Shale- What is its end state and impact?

The need to move beyond forecasts to frameworks
Shale is still evolving, and source of most market uncertainty

- 2018 shale supply is vastly different than 2014
- The unconventional is becoming more conventional, with fewer, larger and slower projects
- Costs declined sharply from 2014-2017, allowing for greater efficiencies and lower break-evens
- Shale will continue to grow, but headwinds are emerging
  - Costs are just beginning to rise
  - Decline rates now 400 kb/d per month
  - Weak WTI prices relative to Brent
  - Drift outside of sweet spots
- Shale is not, and never will be the swing supplier- but is one element of a changing oil market landscape
Shale is not big enough to keep price in a tight band

Shale:
- 5% Shale share of global supply
- 1.4 mmb/d Max growth year

OPEC:
- 40% OPEC share of global supply
- 2.26 mmb/d Avg OPEC spare capacity
Growth has shrunk from many plays to primarily just Permian.
Is unconventional becoming conventional?
Bigger slower projects, lumpier production

Source: EIA, BCG CEI
US shale may look very different with a profit focus
But this evolution may impact larger shale independents first

Source: BCG CEI qualitative analysis
Headwinds may impede shale growth

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<th>Service Sector Costs</th>
<th>Rising service sector costs - with more to come in 2018 as capacity grows tighter</th>
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<td>Sweet Spots</td>
<td>Higher prices allow focus outside of sweet spots, lowering average growth</td>
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<td>Decline Rates</td>
<td>Decline rates now at 400kb/d per month - 85 kb/d higher in 1 year</td>
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<td>Price Spread/Quality</td>
<td>Price spread/quality reduce revenue growth; wide WTI/Brent spread, increased super-light production</td>
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Bakken case study: Beyond sweet spots? Activity diffuses, productivity growth slows

Oil project costs declined
2.5x more oil available at $60/b over 5 years

Breakeven (vertical; USD/b) vs. cumulative production of identified projects (pre-sanction, under development and producing; thousand barrels per day)

Source: Company data, Goldman Sachs; Global Investment research, BCG CEI
...but are again rising
How much of the cost savings is permanent?

Shale costs increase with growth

Index: Jan 2016= 100

Hiring & wages increasing

Source: Census bureau data NAICS PCU21311213111, PCU213112213112, Bureau of Labor Statistics, BCG CEI
US crude discounted + growing super-light grades need more blending to refine

US crude benchmark below Brent

US production getting lighter
Shale decline rate still growing - requiring more new production to show net growth

Annual estimated US shale region decline rates

-6 -4 -2 0 mmb/d


Other Permian
A rule of thumb for shale:

Ignore rules of thumb
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