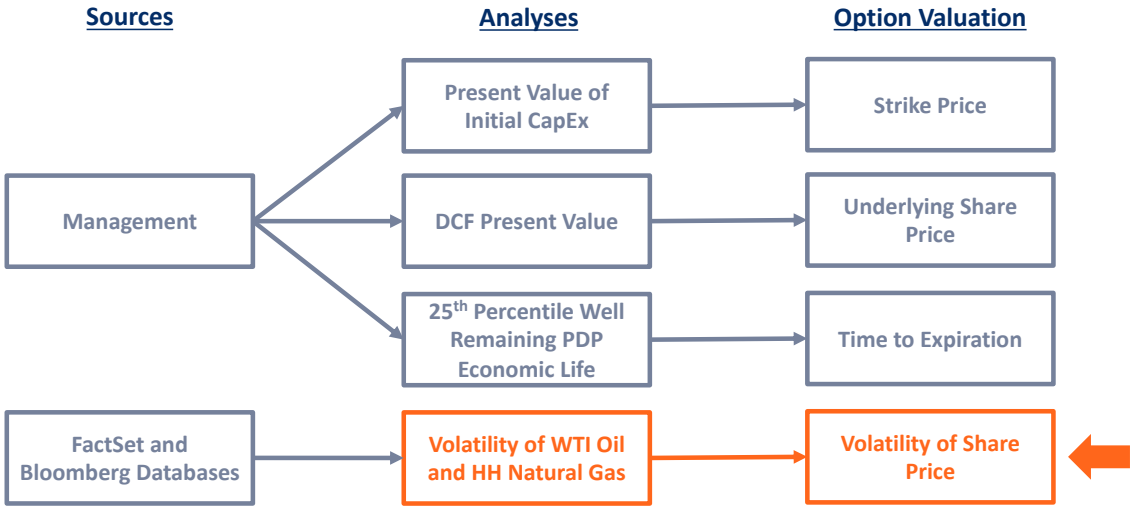
Time remaining on mineral lease (= Time to expiration)

- Time to expiration of a financial call option is analogous to the time remaining on a lease to develop a well.
- All type curves that fall under the same basin were assumed to have their time to expiration equal to the remaining economic life of a 25th percentile well of their basin.

Business Unit	Remaining PDP Economic Life Value	Remaining PDP Economic Life (Years)
APPALACHIA	25th Percentile	34
ROCKIES	25th Percentile	12
BRAZOS VALLEY	25th Percentile	10
GULF COAST	25th Percentile	11
SOUTH TEXAS	25th Percentile	15

Real Option Value Approach

Option Valuation Road Map



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Real Option Value Approach

Crude Oil and Natural Gas Volatility

Historical Annual WTI Crude Oil Volatility
Range = 19.8% - 39.0%
Mean = 30.0%
Median = 30.6%

Implied Forward Annual WTI Crude Oil Volatility
Range = 27.4% to 58.5%
Mean = 41.1%
Median = 43.4%

Historical Annual Natural Gas Volatility
Range = 21.5% - 36.2%
Mean = 30.3%
Median = 32.0%

Implied Forward Annual Natural Gas Volatility
Range = 20.4% to 63.1%
Mean = 46.3%
Median = 57.5%

The UCC Selected a 20% Volatility for both Crude Oil and Natural Gas

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Real Option Value Approach

Valuing CHK's Remaining Locations

- Within the same type curve, there could be remaining locations that are classified as either proved undeveloped (PUD), probable or possible (reserve categorizations).
- Each remaining location should be risk adjusted based on its reserve categorization.

Reserve Category	Risk Adjustment
Proved Undeveloped (PUD)	82.50%
Probable	50.00%
Possible	17.50%

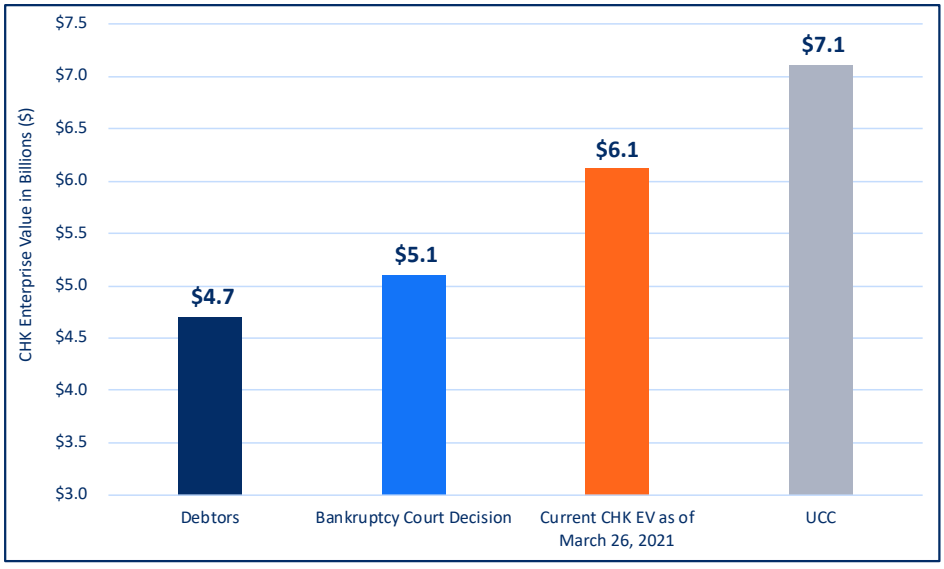
($ millions) Reserve Category	# of Remaining Locations	Risk Unadjusted Value	Risk Adjusted Value
Proved Undeveloped (PUD)	979	$ 740	$ 387
Probable	1,359	1,068	157
Possible	6,052	2,959	40
All Categories	8,389	$ 4,768	**$ 584**

Chesapeake Energy Current Enterprise Value

Security	Price ($/share)	Shares Outstanding	Total Market Value ($ millions)
Common Stock	$ 42.77	97,907,082	$ 4,187
Class A Warrants	$ 19.65	11,111,111	218
Class B Warrants	$ 18.25	12,345,697	225
Class C Warrants	$ 16.11	13,717,420	221
Total Equity			$ 4,852
Net Debt			1,271
Total Enterprise Value			**$ 6,123**

Case Study Conclusion

CHK Enterprise Value Summary



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Faculty

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Dr. Israel Shaked is a founder and managing director of The Michel-Shaked Group in Boston, where he provides valuation, expert testimony, corporate finance and business consulting services to corporations and government entities worldwide. He is also a professor of finance and economics at the Boston University Questrom School of Management and a two-time winner of Boston University's Broderick Prize for Excellence in Teaching. His academic and professional research covers such areas as valuation, bankruptcy, fraudulent conveyance, investment analysts, financial distress, LBOs, international business, mergers and acquisitions, economics, corporate structure analysis, corporate financial decisions and capital markets. Dr. Shaked was director of the Boston Chartered Financial Analysts (CFA) Examination Review Program for 19 years, as well as a co-founder and director of the Institute of Chartered Pension Professionals (ICPP). He served for 20 years as a member of the *ABI Journal* editorial board and a contributing editor. He has also authored or co-authored numerous articles and several books, including *A Practical Guide to Bankruptcy Valuation, Second Edition* (ABI 2016), and he appears regularly on television and in the press commenting on contemporary financial and business issues. Dr. Shaked has delivered hundreds of seminars to corporate executives and law firms globally, and has been engaged as an expert witness offering testimony at depositions, arbitrations and trials on numerous cases. He is renowned and relied on for his expertise in valuation matters, and his ability to explain the complexities of valuation clearly to a judge, jury, arbitrator or regulatory authority. Mr. Shaked received a B.A. in economics and a B.A. in statistics from the Hebrew University of Jerusalem, his M.B.A. with a concentration in finance from the Hebrew University of Jerusalem, and his Doctor of Business Administration (D.B.A.) from Harvard Business School.