Anadarko Basin – Drilling Learning Curves Drivers

Pete Chacon

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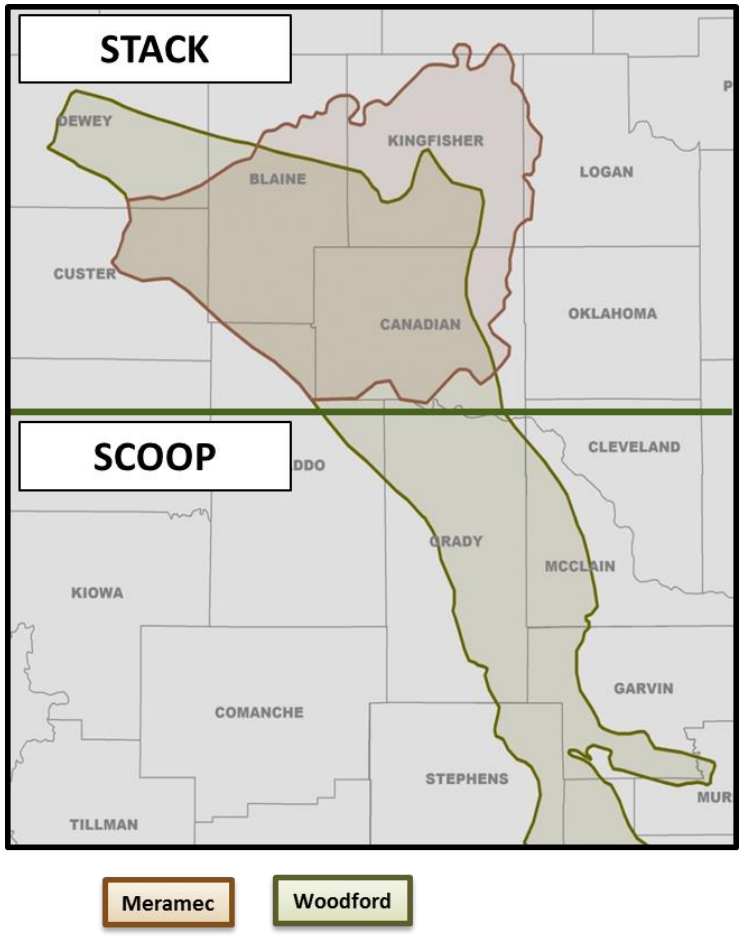
Advancing the Learning Curve

- In 2015
  - Made significant step changes in drilling learning curve in all our playtypes
  - Also predicted the step changes
- Focusing today on SCOOP and STACK 2015 Learning Curves
- What's next in 2016+?



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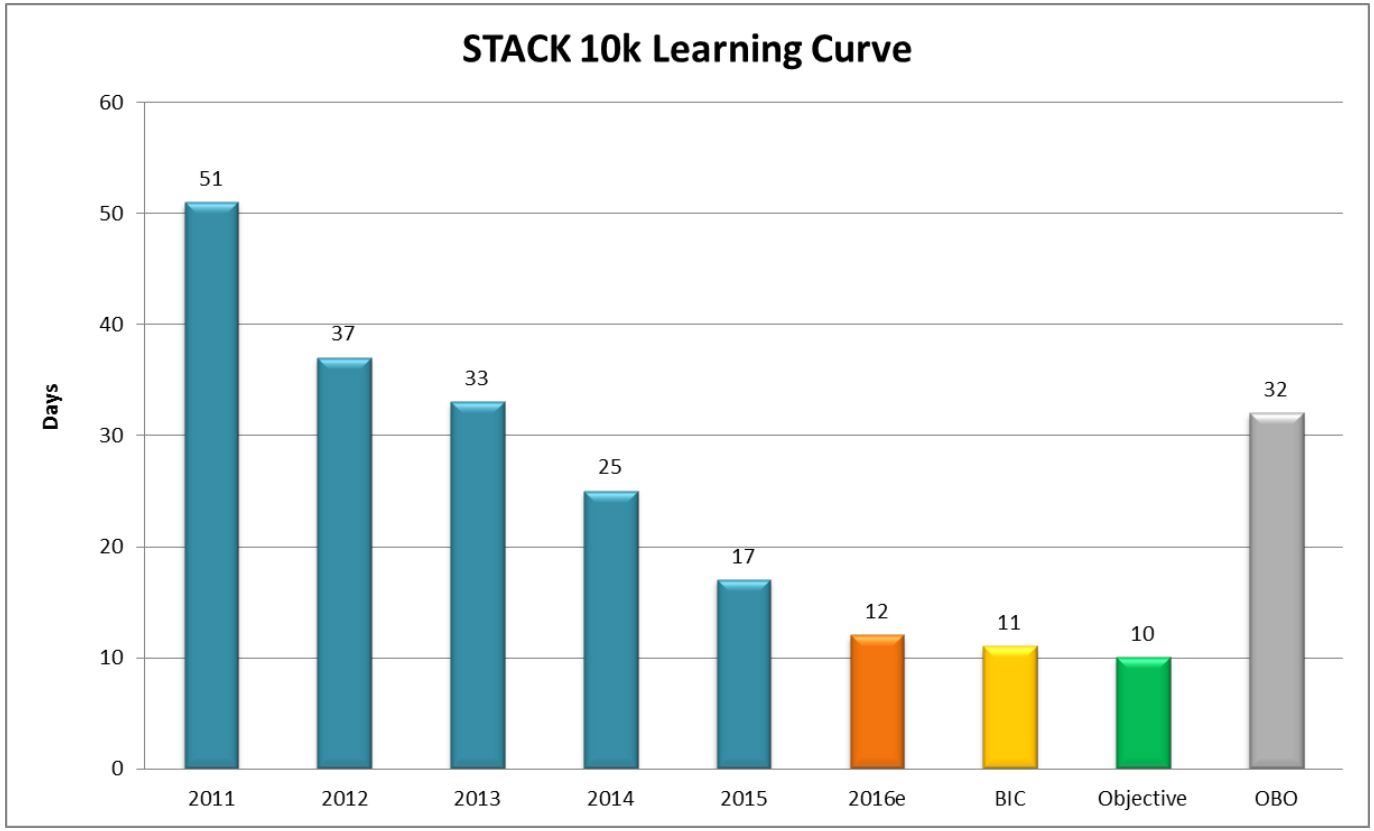
STACK Learning Curve



- 2014 vs 2015:
  - Averaged +30% improvement in Days to TD
  - Exited 2015 with +50% improvement in Days to TD
  - Averaged +28% improvement in Drill and Case cost

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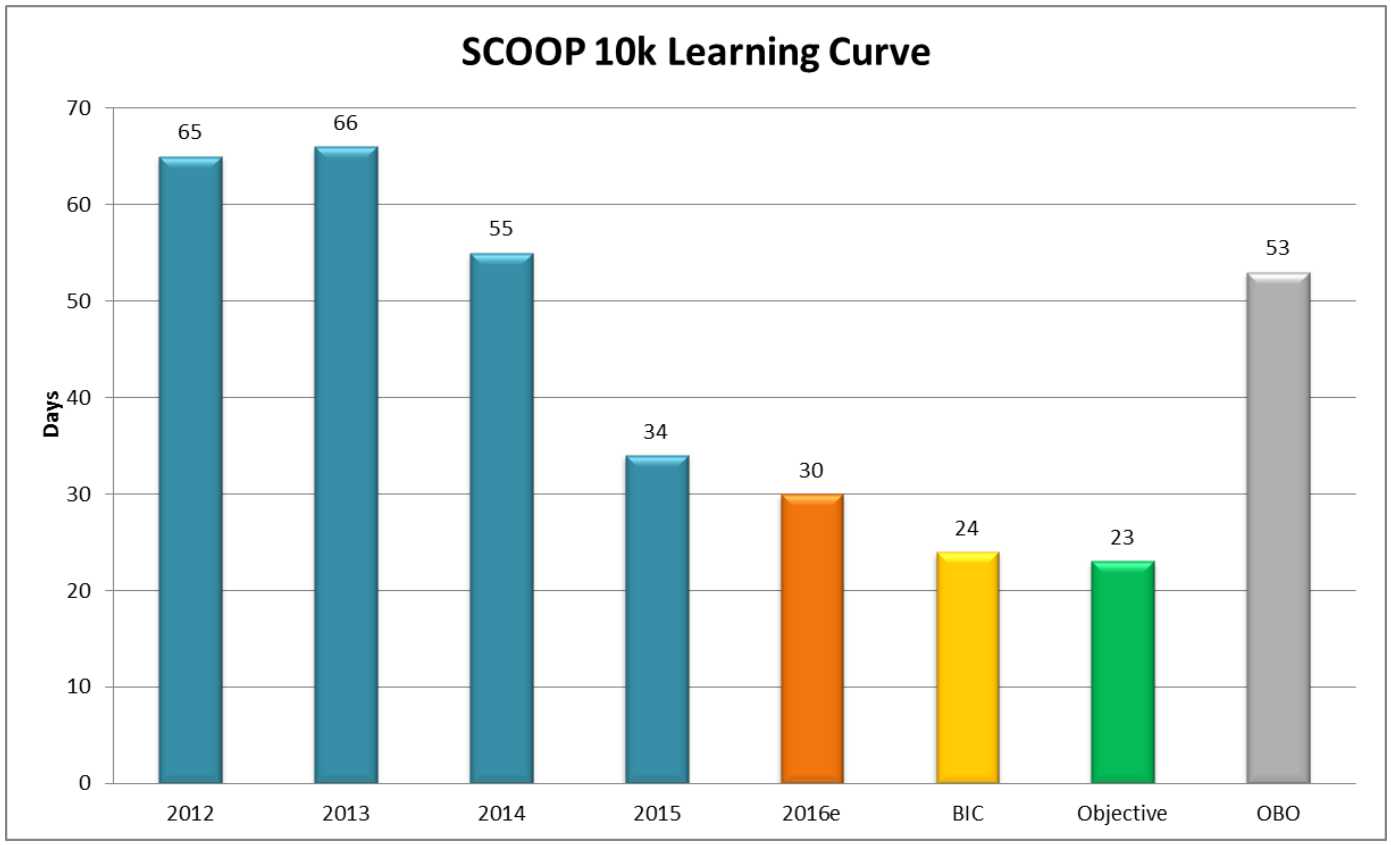
SCOOP Learning Curve



- 2014 vs 2015:
  - Averaged +38% improvement in Days to TD
  - Exited 2015 with +45% improvement in Days to TD
  - Averaged +40% improvement in Drill and Case cost

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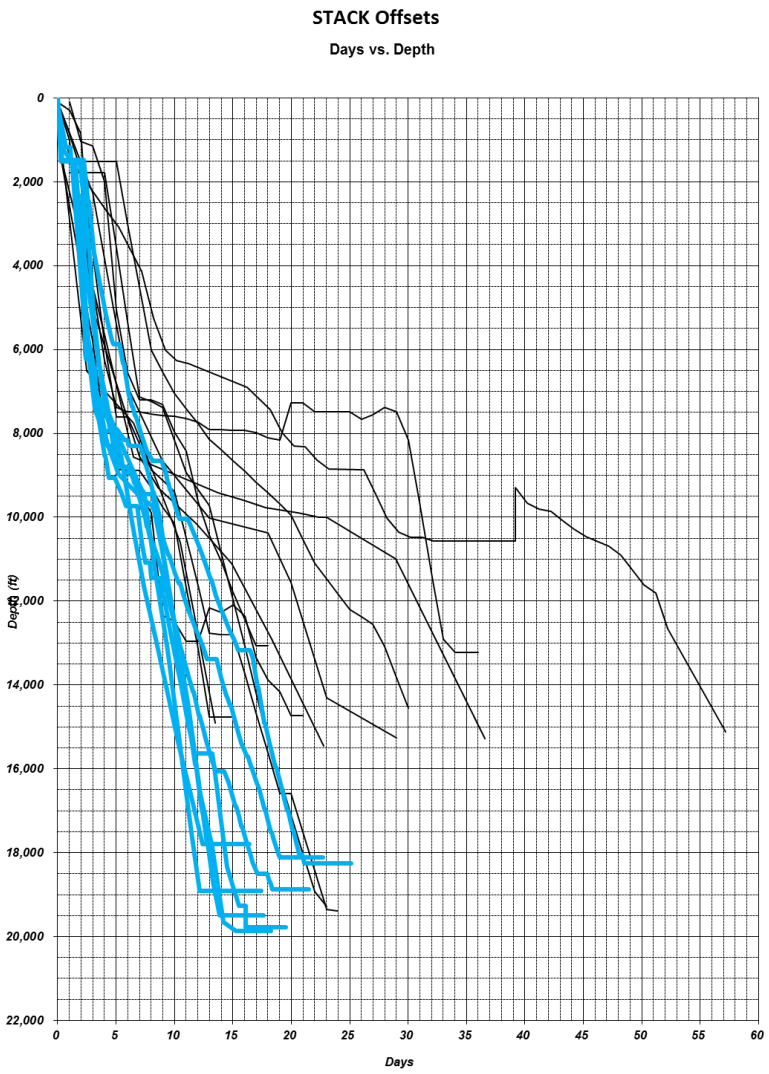
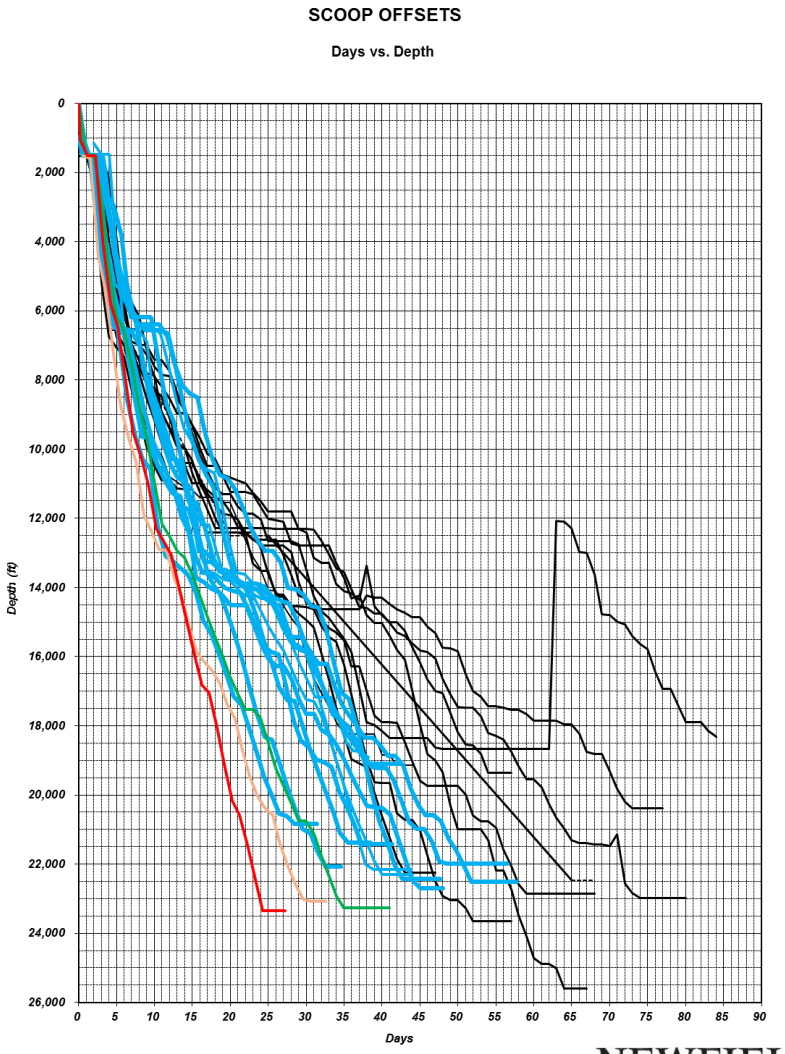
SCOOP & STACK Day Curves





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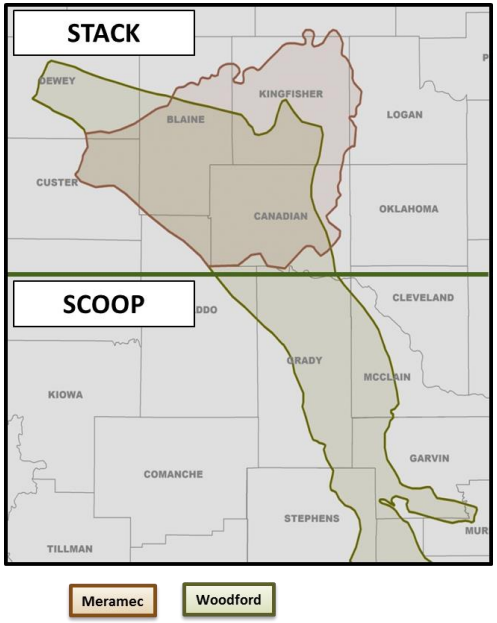
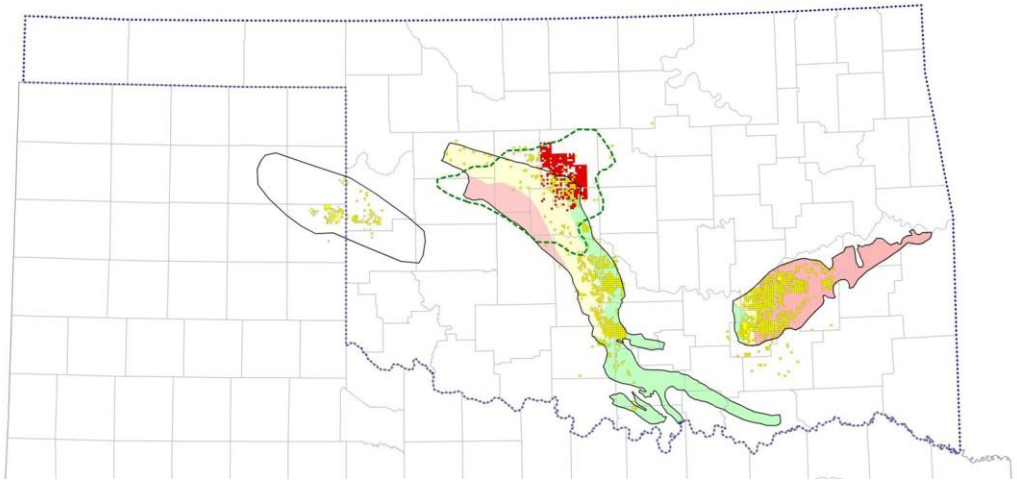
Rewinding the Clock…

- Back to September 2014:
  - Actively Drilling in two major playtypes in Anadarko Basin, SCOOP and STACK
  - The foundation for our team's experience came from Arkoma and Granite Wash drilling programs





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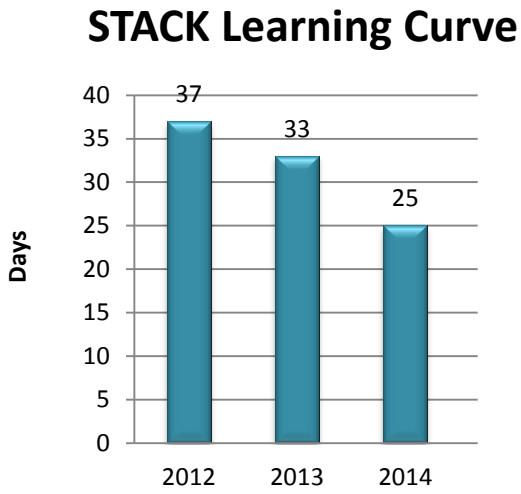
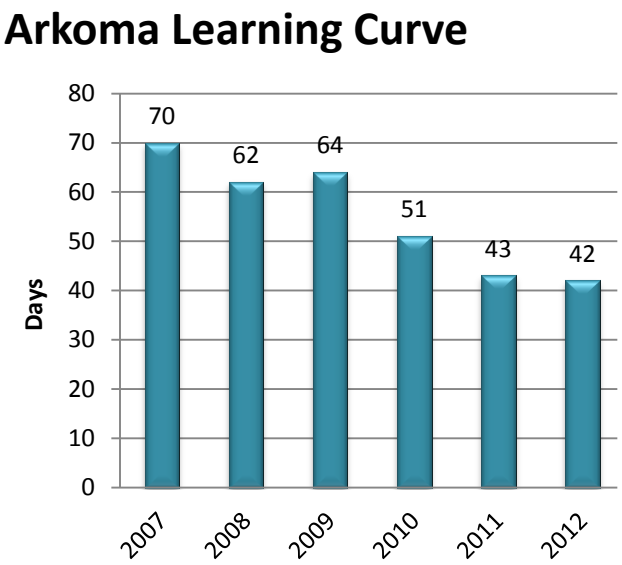
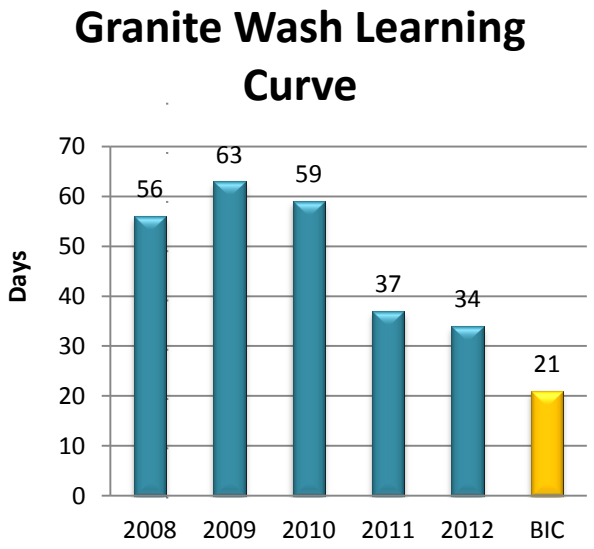
Laying the 2015 Path Forward

- We laid the path forward in 2015 by first looking backwards.
- Looked hard at our Learning Curve histories…what was holding our engineering & drilling performance back? The rock didn't change.







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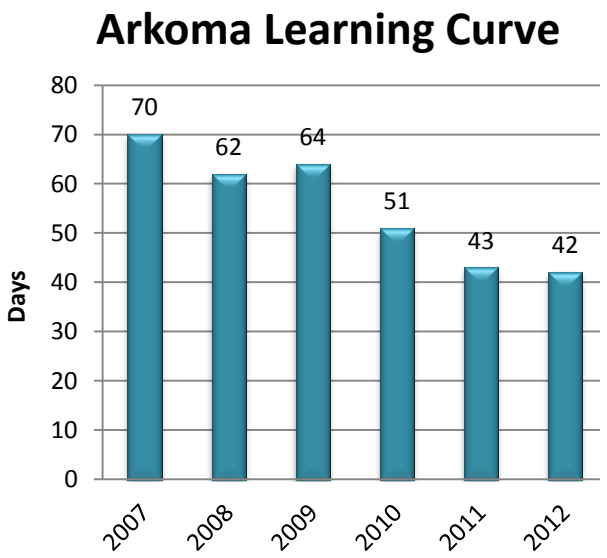
RCA Logic on the Learning Curve

- Engineering - constraint based optimization problem solving
- If current year performance was always possible, then the prior years were engineered as overdesigns and sub-optimal.
- If our engineering output was sub-optimal in prior years, then the failure had to be a result of:
  - Incorrectly defined design constraints
  - Design solutions for incorrectly diagnosed problems
  - Weaknesses in problem solving approach
- Conclusions:
  - Excessive design constraints, inadequate root cause analyses and inappropriate transfer of lessons learned, result in overdesigned wells.
  - If these root causes remain unaddressed, then the current “best” result is still likely an overdesign.
  - If the team is focused on replicating the best achieved to date, then we’re likely attempting to replicate an overdesign.
  - An acceleration of a learning curve will always be paired with a simplification of the design.
- Therefore, in order to design and deliver a well beyond what has already been done:
  - Constraints need to be questioned & tested
  - Problems need to be correctly diagnosed
  - Solving approaches have to be efficiently transferred
  - The next step changes come from simplification of the design, not throwing more complexity into the design.



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Designing in Potential Space

- In order to design and deliver a well beyond what has already been done:
  - Constraints need to be questioned & tested
    - Fear of the test outcome caused us to design around future possibilities that may or not have manifested themselves and accept an overdesign
  - Problems need to be correctly diagnosed
    - The biggest hurdle to a good root cause analysis is getting past the proximate cause
  - Solving approaches have to be efficiently transferred
    - The engineering problem solving approach is the real lesson learned, not the conclusion generated from the
  - An acceleration of the learning curve will always be paired with a simplification of the design.
    - Constantly trying to replicate a result of something already achieved promotes increased complexity. The macro trend of every learning curve is simplification, not increased complexity. You design toward the ideal instead of designing with an eye toward replication

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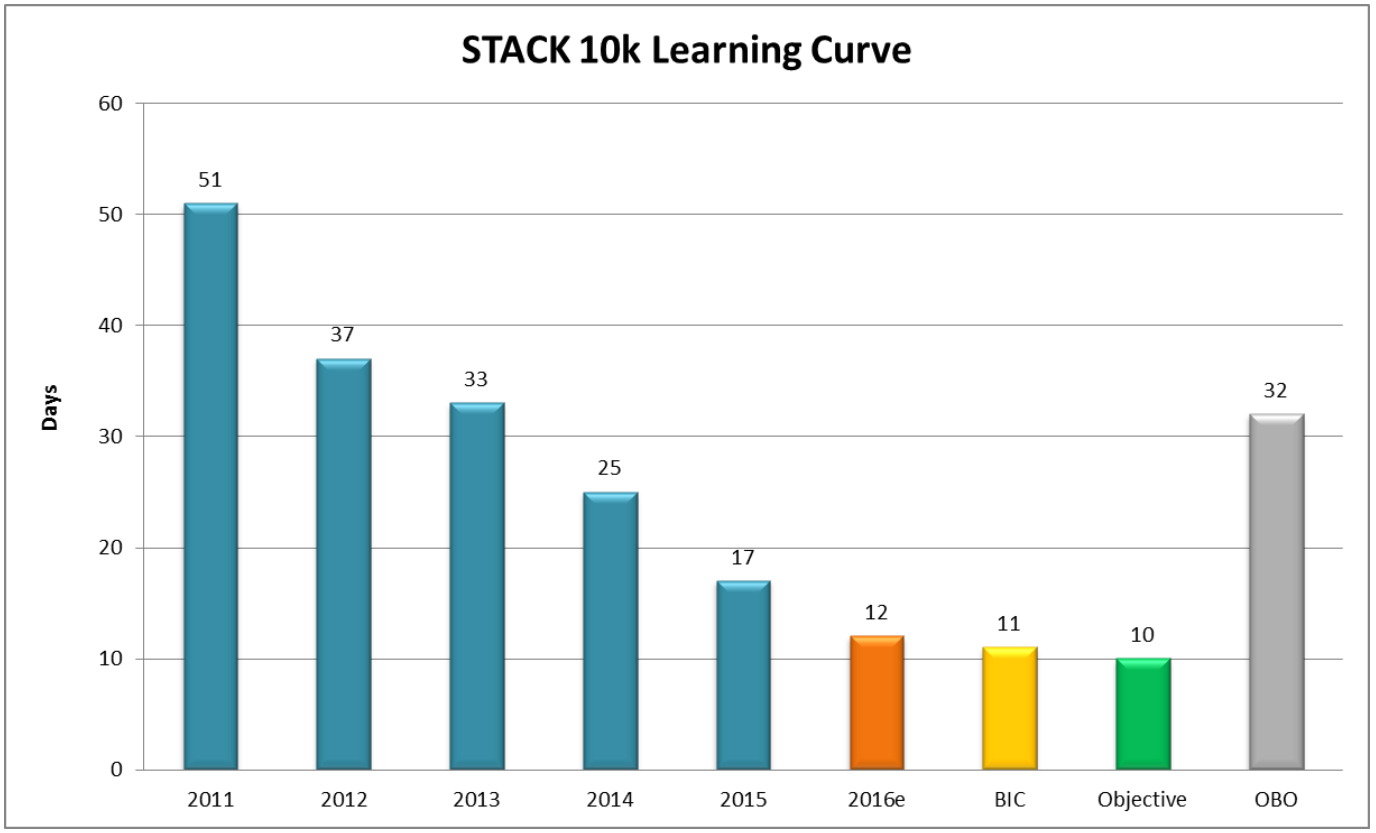
STACK Learning Curve



- BOY 2015 Projections:
  - Predicted we could deliver a <13 day well for $2.6MM
  - Projected an ~35% reduction in Drill & Case cost

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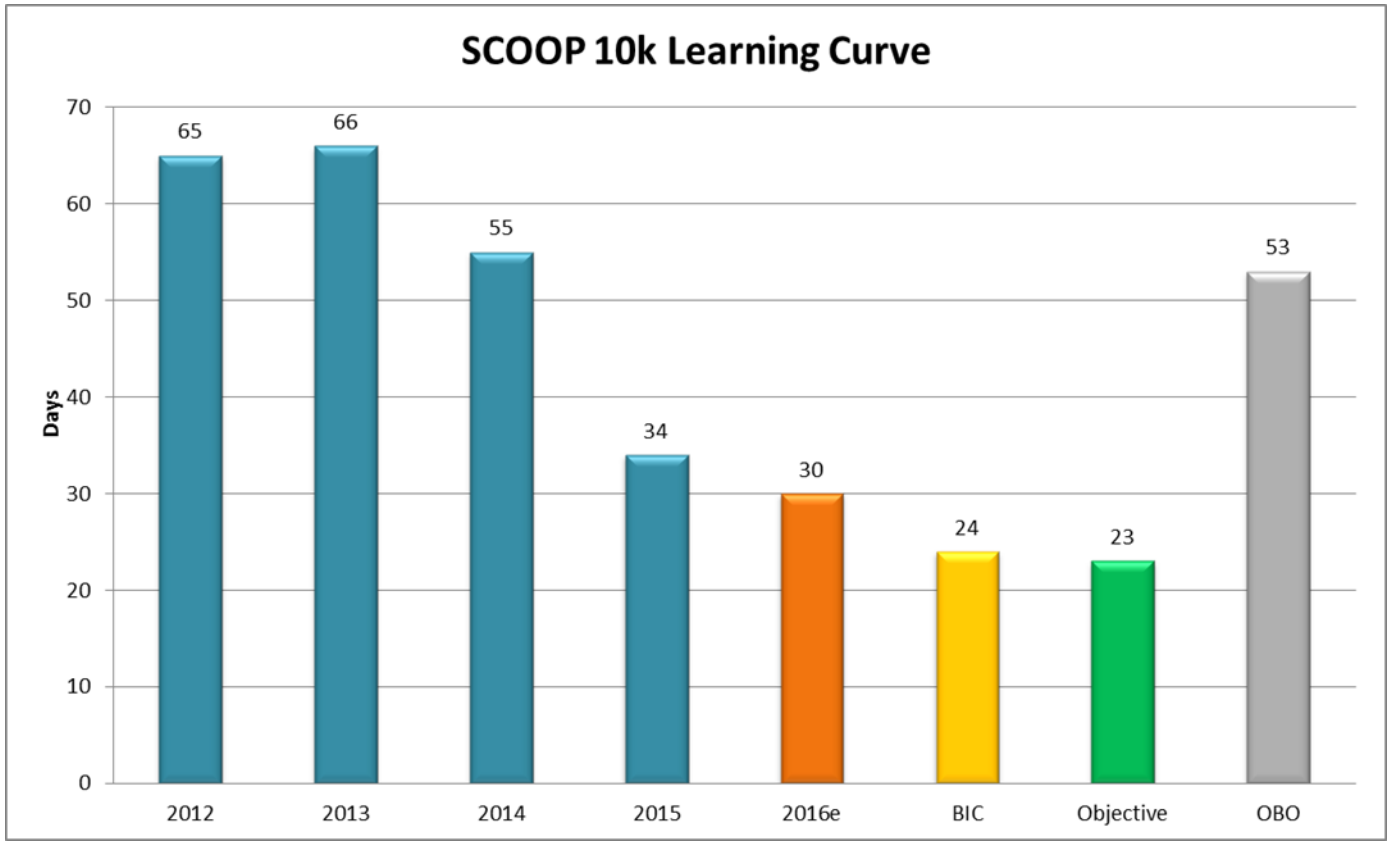
SCOOP Learning Curve



- BOY 2015 Projections:
  - Predicted we could deliver a <30 day well for $3.9MM
  - Projected an ~35% reduction in Drill & Case cost

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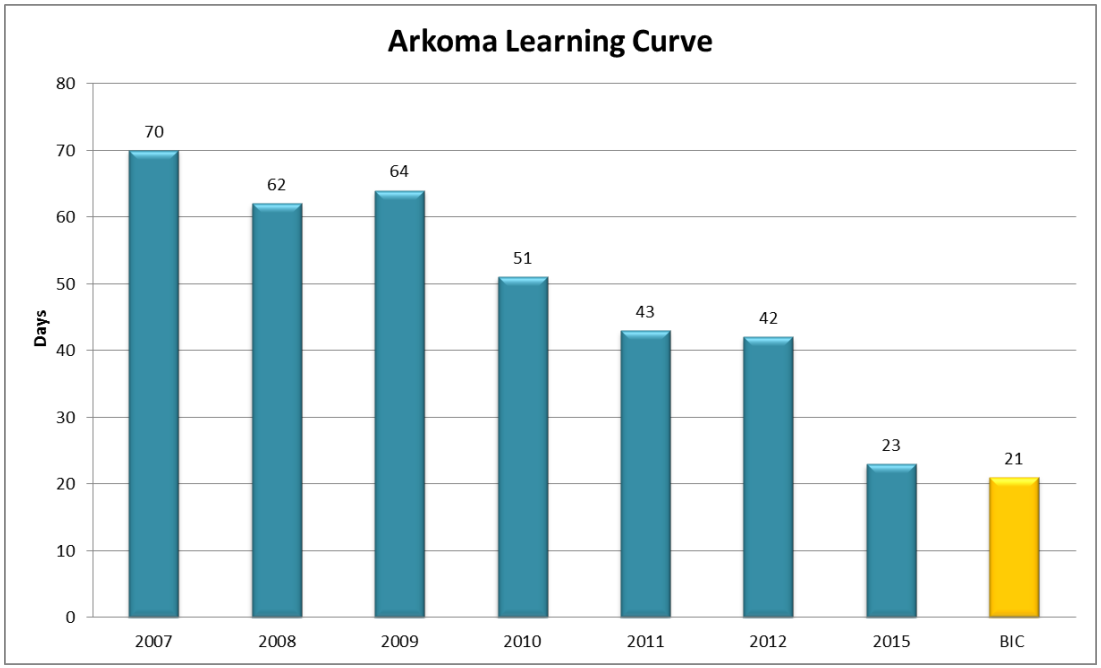
Other 2015 Projects

- Applied our “Vision Well Design” approach in two other projects in 2015 outside Anadarko Basin.
- In both cases, we cut the previous composite BIC in half within 3 wells.



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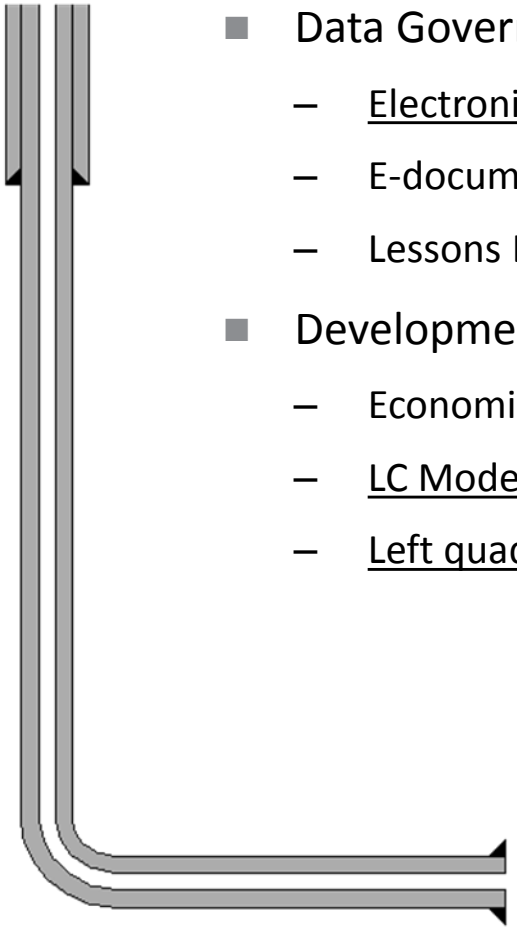
What's the Next Unrealized Potential?

- Well Design
  - Geometry
  - Casing Design
  - Cement Design
  - WH Design
- Drilling Fluid Design
  - Fluid Design
  - Hydraulics
  - Solids Control
  - Waste Management
- BHA Design
  - BHA Design
  - Bit Selection



- Data Governance
  - Electronic well file in database
  - E-document well file
  - Lessons Learned repository
- Development Planning
  - Economies of scale
  - LC Modelling
  - Left quadrant

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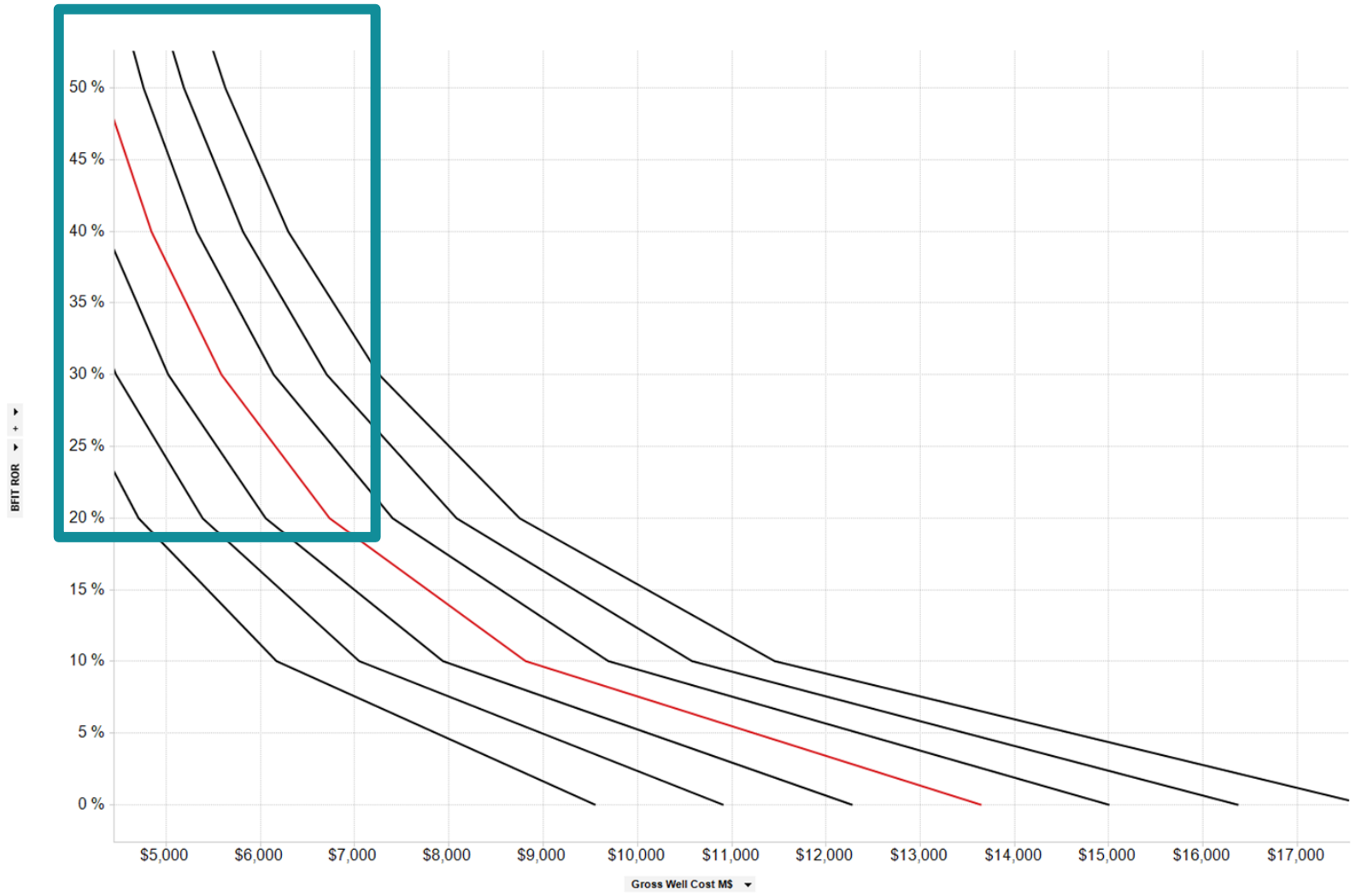
Left Quadrant



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Questions?

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