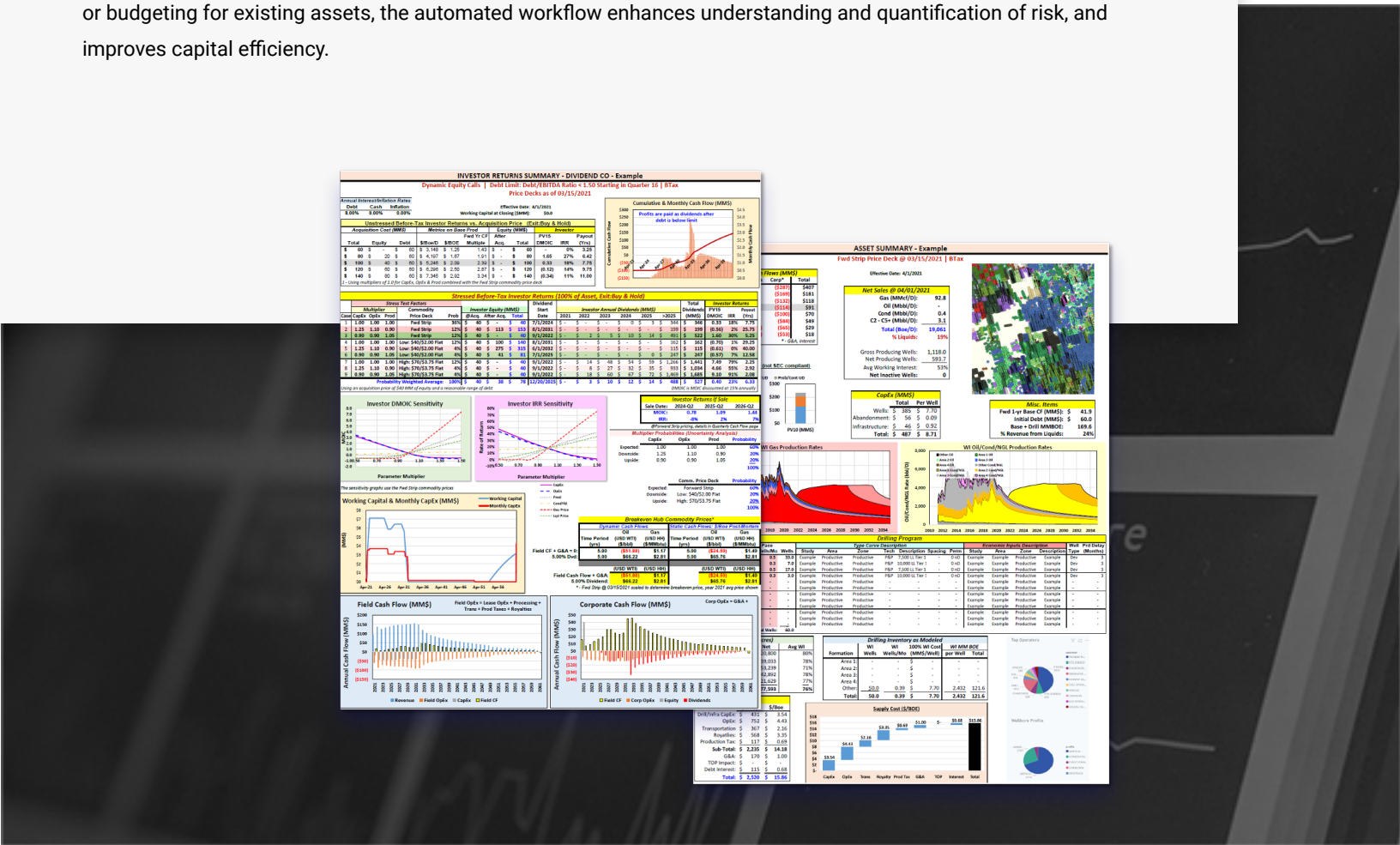
Field Development, Evaluation and Economic Modeling Using PetroVisor™

This whitepaper was originally published by Datagration in May, 2021 prior to the company's acquisition by Weatherford.

PetroVisor workflow provides asset development and corporate-level economics with uncertainty and downside analysis

PetroVisor's field development evaluation and well optimization workflow provides a full drill out economic evaluation of an entire asset or company's portfolio. Results including debt and equity requirements, dividend flow and projected returns are presented from an investor perspective. A flexible drilling scheduler and rapid run times allow multiple field development strategies to be tested in minutes or hours, not days or weeks. Probabilistic inputs for capital costs, operating costs, well production and commodity prices quantify the impact of uncertainty on investor returns and identify conditions that may require a change in strategy before capital is committed.

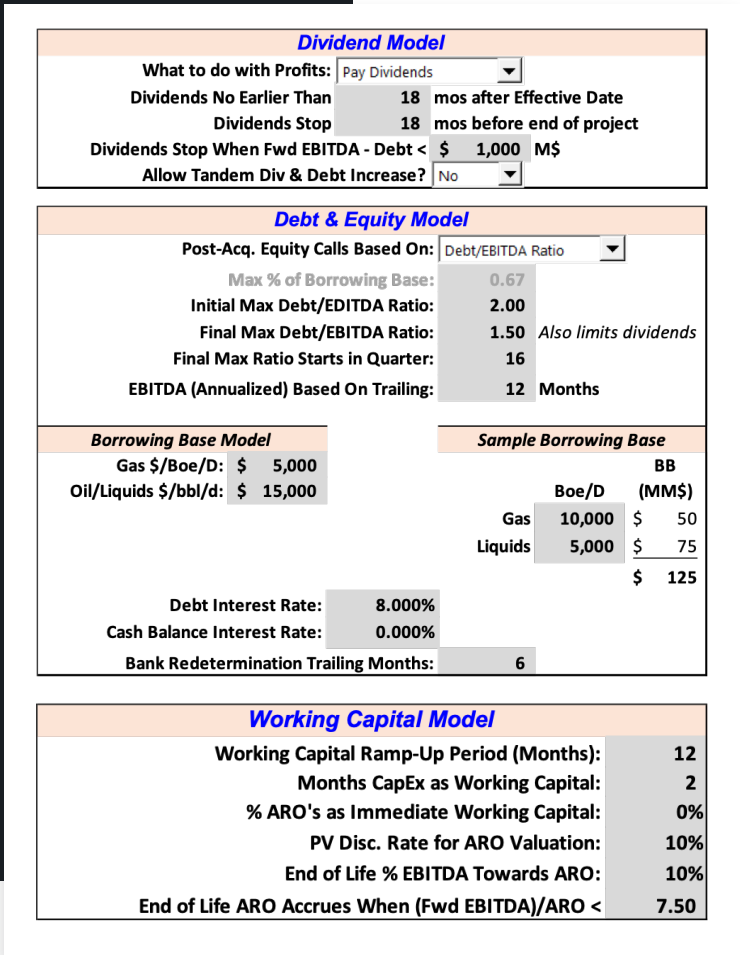
The workflow is automated within the PetroVisor environment allowing quick updates with new data or assumptions to speed up the decision process – a key benefit when evaluating potential acquisitions. Results are summarized for easy consumption by CEOs and leadership teams, directors and investors. Detailed output allows CFOs to review the many cash flow items and integrate them into internal models. Whether acquiring new assets, planning for field development, or budgeting for existing assets, the automated workflow enhances understanding and quantification of risk, and improves capital efficiency.



Workflow sequencing and features

Development Evaluation and Well Optimization Workflow Sequence

1. Input base production, both historic and forecast
2. Input a drilling schedule (full inventory)
   a. Grouped by zone, area, completion and lateral spacing
   b. Grouping dictates per-well costs, production and economic variables
   c. Includes drilling pace and duration
3. Input individual well-related economic variables
4. Input asset and corporate-level economic variables
5. Run cash flows. Compare expected and downside cases against debt and equity limits and investor returns expectations
6. Re-run, testing different drilling schedules to find the optimal schedule
7. Document results with “Investment Book”
8. Export cash flows as needed for internal tools



Dividend Model

What to do with Profits:	Pay Dividends	
Dividends No Earlier Than	18	mos after Effective Date
Dividends Stop	18	mos before end of project
Dividends Stop When Fwd EBITDA - Debt <	$ 1,000	M$
Allow Tandem Div & Debt Increase?	No	

Debt & Equity Model

Post-Acq. Equity Calls Based On:	Debt/EBITDA Ratio	
Max % of Borrowing Base:	0.67	
Initial Max Debt/EDITDA Ratio:	2.00	
Final Max Debt/EBITDA Ratio:	1.50	*Also limits dividends*
Final Max Ratio Starts in Quarter:	16	
EBITDA (Annualized) Based On Trailing:	12	Months

Borrowing Base Model

Gas $/Boe/D:	$ 5,000
Oil/Liquids $/bbl/d:	$ 15,000

Sample Borrowing Base

	Boe/D	BB (MM$)
Gas	10,000	$ 50
Liquids	5,000	$ 75
		$ 125

Debt Interest Rate:	8.000%
Cash Balance Interest Rate:	0.000%
Bank Redetermination Trailing Months:	6

Working Capital Model

Working Capital Ramp-Up Period (Months):	12
Months CapEx as Working Capital:	2
% ARO's as Immediate Working Capital:	0%
PV Disc. Rate for ARO Valuation:	10%
End of Life % EBITDA Towards ARO:	10%
End of Life ARO Accrues When (Fwd EBITDA)/ARO <	7.50

Inputs to this workflow include:

- Individual-well forecasts, both existing wells and drilling candidates
- Drilling inventory well costs
- Various corporate-level economic inputs
- Various standard oilfield well-level economic inputs
- Probabilities for commodity prices, CapEx, OpEx and production multipliers

Individual-well production forecasts and a calibrated well cost model are typically generated from the PetroVisor completion optimization workflow. However, production forecasts and corresponding well costs that are generated outside the workflow can also be used. A drilling inventory is derived by well counts for specific completion designs to be used in each zone at a given lateral spacing for a local area. Local areas are determined as having the same operating costs, plant yields and commodity price basis differentials. The pace and duration of drilling is assigned at the drilling rig level and assumes that each rig drills into a particular zone, with a particular completion design and lateral spacing.

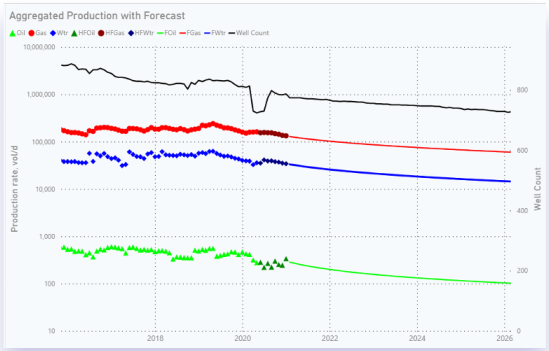
Standard economic inputs used with individual-well cash flows include well costs, fixed and variable operating costs, ownership, plant yields, commodity price differentials, gathering, transportation and processing fees, and abandonment liabilities. These inputs are assigned to logical zone/local geographic area groupings that cover all existing wells and drilling inventory. Cashflow details are generated on a monthly basis with a 40-year forecast.

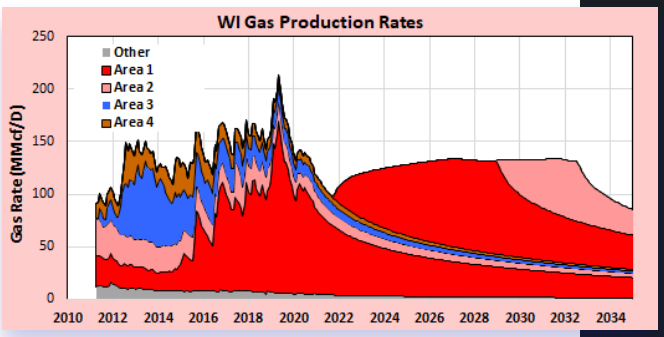
Asset and corporate-level variables include the following:

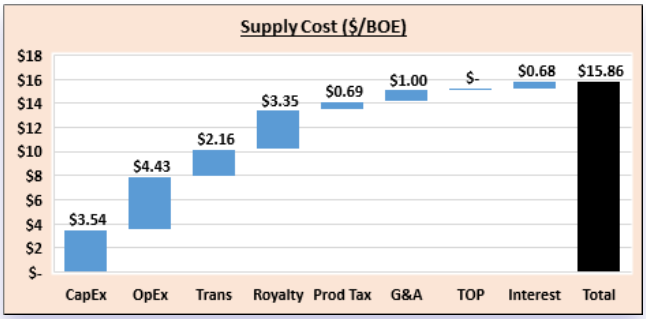
- Current debt amount and interest rate
- G&A and other operational expenses
- Infrastructure costs (plant, pipe, roads, pads)
- Take or pay obligations (plant and/or pipe)
- Current income tax capitalized pools and corporate tax rate
- Inactive-well asset retirement obligations (AROs)
- If an acquisition evaluation, then acquisition cost with equity and debt funding split

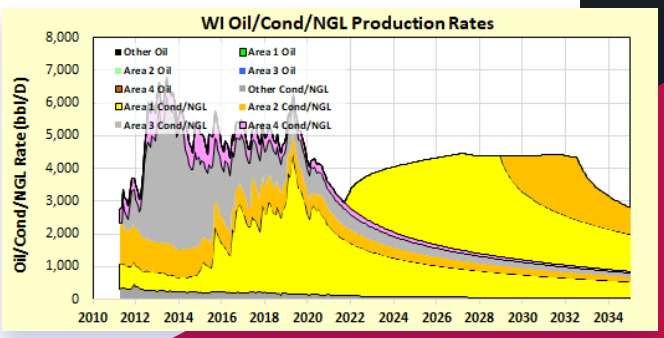
Corporate-level items are handled dynamically in the PetroVisor economics engine to mimic cash flow management for each specific scenario. Features include:

- Debt model - Borrowing base is recomputed twice a year and debt load is limited as either a percent of borrowing base, debt/EBITDA ratio or both
- Working capital model - Working capital is adjusted to smooth/defer equity calls and ensure that lumpy or end of life AROs do not result in equity calls
- Dividend model - Dividends are paid via a forward-looking process where dividends are limited or paid. This reduces the likelihood of future equity calls or debt increases, and ensures zero-debt and zero-cash balance at the end of the asset or corporate life









Match a Drilling Schedule with Corporate Strategy

The drilling schedule answers two critical field development questions:

- How much debt and equity are required for funding?
- How does the drilling schedule fit with overall corporate strategy? (volume growth rate, meet take or pay obligations, pay dividends, fill facilities, or maximize investor returns)

This iterative process evaluates a drilling schedule against the corporate strategy. Using the PetroVisor workflow, inputting a new drilling schedule and re-running the full drill out evaluation, complete with hundreds of sensitivity and probabilistic runs, can be completed quickly. Updating the drilling schedule for a multi-hundred well drilling inventory can be completed in 5 to 15 minutes and re-running the economics usually takes less than ten minutes. One person can run and review 10 or 20 drilling schedules and select a preferred schedule that best achieves the corporate strategy while mitigating downside risk in less than a day.

Downside Considerations and the Impact of Uncertainty

Not every project goes according to plan. Capital and operating costs can increase unexpectedly, well production may be lower than expected and commodity prices can be difficult to predict. The PetroVisor workflow quantifies the impact of these uncertainties on cash flow and investor returns as part of the oil and gas economic evaluation. With this analysis, project performance, debt and equity requirements and investor returns are quantified for downside cases. Using this information leadership teams and decision makers can speak quantitatively about risk and uncertainty. The workflow's probabilistic approach presents the likelihood of both upside and downside cases. A probability-weighted overall outcome is derived from the mix of upside and downside scenarios.

Drilling Program

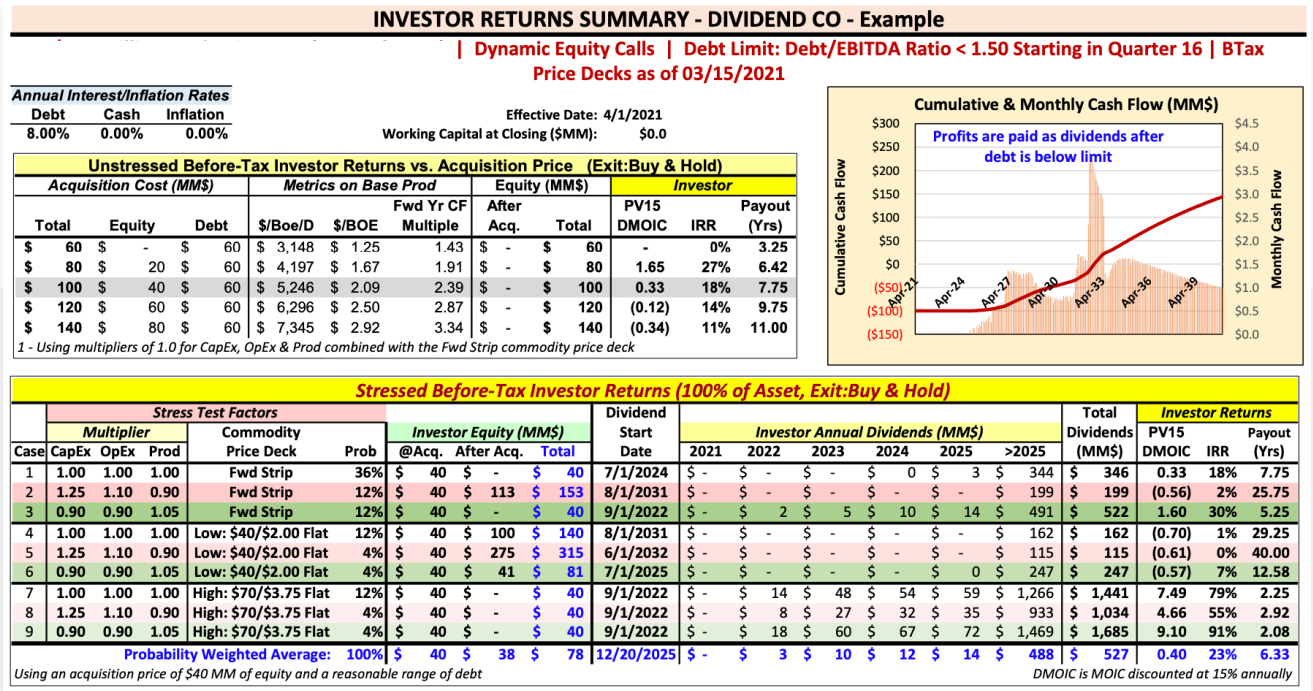
	Start Date		Duration	Pace		*Type Curve Description*							*Economic Inputs Description*				Well	Prd Delay
Rig	Year	Month	(Mo)	Wells/Mo	Wells	Study	Area	Zone	Tech	Description	Spacing	Perm	Study	Area	Zone	Description	Type	(Months)
1	2021	7	66	0.5	33.0	Example	Productive	Productive	P&P	7,500 LL Tier 1	-	0 nD	Example	Example	Productive	Example	Dev	3
2	2027	1	21	0.3	7.0	Example	Productive	Productive	P&P	.0,000 LL Tier :	-	0 nD	Example	Example	Productive	Example	Dev	3
3	2028	10	34	0.5	17.0	Example	Productive	Productive	P&P	7,500 LL Tier 1	-	0 nD	Example	Example	Productive	Example	Dev	3
4	2031	8	9	0.3	3.0	Example	Productive	Productive	P&P	.0,000 LL Tier :	-	0 nD	Example	Example	Productive	Example	Dev	3
			-	-	-	Example	Productive	Productive	-	-	-	-	Example	Example	Productive	Example	-	-
			-	-	-	Example	Productive	Productive	-	-	-	-	Example	Example	Productive	Example	-	-
			-	-	-	Example	Productive	Productive	-	-	-	-	Example	Example	Productive	Example	-	-
			-	-	-	Example	Productive	Productive	-	-	-	-	Example	Example	Productive	Example	-	-
			-	-	-	Example	Productive	Productive	-	-	-	-	Example	Example	Productive	Example	-	-
			-	-	-	Example	Productive	Productive	-	-	-	-	Example	Example	Productive	Example	-	-
			-	-	-	Example	Productive	Productive	-	-	-	-	Example	Example	Productive	Example	-	-
			-	-	-	Example	Productive	Productive	-	-	-	-	Example	Example	Productive	Example	-	-
				Total Wells:	60.0													

Investment Book Provides a Roadmap for Executives and Investors

PetroVisor's field development evaluation and well optimization workflow produces a 16-page Investment Book that provides a comprehensive overview of the production and cash flow aspects of the asset or company, whether for development of existing assets or an acquisition evaluation. Geared towards operator executives and investors, the book presents results visualizations, annualized cashflow details and the many inputs used in the workflow. Updates to the investment book can be produced quickly, allowing real-time assessment of changing acquisition bid prices, commodity prices and numerous assumptions. The Investment Book can be saved as a PDF for easy review and sharing as required.

Included in the Investment Book are:

- Asset summary page (number of wells, production data, drilling schedule, supply cost, required capital)
- Investment summary page (investment required, investment schedule, investment returns, dividends, downside evaluation, working capital and monthly capital, field cash flow and corporate cash flow)
- Quarterly production, cash flow and investor returns summary for the next six years
- User-defined inputs to the workflow
- Breakeven commodity prices
- Annualized cash flow details (royalties, take or pay obligations, corporate income tax schedule)
- Annualized production rates, both base production and new drills
- Single-well, half-cycle economics for the various completion designs and formations used in the drilling schedule
- Completion design details and the resulting production type curves



INVESTOR RETURNS SUMMARY - DIVIDEND CO - Example

| Dynamic Equity Calls | Debt Limit: Debt/EBITDA Ratio < 1.50 Starting in Quarter 16 | BTax

Price Decks as of 03/15/2021

Annual Interest/Inflation Rates

Debt	Cash	Inflation
8.00%	0.00%	0.00%

Effective Date: 4/1/2021
Working Capital at Closing ($MM): $0.0

Unstressed Before-Tax Investor Returns vs. Acquisition Price (Exit:Buy & Hold)

Acquisition Cost (MM$)			*Metrics on Base Prod*			*Equity (MM$)*		*Investor*		
Total	Equity	Debt	$/Boe/D	$/BOE	Fwd Yr CF Multiple	After Acq.	Total	PV15 DMOIC	IRR	Payout (Yrs)
$ 60	$ -	$ 60	$ 3,148	$ 1.25	1.43	$ -	$ 60	-	0%	3.25
$ 80	$ 20	$ 60	$ 4,197	$ 1.67	1.91	$ -	$ 80	1.65	27%	6.42
$ 100	$ 40	$ 60	$ 5,246	$ 2.09	2.39	$ -	$ 100	0.33	18%	7.75
$ 120	$ 60	$ 60	$ 6,296	$ 2.50	2.87	$ -	$ 120	(0.12)	14%	9.75
$ 140	$ 80	$ 60	$ 7,345	$ 2.92	3.34	$ -	$ 140	(0.34)	11%	11.00

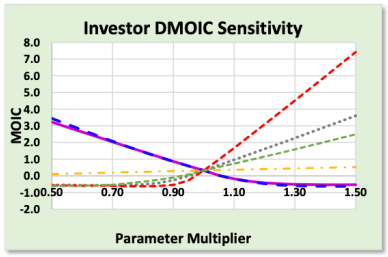
1 - Using multipliers of 1.0 for CapEx, OpEx & Prod combined with the Fwd Strip commodity price deck

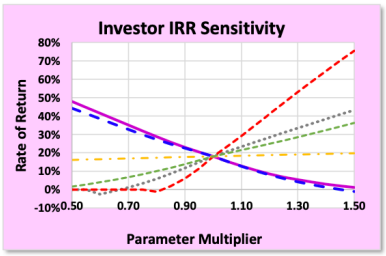
Stressed Before-Tax Investor Returns (100% of Asset, Exit:Buy & Hold)

	Stress Test Factors					*Investor Equity (MM$)*			Dividend Start	*Investor Annual Dividends (MM$)*						Total Dividends	*Investor Returns*		
	Multiplier			Commodity													PV15		Payout
Case	CapEx	OpEx	Prod	Price Deck	Prob	@Acq.	After Acq.	Total	Date	2021	2022	2023	2024	2025	>2025	(MM$)	DMOIC	IRR	(Yrs)
1	1.00	1.00	1.00	Fwd Strip	36%	$ 40	$ -	$ 40	7/1/2024	$ -	$ -	$ -	$ 0	$ 3	$ 344	$ 346	0.33	18%	7.75
2	1.25	1.10	0.90	Fwd Strip	12%	$ 40	$ 113	$ 153	8/1/2031	$ -	$ -	$ -	$ -	$ -	$ 199	$ 199	(0.56)	2%	25.75
3	0.90	0.90	1.05	Fwd Strip	12%	$ 40	$ -	$ 40	9/1/2022	$ -	$ 2	$ 5	$ 10	$ 14	$ 491	$ 522	1.60	30%	5.25
4	1.00	1.00	1.00	Low: $40/$2.00 Flat	12%	$ 40	$ 100	$ 140	8/1/2031	$ -	$ -	$ -	$ -	$ -	$ 162	$ 162	(0.70)	1%	29.25
5	1.25	1.10	0.90	Low: $40/$2.00 Flat	4%	$ 40	$ 275	$ 315	6/1/2032	$ -	$ -	$ -	$ -	$ -	$ 115	$ 115	(0.61)	0%	40.00
6	0.90	0.90	1.05	Low: $40/$2.00 Flat	4%	$ 40	$ 41	$ 81	7/1/2025	$ -	$ -	$ -	$ -	$ 0	$ 247	$ 247	(0.57)	7%	12.58
7	1.00	1.00	1.00	High: $70/$3.75 Flat	12%	$ 40	$ -	$ 40	9/1/2022	$ -	$ 14	$ 48	$ 54	$ 59	$ 1,266	$ 1,441	7.49	79%	2.25
8	1.25	1.10	0.90	High: $70/$3.75 Flat	4%	$ 40	$ -	$ 40	9/1/2022	$ -	$ 8	$ 27	$ 32	$ 35	$ 933	$ 1,034	4.66	55%	2.92
9	0.90	0.90	1.05	High: $70/$3.75 Flat	4%	$ 40	$ -	$ 40	9/1/2022	$ -	$ 18	$ 60	$ 67	$ 72	$ 1,469	$ 1,685	9.10	91%	2.08
				Probability Weighted Average:	100%	$ 40	$ 38	$ 78	12/20/2025	$ -	$ 3	$ 10	$ 12	$ 14	$ 488	$ 527	0.40	23%	6.33

Using an acquisition price of $40 MM of equity and a reasonable range of debt

DMOIC is MOIC discounted at 15% annually





Investor Returns if Sale			
Sale Date:	2024-Q2	2025-Q2	2026-Q2
MOIC:	0.78	1.09	1.44
IRR:	-8%	2%	7%

@Forward Strip pricing, details in Quarterly Cash Flow page

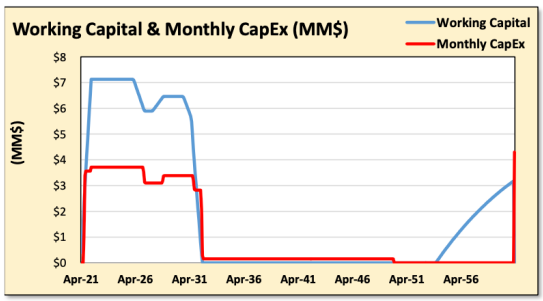
Multiplier Probabilities (Uncertainty Analysis)

	CapEx	OpEx	Prod	Probability
Expected:	1.00	1.00	1.00	60%
Downside:	1.25	1.10	0.90	20%
Upside:	0.90	0.90	1.05	20%
				100%

The sensitivity graphs use the Fwd Strip commodity prices

CapEx
OpEx
Prod
CondYld
Gas Price
Lqd Price

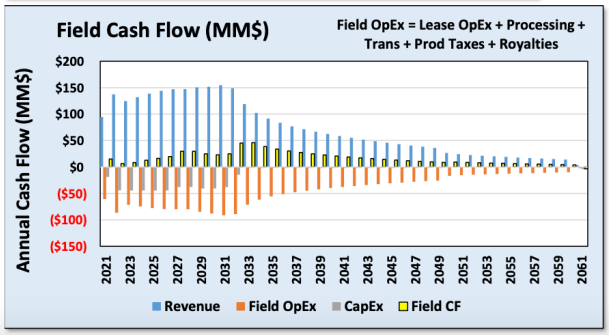
	Comm. Price Deck	Probability
Expected:	Forward Strip	60%
Downside:	Low: $40/$2.00 Flat	20%
Upside:	High: $70/$3.75 Flat	20%
		100%

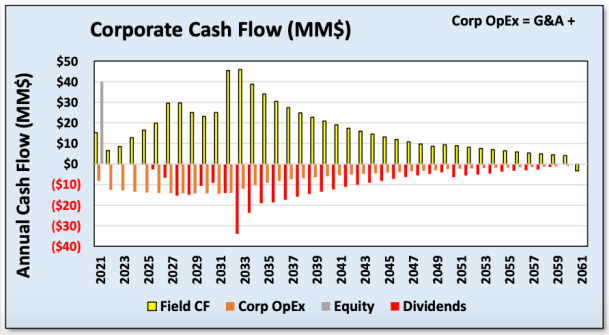


*Breakeven Hub Commodity Prices**

	Dynamic Cash Flows			Static Cash Flows: $/Boe Post-Mortem		
	Time Period (yrs)	Oil (USD WTI) ($/bbl)	Gas (USD HH) ($/MMbtu)	Time Period (yrs)	Oil (USD WTI) ($/bbl)	Gas (USD HH) ($/MMbtu)
Field CF + G&A = 0:	5.00	($51.88)	$1.17	5.00	($24.59)	$1.49
5.00% Dvd:	5.00	$66.22	$2.81	5.00	$65.76	$2.81
		(USD WTI)	(USD HH)		(USD WTI)	(USD HH)
Field Cash Flow + G&A:		($51.88)	$1.17		($24.59)	$1.49
5.00% Dividend:		$66.22	$2.81		$65.76	$2.81

** - Fwd Strip @ 03/15/2021 scaled to determine breakeven price, year 2021 avg price shown*





Summary

PetroVisor's development evaluation and optimization workflow provides a comprehensive planning solution for oil and gas economic evaluation. Various completion and well optimization scenarios are presented and compared. Numerous formation, completion, drilling and economic inputs are adjusted to show results under different conditions. The workflow's oil and gas financial modeling engine provides a comprehensive overview of the production and cash flow aspects of the asset or company in a concise, PDF-based Investment Book. The development evaluation and optimization workflow provides valuable information for both operator and investor for any oil and gas field development project.