Welcome!

The program will begin soon.

You will not hear audio until we begin.

Introduction to the PRMS Application Guidelines

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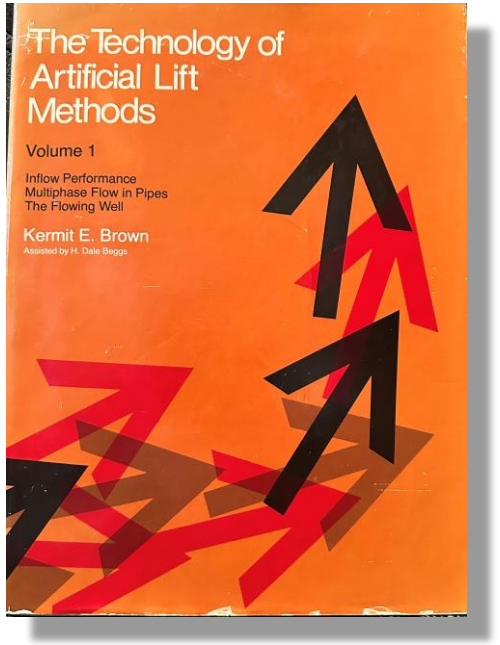
Webinar Agenda

- Introduction: What is the “AG”?
- Brief History
- What’s New for 2022
- Review Process
- Selected Examples
- Future
- Acknowledgments
- Q&A

Foreword

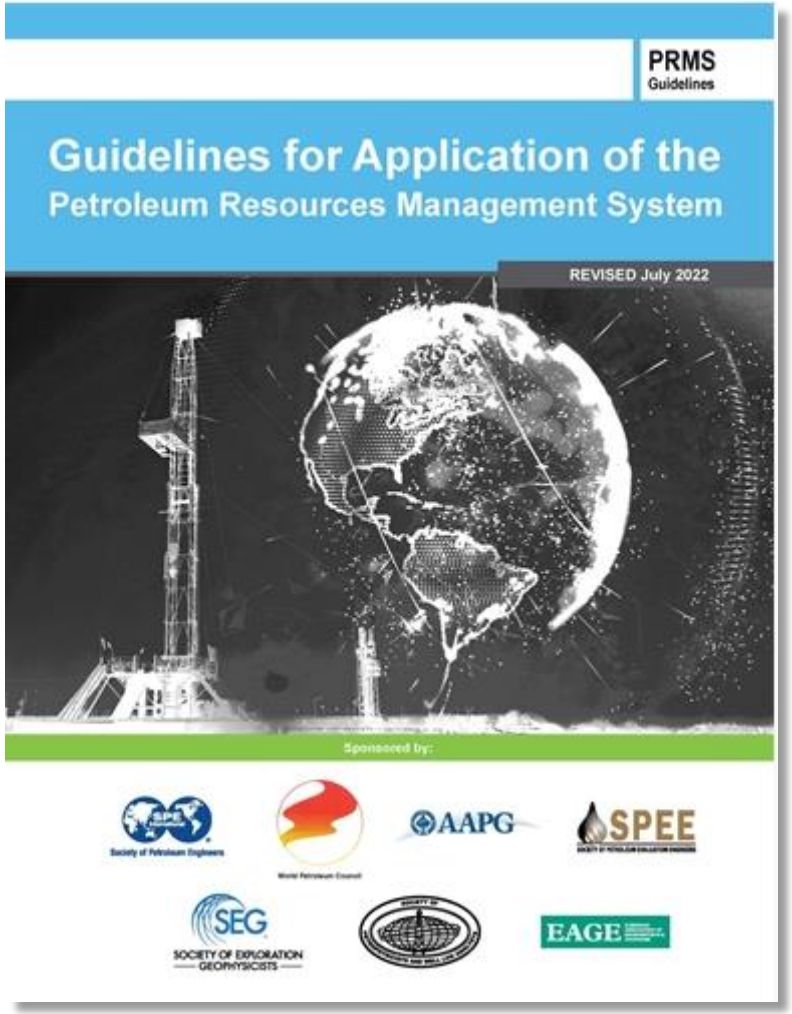
"Oil in the tank means money in the bank."

– Kermit Brown, Fall Semester 1978, University of Tulsa



Introduction

- What is the “Application Guidelines (AG)”?
  - A companion volume to the *Petroleum Resources Management System (PRMS)*
  - Intent is to provide further clarity and example applications
  - Not intended to replace any principles within PRMS

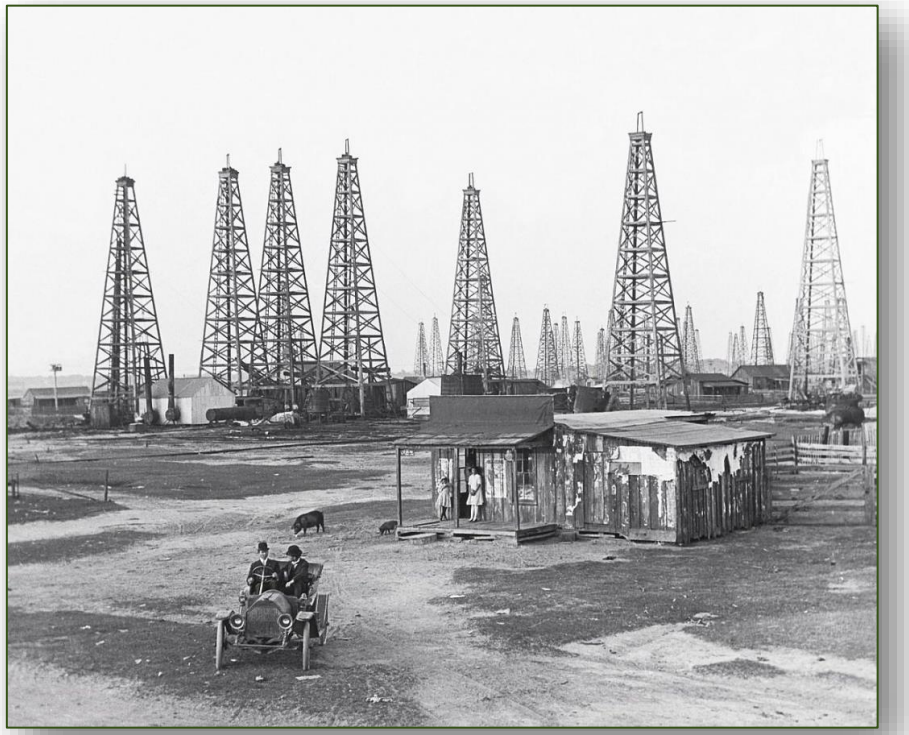


Disclaimer!

- Any application of the PRMS must be based on the totality of the data at hand
- Examples within the “AG” are assessed with the facts pertaining to those examples
- The results from the examples are not intended to be universally true for all situations and/or data

Brief History

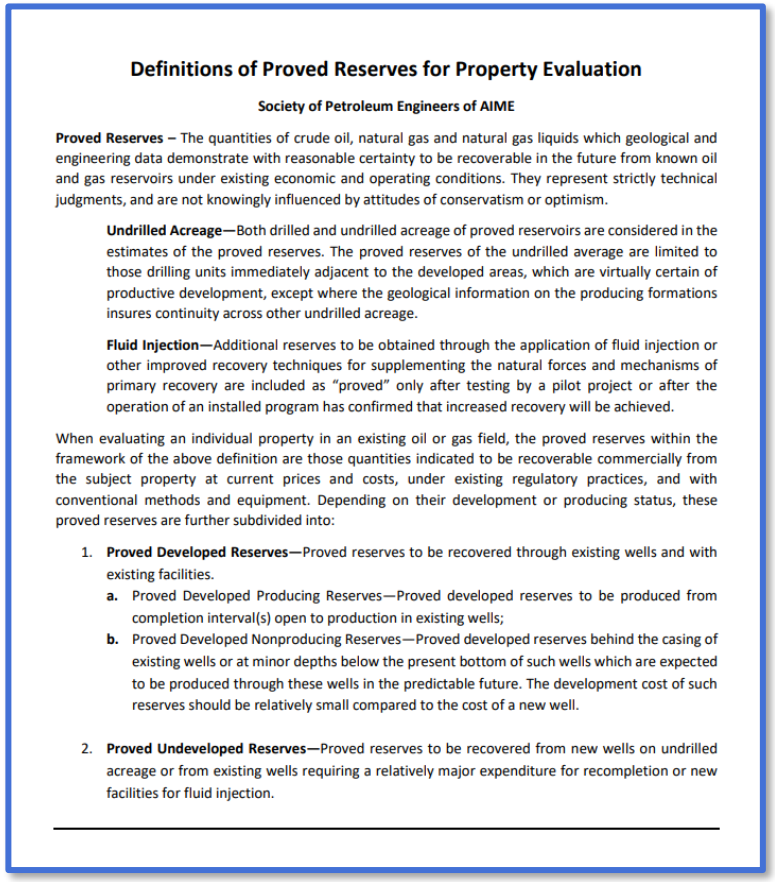
- First reserves definitions in 1937 from the API
  - API formed post-WWI from National Petroleum War Service Committee
  - Purpose: basis for API's annual estimates of Proved oil reserves
- Gas Proved reserves definitions appear in 1961
  - American Gas Association definitions ~1946
  - API combined definitions with AGA



Brief History (continued)

- SPE modifies these & publishes their first definitions in 1965
  - July 1965 JPT p. 815

- SPE further updated definitions in
  - 1981
  - 1987 (first Probable & Possible Reserves definitions)
  - 1997 (first treatment of probabilistic methods)
  - 2000 (first Resources definitions)



Definitions of Proved Reserves for Property Evaluation

Society of Petroleum Engineers of AIME

Proved Reserves – The quantities of crude oil, natural gas and natural gas liquids which geological and engineering data demonstrate with reasonable certainty to be recoverable in the future from known oil and gas reservoirs under existing economic and operating conditions. They represent strictly technical judgments, and are not knowingly influenced by attitudes of conservatism or optimism.

Undrilled Acreage—Both drilled and undrilled acreage of proved reservoirs are considered in the estimates of the proved reserves. The proved reserves of the undrilled average are limited to those drilling units immediately adjacent to the developed areas, which are virtually certain of productive development, except where the geological information on the producing formations insures continuity across other undrilled acreage.

Fluid Injection—Additional reserves to be obtained through the application of fluid injection or other improved recovery techniques for supplementing the natural forces and mechanisms of primary recovery are included as "proved" only after testing by a pilot project or after the operation of an installed program has confirmed that increased recovery will be achieved.

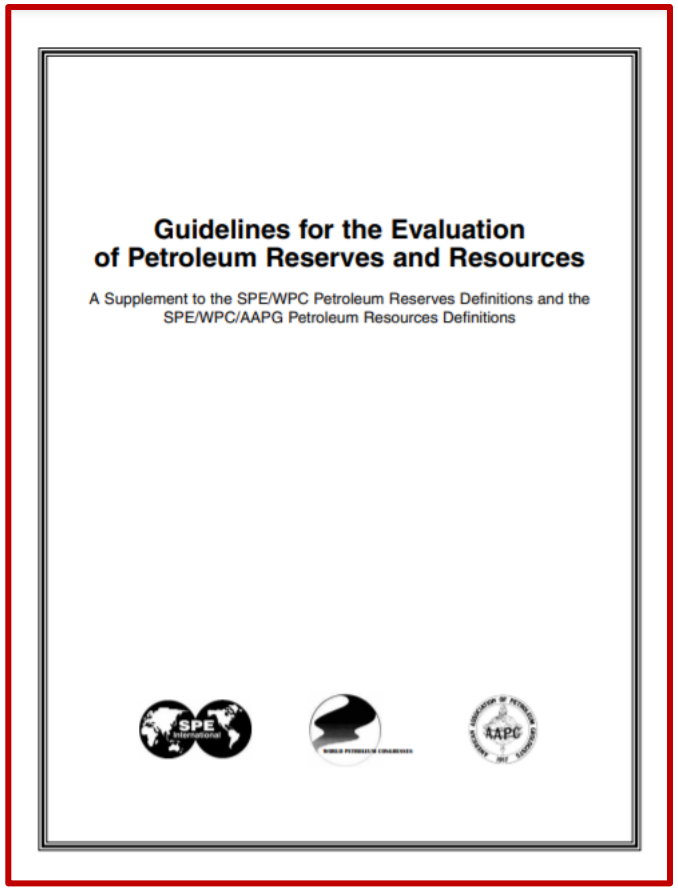
When evaluating an individual property in an existing oil or gas field, the proved reserves within the framework of the above definition are those quantities indicated to be recoverable commercially from the subject property at current prices and costs, under existing regulatory practices, and with conventional methods and equipment. Depending on their development or producing status, these proved reserves are further subdivided into:

1. **Proved Developed Reserves**—Proved reserves to be recovered through existing wells and with existing facilities.
   a. Proved Developed Producing Reserves—Proved developed reserves to be produced from completion interval(s) open to production in existing wells;
   b. Proved Developed Nonproducing Reserves—Proved developed reserves behind the casing of existing wells or at minor depths below the present bottom of such wells which are expected to be produced through these wells in the predictable future. The development cost of such reserves should be relatively small compared to the cost of a new well.

2. **Proved Undeveloped Reserves**—Proved reserves to be recovered from new wells on undrilled acreage or from existing wells requiring a relatively major expenditure for recompletion or new facilities for fluid injection.

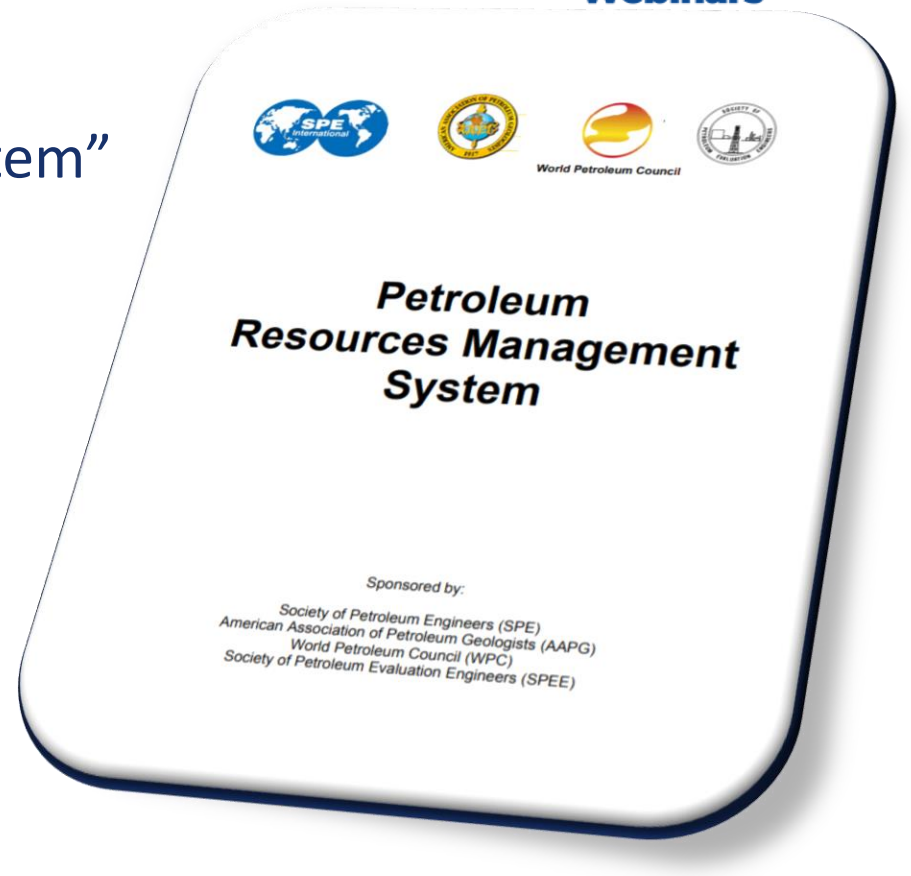
Brief History (continued)

- No guidelines for application of these reserves definitions appeared until 2001
- "Guidelines for the Evaluation of Petroleum Reserves and Resources" was co-sponsored by the WPC and AAPG
  - 139 pages
- Intended to complement use of 2000 SPE/WPC/AAPG document (formally published in 2005)
  - ± 4-6 pages



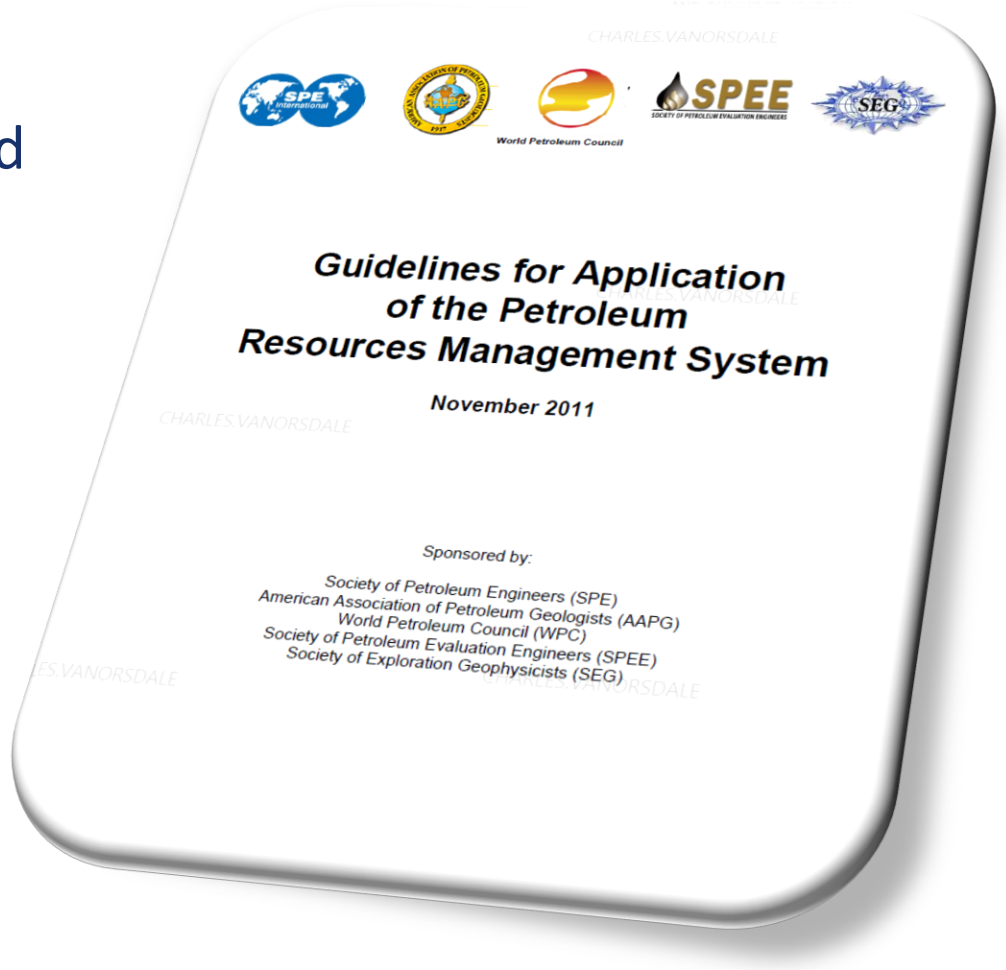
Brief History (continued)

- In 2007, first “Petroleum Resources Management System” (PRMS) released
- Major update
  - 49 pages
- Industry feedback requested further clarification & amplification of PRMS principles



Brief History (continued)

- Consequently, the 2001 “Guidelines” were updated to reflect the new PRMS
- New “Guidelines for Application of the PRMS” was published in 2011
  - 221 pages
- PRMS co-sponsors SPE, AAPG, WPC, and SPEE joined by SEG



Brief History (continued)

- The 2011 version had two new chapters

2001 Document
139 Pages

Table of Contents

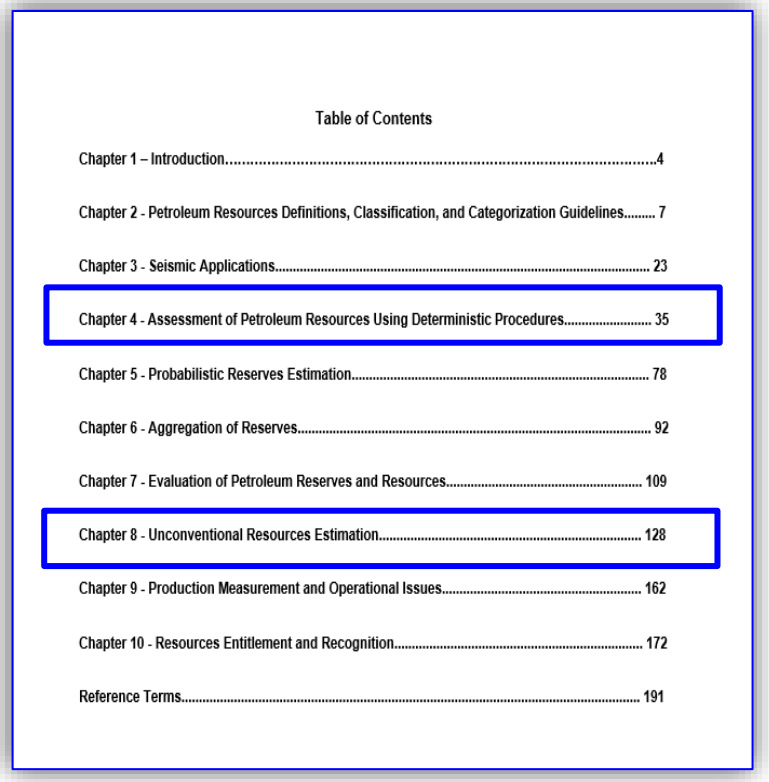


Table of Contents

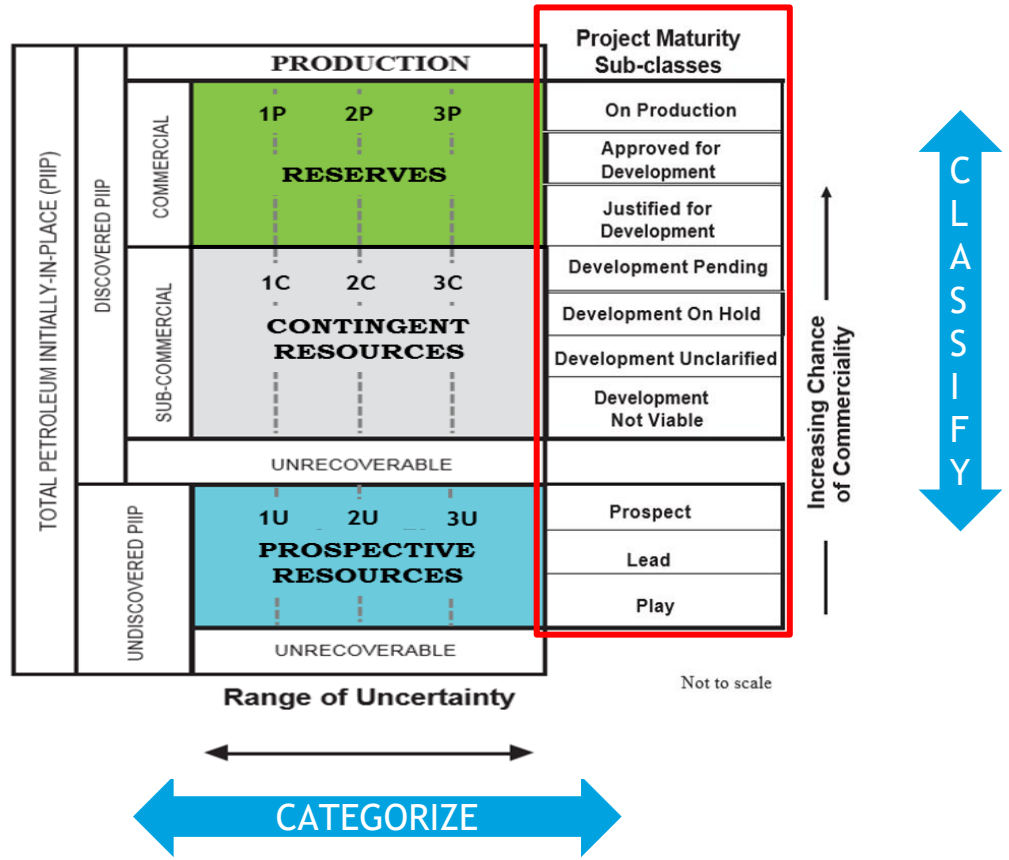
2011 Document
221 Pages

The New PRMS

- Major industry changes required updating the 2007 PRMS
- New PRMS was released in June 2018
  - Version 1.01 released shortly after with some corrections
  - *Errata to v1.01 recently released and erroneously shown as "Revised August 2022 - Version 1.02 "*
  - Not revised!
  - "Revised June 2018 - Version 1.03" now available online
- Notable additions due to surge in unconventional resources

Resources Classification Framework

- Classify by chance of commerciality (directly related to project maturity)
- Categorize by level of uncertainty within each class
- Maturity sub-classes may be used to describe chance of commerciality



What's New for 2022

- In early 2019, discussions began to update the "AG"
  - Reflect 2018 PRMS
  - Overhaul 2011 chapter on Unconventional Resources

JPT Sept. 30, 2014 https://jpt.spe.org/shale-evolution-zipper-fracture-takes-hold

Collaborative Effort

- Update was spearheaded by SPE OGRC

- Co-sponsoring organizations were:

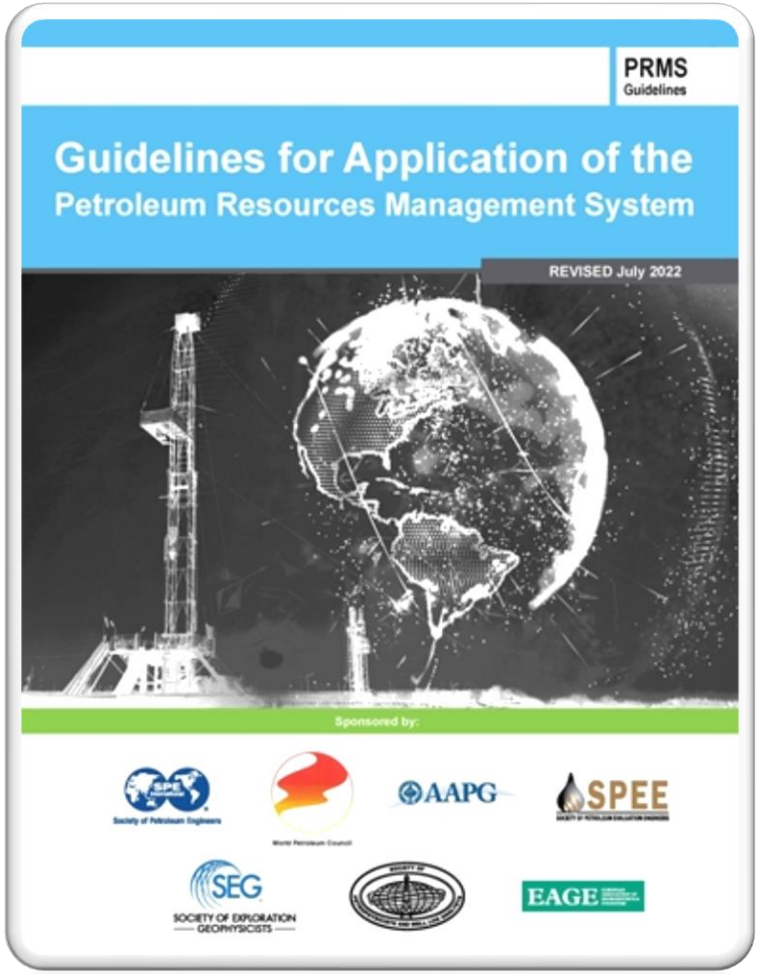
Review Process

- New “AG” not merely a refresh of 2011 document, but complete re-write by current subject matter experts
- Once a draft is ready for each chapter, a 9-step process was used to prepare the document for SPE Board approval

1. Each chapter is reviewed by all Chapter Chairs
2. OGRC Steering Committee (SC)
3. SC feedback followed up by individual Chapter Chairs & their team
4. Revised chapters passed on to OGRC
5. OGRC feedback incorporated
6. Chapters passed to Co-sponsoring (“Sister”) Societies
7. Sister Society feedback shared with Chapter Chairs
8. Chapters passed on to SPE Technical Editor(s)
9. Final review post-TE within OGRC/AG Chairs

The New “AG”

- SPE Board approved the new AG in July 2022
- Co-sponsoring societies approved shortly thereafter
- New version is 375 pages
- Available on SPE website



Content - Updated “Application Guidelines”

- **Chapters:**
  1. Introduction
  2. Petroleum Resources Definitions, Classification & Categorization
  3. Seismic Applications
  4. Assessment of Petroleum Resources Using Deterministic Procedures
  5. Petrophysics
  6. Reservoir Simulation
  7. Probabilistic Resources Estimation
  8. Aggregation of Reserves and Resources
  9. Evaluation of Petroleum Reserves and Resources
  10. Unconventional Resources Estimation
  11. Production Measurement and Operational Issues
  12. Resources Entitlement and Recognition

  Glossary

New Chapters

Content - Updated “Application Guidelines” (cont’d)

- Chapter 5 Petrophysics added to address PRMS-2018 first definition of “Net Pay”

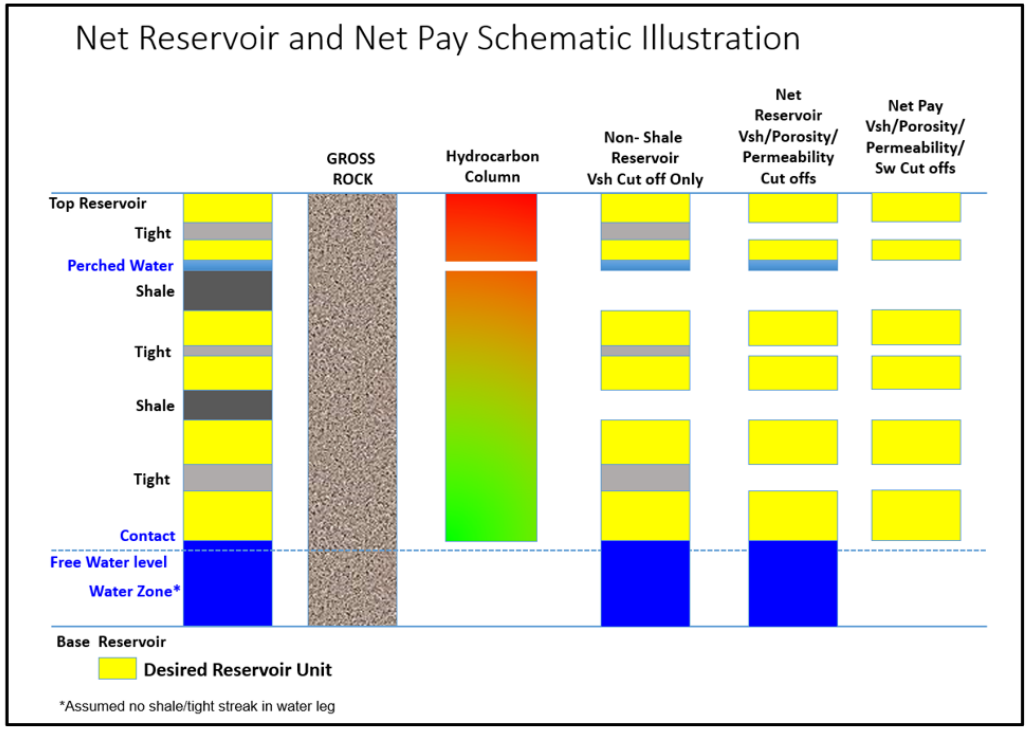


Fig. 5.2: Net reservoir and net pay description (Modified from Worthington and Cosentino, SPE-84387-PA, 2003).

Net Pay:

The portion (after applying cutoffs) of the thickness of a reservoir from which petroleum can be produced or extracted. Value is referenced to a true vertical thickness measured.

Content - Updated “Application Guidelines” (cont’d)

- Chapter 6 Reservoir Simulation added to assist with principles in modeling of recoverable resources and development scenarios

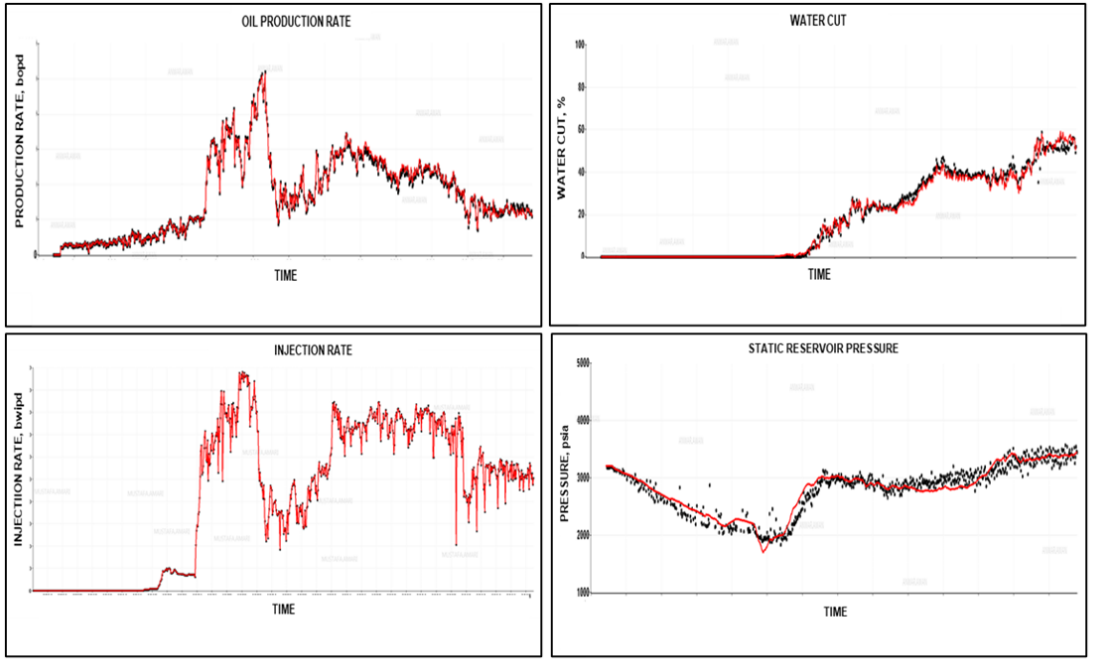


Fig. 6.2b- Common Suite of History Matching Plots

Reservoir Simulation:

… a more rigorous form of material balance analysis. While such modeling can be a reliable predictor of reservoir behavior under a defined development program, the reliability of input rock properties, reservoir geometry, relative permeability functions, fluid properties, and constraints (e.g., wells, facilities, and export) are critical. Predictive models are most reliable in estimating recoverable quantities when there is sufficient production history to validate the model through history matching. (PRMS § 4.1.3.2)

Selected Examples

- Commercial Maturity (Chapter 2)
- Petrophysics (Chapter 5)
- Running a Cash Flow (Chapter 9)

Selected Examples

- Commercial Maturity (Chapter 2)
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Selected Examples: Commercial Maturity

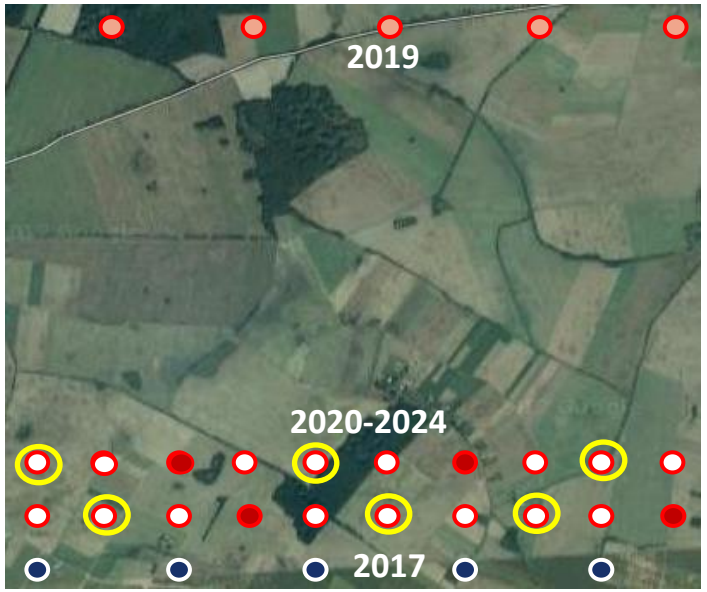
- In 2017, five CBM exploration/appraisal wells are drilled in the southern part of a license block
- In 2018, a production pilot began with the commissioning of flowlines and a compression station selling gas from these wells to pressurized-gas filling stations in the vicinity
- Contract is for 15 years

Selected Examples: Commercial Maturity

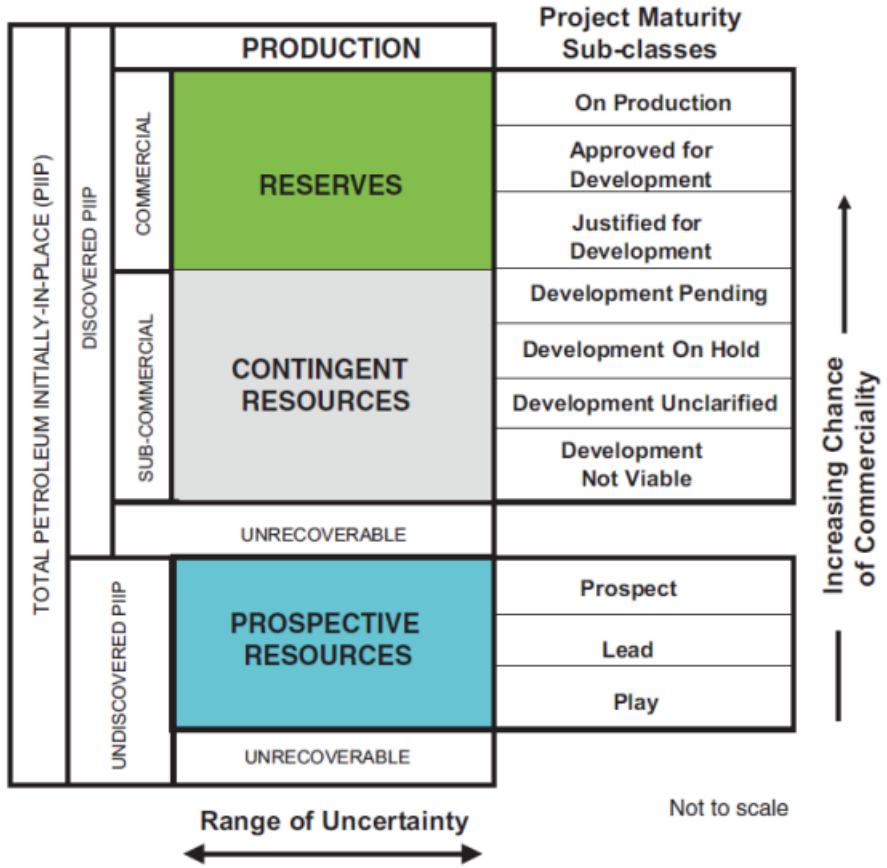
- In 2019, five wells are drilled & completed in the northern part of the license
- Coal characteristics are similar to the southern pilot wells
- Producing company decided to complete the wells without acquiring core data or testing
- Contracts for the gas from these wells were negotiated
- Compression units and flowlines were budgeted as part of the business plan
- However, public demonstrations and complaints filed with the local council result in public hearing and delay of permitting to produce

Selected Examples: Commercial Maturity

- Nevertheless, company commits to drill 20 wells between 2020 to 2024 as **Phase II**
- First 4 wells drilled in 2020 & demonstrated similar geological & petrophysical properties as the 2017 wells
- The 2020 wells are not tested, but were ready for production as of the December 31, 2020 evaluation date
- Six other wells are scheduled to be drilled in 2021
- Fifteen-year sales contracts are being negotiated for these first 10 wells of Phase II
- The last 10 wells will be drilled later as *infills*

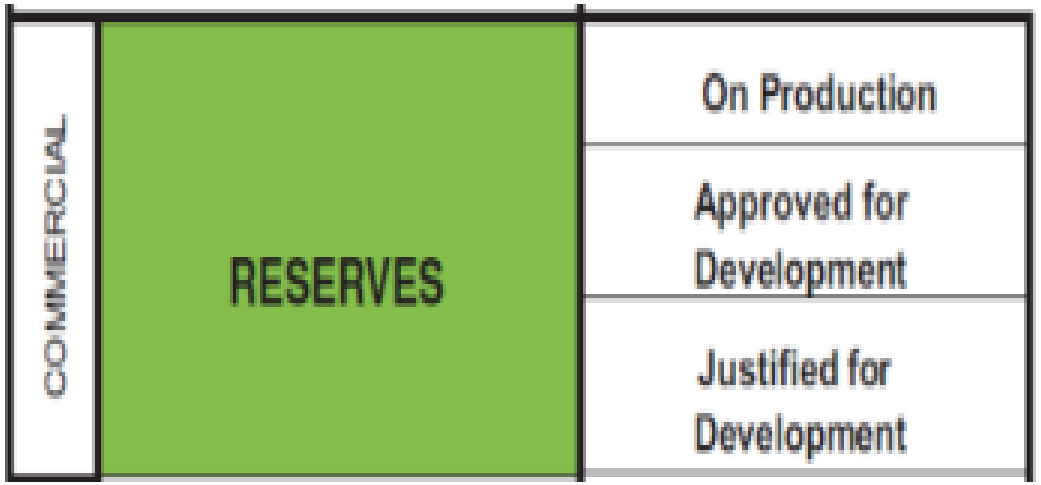


Selected Examples: Commercial Maturity Refresher



- Project Maturity Sub-classes permit the evaluator to convey the relative chance for a project to reach commerciality, i.e. development
- Project Maturity Sub-classes are intended to convey the Chance of a Project being Commercialized (monetized)
- Currently there is no "scale" on the y-axis
  - Maybe $P_c \approx 90\%$ for Justified for Development?
  - Maybe $P_c \approx 25\%$ for Development Not Viable?
  - These values will likely vary by company, and even within a company (by business/area units)
- PRMS leaves it up to the evaluator to defend P_c
- For our example, we have Discovered PIIP, so concentrate on Contingent Resources and Reserves

Selected Examples: Commercial Maturity Refresher



The development project is currently producing or capable of producing and selling petroleum to market. (See Glossary)

Justified for Development Reserves are reclassified to Approved for Development after the FID has been made. (See § 2.1.3.5.5)

All participating entities have agreed and there is evidence of a committed project (*firm intention to proceed* with development within a reasonable time-frame) There must be no known contingencies that could preclude the development from proceeding. (See § 2.1.3.5.4)

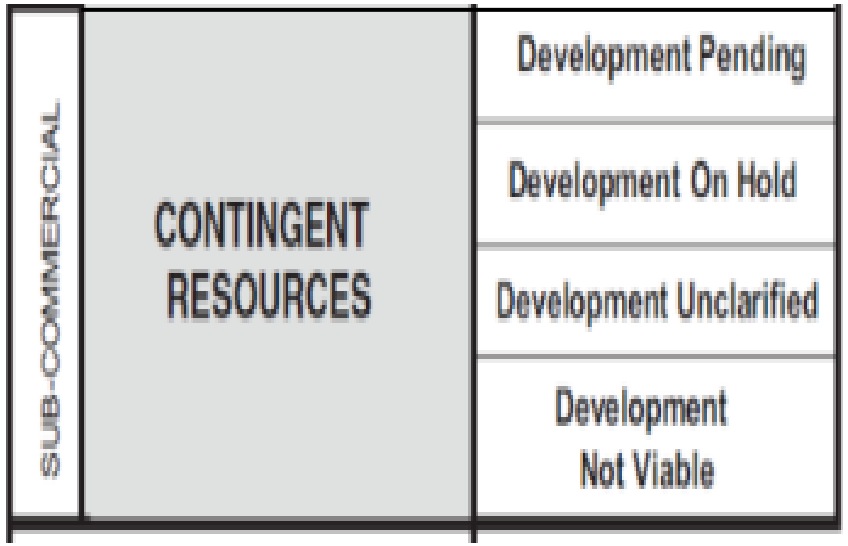
CONTINGENT RESOURCES

RESERVES

COMMERCIALITY

Without new technical information, there should be no change in the distribution of technically recoverable resources and the categorization boundaries when conditions are satisfied to reclassify a project from Contingent Resources to Reserves. (See § 2.2.2.6)

Selected Examples: Commercial Maturity Refresher



A discovered accumulation where project activities are ongoing to justify commercial development in the foreseeable future. (See Table 1.) Outstanding contingencies are identified & being addressed in a reasonable time frame.

A discovered accumulation where project activities are on hold and/or where justification as a commercial development may be subject to significant delay. (See Table 1.) A development plan has been identified, commerciality has a reasonable chance, but contingencies still being identified.

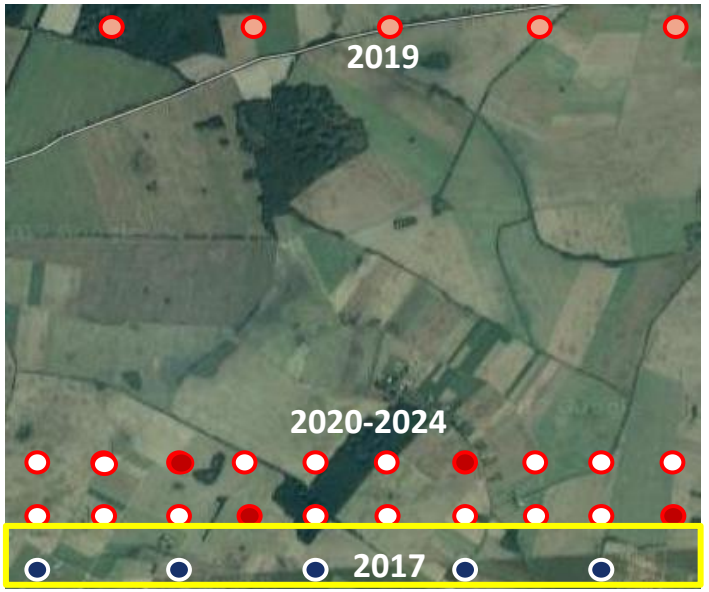
A discovered accumulation where project activities are under evaluation and where justification as a commercial development is unknown based on available information. (See Table 1.) Appraisal is ongoing, but the development plan & scope are undecided, and contingencies still unknown.

A discovered accumulation for which there are no current plans to develop or to acquire additional data at the time because of limited commercial potential. (See Table 1.) The project is technically viable but lacks potential for development, acquiring data, or removing contingencies. Generally, Economically Not Viable Contingent Resources.

Selected Examples: Commercial Maturity

Can the Entity claim any Reserves from the 2017 Pilot Area wells?

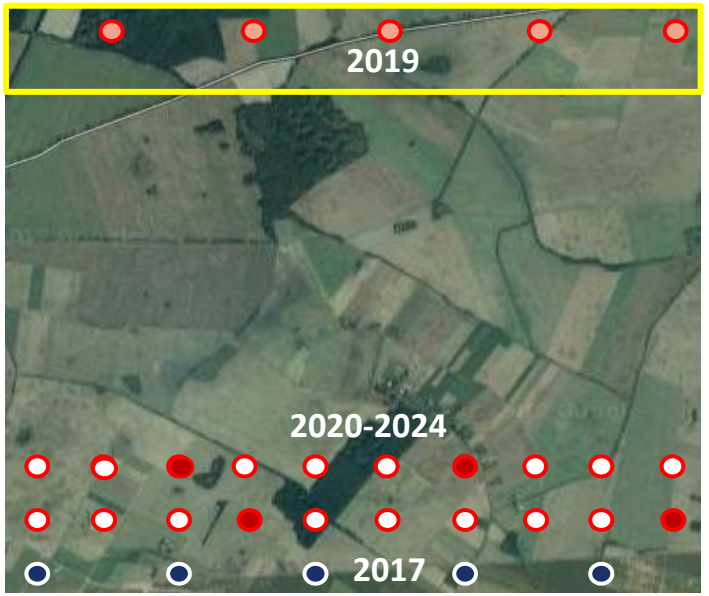
- Assume all Commerciality criteria were met
- The wells are currently producing
- Reserves may be assigned for the duration of the contract period
  - Maturity sub-class: On Production
- If the wells still economic after contract expiry, quantities would be Contingent Resources
  - Maturity sub-class: Development Pending or On Hold
  - Depends upon likelihood of extending gas contract



3.1.3.5 In some situations, entities may choose to initiate production below or continue production past the economic limit. Production must be economic to be considered as Reserves, and the intent to or act of producing sub-economic resources does not confer Reserves status to those quantities.

Selected Examples: Commercial Maturity

Can the Entity claim any Reserves from the 2019 (Northern Area) wells?

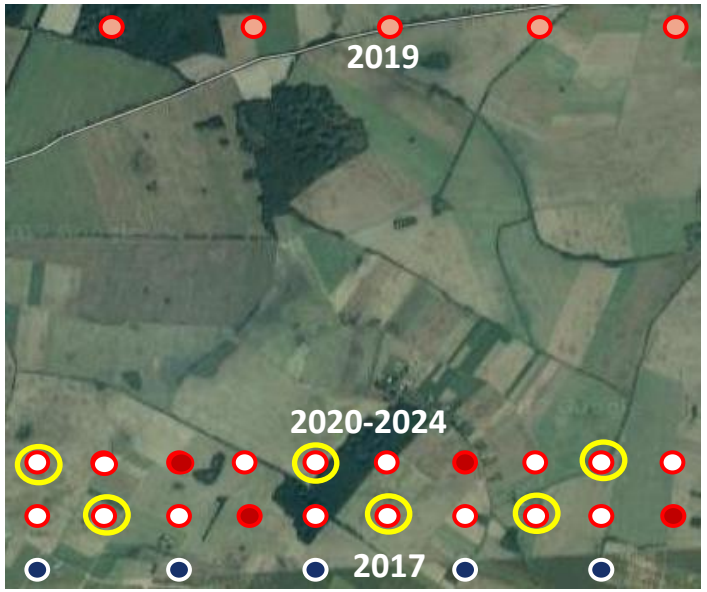


- Wells completed, facilities costs in budget
- A market exists (contract in negotiation)
- However public opposition concerns regulators
- Last 2 items are Contingencies that prevent FID (and "Reserves – Approved for Development")
- Not "Reserves – Justified for Development" due to protests that have potential to prevent the development from proceeding
- Entity cannot claim Reserves, but Contingent Resources – Development On Hold (not Pending, since Contingencies not reasonably expected to be resolved in reasonable time frame)

Selected Examples: Commercial Maturity

Can the Entity claim any Reserves from the Phase II 2020 and/or 2021 wells?

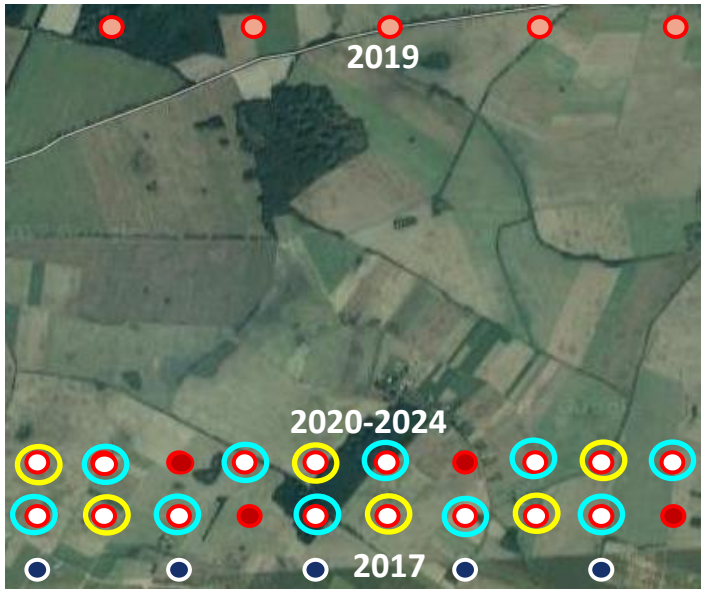
- Sales contracts being negotiated for these 10 wells, with no delays foreseen
- Four 2020 wells' quantities are Reserves: not on production, but capable of being produced
  - Maturity sub-class: On Production
- Six 2021 wells not drilled as of 12/31/2020
  - All necessary approvals obtained
  - Capital funds committed (FID) & wells scheduled to drill
  - Maturity sub-class: Approved for Development



Selected Examples: Commercial Maturity

Can the Entity claim any Reserves from the Phase II Undrilled wells?

- There is a firm intention to proceed within a five-year time frame
- Development plan is well-defined
- Reasonable expectation of sales contract
- No known contingencies
- Entity can claim Reserves *(undeveloped)*
  - Maturity sub-class: Justified for Development
  - Not Approved for Development yet: pending impact of lower well spacing/interference



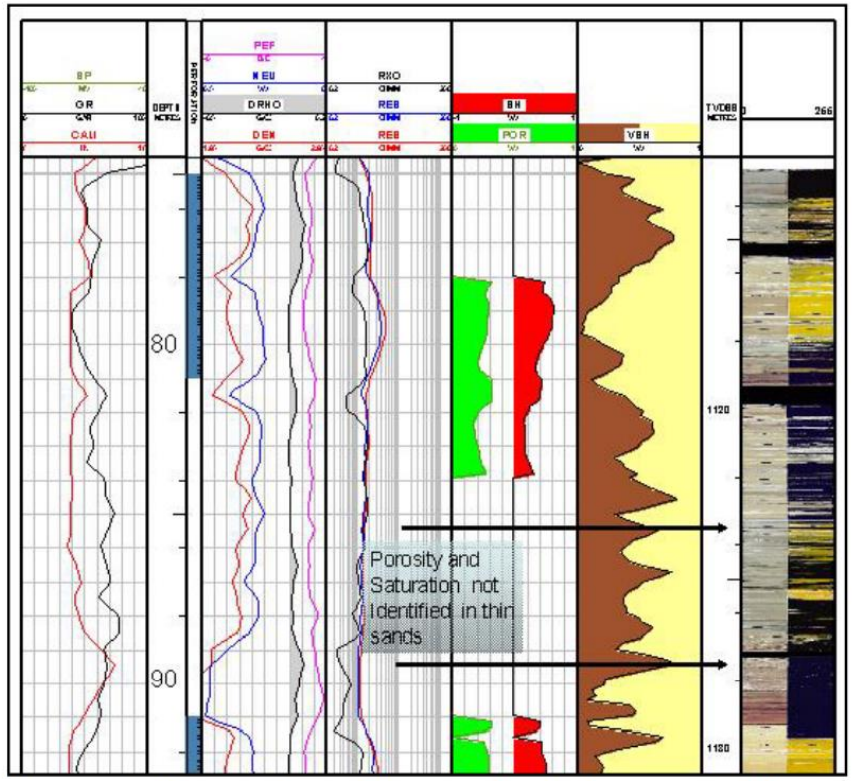
Selected Examples

- Commercial Maturity (Chapter 2)
- Petrophysics (Chapter 5)
- Running a Cash Flow (Chapter 9)

Selected Examples: Petrophysics

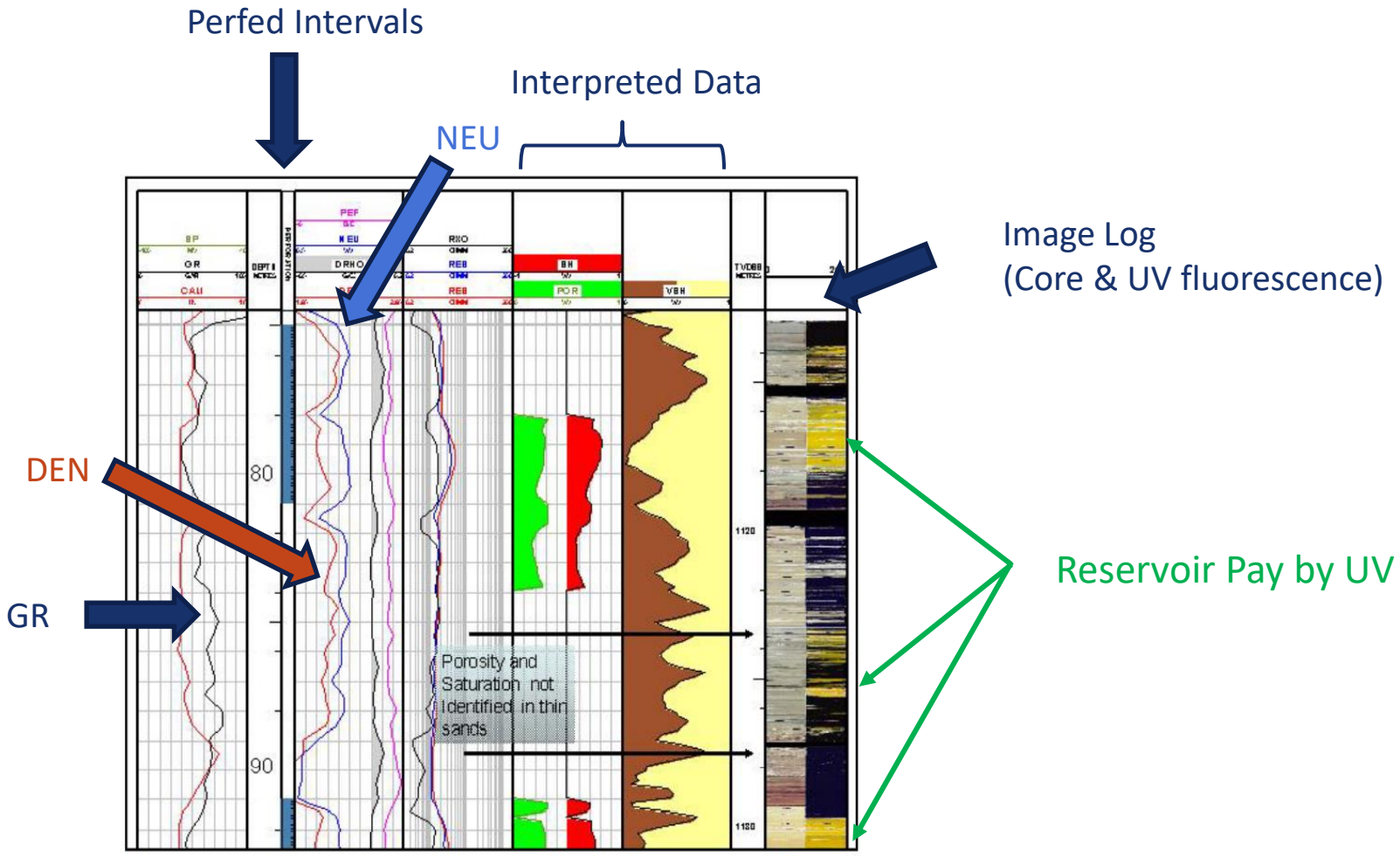
Estimating net pay in laminated sand-shale sequence

- Middle East reservoir
- Thin laminations typically < vertical resolution of most logging tools
- ∴ Resistivity of hydrocarbon beds suppressed by shale and S_w in thin sands may be overestimated (and ø may be underestimated)



Comparison of petrophysical curves with core data showing thinner missed pay sand. Depths are for scale only. *SPWLA-MERS-2007-R*

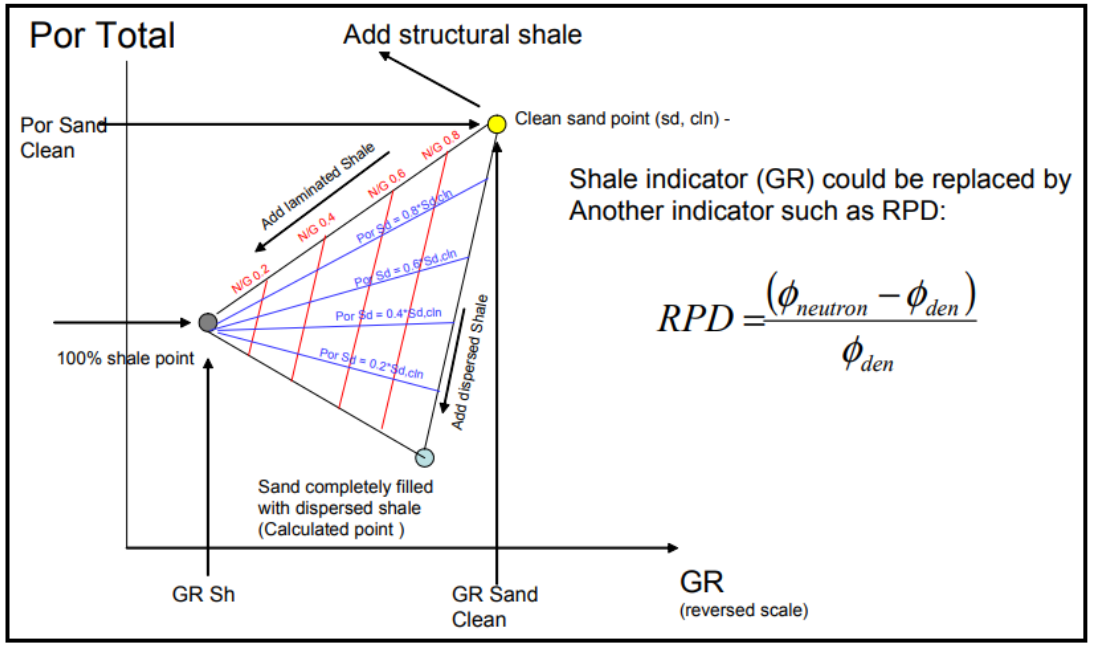
Selected Examples: Petrophysics



Comparison of petrophysical curves with core data showing thinner missed pay sand. Depths are for scale only. *SPWLA-MERS-2007-R*

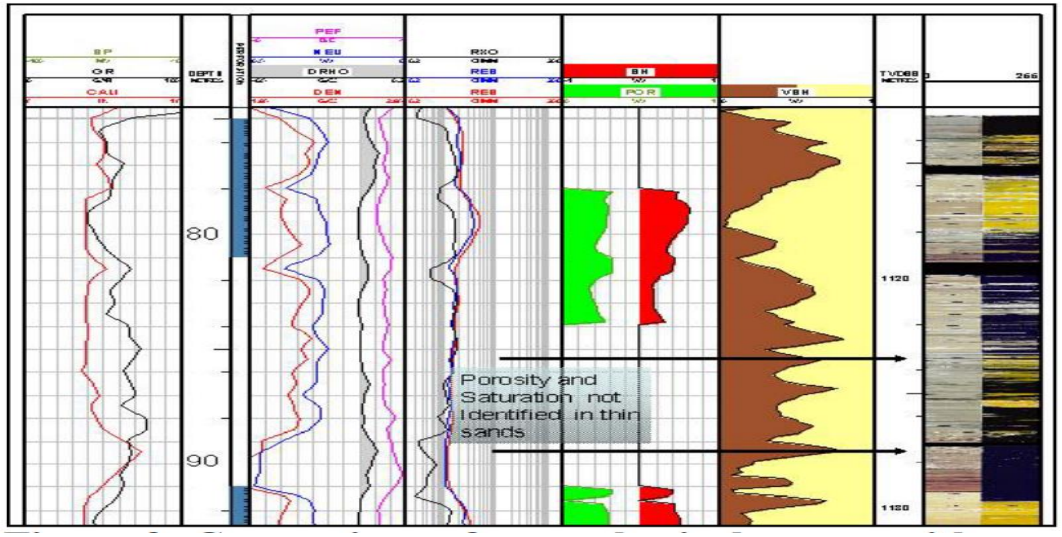
Selected Examples: Petrophysics

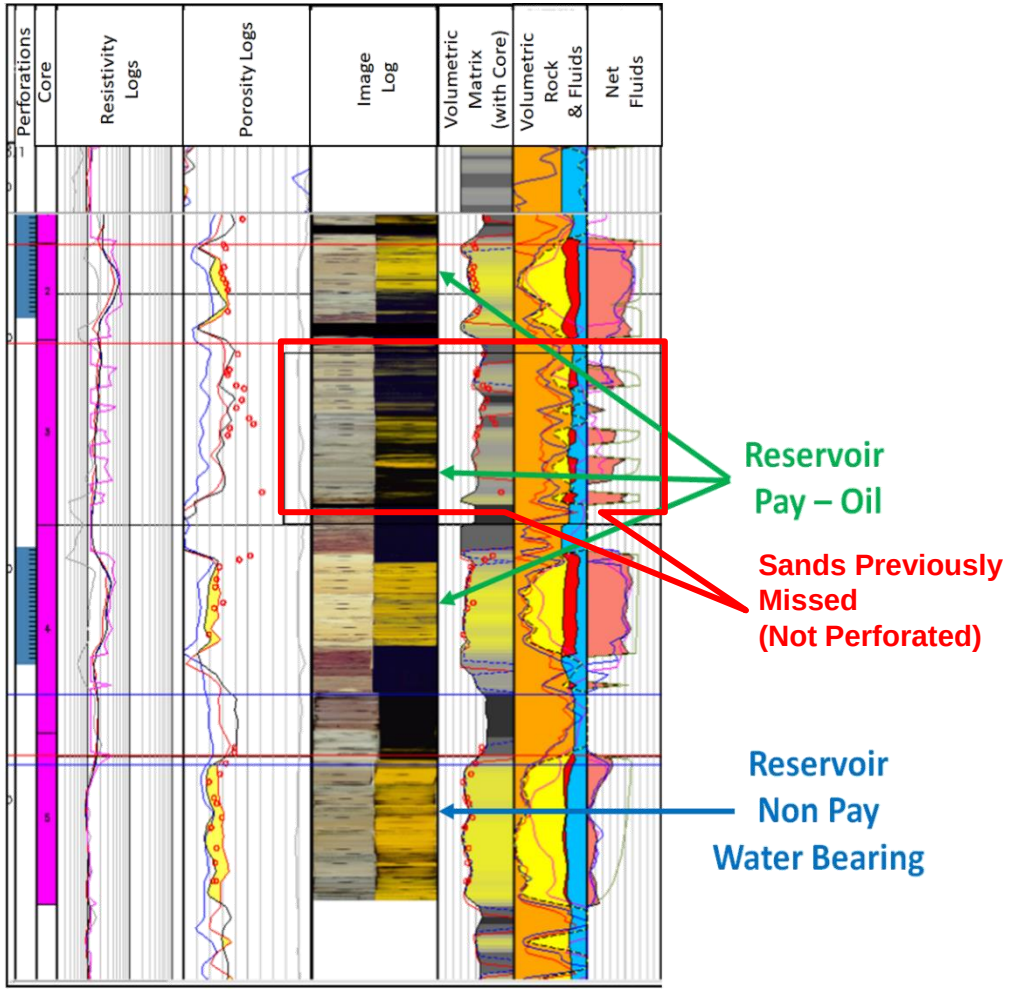
- Petrophysicists can tackle laminated shale assessment in a number of ways
- Authors of example used “Thomas-Stieber” cross-plot technique
- Instead of GR, technique modified to calculate a Relative Porosity Difference (RPD)
- Intent is to estimate the Net-to-Gross ratio by differentiating dispersed (pore-filling) from laminated shale
  - NTG = Bulk Volume of Sand Lamination/Total Bulk Volume
- Technique described in SPWLA-MERS-2007-R



The Thomas-Stieber Cross Plot. *SPWLA-MERS-2007-R*

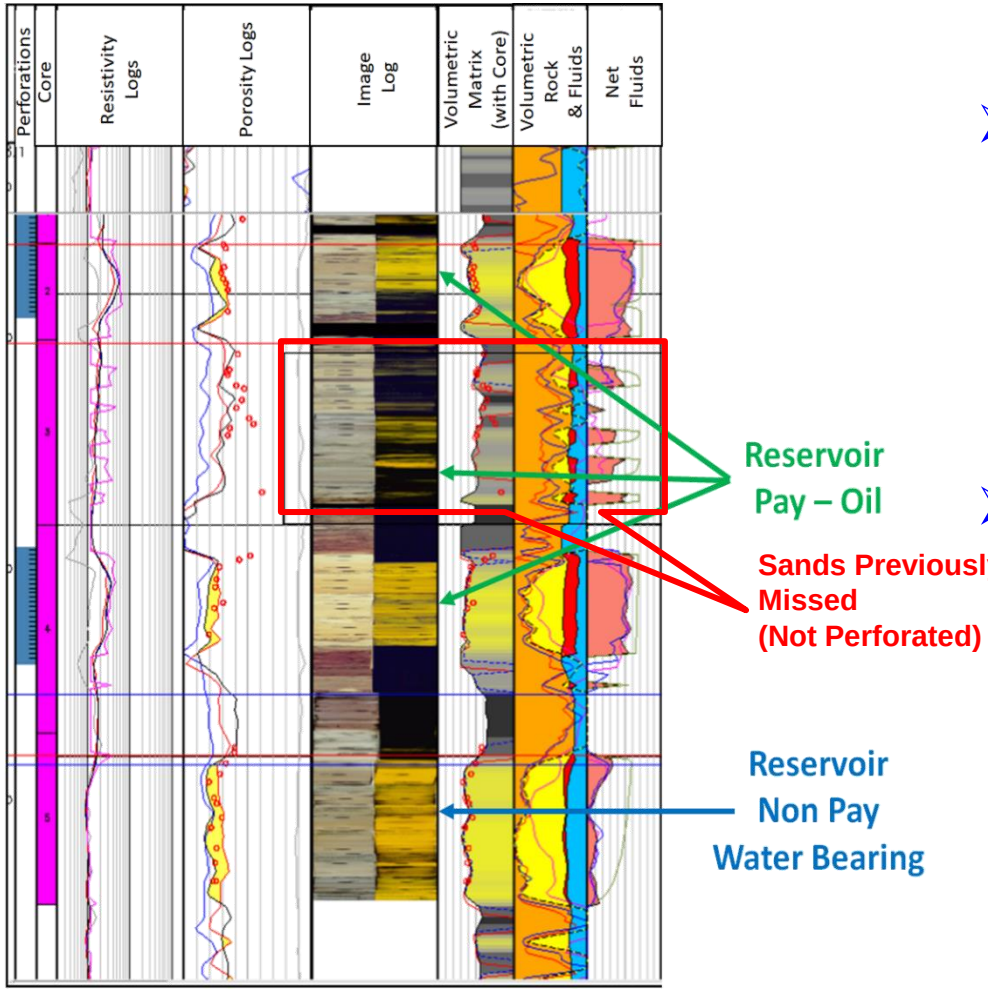
Selected Examples: Petrophysics





- Interpretation finds “bypassed” net pay
- Evidence of oil producibility should be addressed by dynamic data such as RFT
- Useful for 1P/2P/3P or 1C/2C/3C

Selected Examples: Petrophysics



- Scenario 1: Perfed intervals are put on production & all Reserves criteria are met
  - Reserves associated with perfed intervals could be Proved Developed Producing
  - Incremental Reserves from non-perfed sands could be Developed Non-Producing (i.e., Behind-Pipe)
    - Proved if reasonably certain
- Scenario 2: Perfed intervals are put on production & all Reserves criteria are met
  - PLT indicates flow contribution from non-perfed interval(s)
  - Reserves associated with perfed and contributing non-perfed intervals could be Proved Developed Producing
  - Incremental Reserves from non-contributing non-perfed sands could be Developed Non-Producing
    - Proved if reasonably certain

Selected Examples

- Commercial Maturity (Chapter 2)
- Petrophysics (Chapter 5)
- Running a Cash Flow (Chapter 9)

Selected Examples: Cash Flow Refresher

- CF for either developed or undeveloped projects
- Need to test for Economic Limit (EL)
  - Production rate at the time when the maximum cumulative net cash flow occurs for a project
  - At that point, cash inflow = cash outflow
  - ADR* is not part of economic limit assessment (§ 3.1.2.4)
- (+) Cumulative net CF establishes *economic producibility* for ongoing or undeveloped project
- (-) Cumulative net CF
  - Moves developed Reserves to Contingent Resources
  - Prevents undeveloped quantities from being Reserves

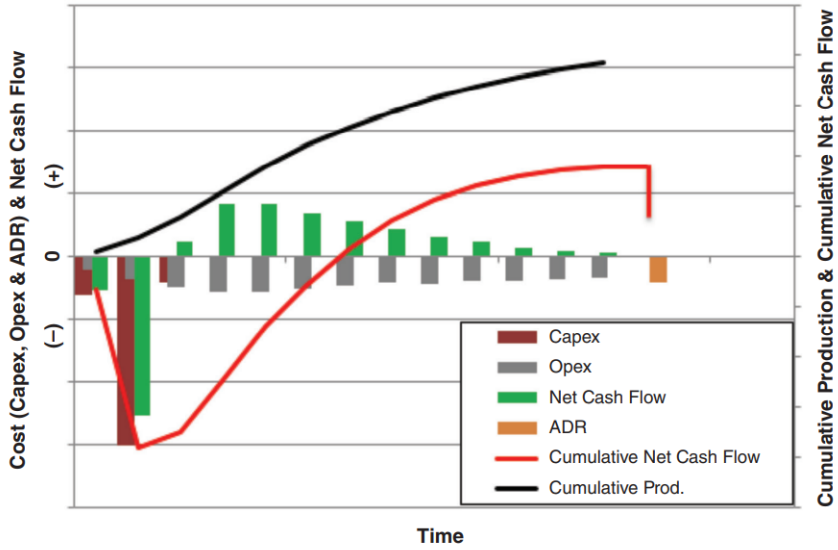


Figure 3.1—Undeveloped project economic forecast

Reasonably forecasted conditions required in CF

*ADR = Abandonment, Decommissioning & Restoration

Selected Examples: Cash Flow Refresher

- With *economic producibility* established, undeveloped projects must also achieve *economic viability* (chance for commercialization)
- Cumulative net CF must > ADR obligation for undeveloped projects (§ 3.1.2.5)
  - If not, the undeveloped quantities are economic but not commercial
  - ∴ Quantities are Contingent Resources

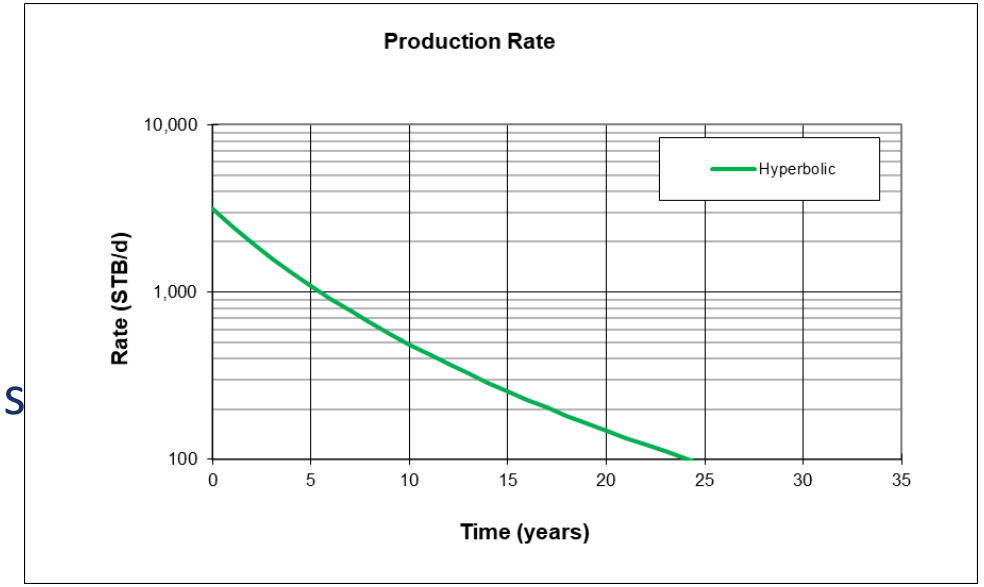
3.1.2.1 Economic determination of a project is tested assuming a zero percent discount rate (i.e., undiscounted). A project with a positive undiscounted cumulative net cash flow is considered economic. Production from the project is economic when the revenue attributable to the entity interest from production exceeds the cost of operation. A project's production is economically producible when the net revenue from an ongoing producing project exceeds the net expenses attributable to a certain entity's interest. The ADR costs are excluded from the economically producibility determination. A project is commercial when it is economic and it meets the criteria discussed in Section 2.1.2.

3.1.2.2 Economic viability is tested by applying a forecast case that evaluates cash-flow estimates based on an entity's forecasted economic scenario conditions (including costs and product price schedules, inflation indexes, and market factors). The forecast made by the evaluator should reflect and document assumptions the entity assesses as reasonable to exist throughout the life of the project. Inflation, deflation, or market adjustments may be made to forecast costs and revenues.

3.1.2.5 Figure 3.1 illustrates a net cash-flow profile for a simple project. The project's cumulative net cash flow exceeds the ADR liability, thereby satisfying the economic viability required to consider a project's quantities as Reserves. The project's economic production (i.e., economic producibility) is truncated at the economic limit when the maximum cumulative net cash flow is achieved, before consideration of ADR.

Selected Examples: Cash Flow

- Well ALPHA-1 discovers oil updip from an old well that was wet in the subject reservoir
- Rock & fluid properties establish analogy with nearby fields productive in same reservoir
- Analogs produced using PM by water injection
- Proposed development plan assumes re-entry of discovery well & drilling two more producers, 3 WI wells & 1 WSW
- Wells can be tied into existing facilities nearby
- “Best estimate” forecast created with test data & analogs



Selected Examples: Cash Flow

- A concession agreement with the host government establishes:
  - 40 year term
  - Bonus paid to government in 10th year
  - Government retains royalty interest
  - Government imposes production taxes as % of revenue
- Economic input parameters are as follows:

INPUT ASSUMPTIONS					
Oil Price, $/bbl	50	Government Royalty	12.5%	CapEx, Wells, $MM	24
Gas Price, $/MMBTU	2.50	Government Bonus, $MM	20	CapEx, Facilities, $MM	100
BTU Content, BTU/SCF	1300	Production Tax, % Revenue	10%	OpEx, $M/month*	112.5
Gas Price, $/MSCF	3.25	ADR Liability, $MM	20		
Oil Price Cap, $/bbl	75	Income Tax Rate, %	10%	Terminal Decline Rate, %/yr	8%
Gas Price Cap, $/MSCF	5	Discount Rate, %	10%	• Pressure Maintenance by Water Injection	
Currency Inflation Rate, %/yr	2%	Concession Term, yrs	40	• Government Bonus Non-Tax Deductible	
Mid-Year Escalation		ADR Incurred in Year	EL + 1	* Three producers, three injectors	

Selected Examples: Cash Flow

- How about PRMS Commerciality criteria (§ 2.1.2.1)?
  - Discovered recoverable quantities (Contingent Resources) may be considered commercially mature, and thus attain Reserves classification, if the entity claiming commerciality has demonstrated a firm intention to proceed with development.
  - This means the entity has satisfied the internal decision criteria (typically rate of return at or above the weighted average cost-of-capital or the hurdle rate).

Commerciality is achieved with the entity's commitment to the project and all of the following criteria:

A. Evidence of a technically mature, feasible development plan. ✓
B. Evidence of financial appropriations either being in place or having a high likelihood of being secured to implement the project. ✓
C. Evidence to support a reasonable time-frame for development. ✓
D. A reasonable assessment that the development projects will have positive economics and meet defined investment and operating criteria. This assessment is performed on the estimated entitlement forecast quantities and associated cash flow on which the investment decision is made (see Section 3.1.1, Net Cash-Flow Evaluation). ***TBD***
E. A reasonable expectation that there will be a market for forecast sales quantities of the production required to justify development. There should also be similar confidence that all produced streams (e.g., oil, gas, water, CO_2) can be sold, stored, re-injected, or otherwise appropriately disposed. ✓
F. Evidence that the necessary production and transportation facilities are available or can be made available. ✓
G. Evidence that legal, contractual, environmental, regulatory, and government approvals are in place or will be forthcoming, together with resolving any social and economic concerns. ✓

Selected Examples: Cash Flow

- CF is run, undiscounted, to determine the EL
- All prices & expenses are in nominal dollars
- Escalations reflect contract and/or forecasted economic conditions

A	B	C	D	E	F	G	H	I	J	K	L	M	N
	Gross (100%) Production		Net (Entitled) Production		Prices (Nominal)		Net Revenue	Net OPEX	Prod'n Taxes	Capital Costs	Bonus	Net Cash Flow	Cum. Net Cash Flow
Year	Oil	Gas	Oil	Gas	Oil	Gas	*Nominal*	*Nominal*	*Nominal*	*Nominal*	*Nominal*	*Nominal*	*Nominal*
	MSTB	*MMSCF*	*MSTB*	*MMSCF*	*$/BBL*	*$/MCF*	*$MM*	*$MM*	*$MM*	*$MM*	*$MM*	*$MM*	*$MM*
1					50.498	3.282	-	-	-	10.100		(10.100)	(10.100)
2					51.507	3.348	-	-	-	56.658		(56.658)	(66.758)
3					52.538	3.415	-	-	-	52.538		(52.538)	(119.295)
4	1020.179	612.108	892.657	535.594	53.588	3.483	49.702	0.965	4.970			43.767	(75.528)
5	808.088	484.853	707.077	424.246	54.660	3.553	40.156	0.984	4.016	9.839		25.318	(50.211)
6	649.932	389.959	568.690	341.214	55.753	3.624	32.943	1.505	3.294			28.143	(22.067)
7	529.771	317.863	463.550	278.130	56.868	3.696	27.389	1.535	2.739			15	1.048
8	436.965	262.179	382.344	229.406	58.006	3.770	23.043	1.566	2.304			73	20.220
9	364.233	218.540	318.704	191.222	59.166	3.846	19.592	1.597	1.959			16.035	36.256
10	306.487	183.892	268.176	160.905	60.349	3.923	16.815	1.629	1.682		20.000	(6.496)	29.760
11	260.099	156.060	227.587	136.552	61.556	4.001	14.556	1.662	1.456			11.438	41.198
12	222.441	133.464	194.636	116.781	62.787	4.081	12.697	1.695	1.270			9.732	50.930
13	191.574	114.944	167.627	100.576	64.043	4.163	11.154	1.729	1.115			8.309	59.240
14	166.052	99.631	145.295	87.177	65.324	4.246	9.861	1.764	0.986			7.112	66.351
15	144.779	86.868	126.682	76.009	75.000	5.000	9.881	1.799	0.988			7.094	73.445
16	126.918	76.151	111.053	66.632	75.000	5.000	8.662	1.835	0.866			5.961	79.406
17	111.818	67.091	97.841	58.705	75.000	5.000	7.632	1.872	0.763			4.997	84.403
18	98.974	59.384	86.602	51.961	75.000	5.000	6.755	1.909	0.675			4.170	88.573
19	87.983	52.790	76.985	46.191	75.000	5.000	6.005	1.947	0.600			3.457	92.030
20	78.527	47.116	68.711	41.227	75.000	5.000	5.359	1.986	0.536			2.837	94.868
21	70.351	42.211	61.557	36.934	75.000	5.000	4.801	2.026	0.480			2.295	97.163
22	63.248	37.949	55.342	33.205	75.000	5.000	4.317	2.067	0.432			1.819	98.982
23	57.050	34.230	49.919	29.951	75.000	5.000	3.894	2.108	0.389			1.396	100.378
24	51.619	30.972	45.167	27.100	75.000	5.000	3.523	2.150	0.352			1.021	101.399
25	46.842	28.105	40.986	24.592	75.000	5.000	3.197	2.193	0.320			0.684	102.083
26	42.623	25.574	37.295	22.377	75.000	5.000	2.909	2.237	0.291			0.381	102.464
27	38.886	23.331	34.025	20.415	75.000	5.000	2.654	2.282	0.265			0.107	102.571
28	35.563	21.338	31.118	18.671	75.000	5.000	2.427	2.327	0.243			(0.143)	102.429
29	32.600	19.560	28.525	17.115	75.000	5.000	2.225	2.374	0.222			(0.371)	102.057
30	29.951	17.970	26.207	15.724	75.000	5.000	2.044	2.421	0.204			(0.582)	101.476
SUM	***6,073.55***	***3,644.13***	***5,314.36***	***3,188.62***			***334.19***	***50.16***	***33.42***	***129.13***	***20.00***	***101.48***	

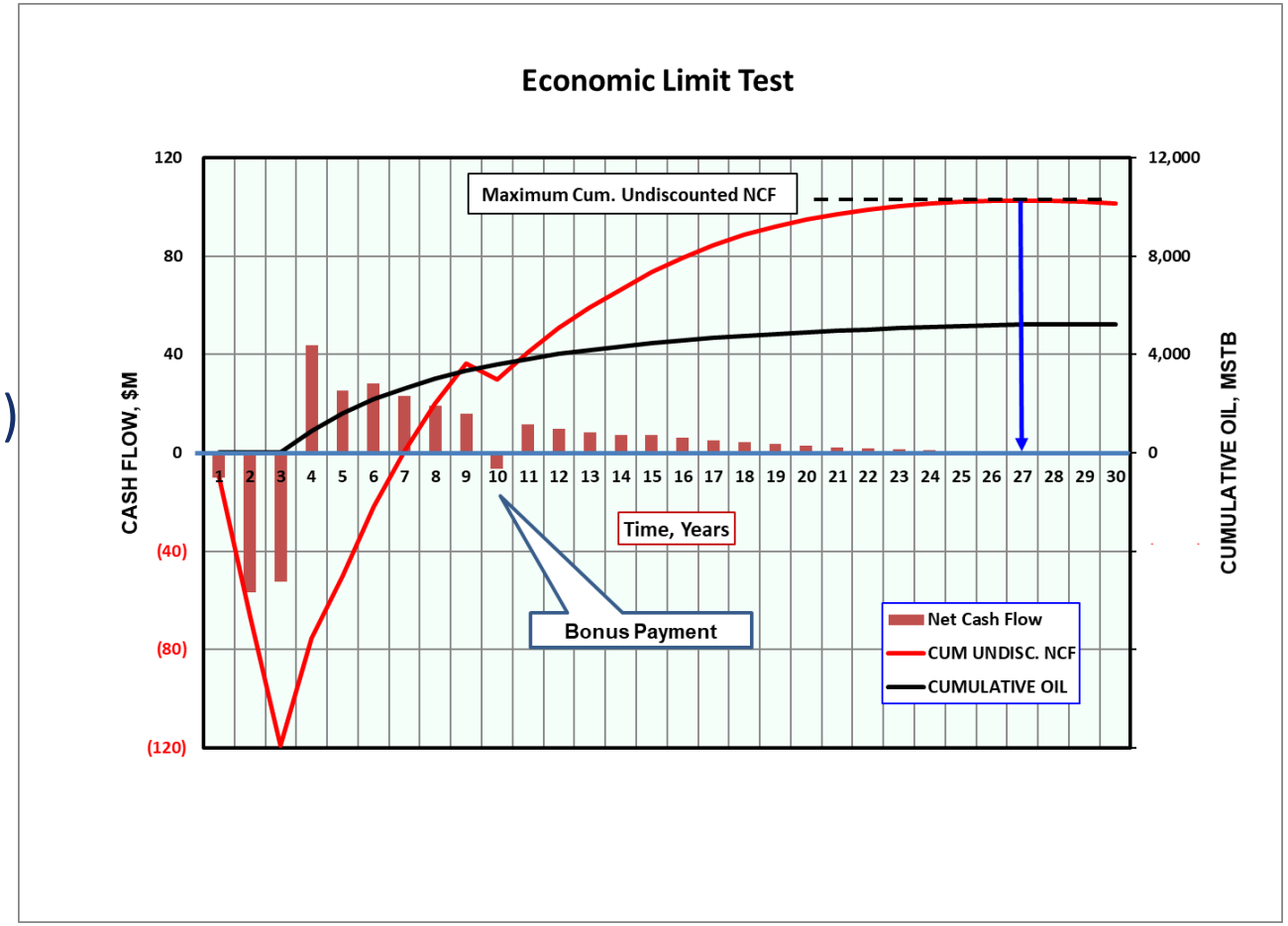
Injectors drilled

Bonus to Government

(-) CF

Selected Examples: Cash Flow

- Graph of CF analysis shows
  - Net CF = net revenue – net expenditures
  - Cumulative produced oil
  - Cumulative undiscounted NCF
- Project with a (+) undiscounted cumulative NCF is economic (§ 3.1.2.1)
- Maximum cum. NCF occurs in year 27
- Establishes EL & potential reserves
  - Assuming no technical constraints
  - Economic life < concession term
- Project is *economically producible*



Selected Examples: Cash Flow

- Undeveloped project must also be *economically viable*
  - Requires comparison of cumulative NCF to ADR obligation (using forecasted economic conditions)
- The project's cumulative net cash flow exceeds the ADR liability, thereby satisfying the economic viability required to consider a project's quantities as Reserves (§ 3.1.2.5)

A	B	C	P	Q	R	S	T	U
Year	Gross (100%) Production Oil	Gross (100%) Production Gas	Economic Net Oil Produced	Economic Net Gas Produced	Total Net Revenue	Total Net Costs	Total Net Cash Flow	ADR Liability
	MSTB	MMSCF	MSTB	MMSCF	Nom. $MM	Nom. $MM	Nom. $MM	Nom. $MM
1			-	-	-	10.100	(10.100)	-
2			-	-	-	56.658	(56.658)	-
3			-	-	-	52.538	(52.538)	-
4	1020.179	612.108	892.657	535.594	49.702	5.935	43.767	-
5	808.088	484.853	707.077	424.246	40.156	14.838	25.318	-
6	649.932	389.959	568.690	341.214	32.943	4.800	28.143	-
7	529.771	317.863	463.550	278.130	27.389	4.274	23.115	-
8	436.965	262.179	382.344	229.406	23.043	3.870	19.173	-
9	364.233	218.540	318.704	191.222	19.592	3.557	16.035	-
10	306.487	183.892	268.176	160.905	16.815	23.311	(6.496)	-
11	260.099	156.060	227.587	136.552	14.556	3.118	11.438	-
12	222.441	133.464	194.636	116.781	12.697	2.965	9.732	-
13	191.574	114.944	167.627	100.576	11.154	2.845	8.309	-
14	166.052	99.631	145.295	87.177	9.861	2.750	7.112	-
15	144.779	86.868	126.682	76.009	9.881	2.787	7.094	-
16	126.918	76.151	111.053	66.632	8.662	2.701	5.961	-
17	111.818	67.091	97.841	58.705	7.632	2.635	4.997	-
18	98.974	59.384	86.602	51.961	6.755	2.585	4.170	-
19	87.983	52.790	76.985	46.191	6.005	2.548	3.457	-
20	78.527	47.116	68.711	41.227	5.359	2.522	2.837	-
21	70.351	42.211	61.557	36.934	4.801	2.506	2.295	-
22	63.248	37.949	55.342	33.205	4.317	2.498	1.819	-
23	57.050	34.230	49.919	29.951	3.894	2.497	1.396	-
24	51.619	30.972	45.167	27.100	3.523	2.502	1.021	-
25	46.842	28.105	40.986	24.592	3.197	2.513	0.684	-
26	42.623	25.574	37.295	22.377	2.909	2.528	0.381	-
27	38.886	23.331	34.025	20.415	2.654	2.547	0.107	-
28	35.563	21.338	-	-	-	-	-	34.477
29	32.600	19.560	-	-	-	-	-	-
30	29.951	17.970	-	-	-	-	-	-
SUM	*6,073.55*	*3,644.13*	*5,228.51*	*3,137.11*	*327.50*	*224.93*	*102.57*	*34.48*

Selected Examples: Cash Flow

- Now we consider commerciality to the entity's entitlement
- Using entity's economic net oil & gas and the cumulative undiscounted NCF and ADR obligation as before, we include entity's income tax assessment (optional) and discount NCF at entity's discount rate
- Before the ADR obligation, the cumulative undiscounted *post-tax* NCF is $90.3 million but only $5.4 million when discounted
- Because cumulative discounted NCF (i.e., Net Present Value "NPV") > 0, the entity's required rate of return has been exceeded

Year	Economic Net Oil Produced	Economic Net Gas Produced	Cum. Undisc. Net Cash Flow	ADR Liability	Cum. Undisc. Net Cash Flow w/Inc. Tax	Cum. Disc. Net Cash Flow w/Inc. Tax
	MSTB	*MMSCF*	*Nom. $MM*	*Nom. $MM*	*Nom. $MM*	*Nom. $MM*
1	-	-	(10.100)	-	(10.100)	(9.630)
2	-	-	(66.758)	-	(66.758)	(58.740)
3	-	-	(119.295)	-	(119.295)	(100.139)
4	892.657	535.594	(75.528)	-	(75.528)	(68.786)
5	707.077	424.246	(50.211)	-	(50.211)	(52.299)
6	568.690	341.214	(22.067)	-	(22.067)	(35.637)
7	463.550	278.130	1.048	-	0.943	(23.253)
8	382.344	229.406	20.220	-	18.198	(14.810)
9	318.704	191.222	36.256	-	32.630	(8.391)
10	268.176	160.905	29.760	-	24.784	(11.564)
11	227.587	136.552	41.198	-	35.078	(7.780)
12	194.636	116.781	50.930	-	43.837	(4.852)
13	167.627	100.576	59.240	-	51.316	(2.580)
14	145.295	87.177	66.351	-	57.716	(0.813)
15	126.682	76.009	73.445	-	64.101	0.790
16	111.053	66.632	79.406	-	69.466	2.015
17	97.841	58.705	84.403	-	73.963	2.948
18	86.602	51.961	88.573	-	77.716	3.656
19	76.985	46.191	92.030	-	80.827	4.190
20	68.711	41.227	94.868	-	83.381	4.588
21	61.557	36.934	97.163	-	85.447	4.880
22	55.342	33.205	98.982	-	87.083	5.091
23	49.919	29.951	100.378	-	88.340	5.239
24	45.167	27.100	101.399	-	89.259	5.336
25	40.986	24.592	102.083	-	89.875	5.396
26	37.295	22.377	102.464	-	90.218	5.426
27	34.025	20.415	102.571	-	90.314	5.434
28	-	-		34.477	55.837	2.926
29	-	-		-	55.837	2.926
30	-	-		-	55.837	2.926
SUM	***5,228.51***	***3,137.11***		***34.48***		

Selected Examples: Cash Flow

- We can summarize the results from the post-tax CF analysis as below

OUTPUT RESULTS			
Economic Life, Years	27	Net Oil Reserves, MSTB	5,229
Is Cumulative Undiscounted NCF > ADR	Y	Net Gas Reserves, MMSCF	3,137
Is Cumulative Discounted NCF > 0?	Y	Cumulative Discounted NCF, $MM (w/ADR)	2.926
		Cumulative Discounted NCF, $MM (pre-ADR)	5.434

- This data will be useful especially if entity is capital-constrained and needs to decide which projects to invest in, or project ranking if they have a portfolio from which to choose
- The entity's hurdle rates for comparison of projects may include NPV, payout time, rate-of-return, and other criteria

Future

- As with PRMS, AG will be “evergreen” document
- Anticipate versioning and/or FAQs available on SPE website

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  - SPEE Reserves Definitions Committee
    - Rawdon Seager, Jorge Faz, Shane Hattingh, John Lee, Rod Sidle, Tim Smith
  - SPE Staff
  - Saudi Aramco

Q & A