

The background of the slide is a collage of four images arranged in a triangular pattern around a central red triangle. The top-left image shows an offshore oil rig in the ocean. The top-right image shows an onshore drilling site in a green field. The bottom-left image shows a 3D seismic scan of a geological formation. The bottom-right image shows a 3D model of a wellbore with various colored zones. The word "HALLIBURTON" is written in white capital letters on the red triangle.

HALLIBURTON

Improving Project NPV through Optimized Processes and Technology

通过施工流程优化和技术革新提高项目净现值

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Solving challenges.™

Abstract: 摘要

Improving Project Net Present Value (NPV) through optimized processes and technology

During the past year, the oil industry has experienced a level of market uncertainty not seen since the 1980's. Latest forecasts expected that we will be dealing with the difficult pricing environment for the next several years. In this climate, we can begin to rebuild the industry into a faster, stronger and more competitive machine. In addition to running leaner companies, everyone will be required to optimize operations in order to run the most efficient business possible. We will be discussing current conditions, as well as introducing several technologies and customized processes that enable operators to realize the full value of their assets in this presentation.

通过施工流程优化和技术革新提高项目净现值

在过去的一年多时间里，石油工业经历了自上世纪80年代以来不确定性最大的一个时期。

目前的低油价局面在持续，甚至在未来几年我们可能都要面对一个相对困难的石油价格环境。我们现在需要开始重建石油工业，使这部“机器”更快、更强、更具竞争力。除了节约运营成本，我们每个人都需要优化作业模式，提高商业效率。这里我们会和大家讨论当前的业内形势，同时介绍几种新技术和为客户量身定制的新作业流程，这些都会帮助客户全面评估他们的油气资源。

Challenges 挑战

■ Current oil/gas market and forecast in depressed market

■ Strategies during the downturn:

- Technologies to reduce subsurface uncertainty
- Operations to improve surface efficiency
- Processes to improve profitability

■ Summary

■ 低油价时期的应对策略

■ 低油价时期的应对策略

- 新技术降低储层认识的不确定性
- 量身定制作业模式提高地面效率
- 优化施工流程提高利润率

■ 总结

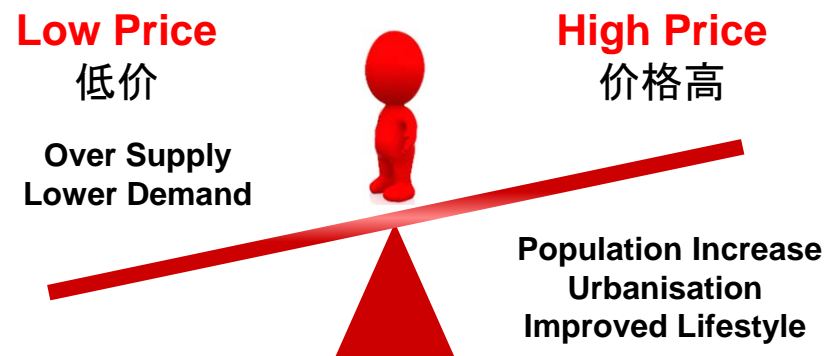
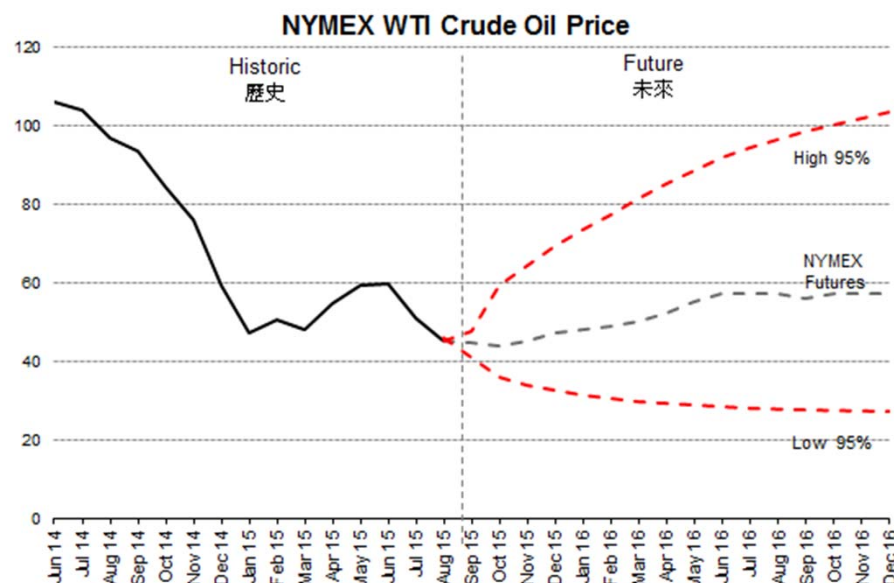
Global Oil Market 全球石油市场

Short Term: 1-3 years

- Over Supply
供应过剩
- Contracting Global Demand
全球需求减缓
- Oil Surplus (2.7 mBod)
石油产量剩余

Long term

- Global Population rise
(9Bn – 2040)
全球人口增长九十亿到2040年
- Increased Urbanisation
城镇化程度提高
- Increasing Middle Class
中产阶层的数量增长



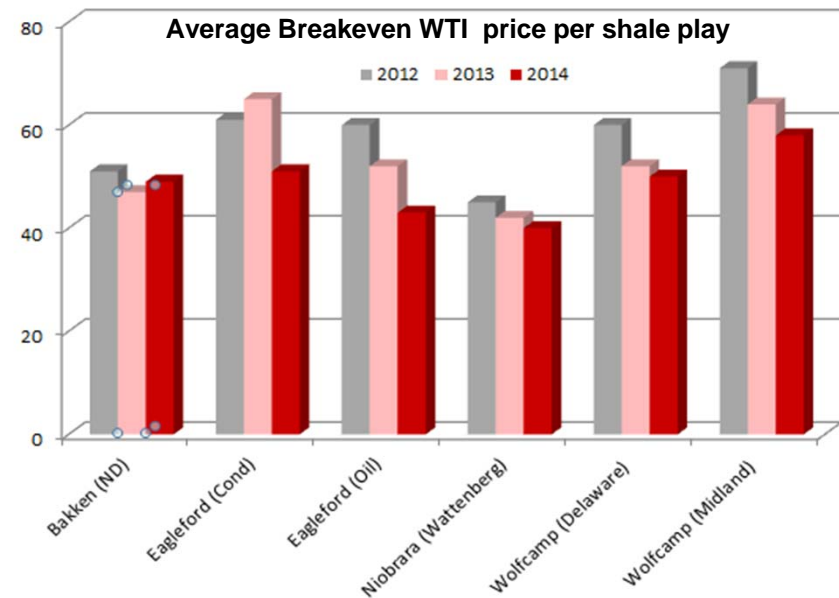
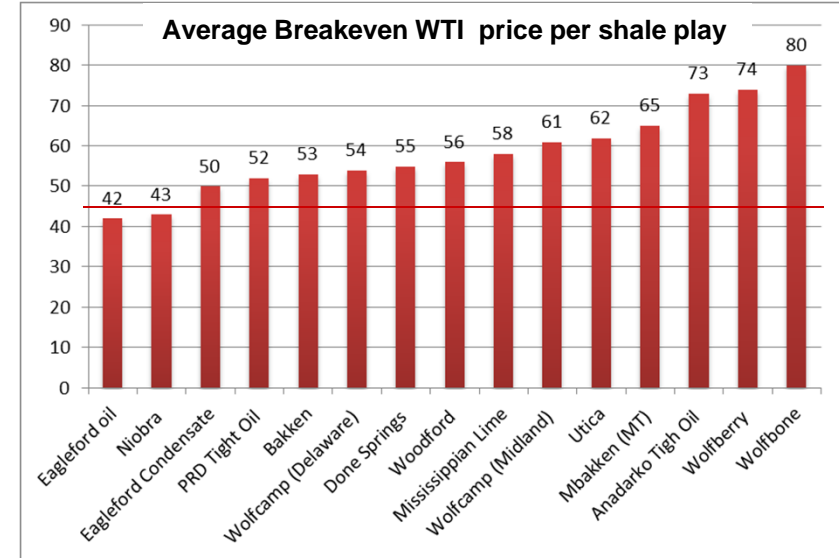
Unconventional Learnings from USA :

- Documented high cost of unconventional plays (greater than breakeven)

数据显示非传统资源成本较高（高于盈亏平衡）

- Improving Economics of shale plays

提高页岩资源的收益



Source : Rystad Energy Q4-2014

Study Return on Capital Employed: US Example

研究已占用资本回报：美国的例子

■ 30% ROI > Cost of Capital

投资回报高于资本成本

■ 48% ROI below Cost of Capital

投资回报率低于资本成本

■ 22% Unprofitable projects

无利可图的项目

Why ? 为什么呢？

1/3 of stages produce 75% of production

1/3阶段产生3/4的生产

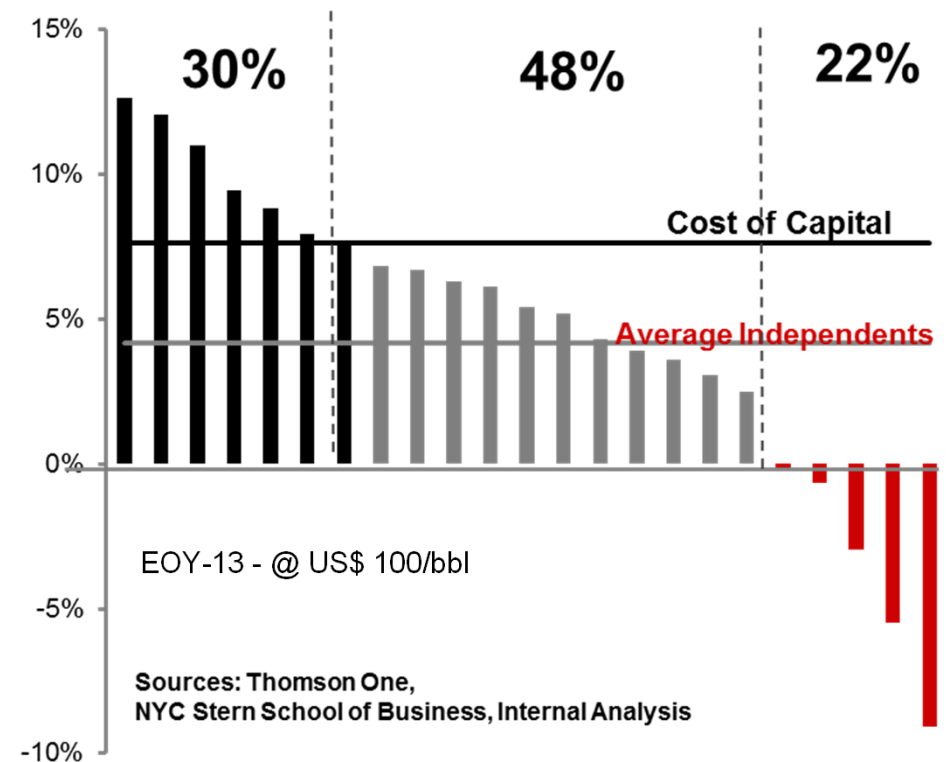
1/3 of stages produce 25% of production

1/3阶段产生1/4的生产

1/3 of stages produce zero

1/3阶段无产出

23 Independent Shale Gas Operators
23个独立页岩气运营商



Strategies for the current market



Common Goals and Challenges挑战

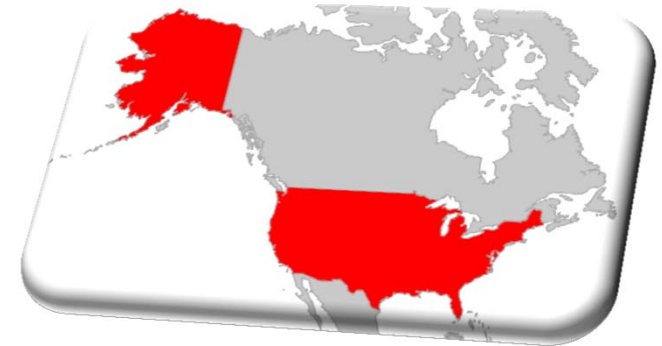
Common Goals

- Environmental Emission Targets
环保排放目标
- Maximize return on investment
最大限度地提高投资回报率
- Established Domestic Market
建立的国内市场
- Energy Independence
能源独立

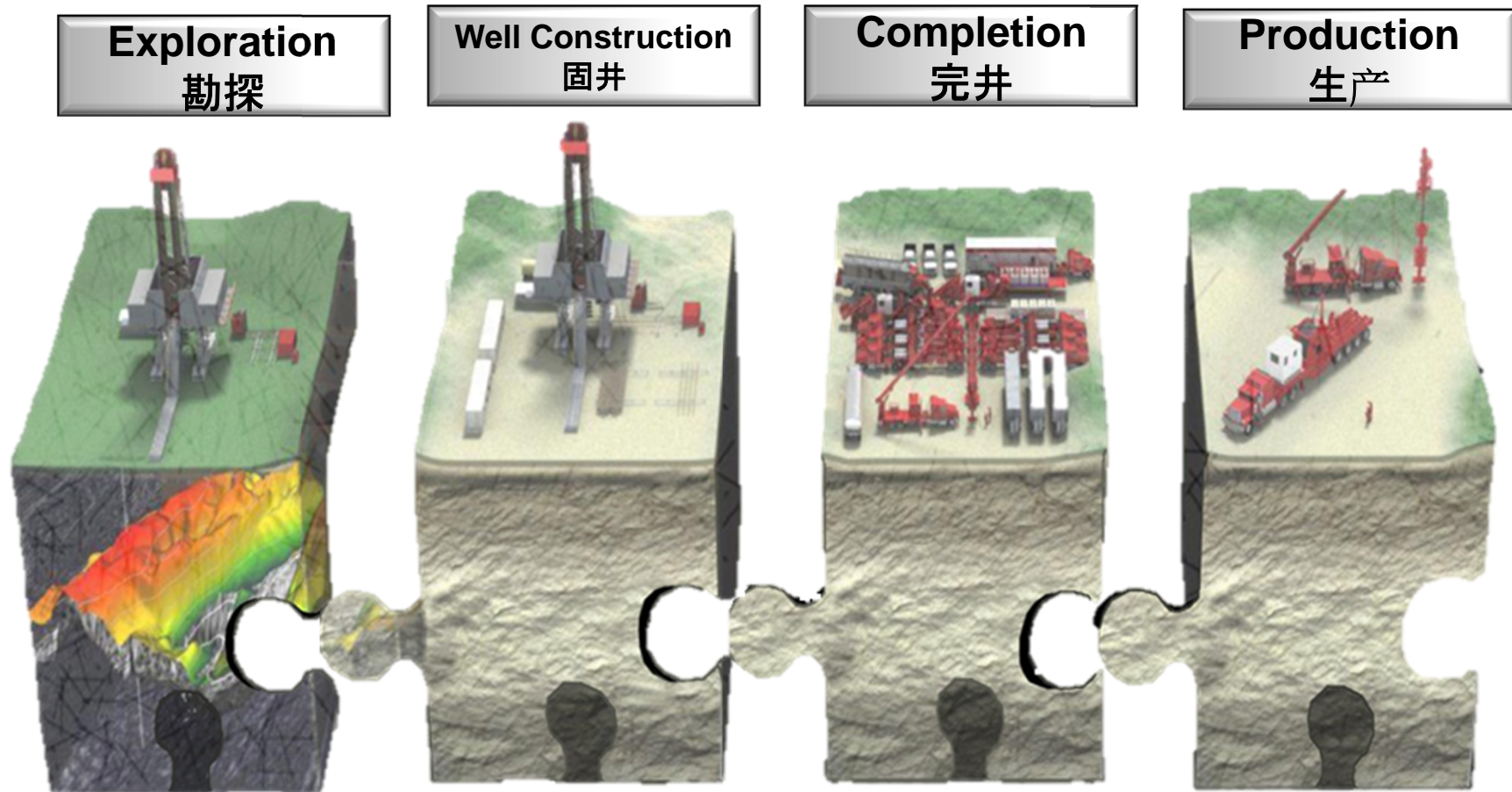


Challenges

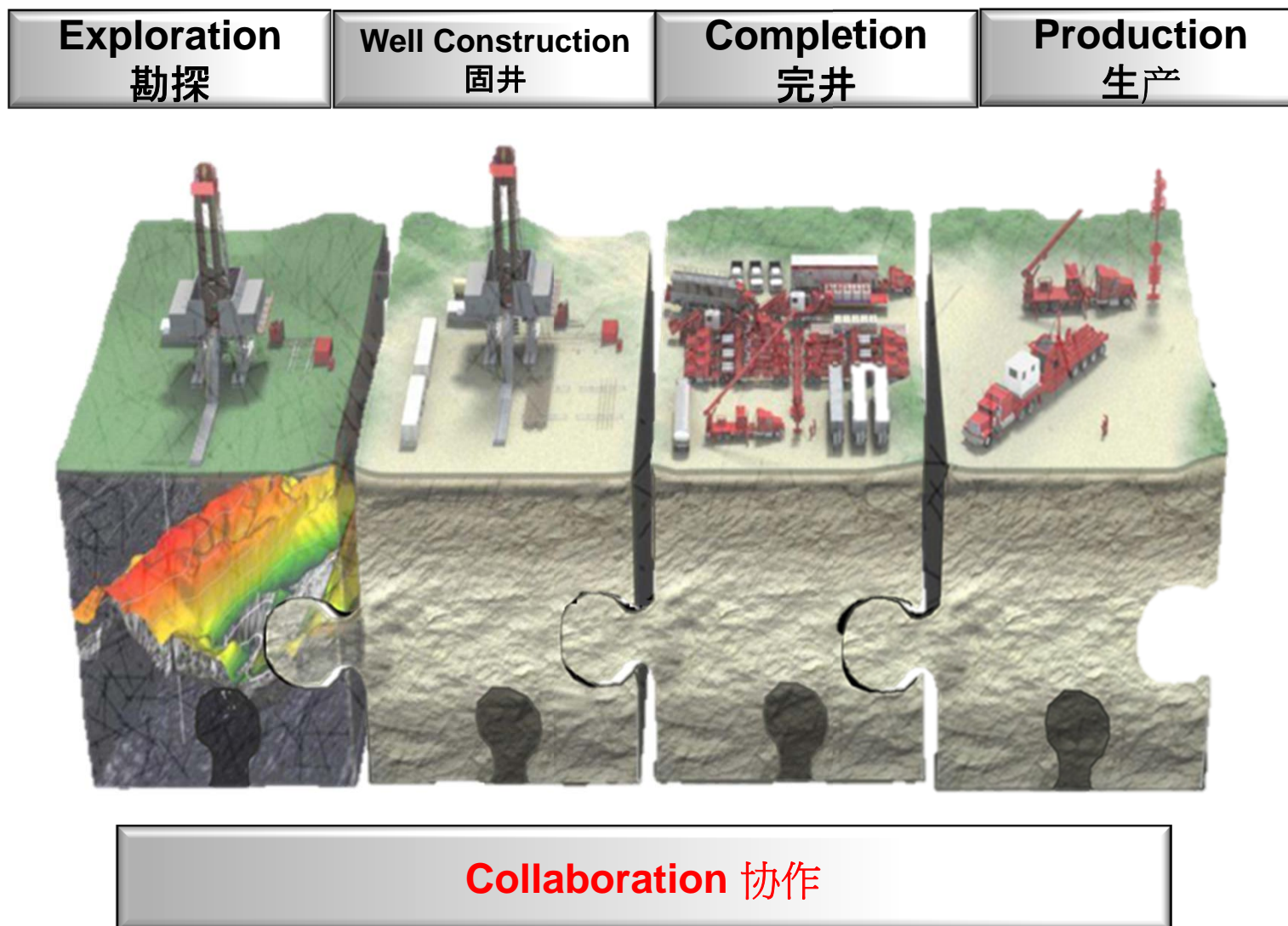
- Extremely complex geology
极其复杂的地质结构
- Project Economics 工程的经济收益
- Supply Chain and supporting infrastructure
物流和基础设施
- Technology Followers (like the rest of the world)
技术追随者



Asset Lifecycle油气井生命周期



Optimized Asset Development 油气田优化开发 - Workflow



Optimised Unconventional workflow: Improving NPV of asset



- Collaboration - Making better decisions, giving better results.

协作，才能做出更好的决策得到更好的结果。

- Improved Subsurface insight from Seismic to stimulation

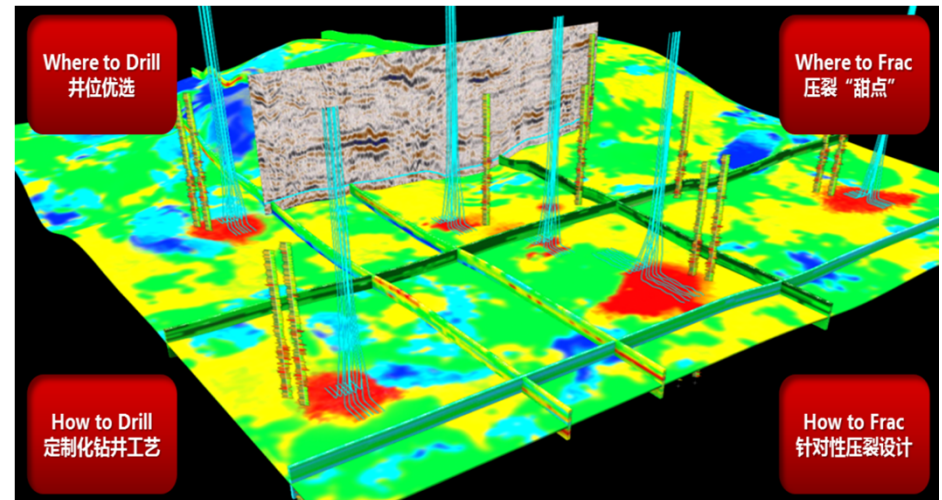
全面的改进从震测探勘到压裂工序的地质认识

- Turning well data into an optimised field development plan

将井下数据转化为一个优化的油田开发方案

- Focusing on Lowering BOE / unit cost

着眼于降低单位生产成本



RESERVOIR
CHARACTERIZATION



WELL PLANNING
AND PLACEMENT



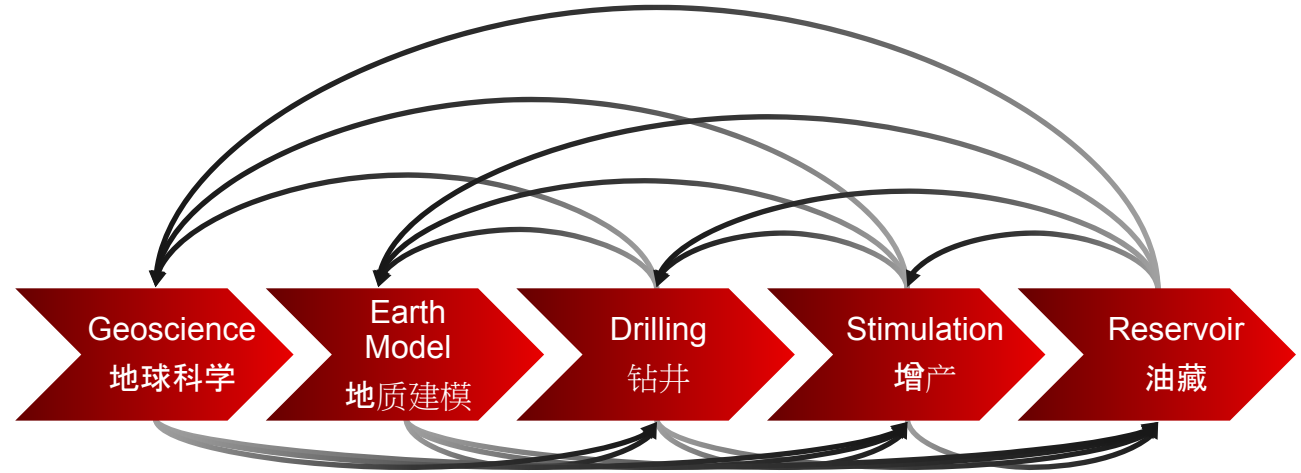
COMPLEX FRAC MODEL/
COMPLETION DESIGN



PRODUCTION MATCHING/
OPTIMIZE MODEL

Integrated Asset Evaluation 油气资源综合评价

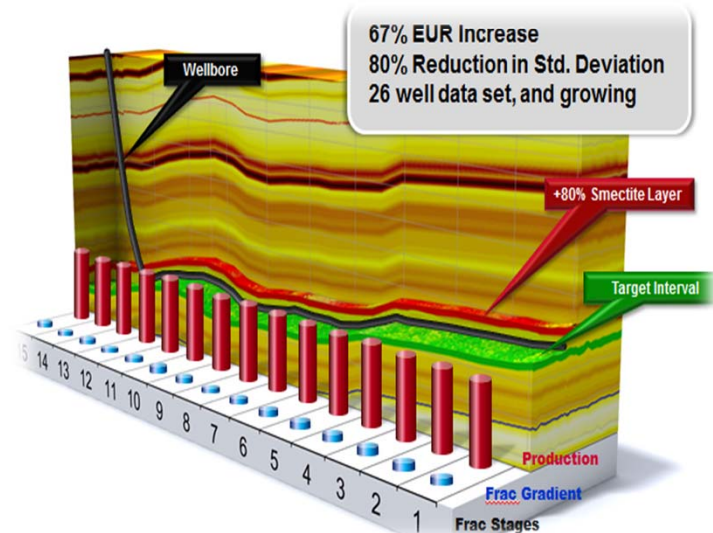
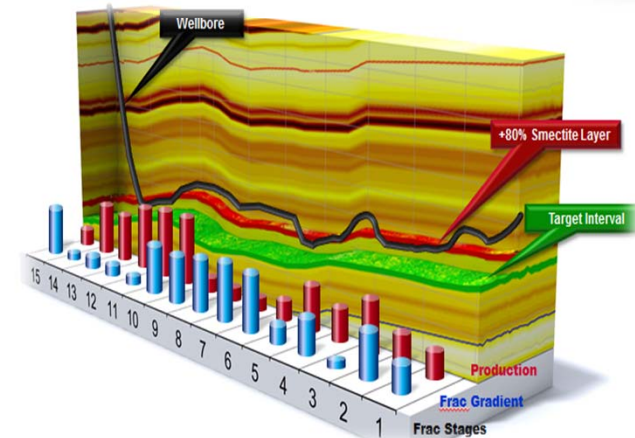
Common Environment 正常商业环境



- Reduction in cycle time by 80% 开发周期降低80%
- Higher initial production rates by 35% 初始产量提高35%
- Improved EUR by 124% 最终采收率提高124%
- Reduce costs per BOE by 40% 油气当量成本降低40%

Workflow Project Results

- Earth Model Generation
地质模型生成
- Surgical Well Placement
精确定位
- Optimized Fracture Design
优化压裂设计
- Enhanced EUR
增加预计最终采收率
- Consistent Well Delivery
提高交井的一致性



Technology Advancement



Wireline Deployed Coring

- Established large diameter Rotary Side wall coring technology
- ROCK and FLUIDS retained at downhole Conditions
- True OGIP measurement



由电缆部署取样

- 成熟的大口径旋转侧壁取样技术
- 岩石和液体样本保持在井下环境
- 真实的测量原始天然气地质储量

2.5X
MORE GAS IN PLACE
THAN
PREVIOUSLY *ESTIMATED*

Technology Advancement

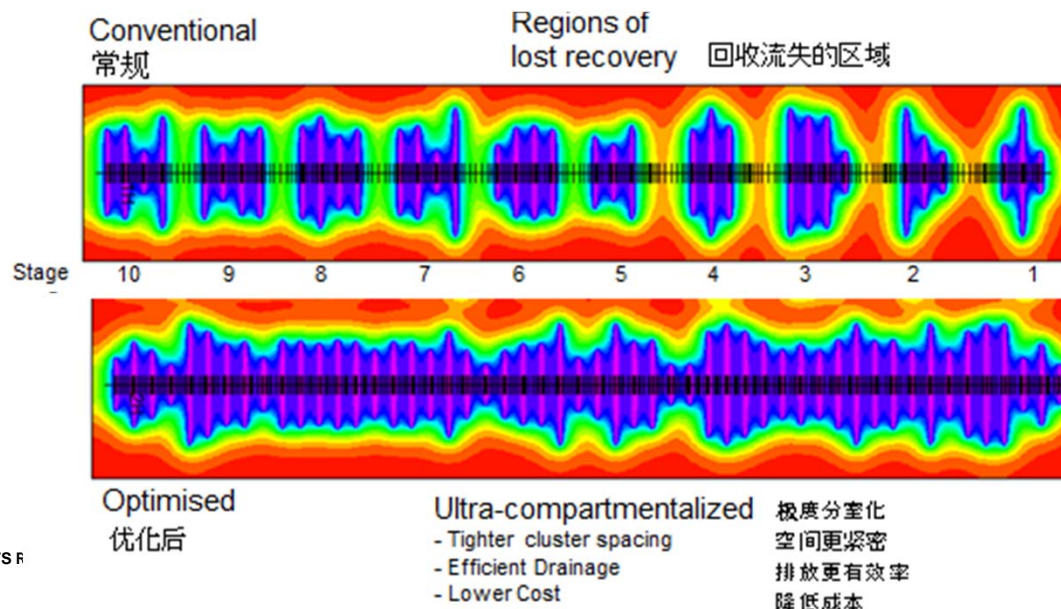


Inter-stage Diversion

- Increased reservoir
- higher production per lb of proppant placed
- Improved cluster efficiency
- Enhanced compartmentalization of primary plug-and-perf (PNP) and sleeve completions
- Refracturing / Recomplete

层内分流

- 增加与油气层的接触
- 让每磅支撑剂带了更高产量
- 提高层簇的效率
- 提高分段射孔和套筒完井的断块复杂程度
- 再度压裂和再度完井



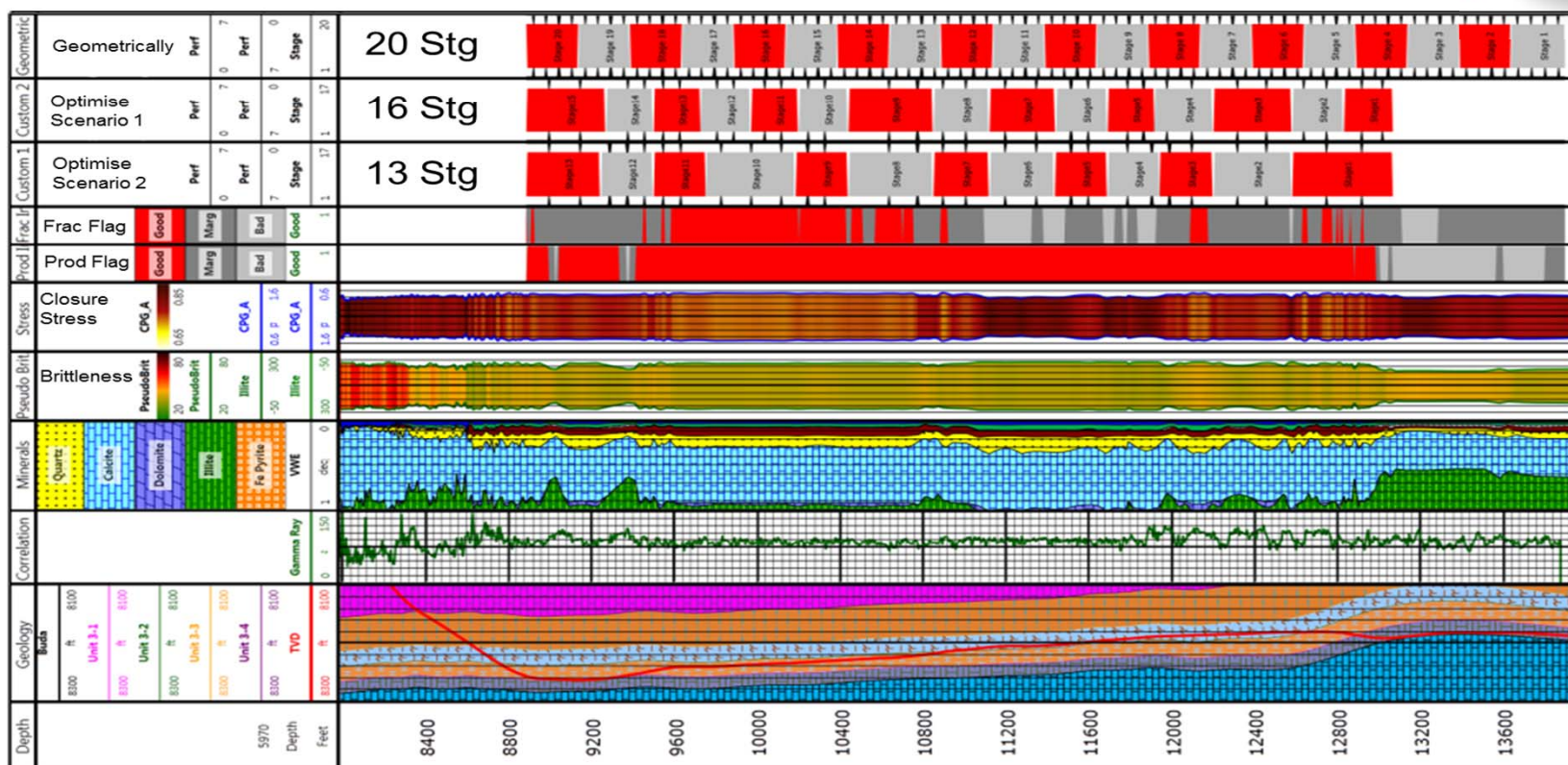
Marcellus:
83% increase in
EUR

Woodford:
46% higher
production

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FracInsightSM 压裂甜点选择

Utilises – Horizontal well data to optimise Frac stages



- Production Index 生产指数
- Frac Index 压裂指数

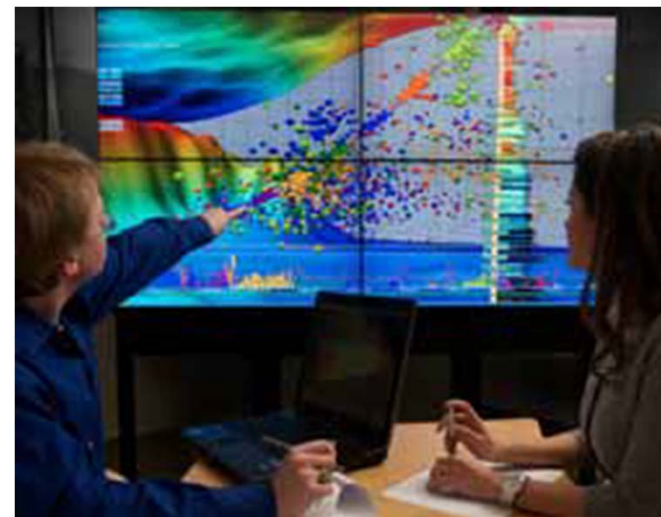
- Improved perforation efficiency 提高射孔效率
- More consistency (更好的一致性)
- Reduced Screen-outs (减少脱沙)
- Reduction in 2/3 underperforming stages (减少三分之二低产出的层面)

Diagnostics:



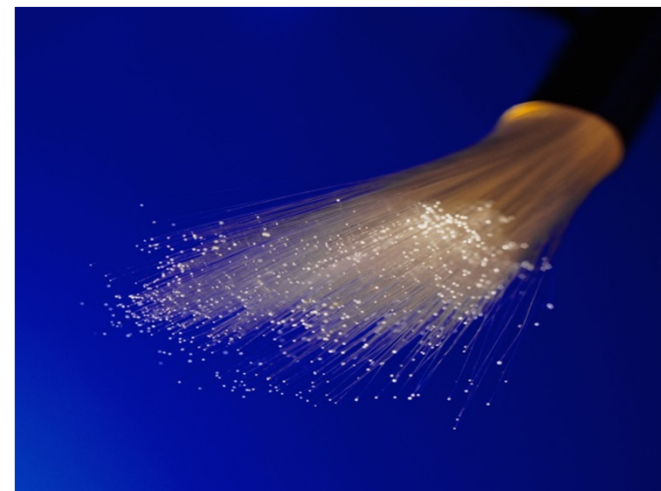
■ FracTrac® – Microseismic Fracture Mapping Service 微地震裂缝监测

- Real-time monitoring 实时监测:
 - Height 缝高 / length 缝长
 - Azimuth 方位
 - Symmetry 对称性
 - Growth 裂缝延伸 vs time 时间
- Allows real-time fracture optimization 可以实时优化调整方案



■ FiberWatch光纤监测

- Distributed Temperature Sensing (DTS) 分布式温度监测
- Digital Acoustic Survey (DAS) 数字化声波监测



Illusion[®] Frac Plugs可溶式压裂桥塞 Self-Removing Technology材料自移除技术



Proven design with the latest technology

- Plugs made from advanced dissolvable metal and dissolvable rubber materials
- Large ID (1.30-in.) allows immediate flowback and well cleanup
- Short compact design aids in pump-down efficiency
- Upon complete dissolution provides full wellbore ID for future operations

Interventional Completions when used with Rapid Ball Dissolving ball technology

已在现场应用的最新技术

- 材料选取高级可溶金属和橡胶
- 大通径，便于压后立即返排
- 紧凑设计，有利于有效泵入井下
- 可完全溶解，为将来作业留下全井筒

可再介入的完井工艺，配合哈里伯顿可溶球，可实现进一步作业



Targeting missed pay Re-Fracs 挖掘老井潜能, 重复压裂

■ ACTIVATESM Refracturing Service

1. Screen candidate wells
2. Design refrac treatment
3. Execute
4. Diagnose

ActivateSM Results :

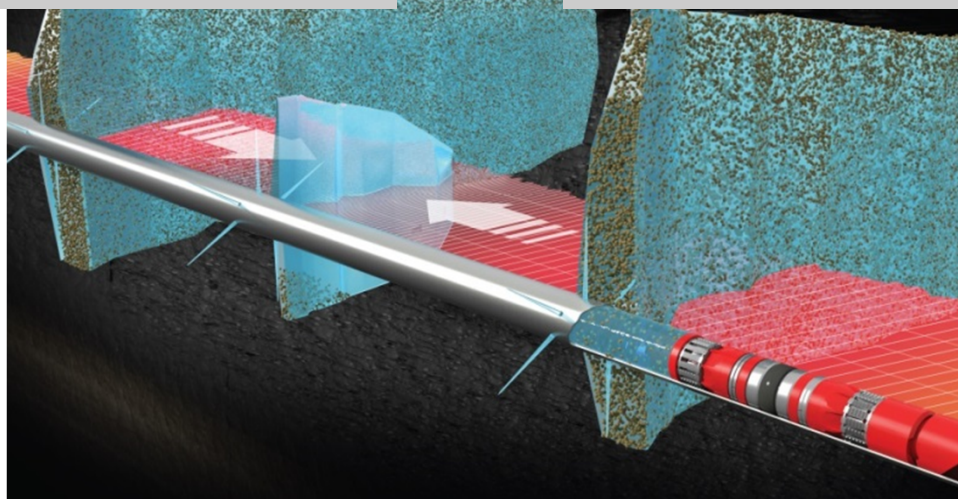
80% increase in EUR

66% Reduced Cost BOE over new drills

■ 重复压裂工艺

1. 筛选目标井
2. 量身定制重复压裂工艺
3. 现场作业实施
4. 效果诊断

在已经实施ACTIVATE工艺的盆地，客户可得到如下收获：
每口井最终采收率提高**80%**
相比钻新井，油气当量投入成本节约**66%**



THANK YOU

Questions?

谢谢，请多指教

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