

# **SURVIVE AND *THRIVE*:** **How to Maximize Value**

Wright & Company, Inc.  
Petroleum Consultants



# Wright & Company, Inc.

Petroleum Consultants

## Our Mission

- Wright & Company, Inc. 's mission is to be client driven with the most reliable, responsive and cost effective professional services possible within the oil and gas industry. This mission is achieved with personal service, understanding, sound judgment and credibility.

## Experience

- Founded in 1988 by D. Randall Wright, P.E.
- With over 200 years of combined experience with major integrated and independent oil and gas companies, major financial institutions and various consulting firms, our engineers and geologists offer sound judgment, experience and dedication
- Clients include major and independent exploration and production companies, investment and commercial banks, law firms, individuals and other consulting firms for specific expertise.

## Services

- **Property Evaluations:** Evaluations of developed and undeveloped properties, both domestic and abroad, including facilities and development plans
- **Audits/Reasonableness Reviews:** Unbiased audits and opinions on both in-house and third party estimates of reserves and economics
- **Reservoir Analysis:** Formation evaluations, reservoir simulations, enhanced recoveries, work-overs, well testing, log analysis, operations and completion optimization
- **Acquisition and Divestiture:** Representation of sell-side, buy-side, joint venture opportunities and financial investments
- **Reserves Estimation:** Volumetric calculations, history match and performance, forecasting future production and cash flow

## Extensive Shale Expertise

- Marcellus/Devonian
- Utica/Point Pleasant
- New Albany
- Haynesville-Bossier
- Huron
- Mississippian Lime
- Eagle Ford
- Antrim
- Niobrara
- Chattanooga
- Permian Basin
- Marble Falls

## Unconventional Resource Plays

- Coal Bed Methane
- Tight Gas Sands
- Vertical and Horizontal
- STACK – Meramac, Oswego
- SCOOP - Woodford

## International Representation

- Representation of various companies throughout the world in due diligence, reserves and economic analysis for investment opportunities in US shale plays including Marcellus, Eagle Ford, Utica, and Niobrara

## Mid-Stream

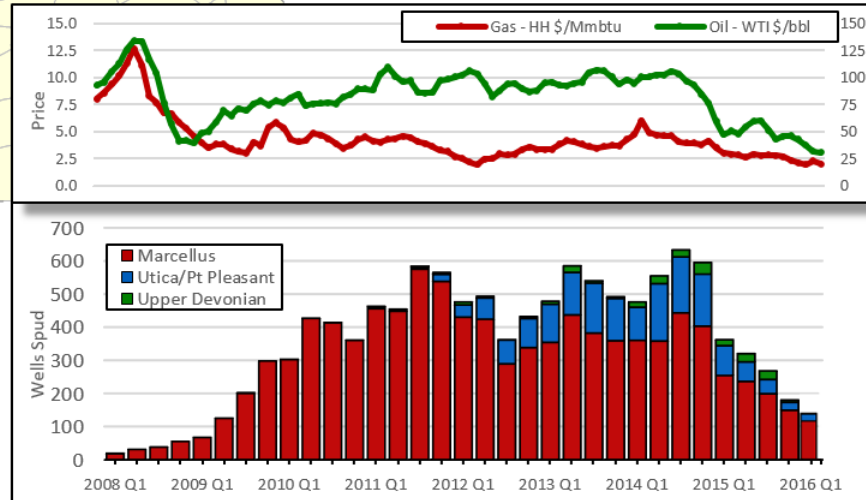
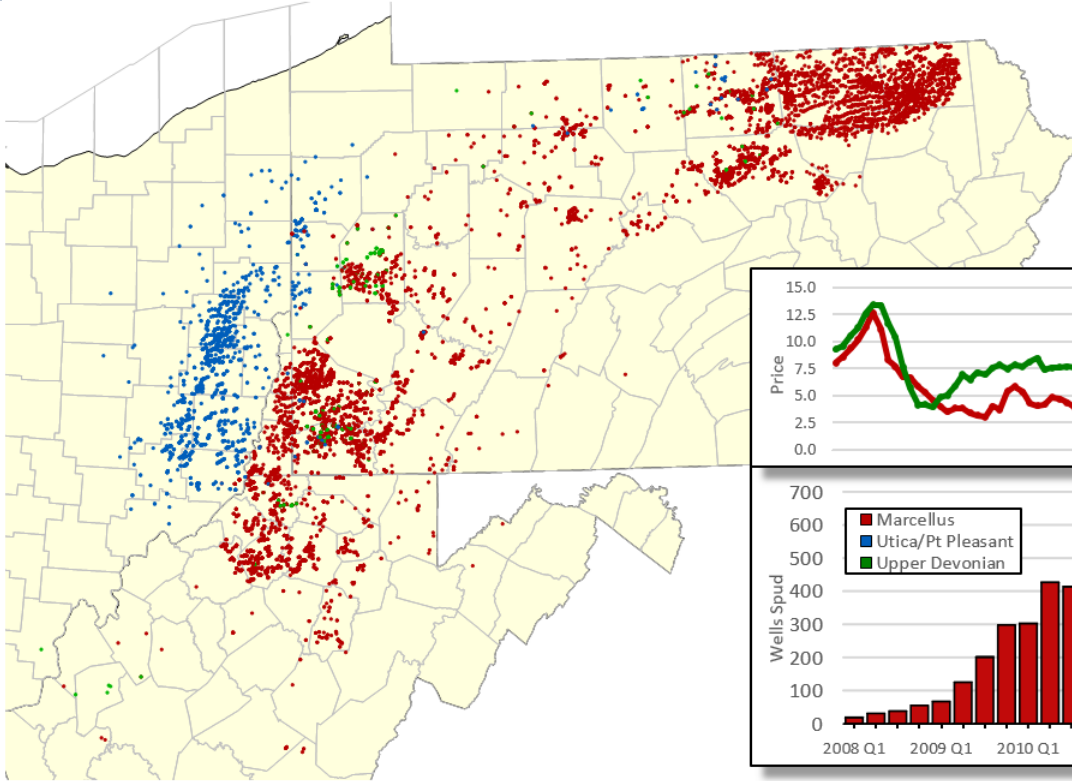
- Evaluations of development plans, Estimated Ultimate Recovery determination, estimating pipeline volumes and future production rates and anticipated sales volumes

## Fair Market Value

- Fairness opinions, negotiations, borrowing base determination for bank financing

# DEVELOPING UNCONVENTIONAL SHALES

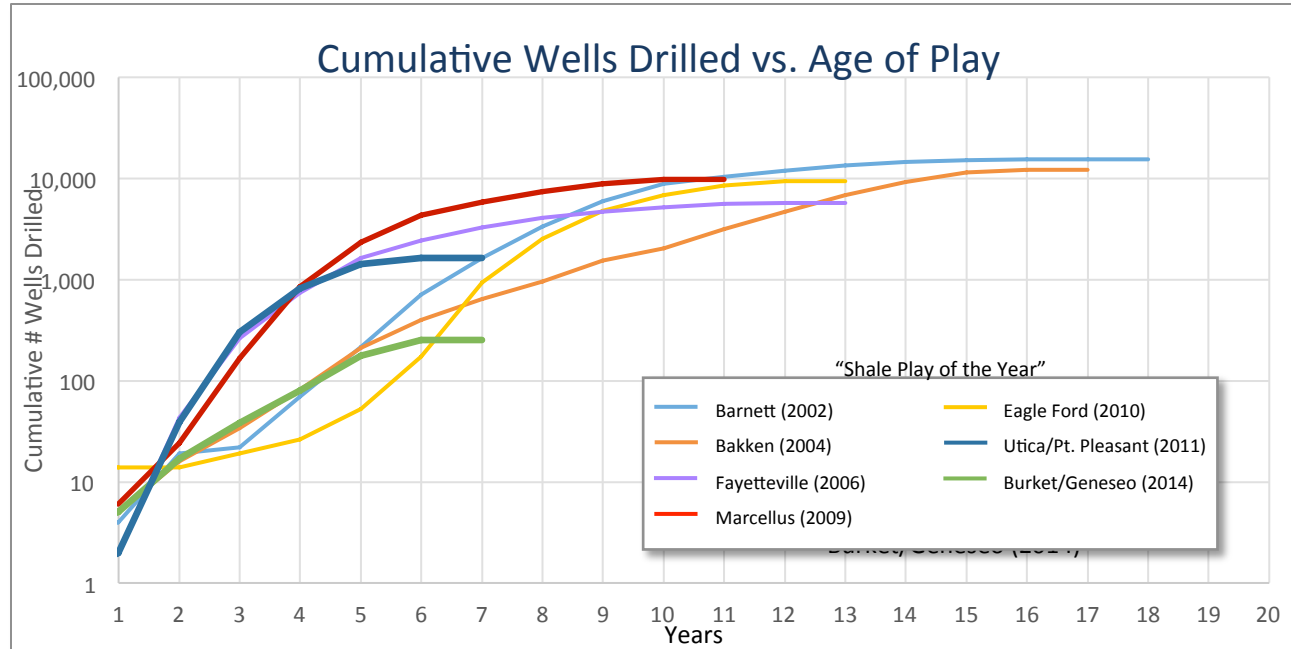
## In the Appalachian Basin



# DEVELOPING UNCONVENTIONAL SHALES

## Comparison of Major Plays

Impacted by Product Prices



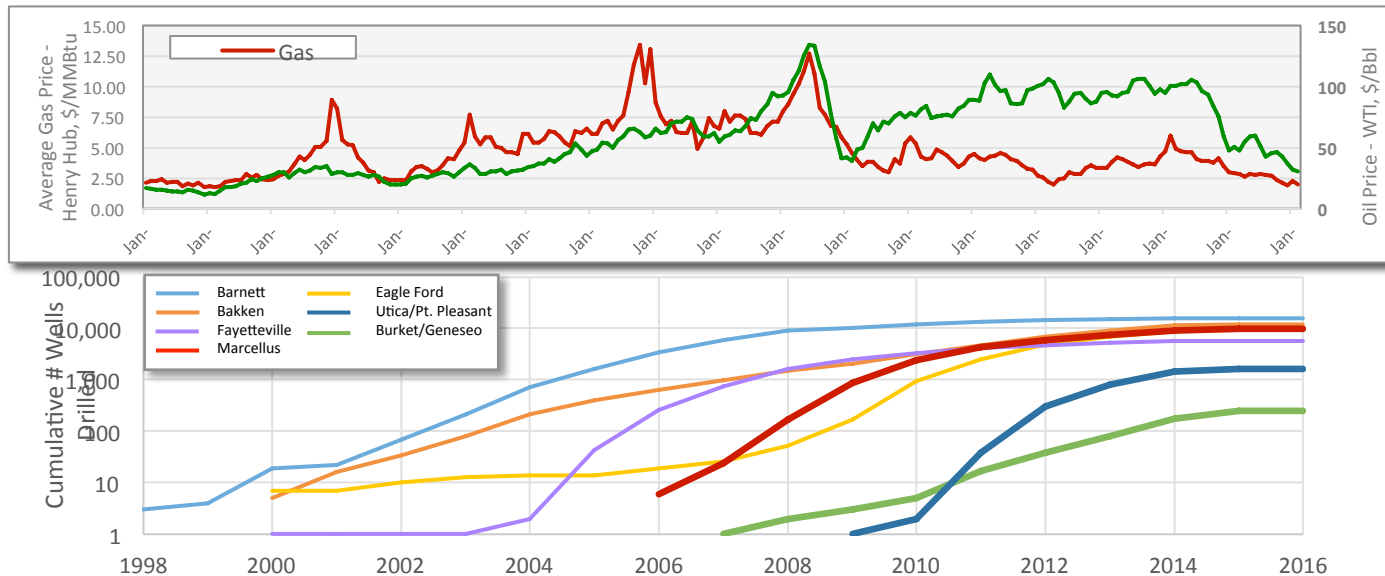


# DEVELOPING UNCONVENTIONALS OVER TIME

## Comparison of Major Plays

Impacted by Product Prices

..... The Juggling Act (Break even)



# DEVELOPING UNCONVENTIONALS OVER TIME

## Comparison of Major Plays

Cumulative Wells Per Year							
Year	Barnett	Bakken	Fayetteville	Marcellus	Eagle Ford	Utica/ Pt Pleasant	Burket/ Geneseo
1998	3						
1999	4						
2000	19	5	1		7		
2001	22	16	1		7		
2002	70	34	1		10		
2003	217	81	1		13		
2004	709	210	2		14		
2005	1,622	401	43		14		
2006	3,351	649	261	6	19		
2007	5,936	962	744	24	26		1
2008	8,891	1,534	1,628	166	53		2
2009	10,366	2,031	2,458	856	172	1	3
2010	12,057	3,153	3,255	2,358	930	2	5
2011	13,521	4,675	4,114	4,375	2,530	39	17
2012	14,538	6,850	4,709	5,856	4,823	300	38
2013	15,174	9,142	5,194	7,388	6,796	821	80
2014	15,568	11,554	5,635	8,952	8,590	1,420	176
2015	15,629	12,082	5,786	9,790	9,418	1,636	252
2016 (Q1)	15,629	12,082	5,786	9,805	9,422	1,636	252

46

54,612

Source: DrillingInfo

# ALL ABOUT BALANCE

## A Real Juggling Act

### 1. Wright & Company, Inc., Independent Consultant - Reserves and Economics

#### ➤ How Operators Can **Survive** and **Thrive**

- Cutting Investments and Costs
- Improving Well Performance
- Increasing Asset Value

### 2. Bernadette Johnson of Ponderosa Energy Advisors LLC

#### ➤ Market Analysis – Macro View

- Very Thorough Evaluation of Natural Gas and Oil Prices
- Rigs Running throughout the World
- Supply and Demand Metrics

# DEVELOPING UNCONVENTIONAL SHALES

## Observations

Wright & Company, Inc.  
Petroleum Consultants

Unique Position – Work with many clients, many speaking at DUG East

- Evaluations for public and private operators, A&D Projects, Midstream Studies

2015 Calendar Year: Wright evaluated thousands of wells and locations in Appalachia

- Marcellus, Utica/Point Pleasant, or Burket/Geneseo
  - Multiple reviews and “look-backs” since Marcellus discovery well
- Not only Appalachian Basin, many other unconventional areas
  - Permian: West Texas
  - Barnett: North-Central Texas
  - Eagle Ford: South-Central Texas
  - SCOOP and STACK: Oklahoma – Lots of new activity
  - Niobrara: Colorado and Wyoming

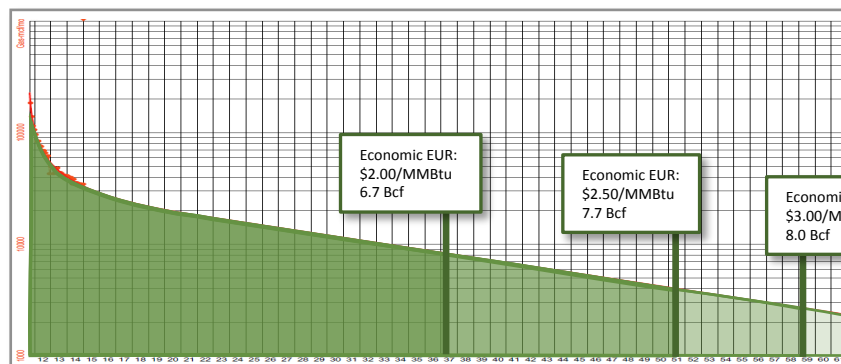
# TECHNICAL EUR VS. ECONOMIC EUR

## Economic Parameters

- “Technical” EUR – Based on reservoir volumetrics/performance/analogy
- “Economic” EUR – function of economic parameters pricing, operating costs

“Economic” reserves can be severely impacted in current environment

- Note: For undeveloped cases, use “Technical” EUR (EUR/1,000’)



Example –  
5,000' horizontal  
Reserves Estimate  
1.3 Bcf/1,000'  
vs.  
1.6 Bcf/1,000'

Technical EUR:  
50 Year  
8.2 Bcf

# SURVIVE AND *THRIVE*





## How to Maximize Value

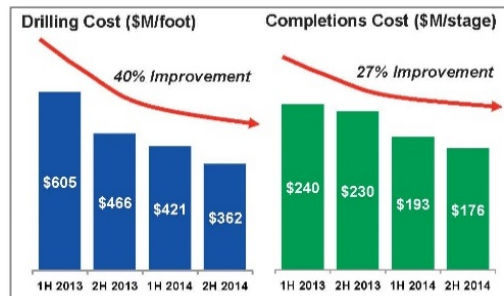
- Reduce Capital Investments and Monthly Expenses
- Improve Overall Well Performance
- Increase Total Asset Value
  
- **CHALLENGE:** How to reduce budgets while drilling the best locations



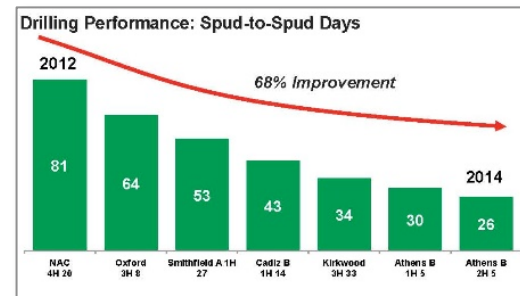
# REDUCING OVERALL INVESTMENT

## Industry Accomplishments

- Drilling and Completion Cost Reductions Continuing
  - AFE's for D&C less than last year and the year before
  - Drilling Rate –  feet/day,  spud-to-spud days
  - Longer Lateral –  higher EUR/well
  - Completions
    - Concurrent hydraulic fracs on same pad to reduce down time 



Hess - DUG East 2015



Hess - DUG East 2015

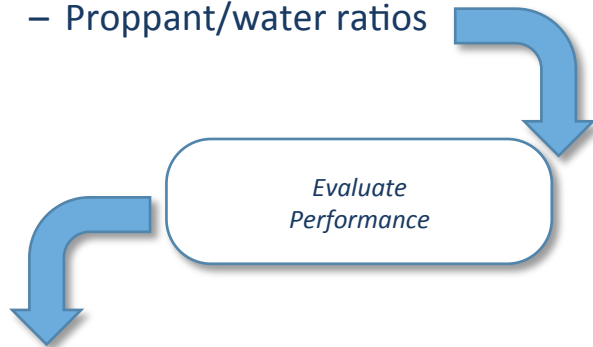
# REDUCING OVERALL INVESTMENT

## Completion Techniques

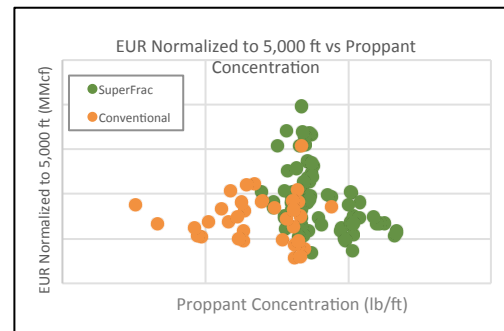
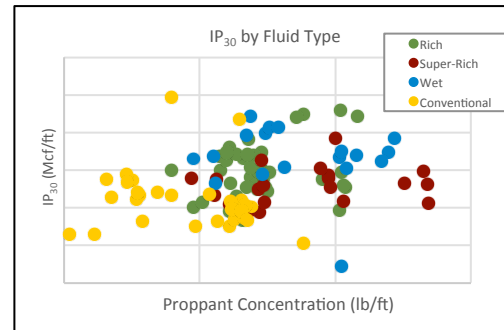
Frac Designs: Changes with Performance Evaluations

➤ Change

- Proppant loads
- Water volumes
- Proppant/water ratios



Optimal Frac Designs for success  
in *your* area, for *your* operations



(Use only what's works – no extra proppant, water, etc. ) – **find point of diminishing returns**

# REDUCING MONTHLY EXPENSES

## Lease Operating Costs

### Water Recycling:

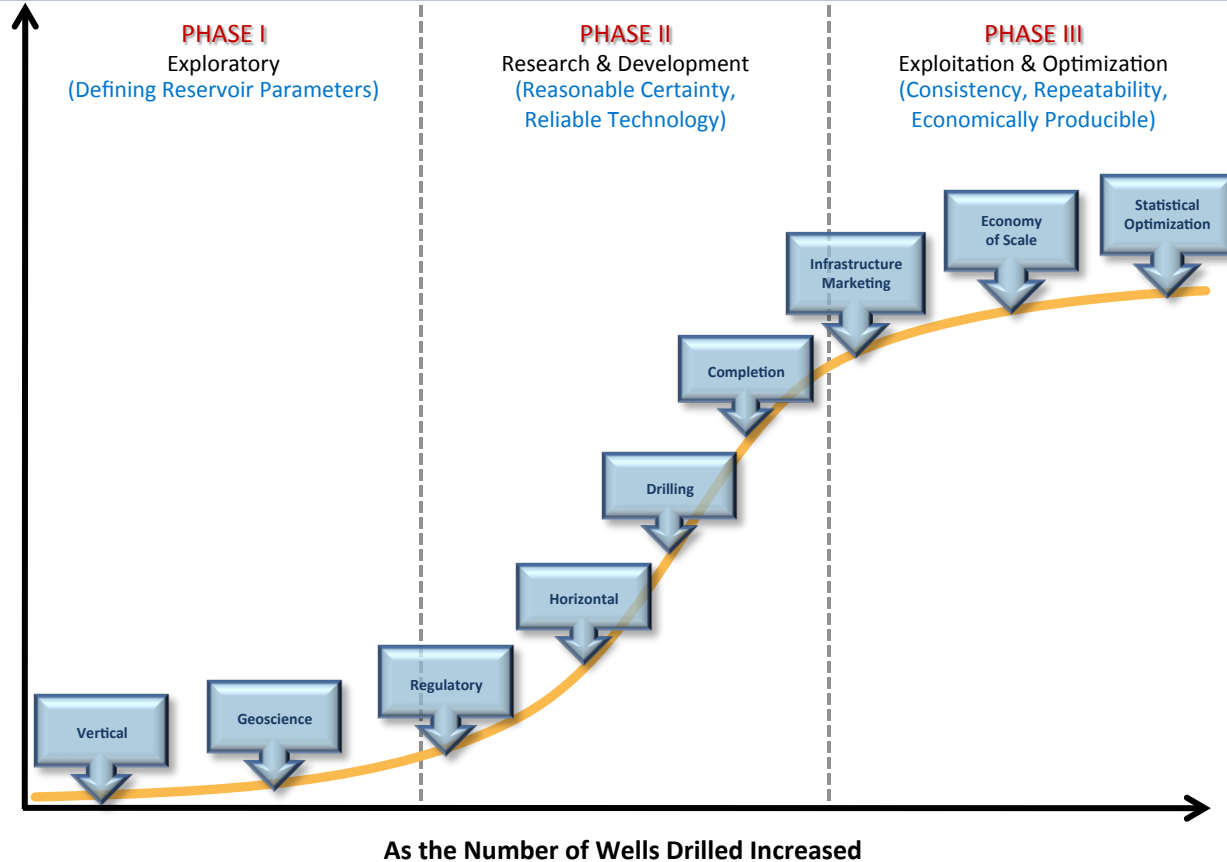
- Operator leased/purchased water tanks
- Customized Frac Designs based on Performance Evaluations
- Collect flowback water – eliminate disposal cost
- Use for future well fracs – cut water purchase (condition/treat water before frac)

### Compression – Gathering and Transportation:

- Rental/Own
- Fees and Services

# RESOURCE PLAY LEARNING CURVE

## Initial Development



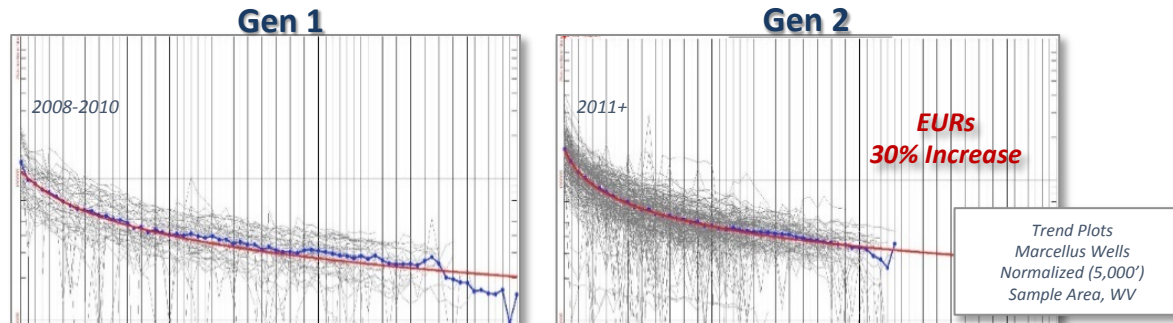
# IMPROVING WELL PERFORMANCE

## Industry Accomplishments

### Industry Accomplishments:

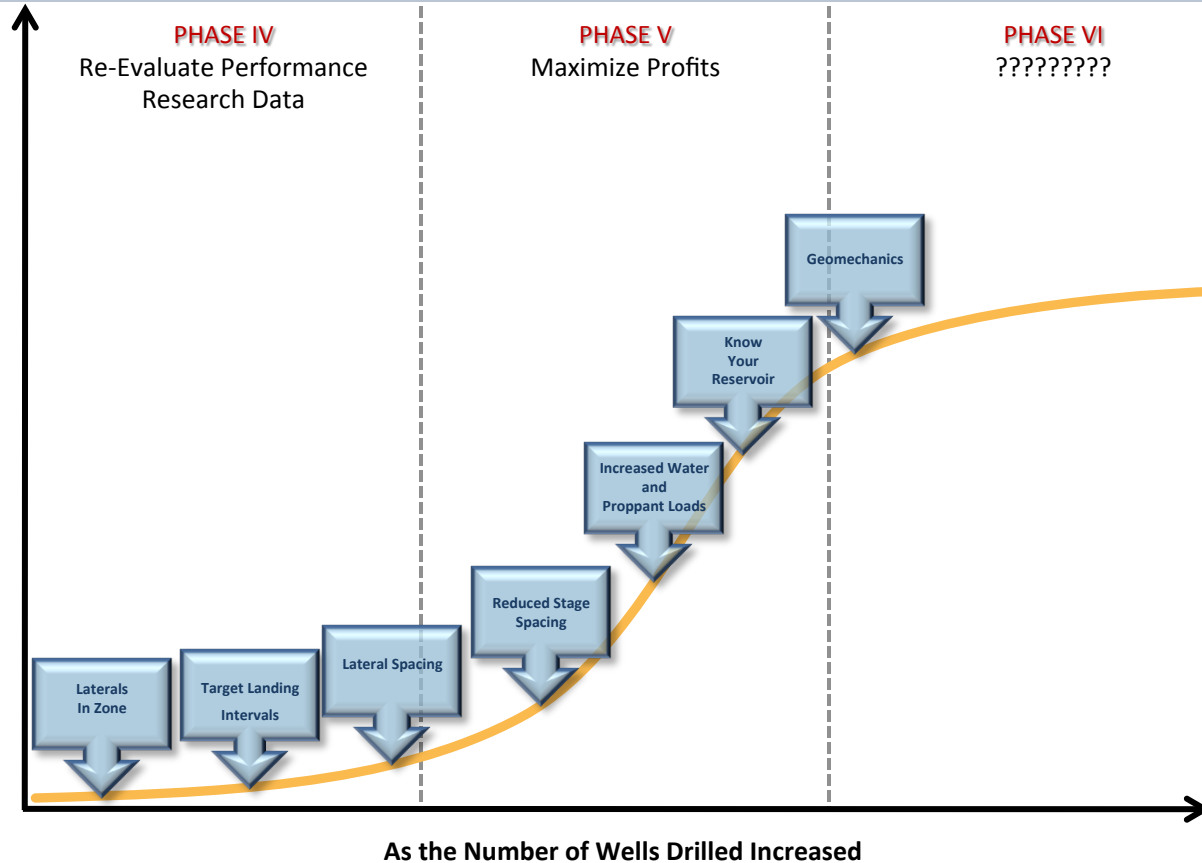
- Learning Curve – Still moving up the curve
- Geologic and drilling control
  - Laterals in zone
  - Target landing intervals
- Spacing (lateral)
- Improved frac designs
  - Reduced stage spacing
  - Increased water and proppant loads

### Obtaining better wells over time - Evident in vintage evaluations



# RESOURCE PLAY LEARNING CURVE

## Future Challenges





# IMPROVING WELL PERFORMANCE

- Accuracy of Horizontal Landing and Staying in Zone
- Flowback Control
- Understanding Geomechanics
- Analyze/Reevaluate Archived Data

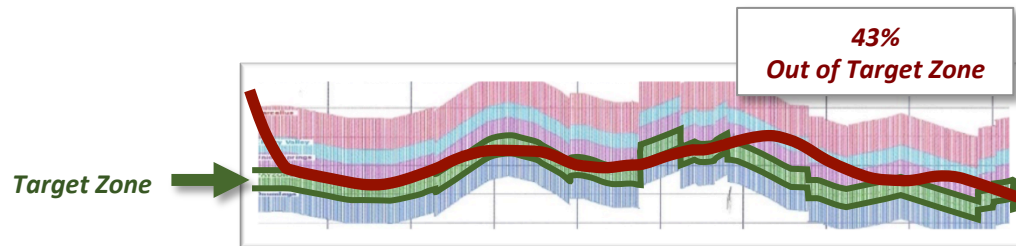
# IMPROVING WELL PERFORMANCE

## Laterals in Zone

- Challenging/complex geology with faulting in certain areas
- Investment in 3D seismic
- Interpret and establish landing target in advance
  - Proactive vs. reactive (after out of zone)
- Geosteering – Critical to success
- Additionally, design completion intervals away from faults

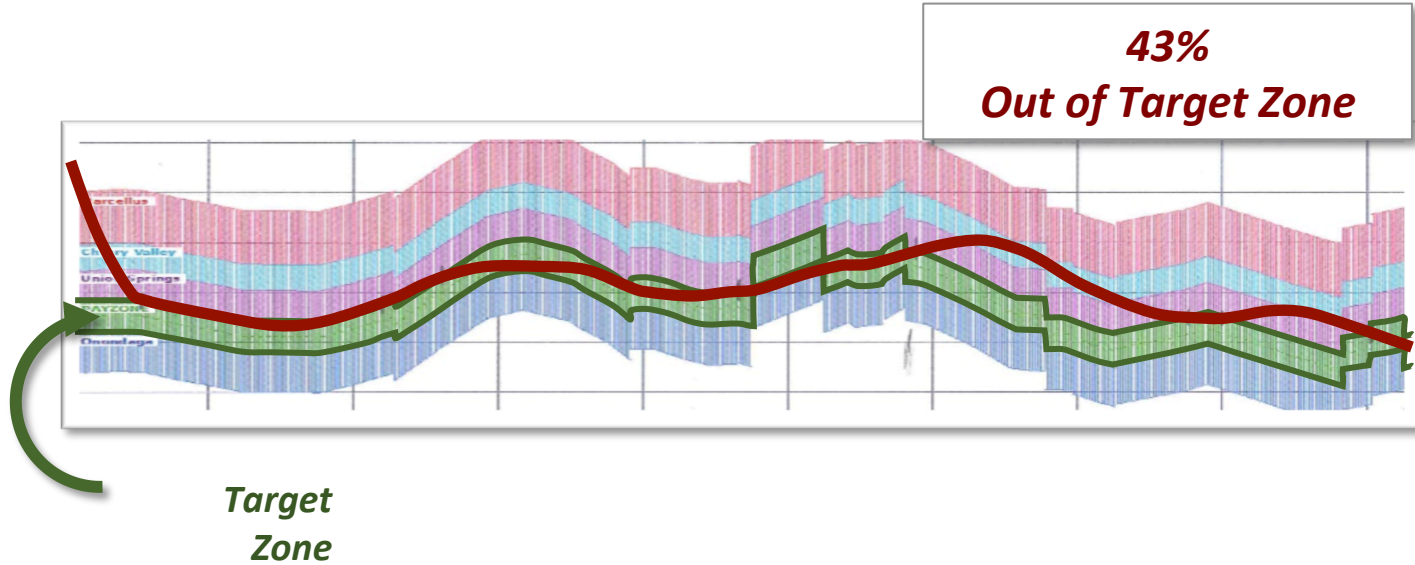
### Results:

- Stay in zone (vs. *example below*)
- Maintain energy of frac (avoid loss in faults)



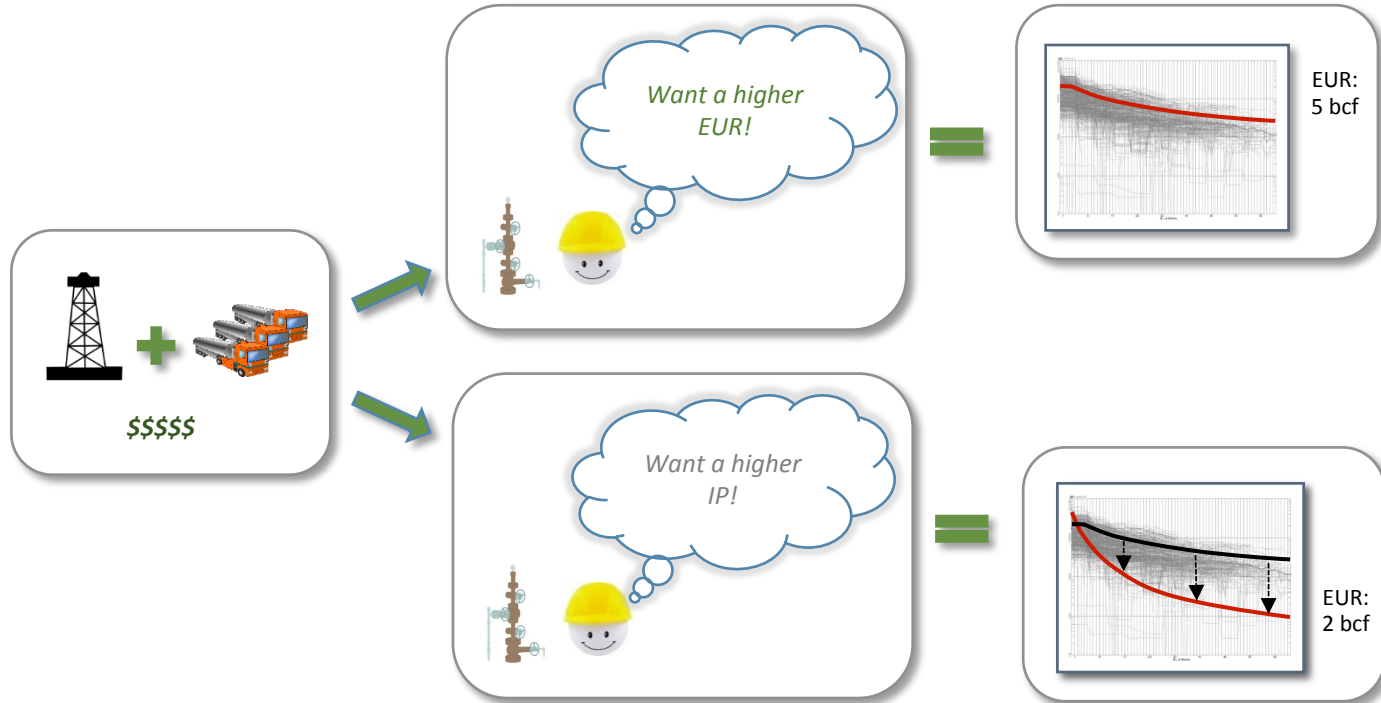
# ACCURACY OF LANDING TARGET

## Staying in Zone



# IMPROVING WELL PERFORMANCE

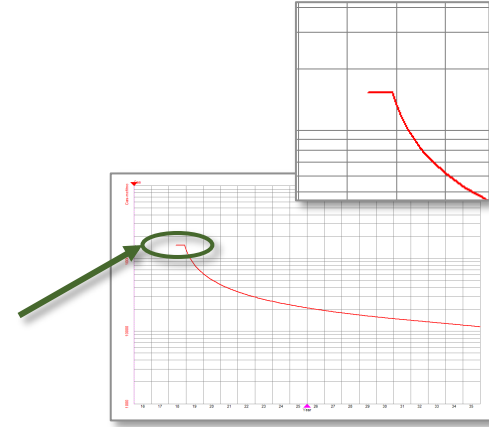
## Flowback Control



# IMPROVING WELL PERFORMANCE

## Flowback Control

- After expensive drilling and completion, May damage a well trying to achieve highest IP rate!
- Many examples of high IP wells, lower EUR
- Some operators, one step farther
  - Development plan –
    - Control “resting” time or flowback rates for 3-6 months,
    - reduce risk of damage,
    - anticipate higher ultimate recovery
  - Can be particularly important in overpressured areas



Results:

- Reduce reservoir damage to achieve higher ultimate recovery

# IMPROVING WELL PERFORMANCE

## Know Your Reservoir

Understanding Geomechanics:

May explain variability in performance – Why do offsets perform differently?

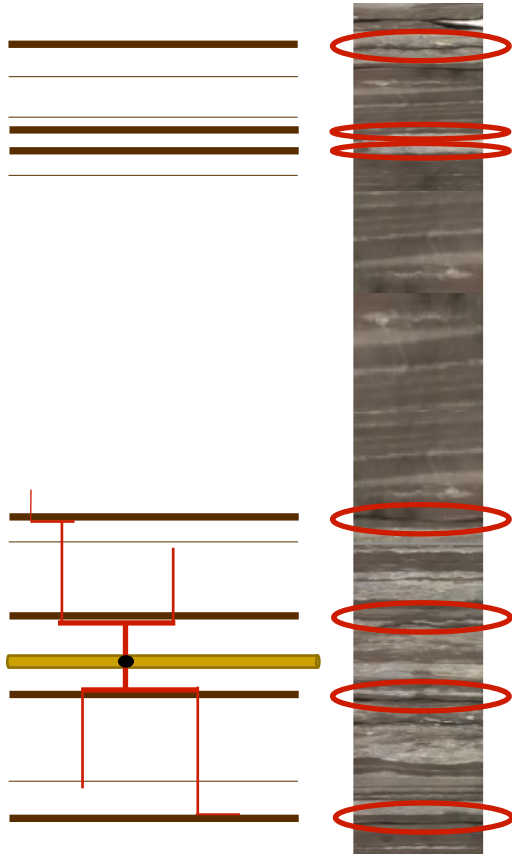
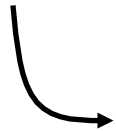
- Traditional landing target in zone
  - Downhole logs – high porosity, TOC, easier to drill
- Additional analysis
  - Cores – Petrophysical, visual inspection
- Identify best interval for frac – connectivity to reservoir
  - Best frac propagation – avoid layers that diffuse frac energy
- Example – highly laminated shale outside Appalachia
  - Cores – analysis – target interval based on geomechanics
  - Consistent 30% increase in well's EUR by moving entry target by only SEVEN feet



# KNOW YOUR RESERVOIR

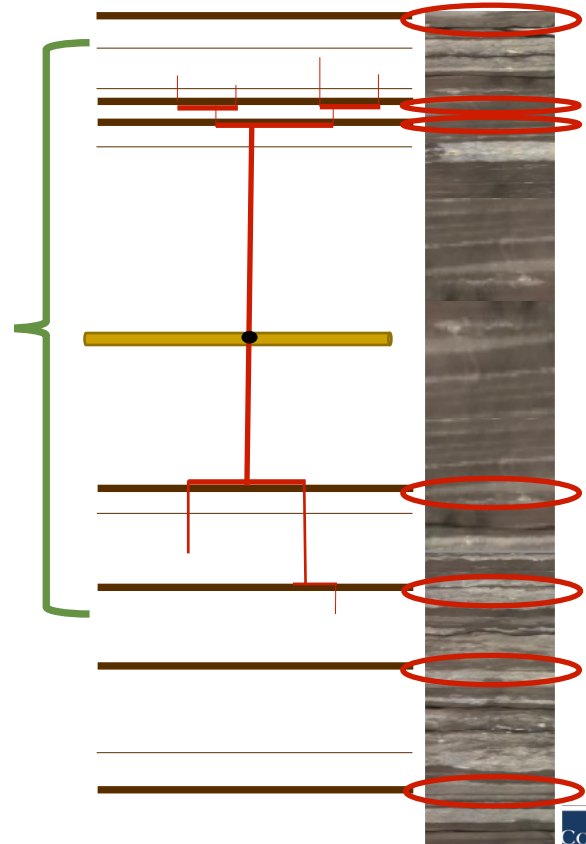
## Geomechanics - Connectivity

Downhole  
log  
indicates  
best zone



*Better frac  
propagation*

Fracs inhibited  
by interfaces/  
heterogeneity



# IT ALL DEPENDS ON THE ROCK

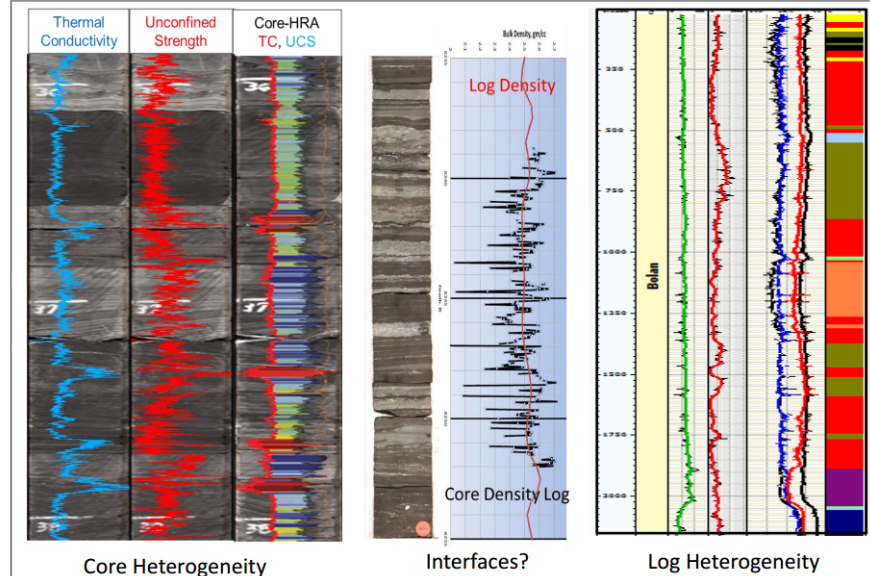
## Where You Are in the Reservoir

- Variability in geologic systems
  - Resource play by definition over a large areal extent
  - Effect of interfaces and planes
  - Many transitional changes in permeability , porosity, TOC, and distribution over thousands of lateral feet
  
- Frac propagation – Connectivity
  - Along weak planes
  - Stress orientation
  - Loss of energy
  - Near-wellbore/far-wellbore

# KNOW YOUR RESERVOIR

## Geomechanics

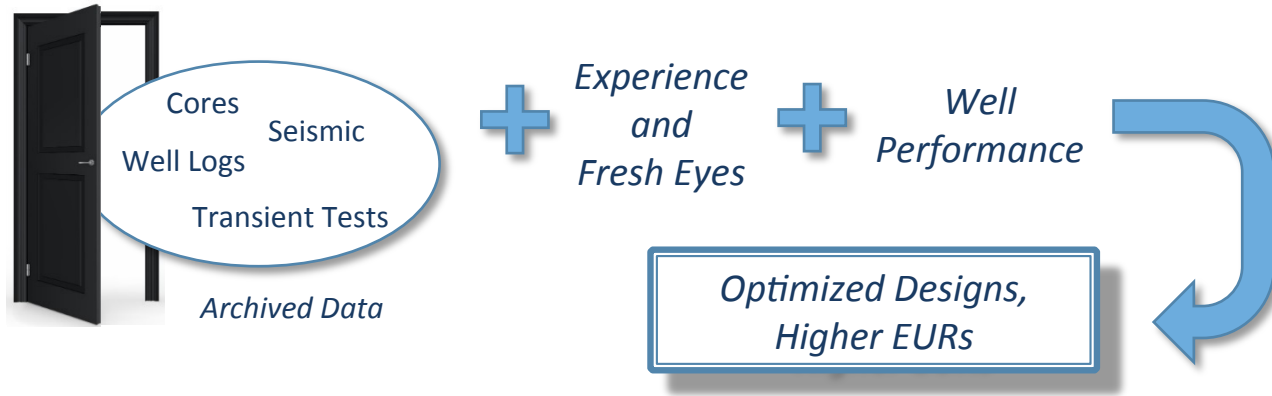
- Production data suggest each well is different
- Logs, cores, and seismic demonstrate changes in geomechanic properties
- Fracs are affected by interfaces, planes of weakness, and abrupt changes in reservoir properties



Source: R. Suarez-Rivera et al., June 16-20, 2012, SPWLA 53<sup>rd</sup> Annual Logging Symposium

# IMPROVING WELL PERFORMANCE

## “What’s in your vault?”



### Example – Eagle Ford: Texas

- Reanalyze old cores,
- Identify best geomechanic target interval
- Maximize frac energy

*Already spent money on it, but  
didn't have time to analyze*

# IMPROVING WELL PERFORMANCE

What it could mean to overall results:

➤ *Example Economics \$/MMBtu and LOE*

Typical Well:

Horizontal Shale Well  
Dry Gas  
6,000-foot Lateral  
D&C ~ 7 MM\$

Additional Analysis:

1 Vertical Core with Analysis  
Estimated 2 - 5 MM\$  
Identify Target Interval  
Potential Results +25% EUR



Pad	Case	CapEx, MM\$	EUR, Bcf	Payout, yrs.	Cashflow, MM\$	PV10, MM\$	ROR, %
4 - Well Pad							
	Standard Horizontal – Simple Core	28	46.5	7.3	25.0	1.7	12.0
	with Geomechanical Model (+ 25% EUR)	33	58.2	6.5	34.4	4.4	14.3
6 - Well Pad							
	Standard Horizontals – Simple Core	42	69.8	7.3	37.5	2.6	12.0
	with Geomechanical Model (+ 25% EUR)	47	87.2	6.0	54.1	8.8	16.3

# INCREASING ASSET VALUE

## Industry Accomplishment

### “More Strategic” in Asset Development

- Consider Drivers
  - Target areas, e.g., dry gas/wet gas/oil
  - Lease expirations
  - Gas contracts, differentials, hedging
  - Volume commitments

### Example of Gas Contract Impacts:

- Operators in same area
  - Same relative EUR/1,000 feet
  - Different gas contracts – pipeline - commitments
- Can have very different reserves assigned

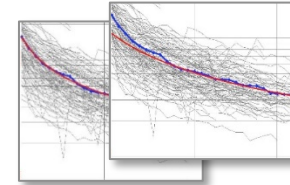


# INCREASING ASSET VALUE

## Evaluation Methods

Evaluate based on actual performance – Decline Curve Analysis

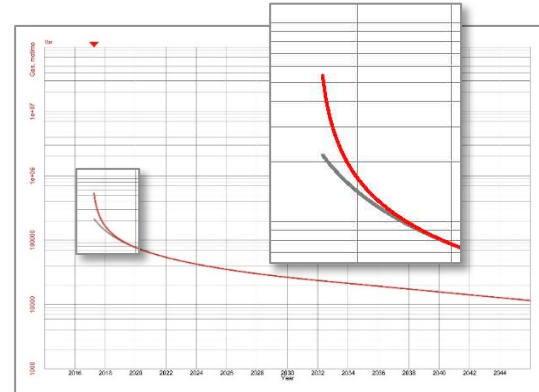
- If wells not curtailed for flowback management
- Initial period hyperbolic decline, higher b-factor
- Estimate using multi-segment curves
- Capture initial high rates
- Honor all data



*b*-factors = 2.10 to 1.55 to 1.2 to 5%

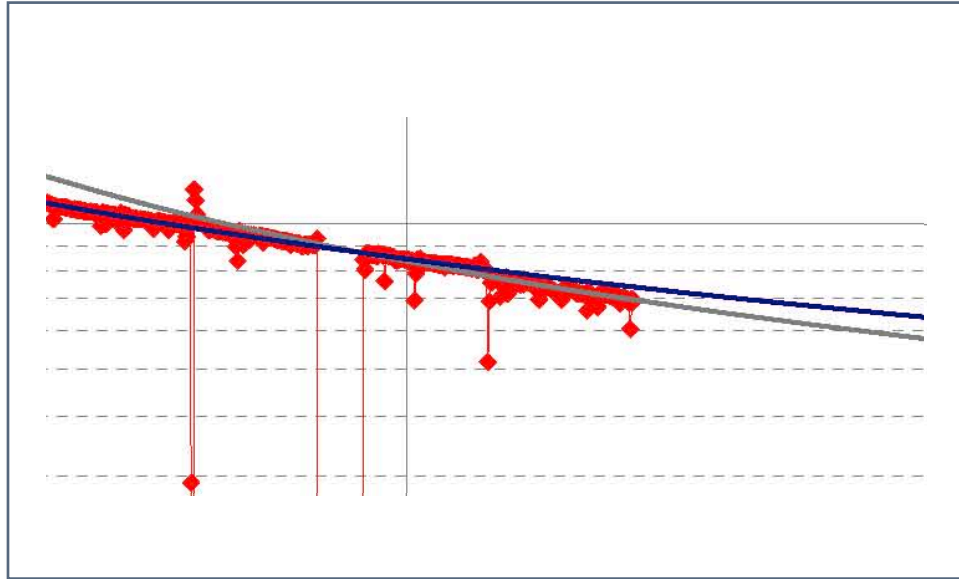
Example: Reserves same, but value can change

	EUR, Bcf	PV10, \$MM
Multi-Segment Hyperbolic: Higher IP		
b-factor = 2.10		
b-factor = 1.55	14.2	8.1
b-factor = 1.2		
D <sub>t</sub> = 5%		
Generalized Single Hyperbolic: Lower IP:		
b-factor = 1.2	14.2	6.6
D <sub>t</sub> = 5%		



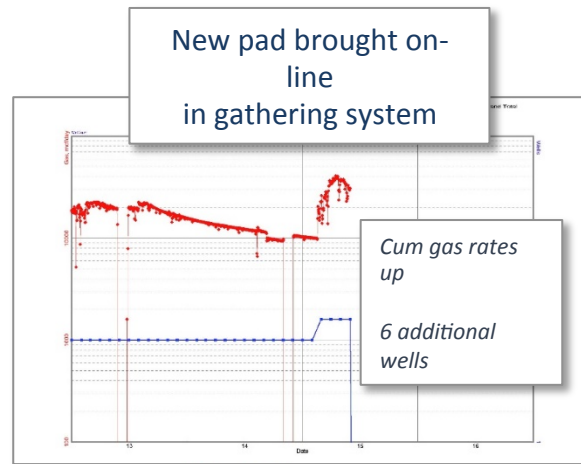
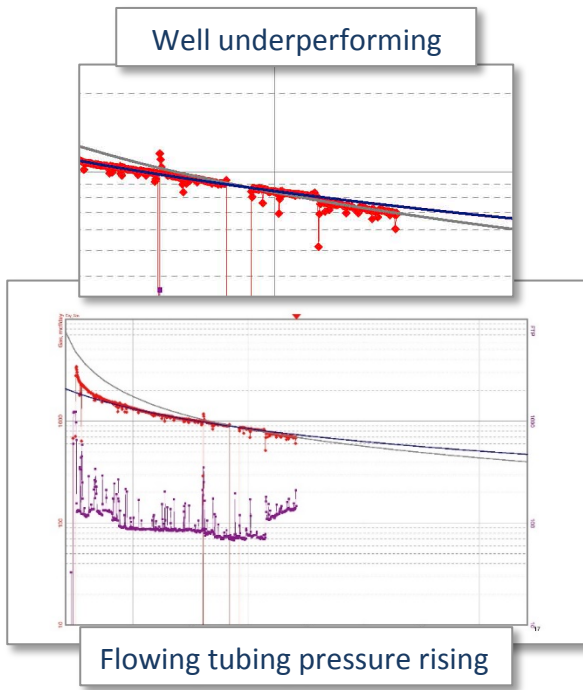
# EVALUATE WELL PERFORMANCE

## Decline Curve Method



# EVALUATE WELL PERFORMANCE

## Consider Impacts of Surrounding Operations



Example Case	EUR, bcf	Years	Cash Flow, \$MM	PV10, \$MM
Original Forecast	4.6	50	3.7	1.7
Impacted, no correction	4.1	50	2.8	1.4
Loss	11%		24%	18%

# CAREFUL ANALYSIS OF PRODUCTION

Consider impacts of surface operations such as:

- If wells feeding into system with increasing pressures,
- Wells will appear to have steeper declines,
- Resulting in reduced EURs (based on Decline Curve Analysis only)

Next:

- Manage gathering system pressures (line size, compression - \$'s)
- Model future rates and EURs to demonstrate no loss in reserves
- May require rate transient analysis (RTA), surface operating equipment modeling software

Results:

- Prevented EUR loss by demonstrating negative impacts of higher system pressures on wells

# MAXIMIZING VALUE

## Increasing Asset Value

Unique Production Performance Profile - Proved

- All Operators are not alike
- Undeveloped locations have reserves assigned based on geology and analogy
- If a particular drilling and completion design results in wells that outperform offset operators, demonstrate the design “uptick” (prove it) across all the acreage to increase undeveloped reserves and value

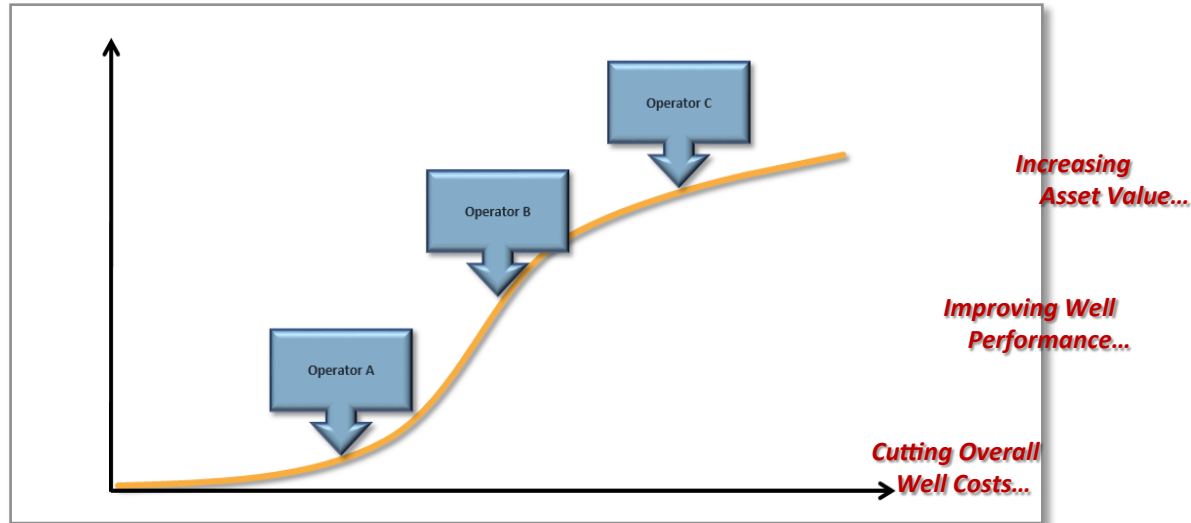
*Operator*  
*A*      *≠*      *Operator*  
*B*      *≠*      *Operator*  
*C*

STUDY, RESEARCH, KNOW YOUR ACREAGE AND WHAT WORKS  
*(Do not assume your reserves will be the same as another operator.)*

# SUMMARY

In the current economic environment, operators must have a strategic plan

- Utilizing all available resources
- Continuing to move up your own learning curve
- Maximize value by reducing cost and improving performance



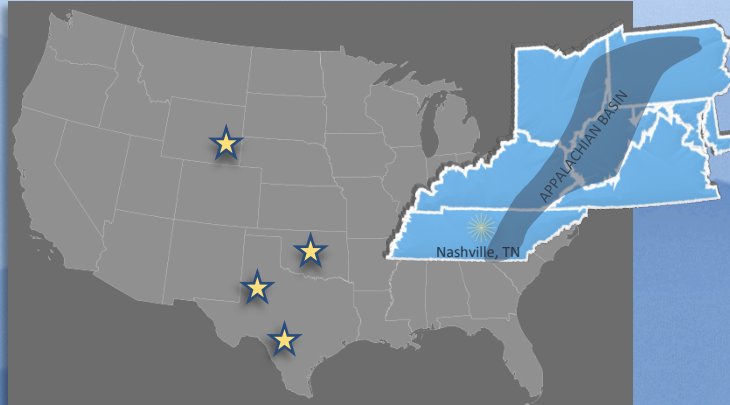
**Survive and *THRIVE***

# THANK YOU!

## Welcome TO OUR BACKYARD

Evaluating unconventional  
resources and serving the  
petroleum industry for

*28 Years*



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**(615) 370-0755**

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**[wrightandcompany.com](http://wrightandcompany.com)**

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