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SHALE 2.0: OPPORTUNITIES & RISKS FOR LNG EXPORT FROM NORTH AMERICA

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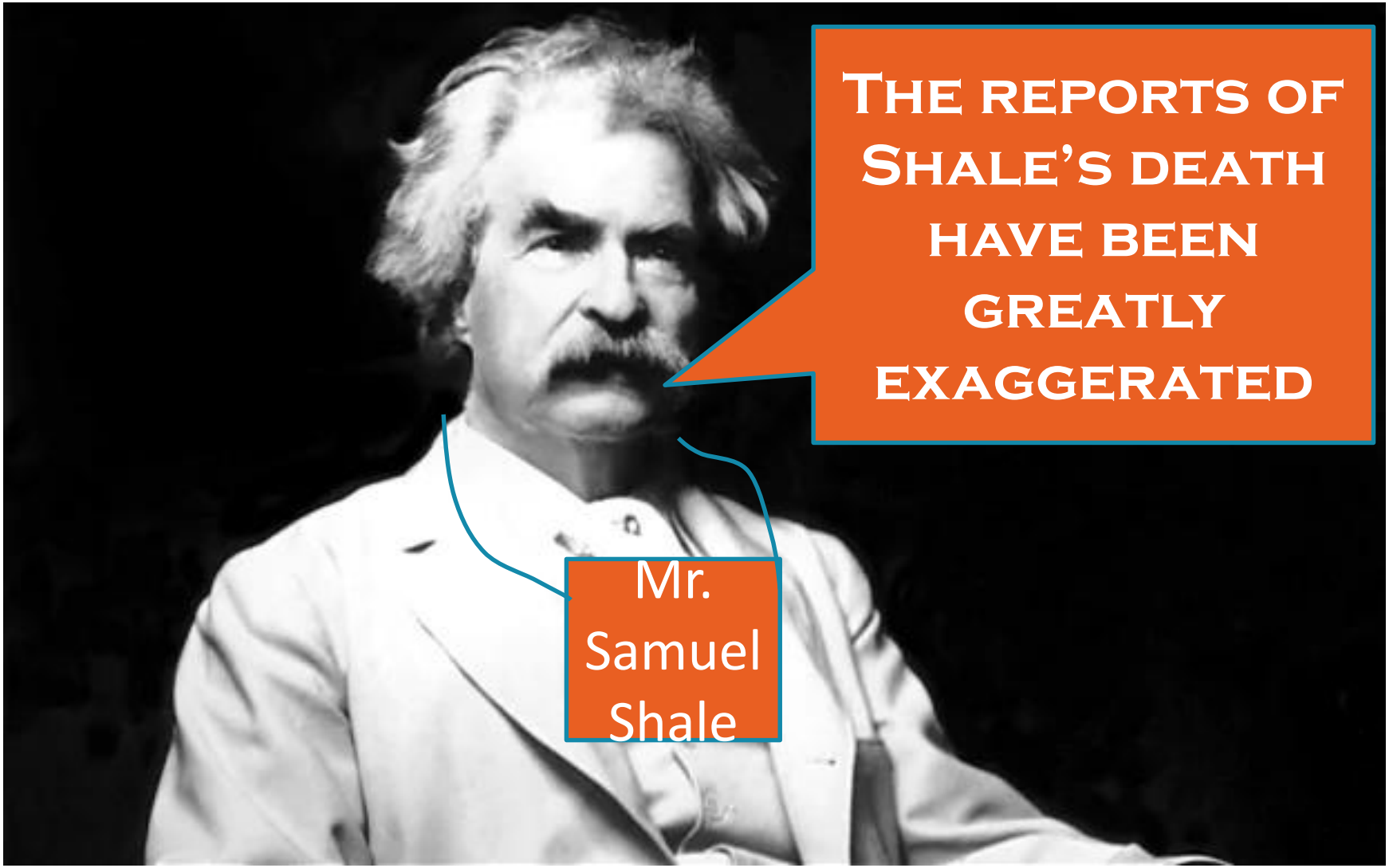
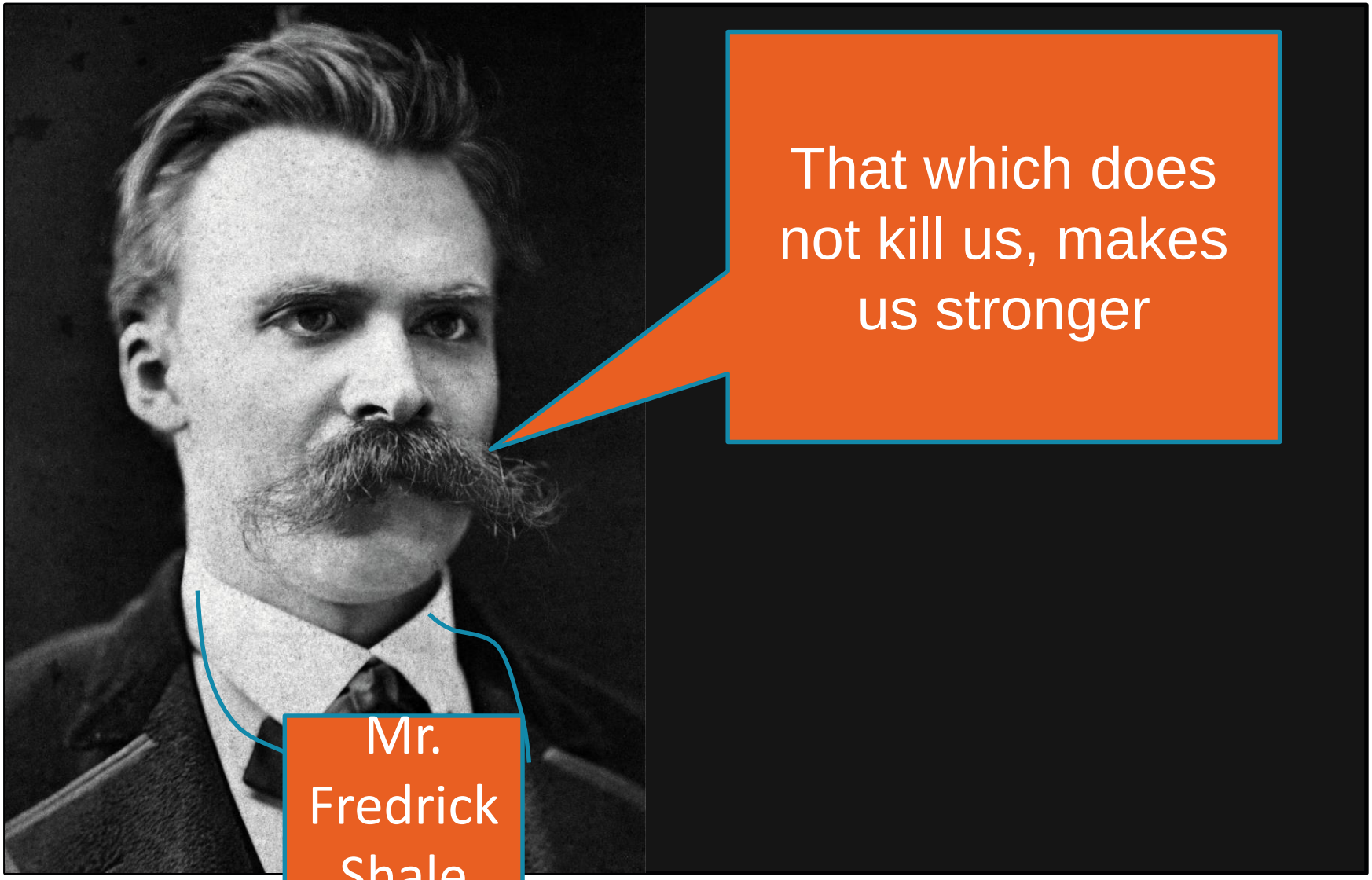
Breaking News

US Shale Boom "Goes Bust"

Oil Change International
April 14, 2015


The reports of Shale's death have been greatly exaggerated
Mr. Samuel Shale


That which does not kill us, makes us stronger
Mr. Fredrick Shale

Conclusion

- An acceleration in “manufacturing learning” is leading a resurgence in shale gas = Shale Gas 2.0
- Implications
  - Forecasts need to be updated
  - Price dynamics will change and impact LNG supply and risk management decisions (e.g. reserves acquisitions for “long-term hedge”)
  - Shale 2.0 meets the needs of new LNG demand very well

Keys to Unconventional Gas

Abundant
- Changes planning paradigm
- Reduces volatility, increases supply security

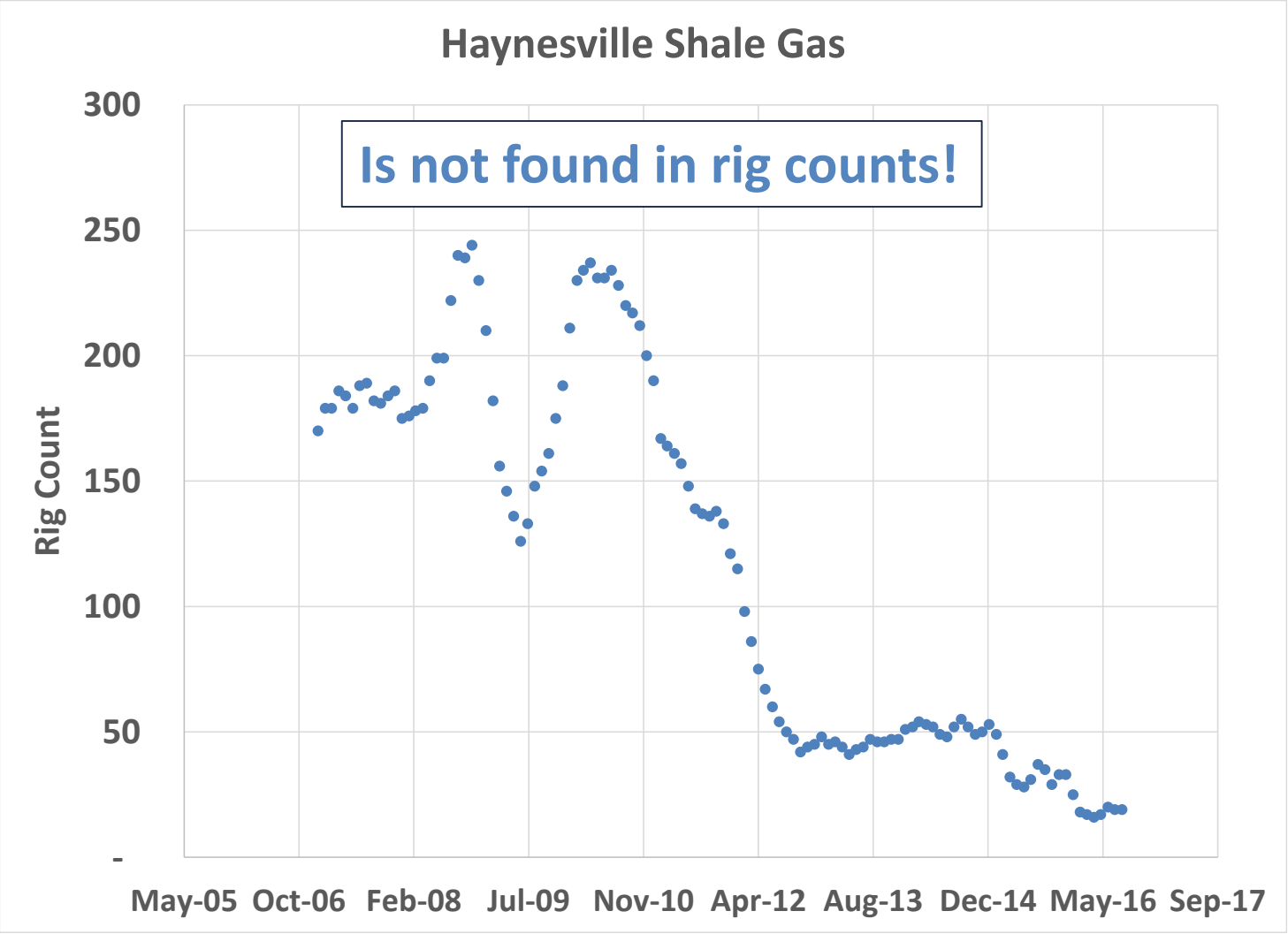
Concentrated
- "Exploration" doesn't apply
- 80% sourced from < 5 plays

Statistical
- 80% value derives from 20% of wells; high decline rate
- Many wells …. Drilling never stops

Manufacturing Learning
- Improvement never stops
- Many wells … Drilling never stops

Infrastructure
- Many stakeholders over a long-time
- Preferences change over time creating long-term risks

The resurgence of shale gas



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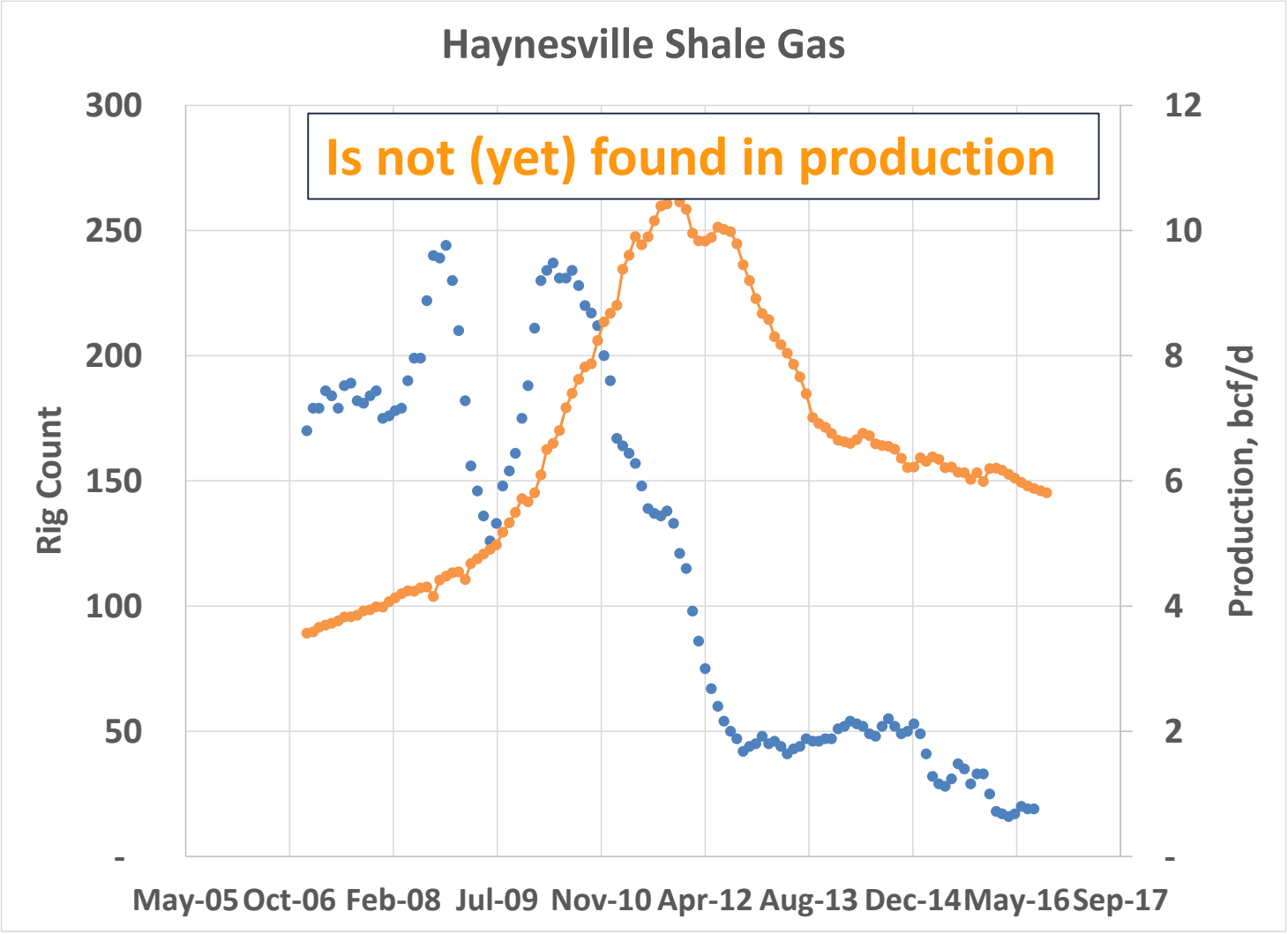

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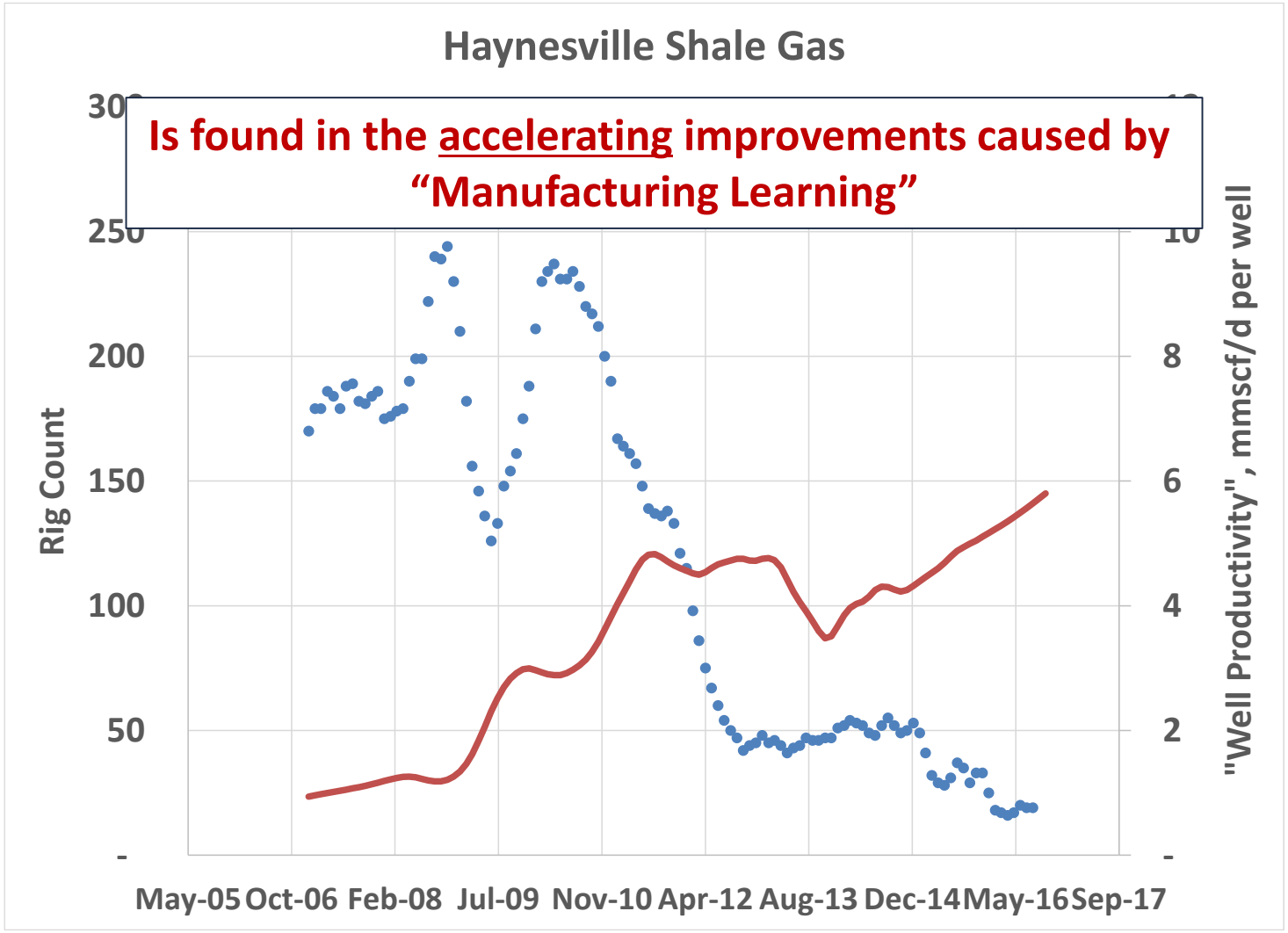

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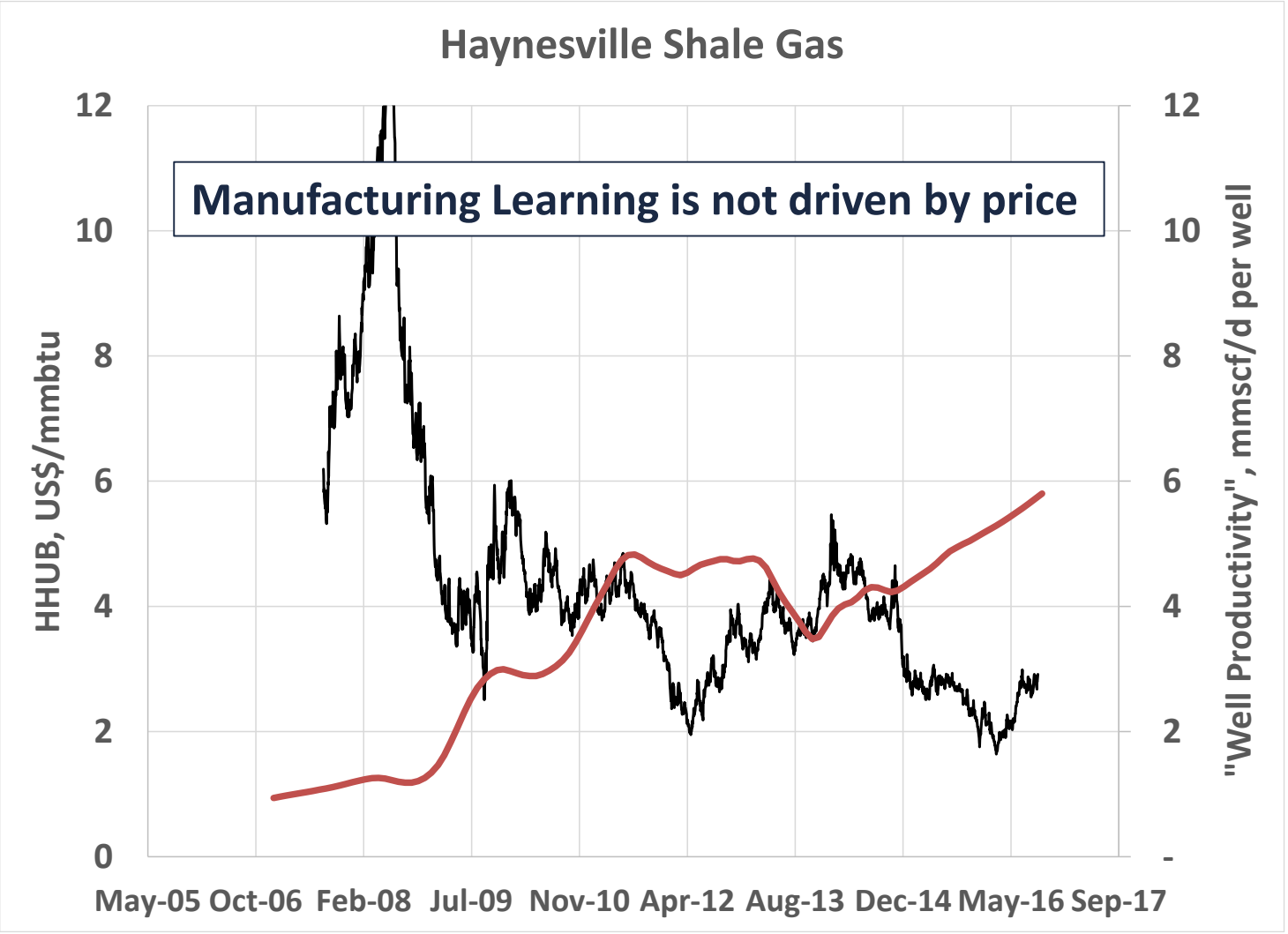

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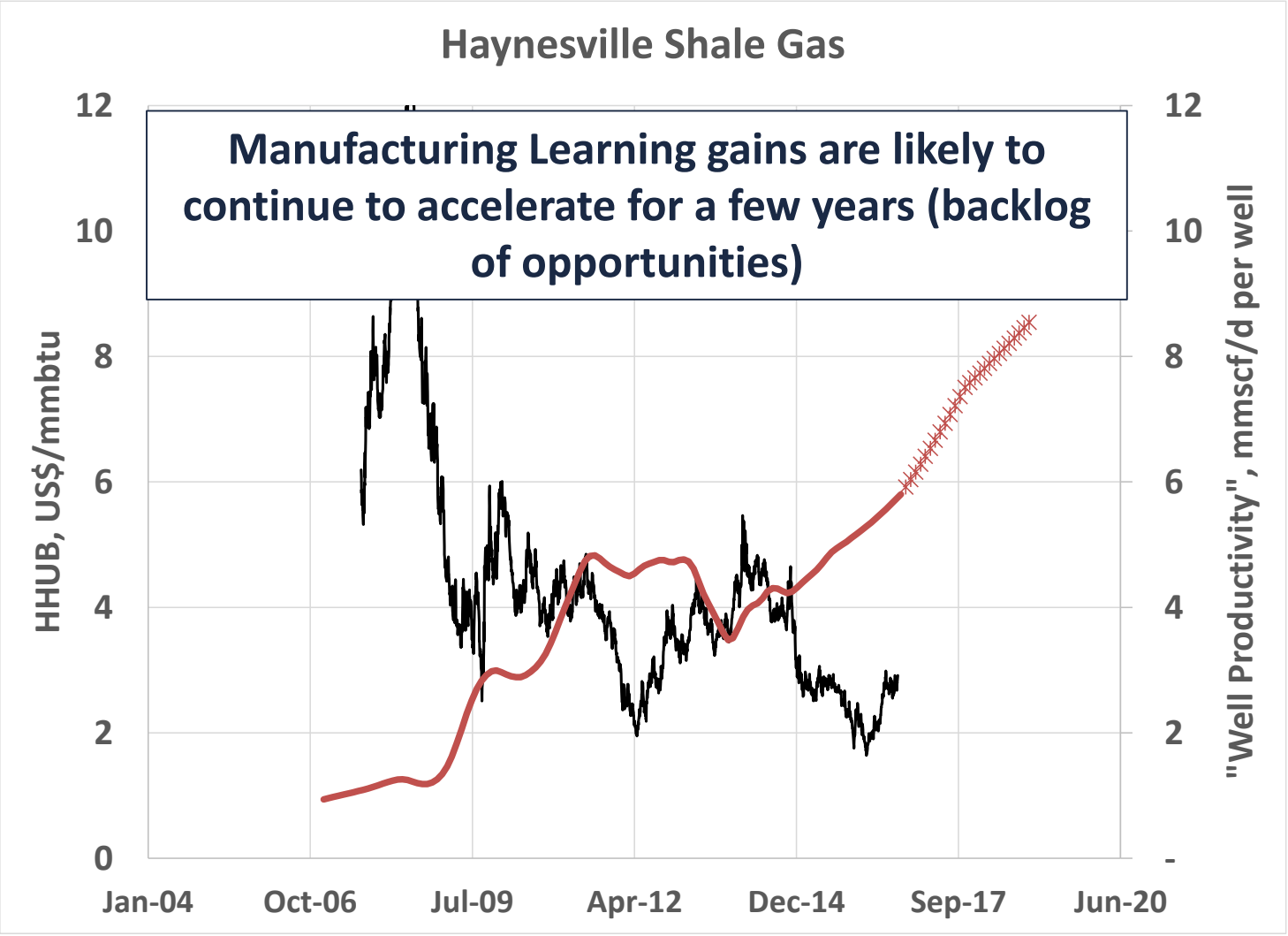
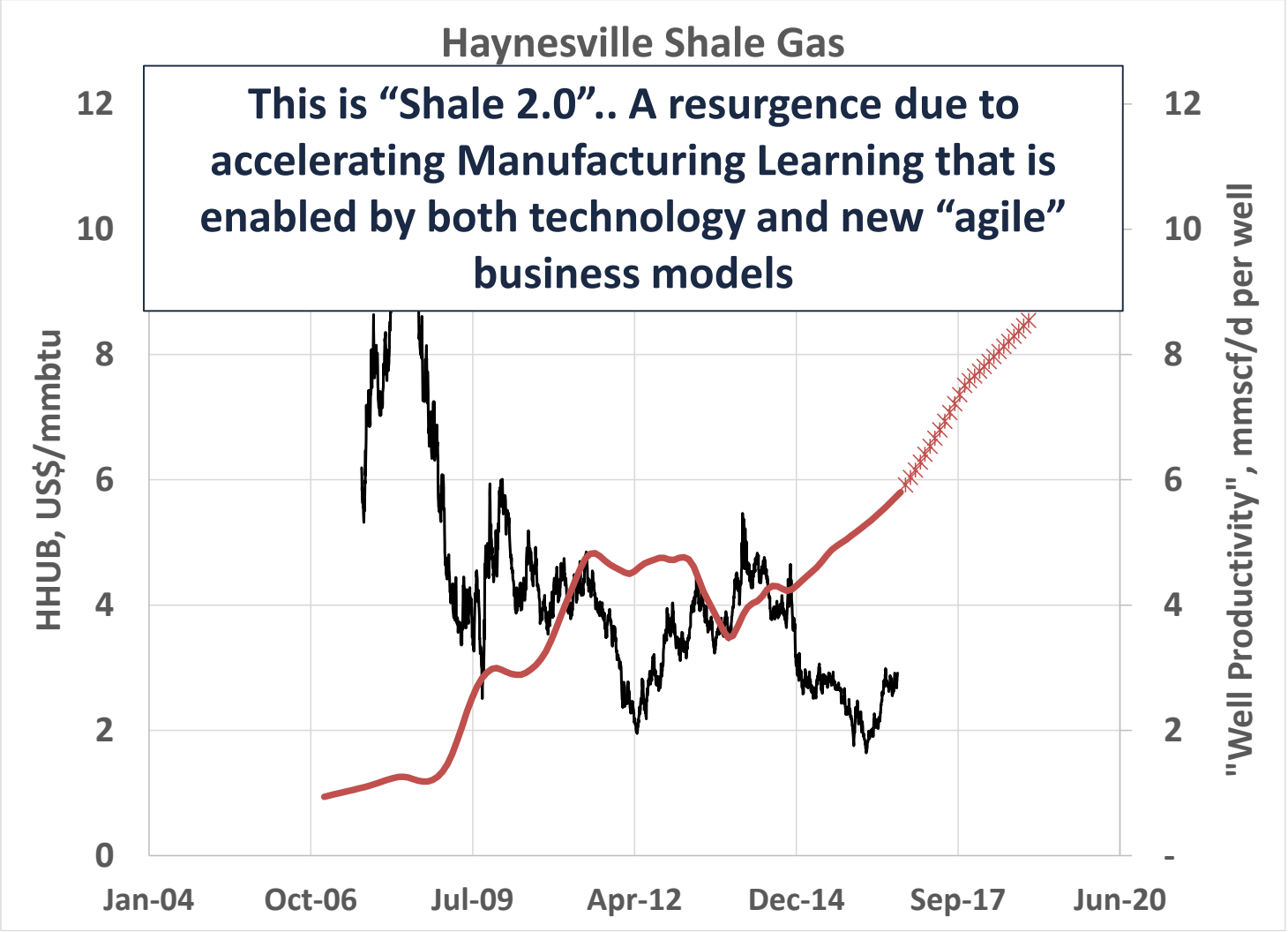
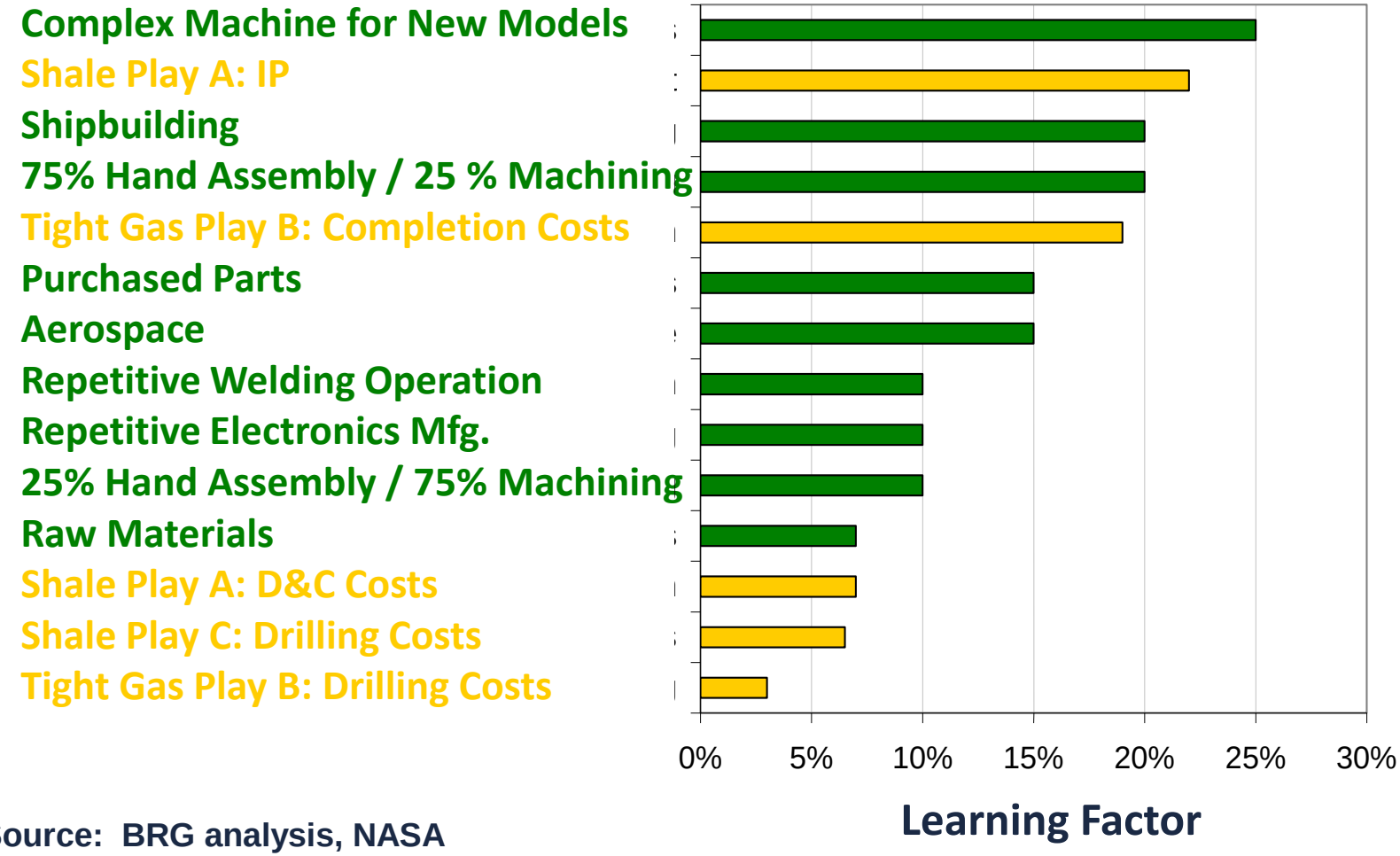


The resurgence of shale gas



"Manufacturing Learning" in Shale 2.0 is similar to other industries

Comparison of Manufacturing Learning across industries

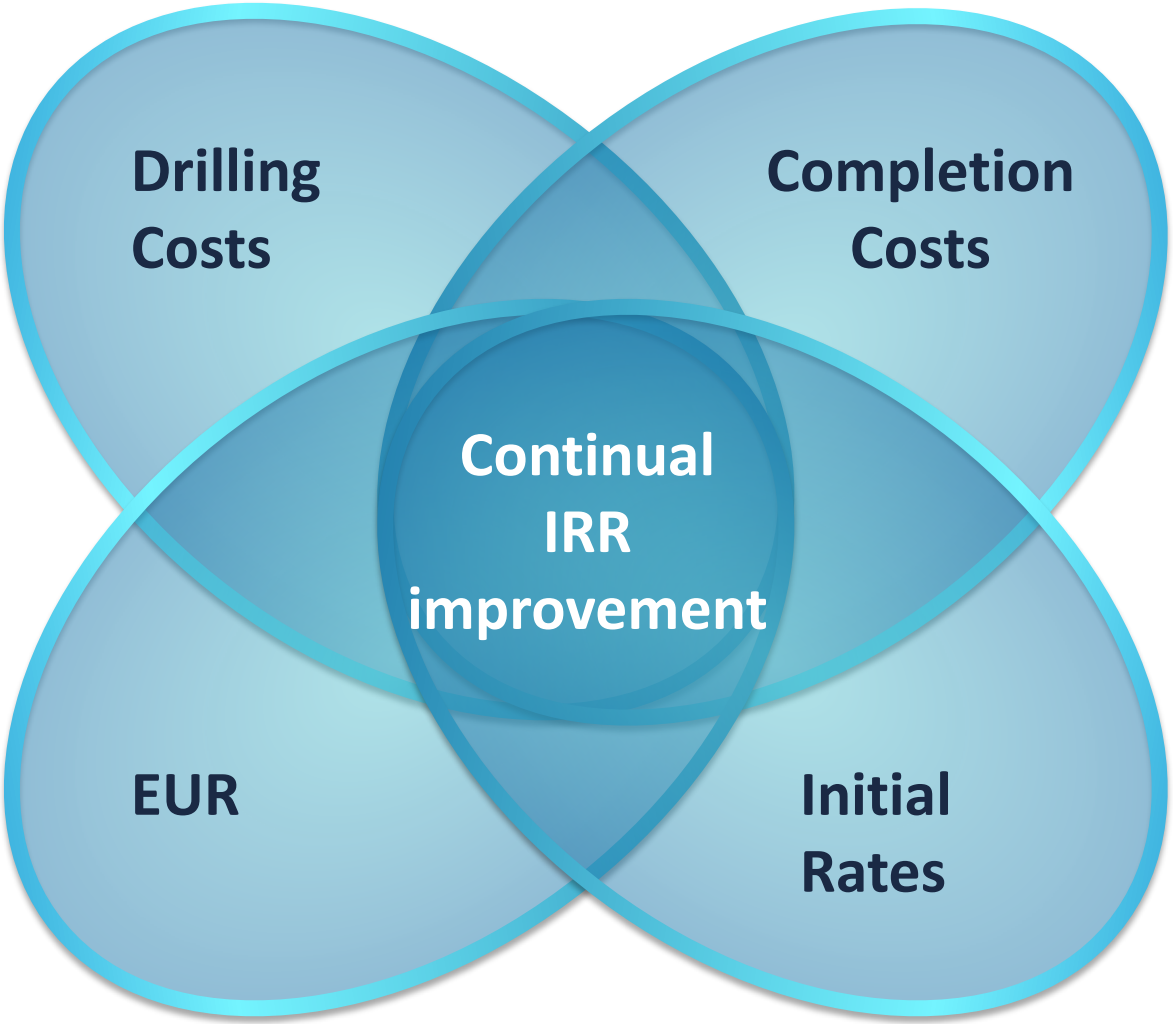


Source: BRG analysis, NASA

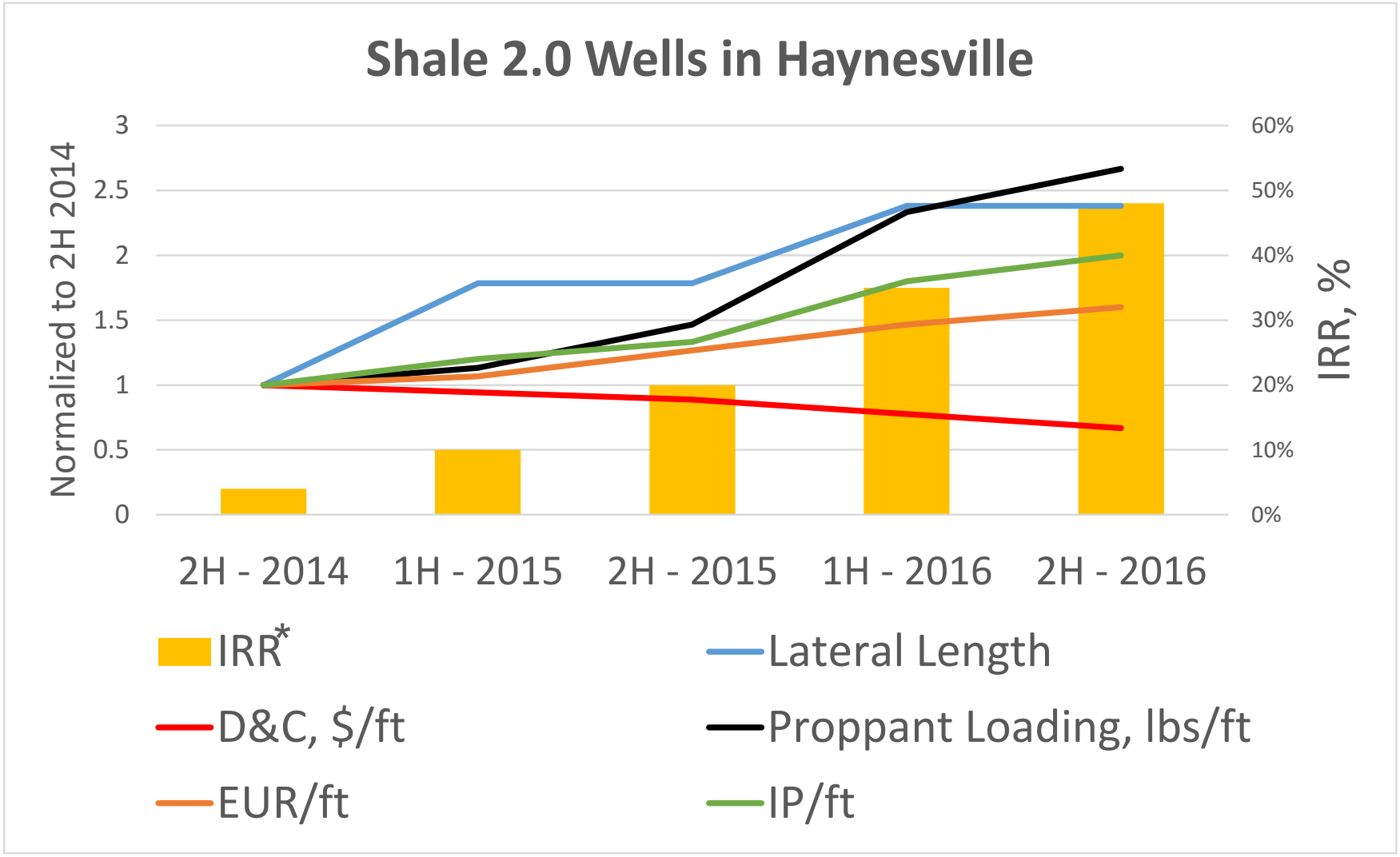
“Moore’s Law” for Shale 2.0

Every time the # of wells doubles, the IRR improves by 20%

(at constant commodity prices)



Shale 2.0 Example

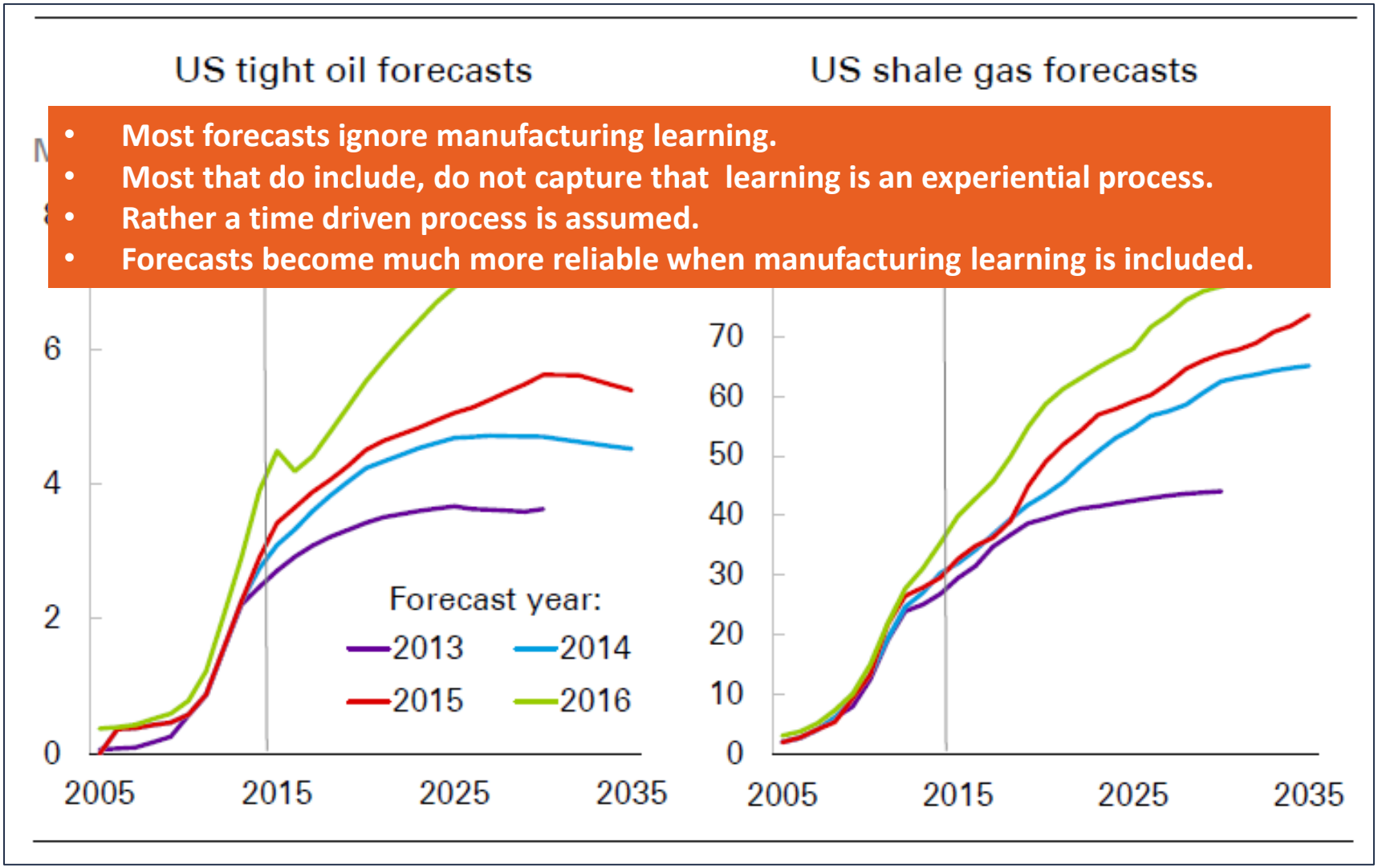


*at $3.00 mscf flat

Implications of Shale 2.0

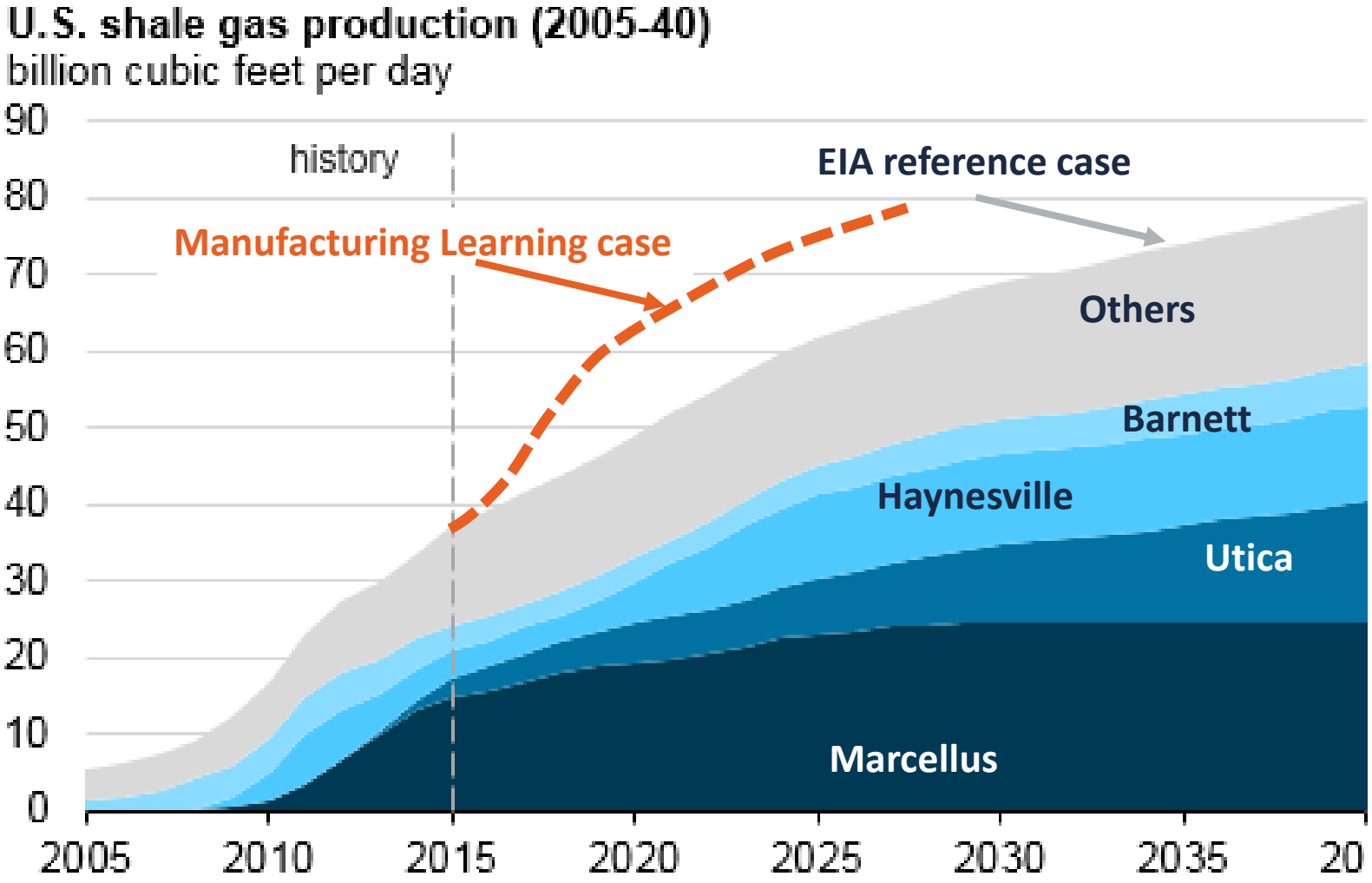
- **Current forecasts are likely wrong**
  - Because manufacturing learning isn't captured correctly; not due to uncertainty

Forecasts have been, and likely are, wrong (play & aggregate level)



Source: EIA, BP 2016 Energy Outlook

Production forecast with manufacturing learning



Source: BRG analysis, EIA

Implications of Shale 2.0

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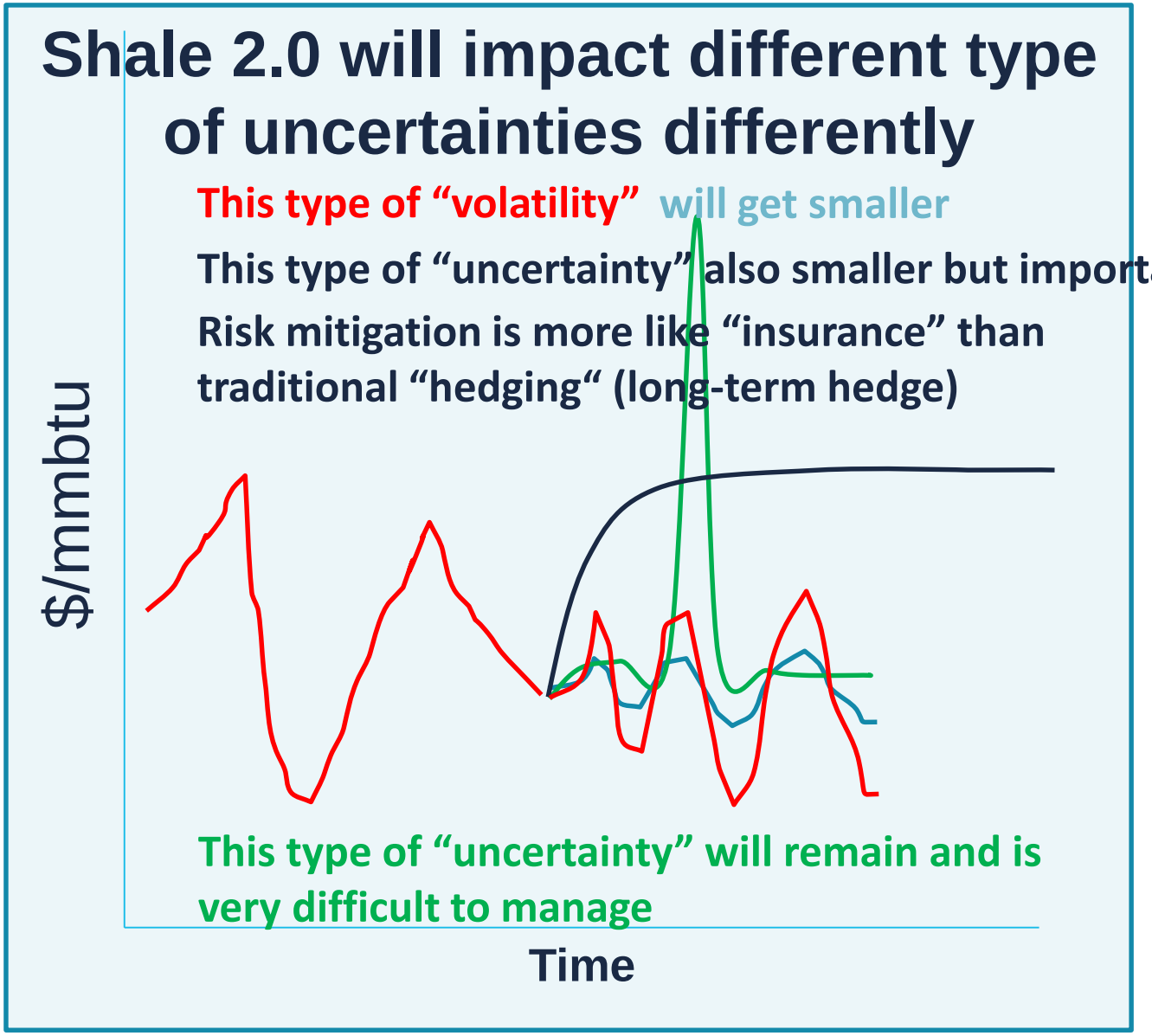
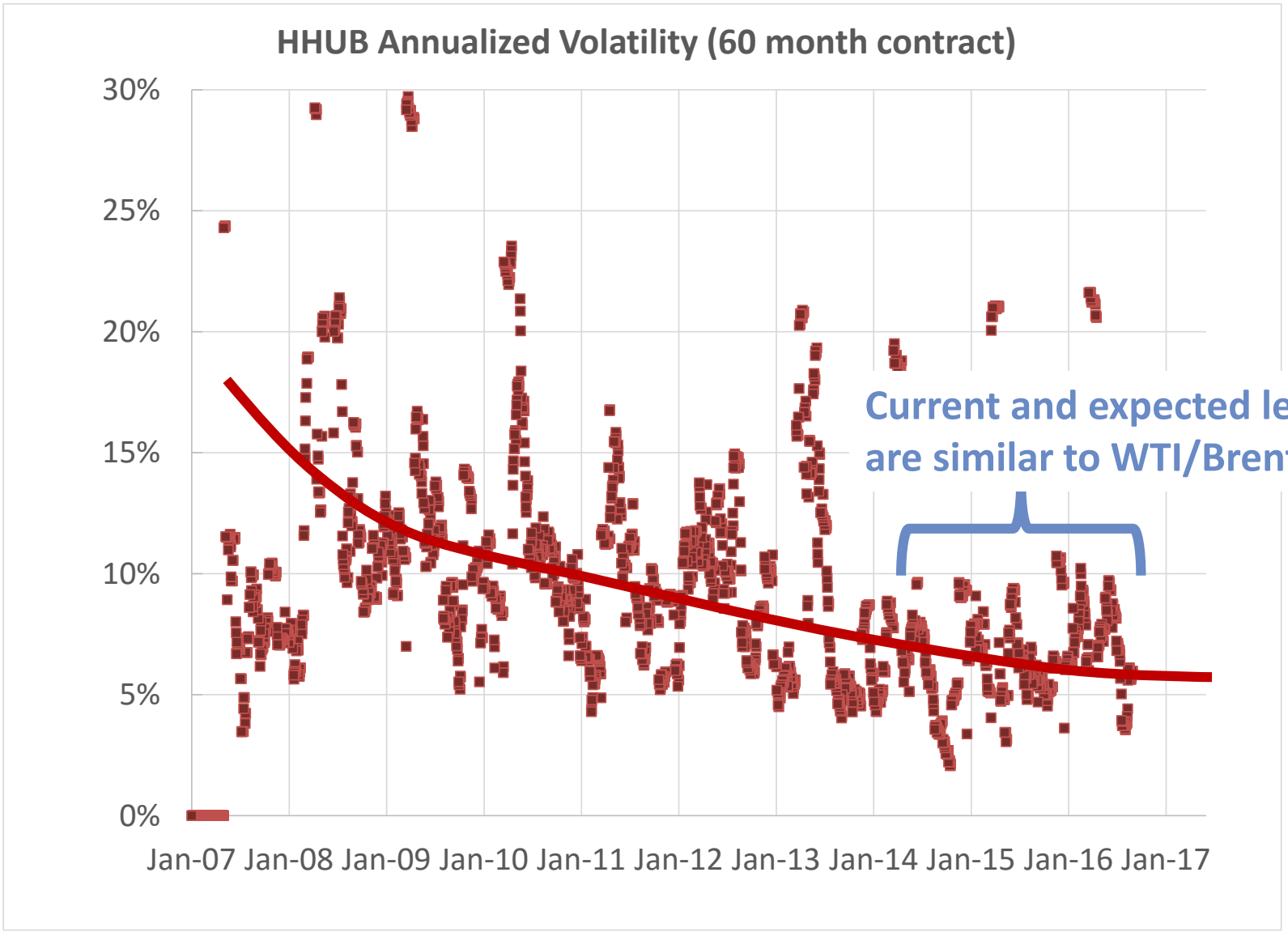
- **HHUB price dynamics will (are!) change (ing!)**
  - Volatility is reduced but long-term uncertainty remains
    - Long-term hedge = "Insurance" = buying reserves

“Volatility”


Shale 2.0 will impact different type of uncertainties differently
This type of “volatility” will get smaller
This type of “uncertainty” also smaller but important
Risk mitigation is more like “insurance” than traditional “hedging“ (long-term hedge)
$/mmbtu
This type of “uncertainty” will remain and is very difficult to manage
Time

Volatility of long-term price indicators has fallen substantially



Asian buyers of US LNG should consider price "insurance" via reserves purchase

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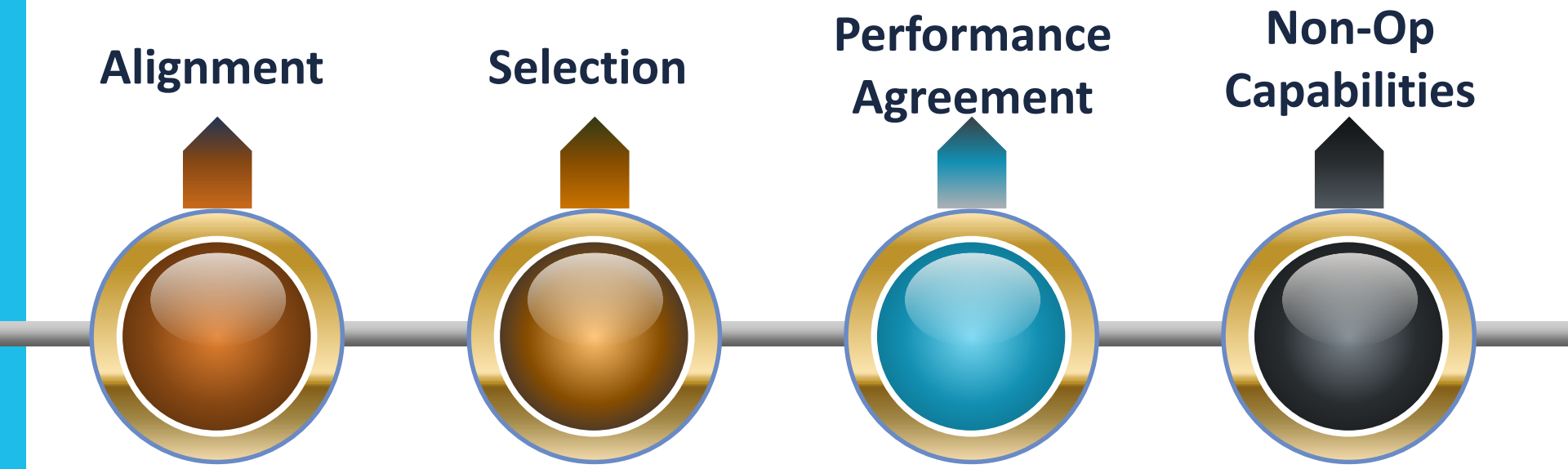

Alignment	Selection	Performance Agreement	Non-Op Capabilities
Engage stakeholders "early & often"; define program success; need for many years of PUDs; value of "hedging"	Cast a broad net for operators; "manufacturing learning" more important than size; don't restrict geography	Negotiate production & cost performance guarantee with operators for sliding scale ownership of upside	Leverage JoA and other agreements, build capabilities to be "active participant"

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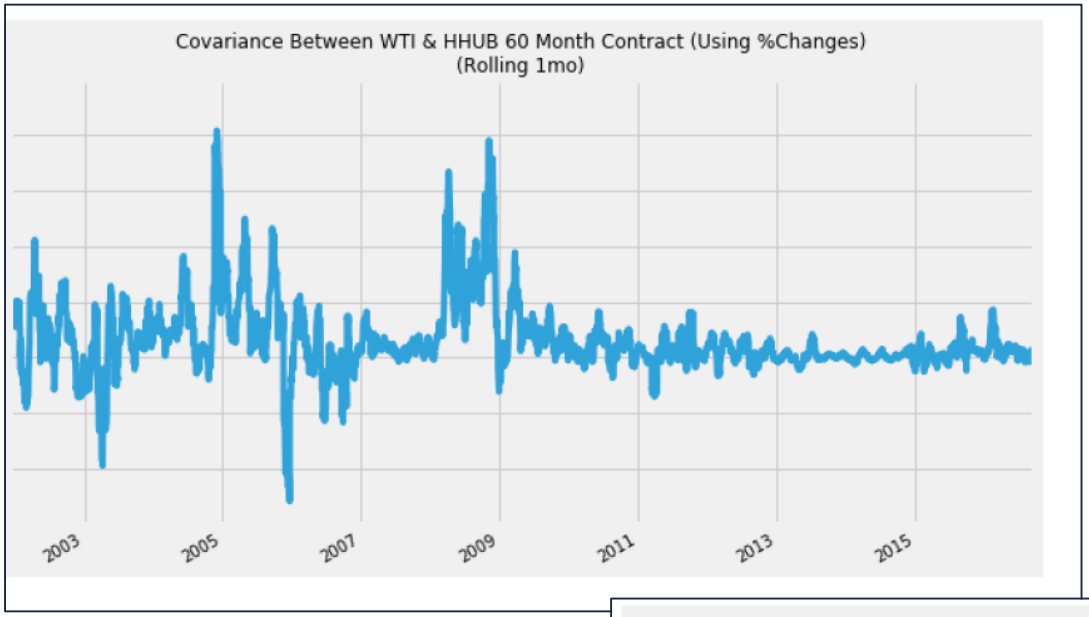
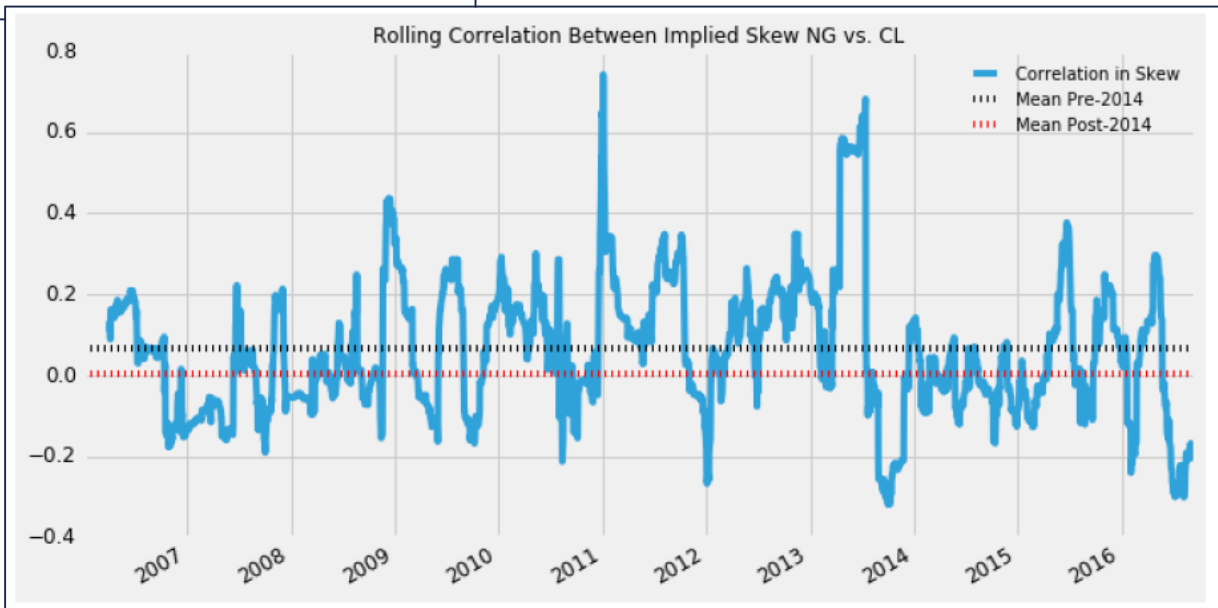
  - HHUB and WTI/Brent further decoupled
    - "all of the above" supply strategies (US Gulf Coast + other crude linked) for Asian LNG are more resilient

Correlation of HHUB/Crude will continue to diminish significantly



Correlation factor has declined by over half in last 2 years and is expected to continue to decouple

Examination of "skewness" (implied vol. of calls/implied vol. of puts) reveals demand for long-term "insurance" is already growing



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- **Where's the demand?**
    - SSLNG, FSRUs match Shale 2.0 growth profile well

Demand from "traditional" LNG market is oversupplied until ~mid-2020s

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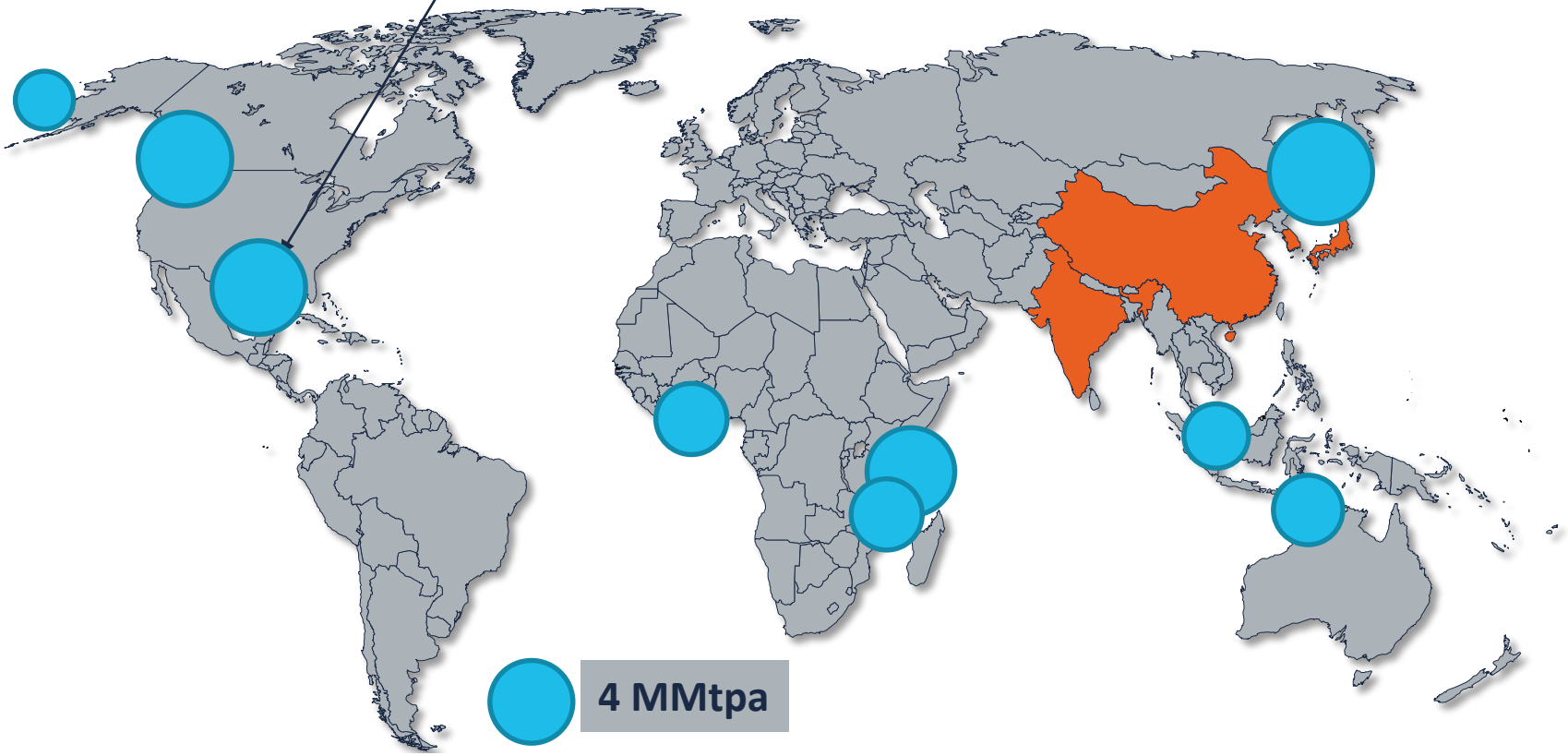
Only 1 (Magnolia) of the almost 20 MMtpa projects that could take FID in the next 12-18 months are directly linked to Shale 2.0.

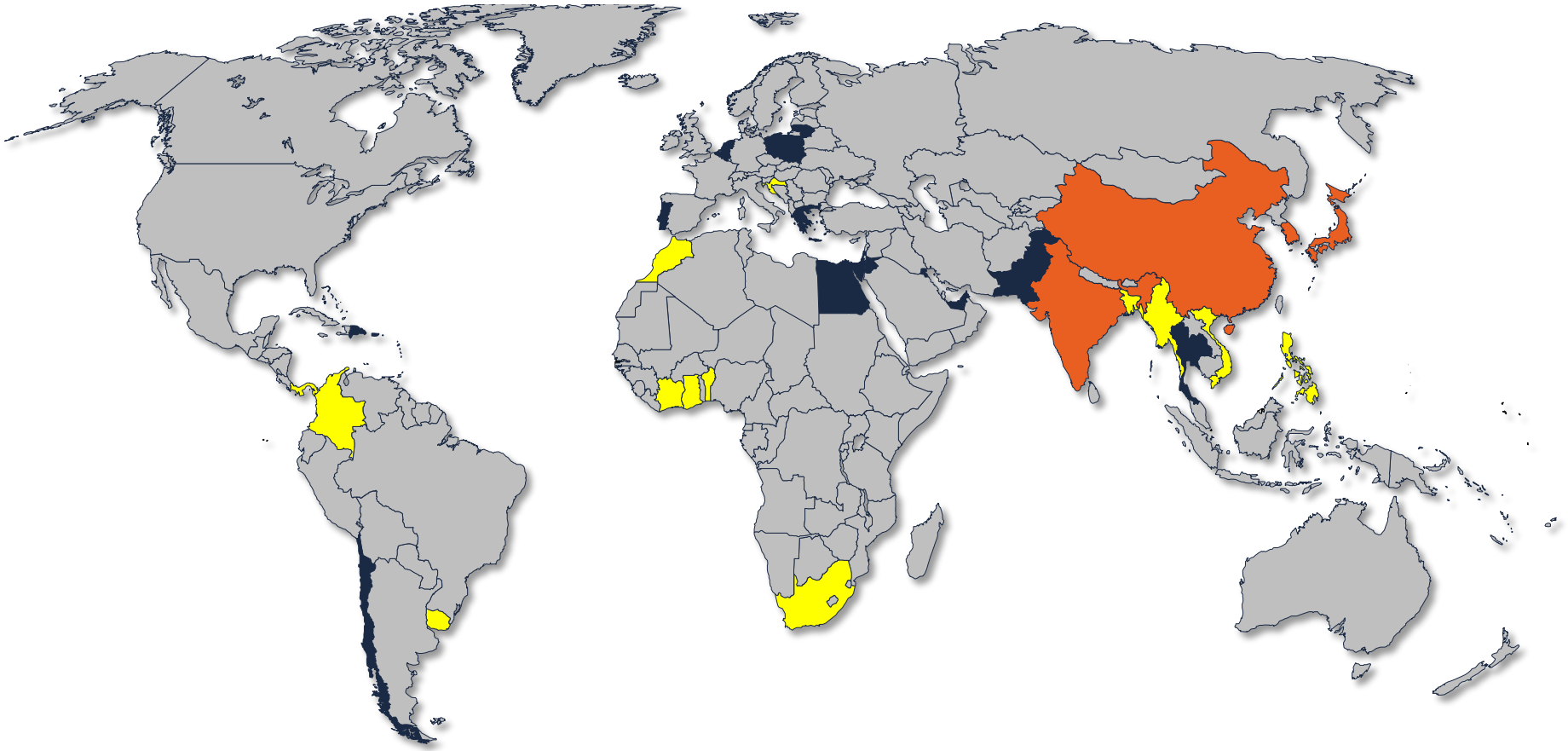
The "big 4" demand centers of traditional LNG account for almost two-thirds of global demand



Projects likely to take FID (or not!) in next 12-18 months

To grow, think small

Small markets (< 3mmtpa, black) have grown their market share by over 50% over the last two years and now account for ~15% of the global market. An equal number of smaller markets are actively trying to establish Small-Scale LNG (SSLNG, yellow).



Shale 2.0 meets the needs of SSLNG better than traditional "big-box" plays

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Small means… Small

- Manufacturing learning increases rates gradually

Small means … Fast

- Shale 2.0 "optionality"

Small means …. Flexible

- Shale 2.0 "optionality"

Small means … Diverse

- Transportation, chemicals, etc.

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