

# Alternate Reserves Estimation Techniques

Two Methods for the Effort of One:

Case studies of 3 mature Texas reservoirs,  
running Material Balance alongside Decline  
Curve Analysis for higher confidence reserves  
estimation

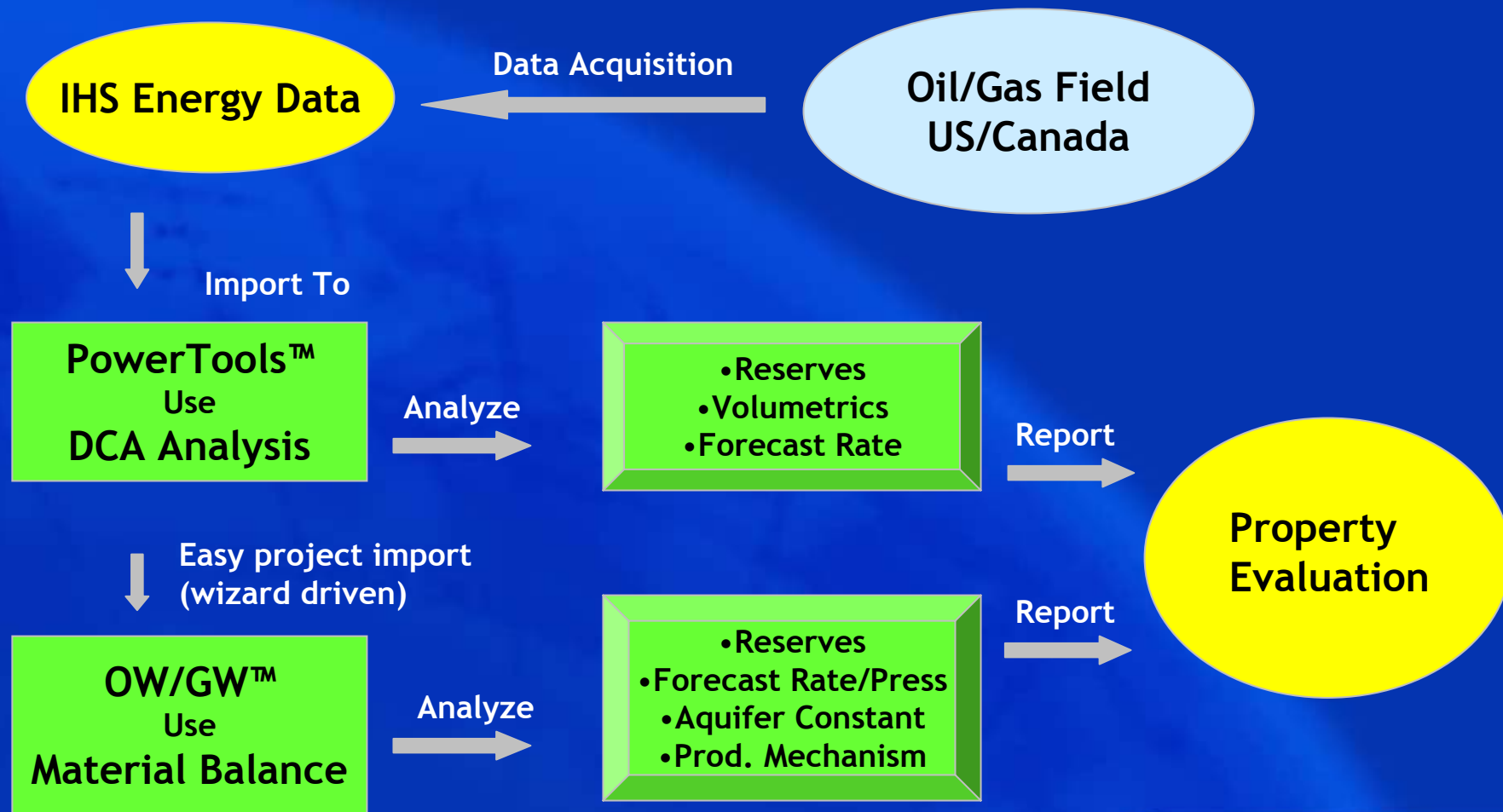
# Define One Project, Use Two Techniques

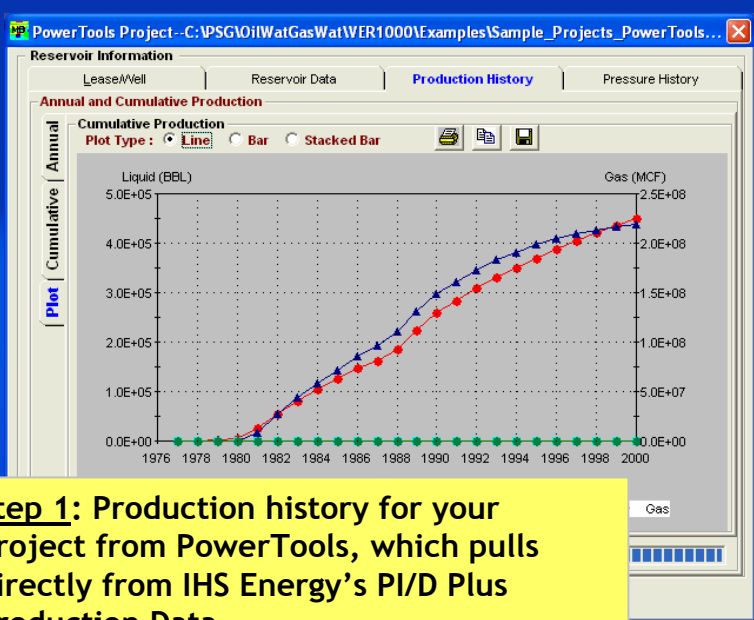
*A PowerTools user can get a fast “second assessment” of reserves*

- Study large numbers of wells quickly in PowerTools using decline curve analysis (DCA)
- Export projects to OilWat/GasWat for fast material balance (MB) analysis
  - Special export interface maximizes use of pressure data from IHS Energy’s production data, as used by PowerTools
  - Minimal data gathering (if any) needed before running MB
- Compare estimates and investigate which provides best explanation of reservoir behavior and remaining producing life

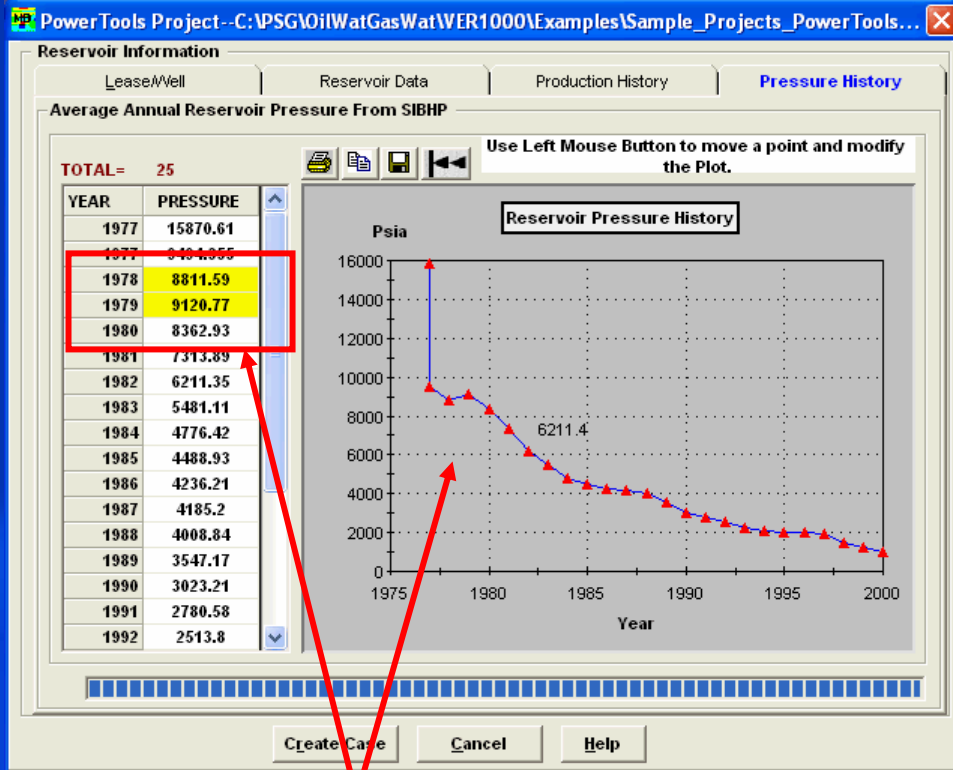
# OilWat/GasWat™-PowerTools™ Link

## How Does It Work?

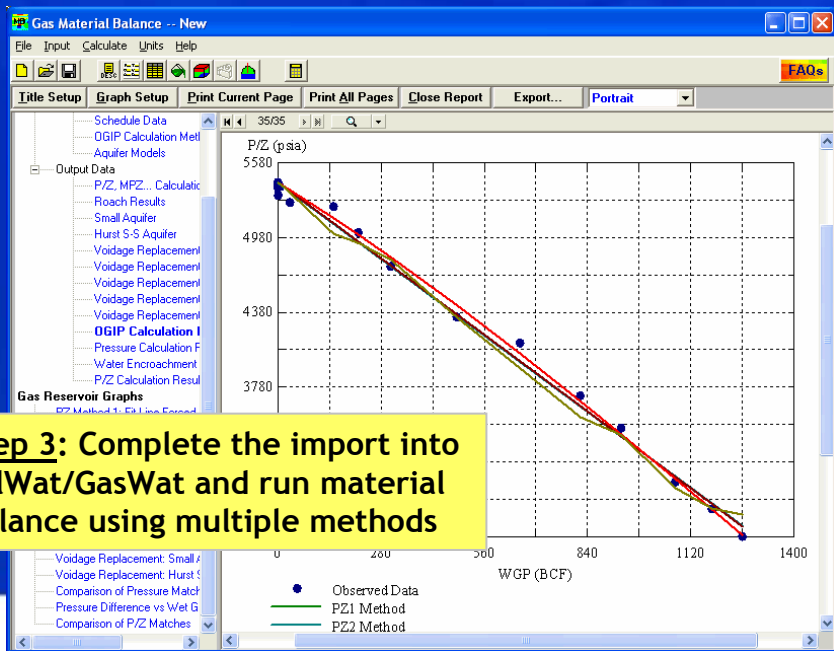




**Step 1:** Production history for your project from PowerTools, which pulls directly from IHS Energy's PI/D Plus Production Data.



**Step 2:** Edit the pressure values as needed either by entering them or by moving the point on the plot with a mouse.

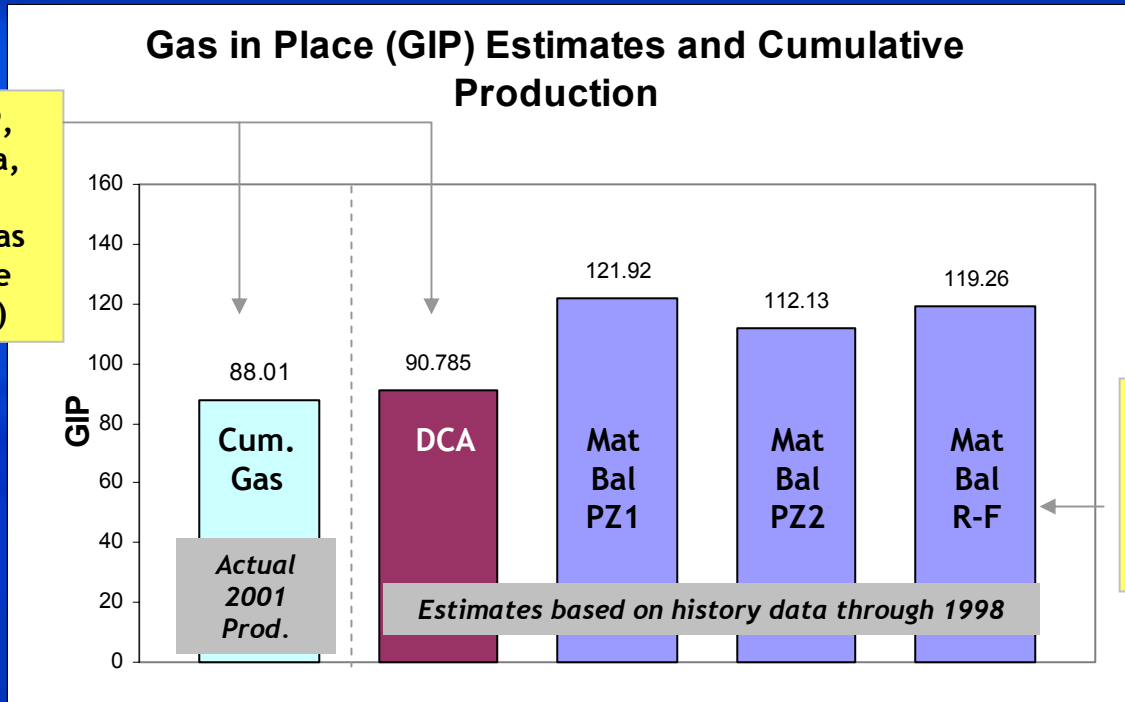


**Step 3:** Complete the import into OilWat/GasWat and run material balance using multiple methods

Moving a PowerTools project into OilWat/GasWat

## Example 1

# High Pressure Dry Gas Reservoir



DCA estimate of GIP, based on 1998 data, suggests that 2001 actual production has nearly depleted the reservoir (unlikely)

Of three material balance techniques, Ramagost-Farshad is good choice for this high pressure reservoir

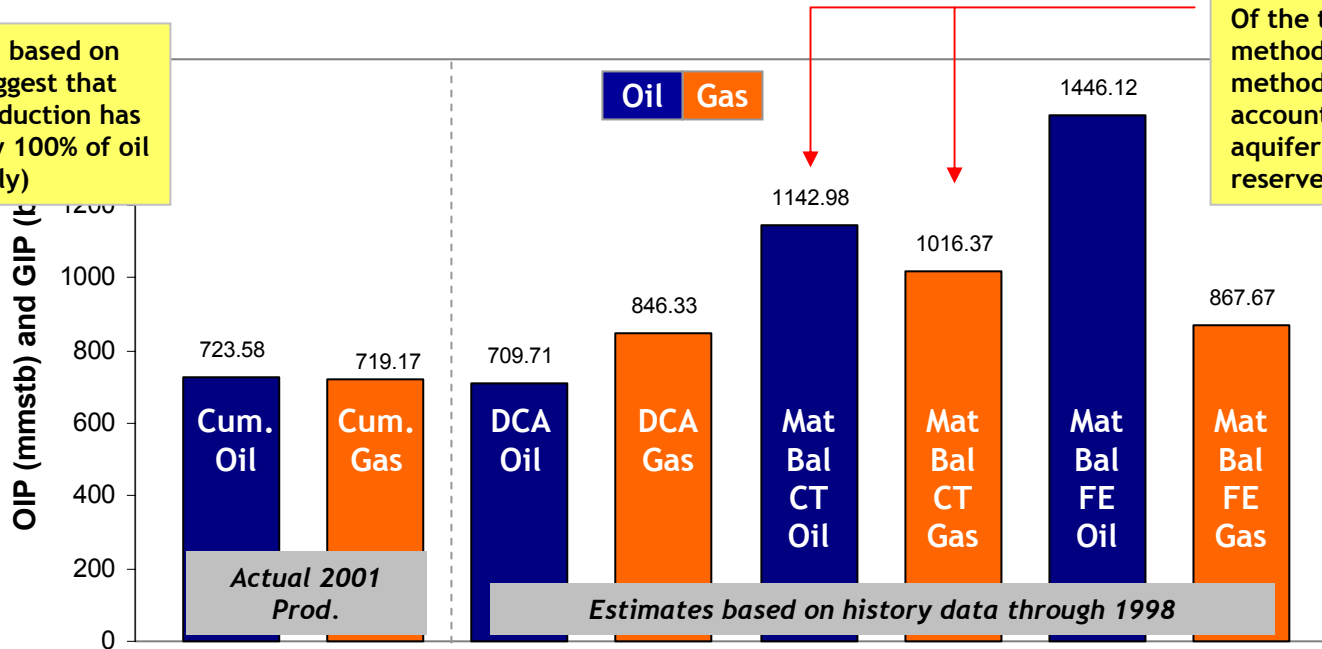
- Material balance estimate from 1998 delivers much more likely estimate of GIP
  - Both methods use 14 years of production history (through 1998)
  - Later, they were compared to cumulative gas production through 2001
  - DCA indicated 97% recovery of GIP (unlikely)
  - Material balance: 72% to 78% recovery
- Material balance accounts for compressibility effect of this type of reservoir, hence more mechanistic calculation of GIP than DCA

## Example 2

# Water Drive Reservoir

### Oil/Gas in Place Estimates and Cum. Production

DCA estimates, based on 1998 data, suggest that 2001 actual production has recovered nearly 100% of oil (unlikely)



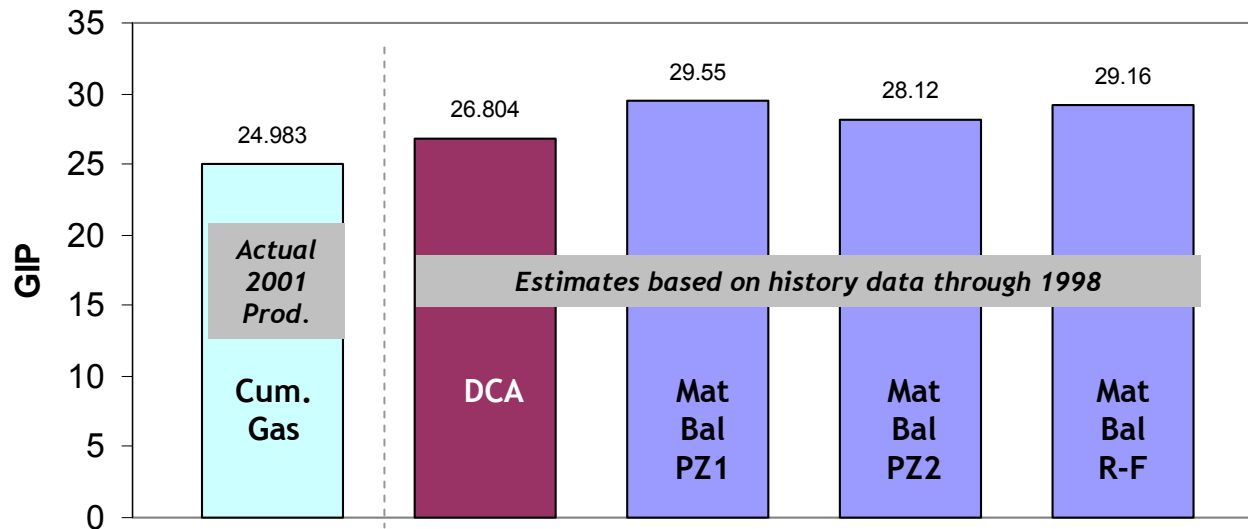
Of the two material balance methods shown, Carter-Tracy method best takes into account the influence of aquifer while estimating reserves.

- For this water and gas-cap drive reservoir, material balance estimate from 1998 delivers much more likely estimate of OIP and GIP
  - Both methods use 19 years of production history (through 1998)
  - Later, they were compared to cumulative oil & gas production through 2001
  - DCA indicated almost 100% recovery of OIP and 85% of GIP (unlikely)
  - Material balance: 50-63% recovery of OIP and 71-83% of GIP

# Example 3

## Sour Gas Reservoir

Gas in Place (GIP) Estimates and Cum. Production



Sour gases (CO<sub>2</sub>, H<sub>2</sub>S) fraction will be taken into account during gas deviation factor (z-factor) calculation when material balance is used

- Material balance estimates are 5% to 19% higher than DCA estimates
  - Both methods use 15 years of production history (through 1998)
  - Later, they were compared to cumulative gas production through 2001
  - DCA indicated 93% recovery of GIP (unlikely)
  - Material balance: 84% to 89% recovery
- Material balance accounts for compressibility effect of this type of reservoir, hence more mechanistic calculation of GIP than DCA

# Conclusions

- Material balance gives a second look at remaining producing life of a reservoir
  - Insights into reservoir mechanics
  - Reserves estimates that may differ from DCA, offering a basis to ask questions and make the highest-confidence assessment
- Reduce risk of over- or under-estimating value of assets in property evaluations