



**Petroleum Economics Software
Symposium 2009**

Monday April 20, 2009
Marathon Oil Corporation Conference Center
Houston, TX 77056

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Vendors

March 2, 2000		April 20, 2009	
		Energy Navigator	Value Navigator
		Enersight	WellSpring
Artesia Data Systems	PEEK		
Doug Boone	ToolKit		
Ensyte	Ensyte		
IHS Energy	PowerTools		
Landmark Graphics	ARIES	Halliburton	ARIES
Merak Projects	Peep	Schlumberger	Merak Peep
Molli Comp Services	MICA	Molli Comp Services	MICA
OGRE Partners	OGRE	OGRE Systems	Continuum
PRMI Software	EUREKA		
SCAI	FEGS	SCAI	FEGS
T&E Garland	What-if		
TRC Consultants	PHDWin	TRC Consultants	PHDWin

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SPEE Committee

- Chairman/Arrangements
 - Kerry Pollard
- Analysis & Program
 - John D. Wright – Norwest Corporation
 - Travis Smith – Colorado School of Mines
- Whip Cracker
 - David K. Gold - SPEE President – Aera Energy

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Special Thanks

To

NORWEST
CORPORATION

For paying me to do this!

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Problem Sets

- 9 categories
- 23 problems

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Categories of Test Cases

1. Constant Rate, Discounting, Payout, Escalation
2. Decline Curve Equations ($0 \leq b \leq 2.15$)
3. Secondary Streams, Incremental Analysis
4. Reversions
5. Overriding Royalty Evaluation
6. Hyperbolic Decline Curve with ending exponential decline
7. Incremental Analysis
8. Fitting Decline Curves to Data
9. "Decision Tree" Calculations

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Goals of Study

- Make sure “engines” calculate correctly.
- Determine some program limitations.
- Put a set of solutions into the public domain with clear indication of how they were calculated (Excel spreadsheet).
- Show the difference between a “shrink-wrapped” version of the software and modified input data to mimic the “solutions”.
- Provide a mechanism to focus discussion.
- Encourage communication.

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Test Procedure

- Send problems to vendors and ask for “shrink-wrapped” answers.
- Collect results and tabulate
- Send “solutions” to vendors
 - Correct “solutions”
 - Correct “solutions”
- Receive revised results from vendors
 - Correct “solutions”
- As results were analyzed ask vendors to check answers that were not as expected
- Receive revised results from vendors
 - Correct “solutions”
- Incorporate and analyze revised results

“The best-laid
schemes of mice
and men / Gang aft
a-gley”
Robert Burns

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General Observations

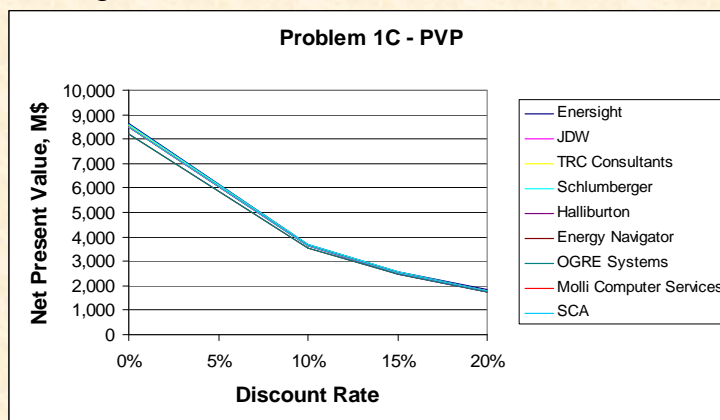
(from 2000 Symposium)

- “Truth” is elusive – there are legitimate differences of opinion on how a calculation should be done
- All the programs are capable of solving many of the problems.
- Some of the programs are capable of solving all of the problems.
- Some of the programs gave significantly different answers than what was expected.
- All of the programs can be misused.
- There is a great need for standardization and communication.

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Good News

- By continuing to work with the vendors we were able to get reasonable agreement with most of them on most problems.
 - Programs or not?



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More Good News

- We were able to make some vendors think about what went into the calculations.
- I think we found some bugs that got or will be fixed.
- The vendors were all very cooperative.
- There seem to be good lines of communication with the vendor technical representatives.

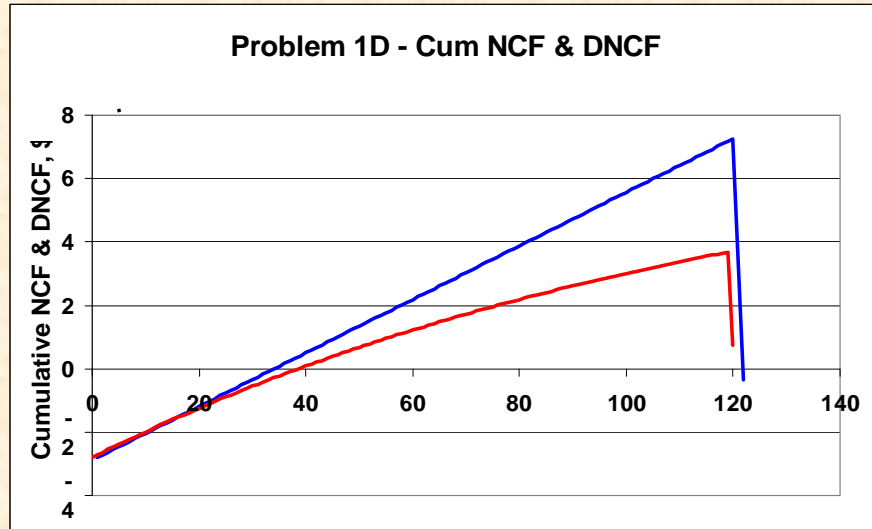
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Bad News

- We had to iterate quite a bit.
- There are still some issues with some programs.
- Multiple rates of return are still a problem (same as 2000)
- Payout calculation with subsequent investments done two ways.
- Are “reserves” gross or net?
- Some programs had issues with unusual decline curves
- There is considerable difference of opinion on the meaning of profit-to-investment ratio and return on investment. (Do you add 1.0 or not?)

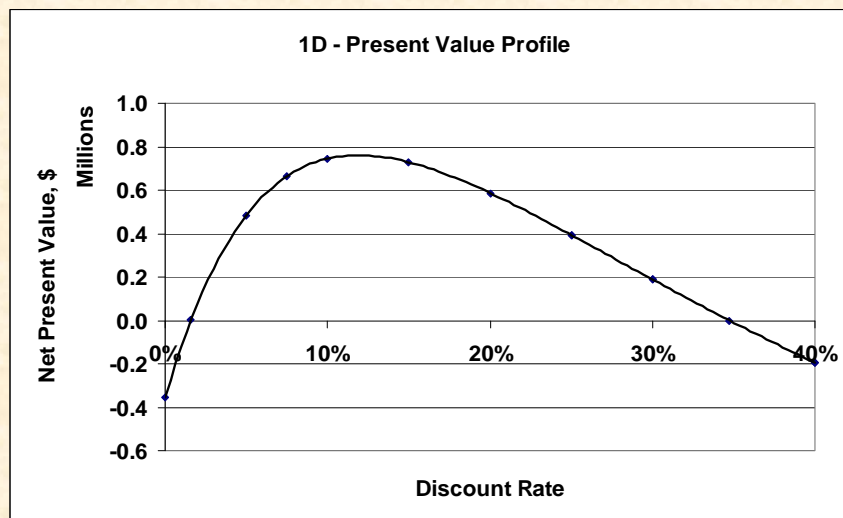
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Multiple IRR - Problem 1D (Two Investments; yr0 & yr10)



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How do you want to handle multiple rates of return?



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Problem 1D Multiple Rates of Return

Software	ROR	Comments
ARIES	0%	Multiple ROR's from PW Profile
Energy Navigator	"N/A"	Multiple rates determined through additional output report
Energisight	Lower	Manually find multiple rates by varying discount rate
Merak Peep	Lower	Multiple rates generated in Excel through Peep Reports
MICA	Higher	Other ROR from NPV profile graph
OGRE	Higher	Also reports present worth profile
PHDWin	Higher	Also reports present worth profile
SCA	"Unknown"	Also reports a present worth profile

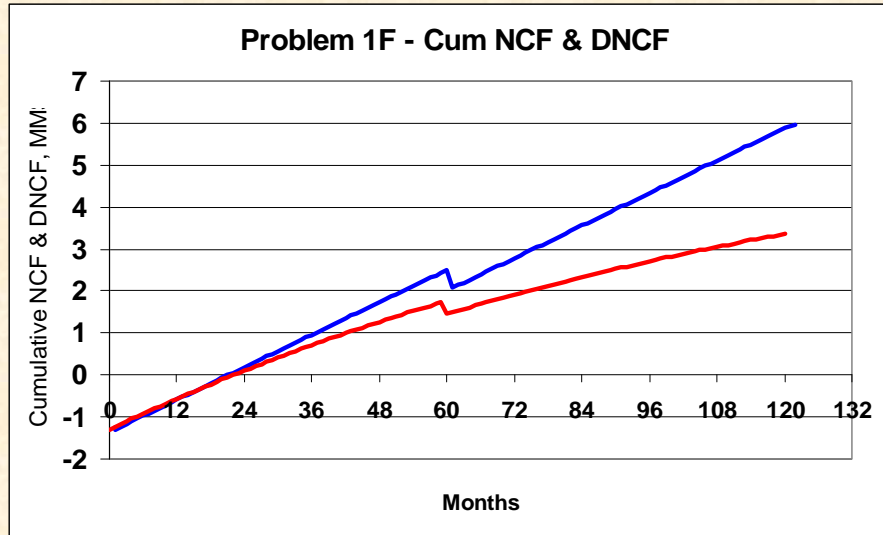
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SPEE Recommended Evaluation Practice #9 – Reporting Multiple Rates of Return

- In cases where multiple rates of return exist, the reported economic summary should alert the user of the report that multiple rates of return exist (in lieu of printing a single rate of return). In these cases the summary output should also refer the reader to the present value profile data. A suggested presentation for such an alert on the summary output might be as follows:
 - *IRR: Multiple rates of return may exist, see present value profile plot*

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Payout: Subsequent Investments



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Payout with later investments

	Payout	Disc PO
Energisight	1.68	1.82
SCA	1.75	1.80
Molli Computer Services	1.75	1.83
Halliburton	1.68	1.84
JDW	1.68	1.84
OGRE Systems	2.25	2.31
Energy Navigator	2.33	2.75
TRC Consultants	2.33 / 1.68	2.33 / 1.84
Schlumberger	1.75	1.75

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Reserves

“I have yet to see any problem, however complicated, which, when you looked at it in the right way, did not become still more complicated.”

Poul Anderson

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Reserves

- Net or Gross?
- What does “Net” mean?
- What do you want if you just say “Reserves”?
- My thoughts
 - Gross Reserves are to the 100% working interest
 - Net Reserves are to the Net Revenue Interest being evaluated (U.S. centric!)
 - Canada reports what I call “Working Interest Reserves” i.e. your W.I. times Gross Reserves.
- SPEE REP #2
 - ... present net salable volumes, i.e., lease fuel should be deducted from the volume available for sales.
- Other thoughts

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Theoretical Decline Curves

6 unknowns

2 equations (rate-time and rate-cum)

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Problem Set 2 (theoretical decline curves)

- Constants
 - W.I., NRI, OPrice, OPEX, $q_i=250$ BOPD, Sev+AdV
- 2A
 - Given, q_i , D_{ei} , b , q_{el} – Calculate N_p , Life
 - $b=0, 0.67, 1.00, 1.50, 2.15$
- 2B
 - Given, q_i , q_{el} , N_p , b – Calculate D_{ei} , Life
 - $b=0, 0.67, 1.00, 1.50, 2.15$
- 2C
 - Given, q_i , q_{el} , N_p , Life – Calculate D_{ei} , b

Everybody
OK

6/8 OK

2/8 OK

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Problem Set 2C (theoretical decline curves)

	Initial Decline Rate	Hyperbolic Exponent
Energisight	0.000	0.000
Halliburton	0.000	0.000
Schlumberger	0.352	0.000
SCA	0.410	0.033
TRC Consultants	0.695	0.913
OGRE Systems	0.695	0.914
JDW	0.696	0.914
Molli Computer Services	0.739	0.886
Energy Navigator	0.870	1.154

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Problem 1F (Multiple Investments-Profit to Inv Ratio)

	NPV-10	Undisc P:I	Disc P:I
Energisight	5,339	8.61	4.32
SCA	5,287	7.60	2.94
TRC Consultants	5,286	7.61	3.28
Halliburton	5,305	7.61	3.29
Energy Navigator	5,318	7.61	3.32
Schlumberger	5,339	8.61	4.32
JDW	5,280	8.60	4.28
Molli Computer Services	5,329	8.60	4.31
OGRE Systems	5,318	8.61	4.32

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Simple Problem

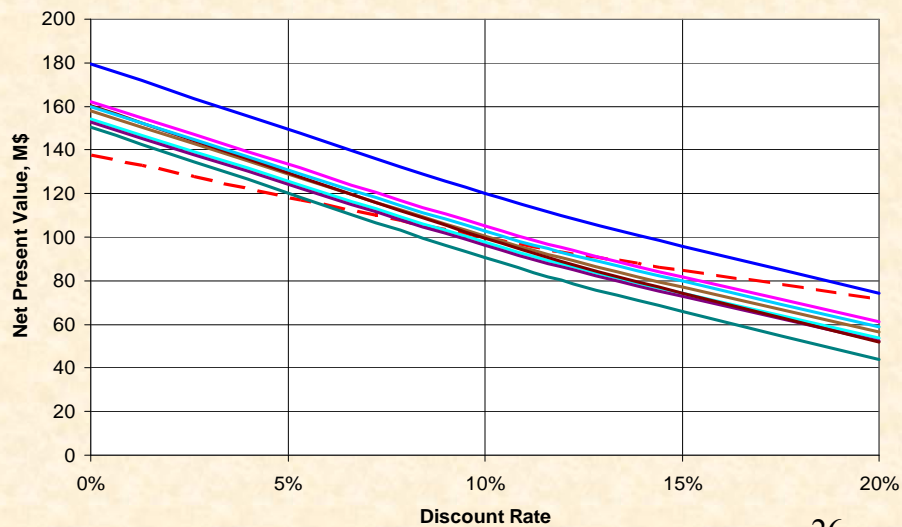
- Well Cost \$425,000
- Drill Date 1/1/2009
- Initial Rate 100 BOPD
- Production begins 2/1/2009
- Exponential decline 50%/year
- WI 100%
- NRI 85%
- Oil \$17.50 escalated @ 3%/year
- LOE \$2000/m escalated @ 3%/year
- Sev + Adv tax 10%

You know the answers will all be the same!

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Results

Anonymous Problem - Present Value Profile



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More Runs

- **Set 1 – 30 Professionals**
NPV 20 Range – 3,448 to 81,711
- **Set 2 – 12 Software Vendors (2000)**
NPV 20 Range – 31,000 to 81,824
- **Set 3 – 32 Professionals**
NPV 20 Range – 9,096 to 97,000
- **Set 4 – 9 Software Vendors (2009)**
NPV 20 Range – 43,862 to 74,217
- **Out of 83 runs – 77 different answers**
 - 30,070 Twice
 - 42,657 Twice
 - 49,222 Twice
 - 53,840 Four Times

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Where Now?

- Results to be posted on SPEE.ORG
- Next symposium April 18, 2011 ?????
 - Need problems & ideas
 - Canadian royalty
 - Production Sharing Contracts
 - ?????
- Need to create some new REP's
 - Reserves Terminology
 - Calculation of Payout & Discounted Payout
 - P:I & ROI (?) Terminology
- Need to get vendors to implement REP's



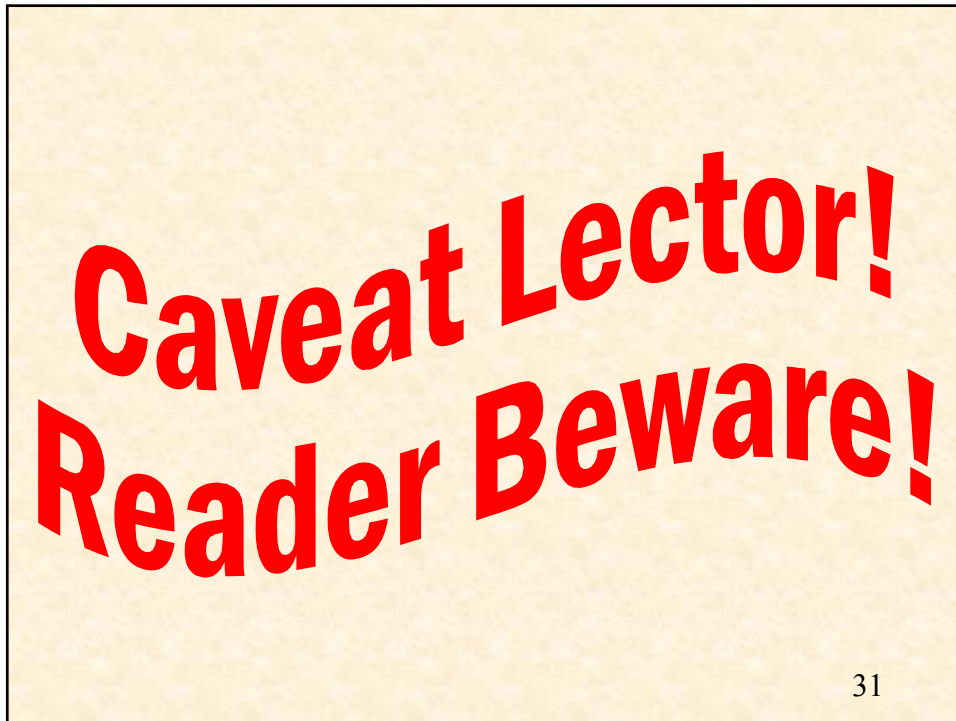
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Final Thoughts

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Caveat Emptor!
Buyer Beware!

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The End

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