PHDWIN
Integrated Economics & Decline Curve Analysis
David Pacinda, P.E.

- President of TRC Consultants, LC
- 1985 graduate Texas A&M Petroleum Engineering
- One of the Founders and Owners
- Happily married (24 years) to my wife Susan with two children, Sarah (17) Michael (14)
TRC CONSULTANTS, LC

- Started in 1986 as an engineering company consulting on A&D projects.
- Developed in-house software for asset evaluations unique to the oil and gas industry.
- Our in-house software became popular with our clients and other engineers.
- By the mid 90’s we were only a software company.

TRC exclusively develops, sells and supports the **PHD Win** family of software.
PHDWin What is it?

Industry Leading, Fully-Featured Decline Curve and Material Balance Analysis Software Integrated with Highly Granular Comprehensive Deterministic Economic Modeling
PHD Win

What is it used for?

- Asset Evaluation (PVFNI)
- Budgeting and Planning
- Prospect Screening
- Reserves Reporting (SEC, NI51-101,..)
- Pre-Drill or Work-over Justification
- Post Project Tracking
- “What If” cases (including Hedging)
- Acquiring / Divesting Assets
**PHDWin** Strategic Advantages

- **Ease Of Use**
  - new users can create quality engineering and run sophisticated economics quickly and efficiently

- **Sophisticated & Comprehensive Modeling**
  - Consistently model the most complicated projects anywhere in the world

- **Industry Proven Standard**
  - PHDWin databases are easily transported and produce repeatable results
  - .phz files are the language of A&D
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PHDWin Easy to use!

- Graphical Windows Interface with extensive use of:
  - "Drop-Down" Menus of User Defined Input Libraries
    - Reserve class & categories
    - Case types
    - Currencies ($, Can$, etc.)
    - Volume units (BBls, Tons, etc.)
  - "Drop-and-Drag" From Lists
    - Incremental & Recompletion Tree
  - Process Wizards for Common Procedures
    - Prospect Builder
**PHDWin Easy to use!**

“Drop-Down” Menus of User Defined Input Libraries

Input Libraries offer Consistent Sorting and Filtering
PHD Win Easy to use!

“Drop-and-Drag” From Lists
PHDWin  Easy to use!

Process Wizards for Common Procedures

Note automatically created “Investments” based on PHDWin Link-Dates.
Link-Dates are a way of timing a cash flow event based on another event. Link-Date events can be within a case or associated with different cases.

Common Examples include:

- Plugging costs at the economic limit of a case
- Investments associated with another cases ECL
- Recompletions
**PHDWin Easy to use!**

- No Need for Memorizing Key Words
- No Need to Know SQL or Other Languages
- No Database Theory Knowledge Necessary
- No Need to Know:
  - ARPs Calculations
  - Volumetric Calculations
  - Discounting Calculations

**PHDWin takes care of the Details!!**
PHDWin Strategic Advantages

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PHD Win: Sophisticated Decline Curves

- Truly integrated decline curve and economics
- Comprehensive decline curve projections
- Rate Time, Rate cum, BHP/Z, etc.
- “Drop and Drag” decline curve manipulation
- View multiple projections on the same graph
- Reconcile decline projections with integrated material balance and volumetric calculations
- View automated volume projections for group cases and summary plots
PHDWin

Sophisticated Decline Curves
PHD Win
Integrated Material Balance
PHDWin Comprehensive Economics

- Supports US, Canadian and International economics within the same database
- Detailed DCF modeling for all assets (100 years monthly) with discounting to the day
- Support individual case economics within recursive group ring fences for PSA & PSC
- True GEL (Group Economic Limit) calculations
- Automated Group expense and investment allocations
- Automatic unit and currency conversions within the database
- Flexible user buildable Cash Formula models for PSA & PSCs
- Sophisticated report totaling and sub-totaling
- Automate Recompletions
- Automate Incremental Benefit calculations
- Automate GELs (Group Economic Limits)
- Automate Investment timing with link dates
- Automate other cascading economic relationships
- True Incremental Economic Benefit calculations (case subtraction – not curve subtraction)
- True Group Economics
- Flexible price, expense, investment and tax inputs
- Automated depreciation and depletion calculations
- Expandable product, revenue, expense and tax streams
- Investment grouping and tracking for capital budgeting
- Sophisticated ownership modeling - Automated Reversions, PSA modeling, multiple ownership decks
Models

Used to link Common case data to a single location

- Convenient data management
- Models supported include:
  - Price
  - Expense
  - Tax Models
  - Shrinkage
  - Escalations & Inflation
  - Depreciation
  - And many others
- Change data in one place and it changes everywhere necessary
PHDWin Comprehensive Automation

- Best way to show a glimpse of the power of PHDWin is to use a common support example:
  - From our Platform.PHZ file
  - Presented in our classes

- Demonstrates:
  - Group Economic Limits (GELs)
  - Recompletions
  - Incremental Economic calculations
Create four PDP cases.

Each has:

- Projections
- Ownership
- Prices
- Expenses
- Investments (P&A)
Create a group case

Group case has:
- Group expenses
  - 10,000 $/month
  - Expense supported by all 4 cases
- Controls the group economic limit (GEL)
- Create three Behind Pipe cases
- Behind Pipe cases are linked to PDP cases as recompletions
  - BHP 1 comes on at ECL of PDP 1
  - BHP 2 comes on at ECL of PDP 2
  - BHP 3 comes on at ECL of PDP 3
- Each case has
  - Projections
  - Ownership
  - Prices
  - Expenses
  - Investments (P&A)
- Projections & economics in BHP cases move in time based on PDP case economic limit (ECL)
Link all cases to the group “All Cases Platform Expense” case previously created
- Each case must support itself
- All cases in aggregate must support the group expense case

Individual cases can die early

No cases can live longer than the GEL
PHD Win Comprehensive Automation

- Link all cases to the group "All Cases Platform Expense"
- Each case must support itself
- All cases in aggregate must support the group expense case
- Individual cases can die early
- No cases can live longer than the GEL

Economic Summary Projection

- Date: 09/08/2013
- Partner: All Cases
- 2000	0.00	85.00	0.00	85.00	48.00	2.00	125.96	15.33	12.39	98.02	97.94
- 2001	0.04	1,628.02	0.03	1,627.99	48.00	2.00	2,426.87	360.00	224.00	3,192.65	3,181.03
- 2002	0.03	1,122.82	0.02	1,122.79	48.00	2.00	1,703.72	360.00	170.34	1,173.38	1,218.27
- 2003	1.93	789.84	1.00	788.83	69.67	2.00	1,335.36	360.00	133.32	947.35	984.35
- 2004	30.23	614.71	28.67	614.43	210.00	2.00	3,159.75	360.00	251.77	2,451.99	4,935.48
- 2005	75.47	513.28	50.16	513.11	48.00	2.00	4,819.33	360.00	702.38	2,828.57
- 2006	75.96	579.58	54.32	579.43	48.00	2.00	4,678.70	360.00	599.99	2,451.99	4,935.48
- 2007	75.86	579.58	54.32	579.43	48.00	2.00	4,678.70	360.00	599.99	2,451.99	4,935.48
- 2008	75.96	579.58	54.32	579.43	48.00	2.00	4,678.70	360.00	599.99	2,451.99	4,935.48
- 2009	75.96	579.58	54.32	579.43	48.00	2.00	4,678.70	360.00	599.99	2,451.99	4,935.48
- 2010	50.97	316.45	0.07	316.38	48.00	2.00	3,532.26	360.00	2,451.99	4,935.48
- 2011	24.89	162.14	0.02	162.12	48.00	2.00	2,399.39	360.00	1,214.42	1,214.42
- 2012	34.35	186.44	0.03	186.41	48.00	2.00	2,081.86	360.00	1,173.38	1,173.38
- 2013	27.26	161.52	0.04	161.48	48.00	2.00	1,843.81	360.00	1,029.44	1,029.44
- 2014	21.72	145.91	0.02	145.89	48.00	2.00	1,534.86	360.00	891.44	891.44

PHD Win Integrated Economics & Decline Curve Analysis
PHD Win Comprehensive Automation

PHD Win has managed and resolved:

- Start dates of BHP recompletions based on PDP economic limits
- Link-Dates to control investment timing
- Allocating expenses from the group case to individual cases based on the optimal allocation method
- Enforcing Group Economic limits
Though this is a great example for calculating “Reserves”

- All Proved can support the Group expense
- PDP & BHP

- Not all PDP reserves carry the same risk
  - Some PDP reserves only require PDP production to support the GEL
  - Other PDP reserves (toward the end of their lives) require Behind Pipe reserves to support the GEL

- This is problematic for A&D
  - Ending production of certain PDP cases REQUIRES Behind Pipe cases to be successful
  - Do you want to pay the same price for these?

Let’s Quantify these Extension cases!
Similar set-up but:

- Two GELs are used.
  - One for PDP
  - One for BHP
- Only PDP cases in in the PDP GEL
- All BHP cases AND PDP Incremental cases are in the BHP GEL
Method 1
- 50,553.71 ND M$
- 14,988.57 Dis M$
- 654.27 MBBLs (gross)
- 15,891.80 MMscf (gross)

Method 2
- 50,553.71 ND M$
- 14,988.57 Dis M$
- 654.27 MBBLs (gross)
- 15,891.80 MMscf (gross)

Model is working correctly
### Economic Projection

**ECONOMIC PROJECTION**

**Platform Incremental Sample**

**Custom Selection**

**Dates:** 01/01/2015 - 12/31/2020

**Discount Rate:** 15.00%

**As of:** 12/31/2000

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**Summary:**

- **Extension cases value**
  - 421.21 ND M$ (extension value)
  - 60.41 Dis M$ (extension value)
  - 0.00 MBBLs (gross)
  - 501.79 MMscf (gross)

- **All in PDP 1 Extension**
- Results will vary with changes in:
  - Price
  - Expense
  - Ownership
  - Investments
  - And other economic parameters
PHDWin Comprehensive Automation

Though this example is simple, client examples include thousands of cases with many more layers of groups.

If you take the time to build the model, PHDWin will take care of the calculations!
PHDWin Strategic Advantages

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PHDWin  
Current Reserves Modeling

US, Canadian and International Economics
PHDWin Industry Standard

- Over 1800 client companies licensed
  - including Operators, Banks, A&D firms and Consulting Firms
- World wide adoption
- Industry standard engineering techniques
- Enforce company standardization of methodology and techniques
- Repeatable results
- Auditable results
- Foster third party data exchange
Thank You for Your Time and Interest!

Please visit us at:

PHDWin.COM