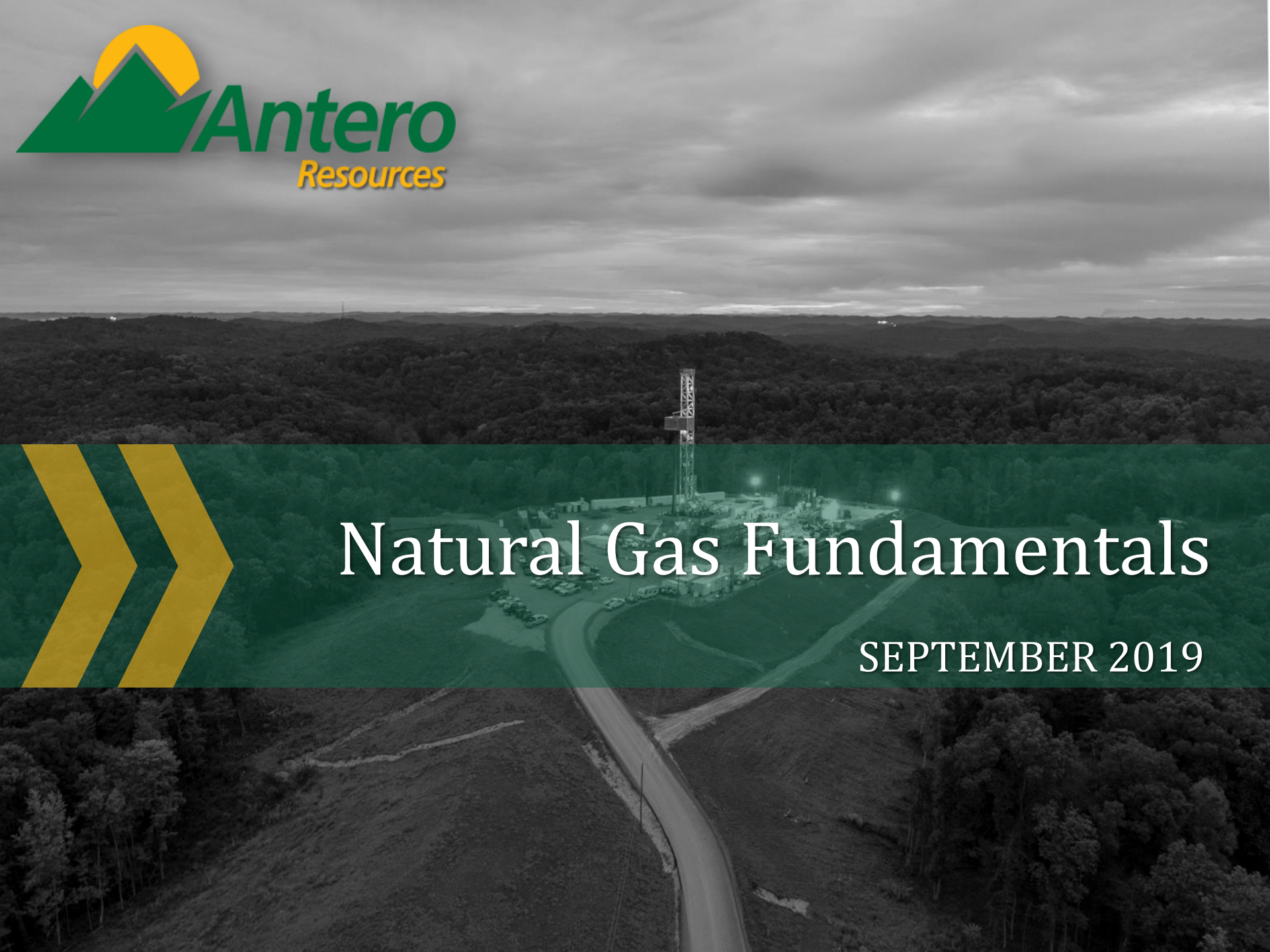

Natural Gas Fundamentals

SEPTEMBER 2019

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Natural Gas Market Overview & Outlook

1 2019 Year-To-Date Snapshot

- **The natural gas front month price has declined 41% year-to-date as record injections to storage in May and June dampened sentiment. Demand has actually been the culprit:**
  - Maintenance at LNG facilities reduced exports to 4.9 Bcf/d average in April/May, touching 3.1 Bcf/d in early April [(2)]. Further maintenance during August reduced exports to 4.5 Bcf/d.
  - Mexico exports declined by 5% in April due to pipeline downtime
  - Mild spring weather resulted in lower than forecast power burn. Despite this negative heating/cooling degree day impact, power burn in August of 2019 was 4% above the same period in 2018
- **While U.S. supply growth was moderate during the first half of 2019, the markets are pricing in Permian growth from GCX in-service expected in October 2019**
  - First half 2019 U.S. supply growth was just 1.2 Bcf/d compared to 4 Bcf/d in 2018
  - Supply growth driven primarily by Haynesville, Eagle Ford and Scoop Stack
  - The Gulf Coast Express in-service is expected to increase Permian volumes by 2 Bcf/d by year end 2019

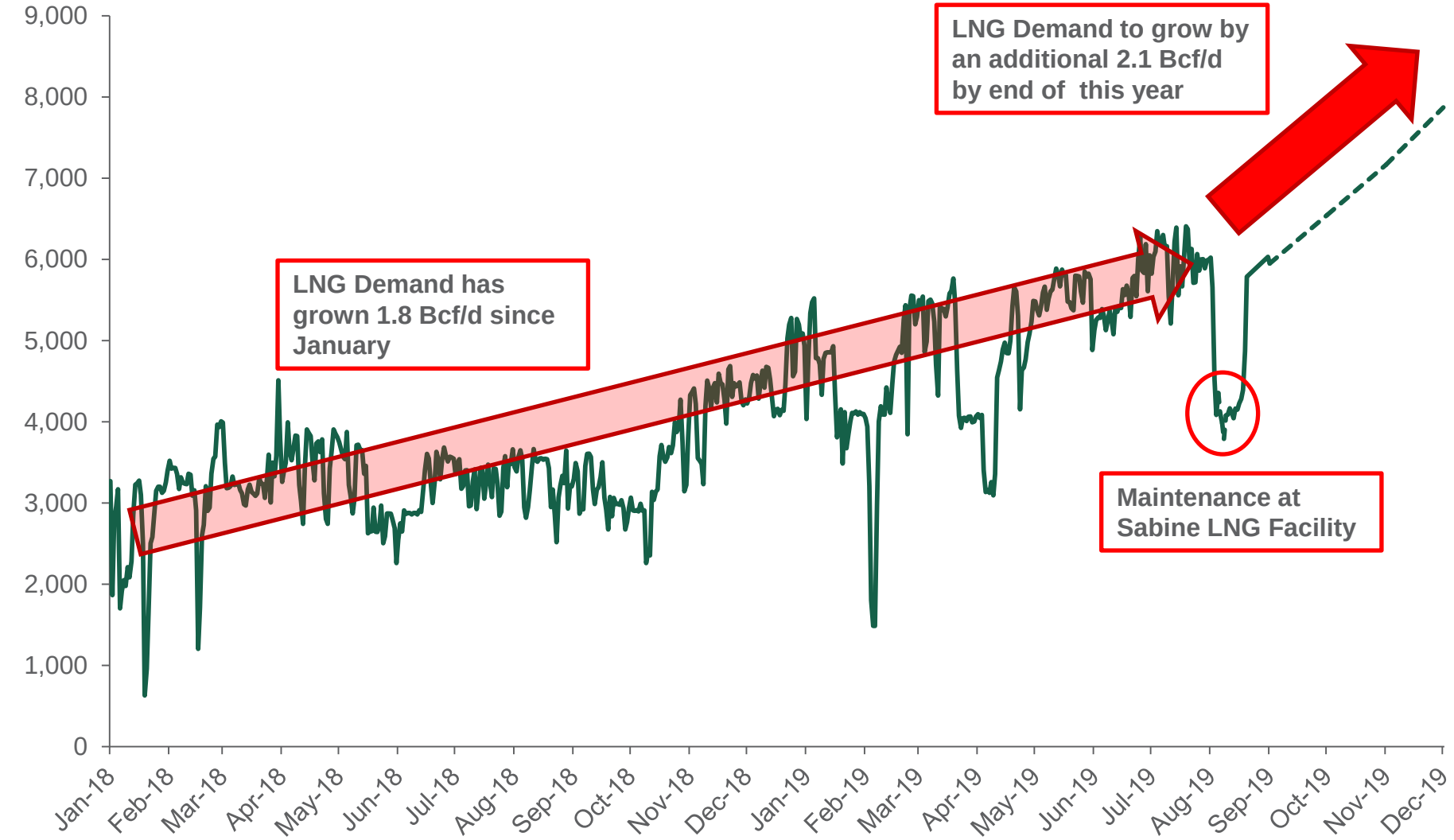
2 Remainder of 2019 & Beyond Outlook

- **Demand accelerated during the summer season due to structural demand**[(2)]
  - LNG exports increased to over 6 Bcf/d in early July, benefitting from the recent start up of Cameron LNG
  - Mexico exports forecasted to grow to over 6 Bcf/d during 2020
  - Power burn demand averaged a record 37.7 Bcf/d this summer, an increase of nearly 3% from 2018, driven by continued coal plant retirements, gas fired capacity additions and higher utilization of gas fired generation. [(2)]
- **Second wave LNG timelines could accelerate as momentum continues with FERC approvals and projects compete to secure supply agreements and sales contracts**
  - Gap between 1st and 2nd wave projects has narrowed to just a nine month period during 2021 and could see further tightening as projects compete for the competitive advantage of early 2nd wave startups
- **Exit-to-exit U.S. supply growth expected to slow dramatically in 2020**
  - Projected growth of just 2.6%, below estimated demand growth of 4% next year

1) Based on S&P Global Platts estimates for 4Q over 4Q production
2) Based on S&P Global Platts estimates

LNG Exports

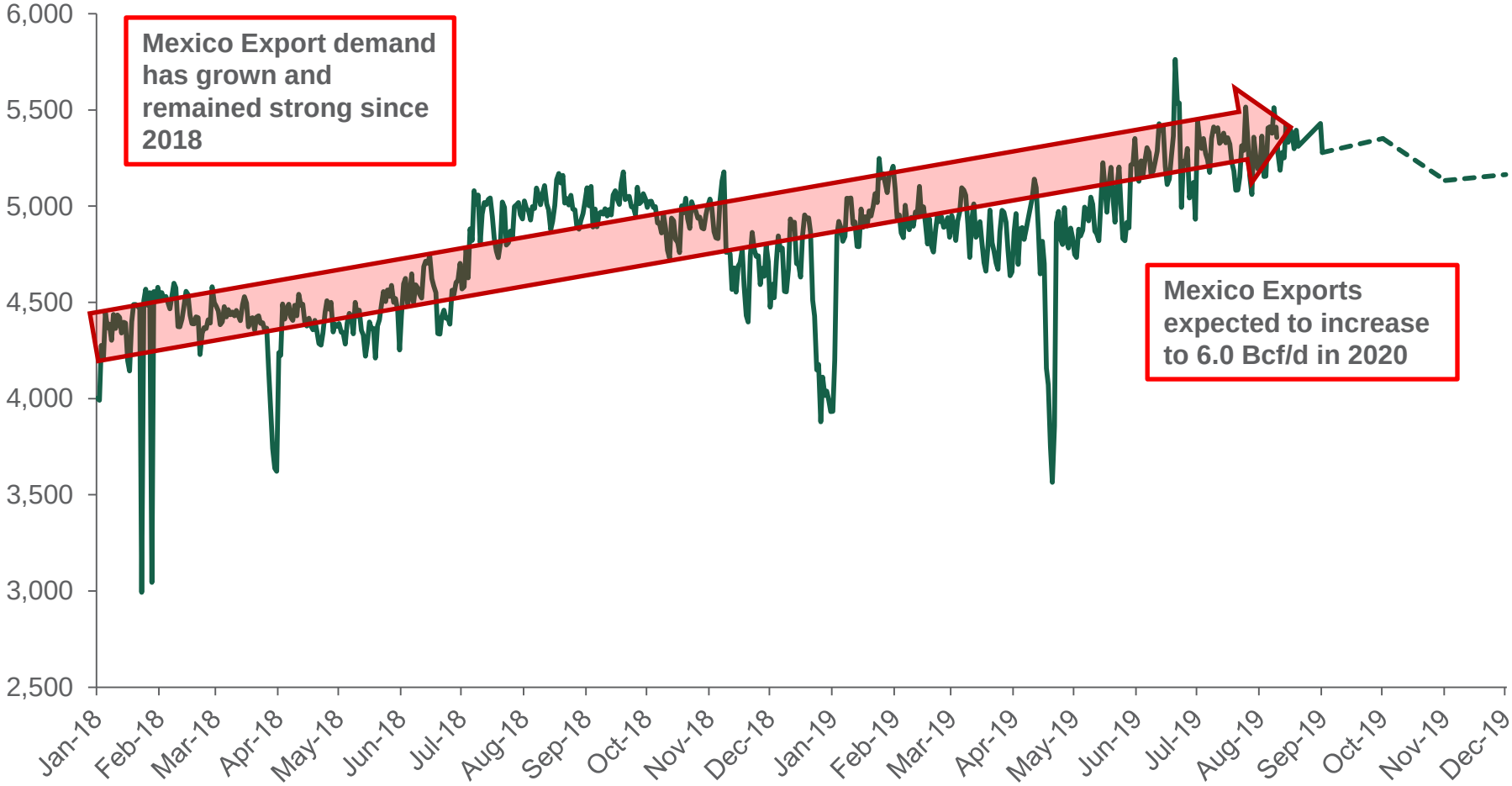
- Weaker than expected feedgas demand has amplified the U.S. excess supply problem



Source: S&P Global Platts.

Mexico Exports

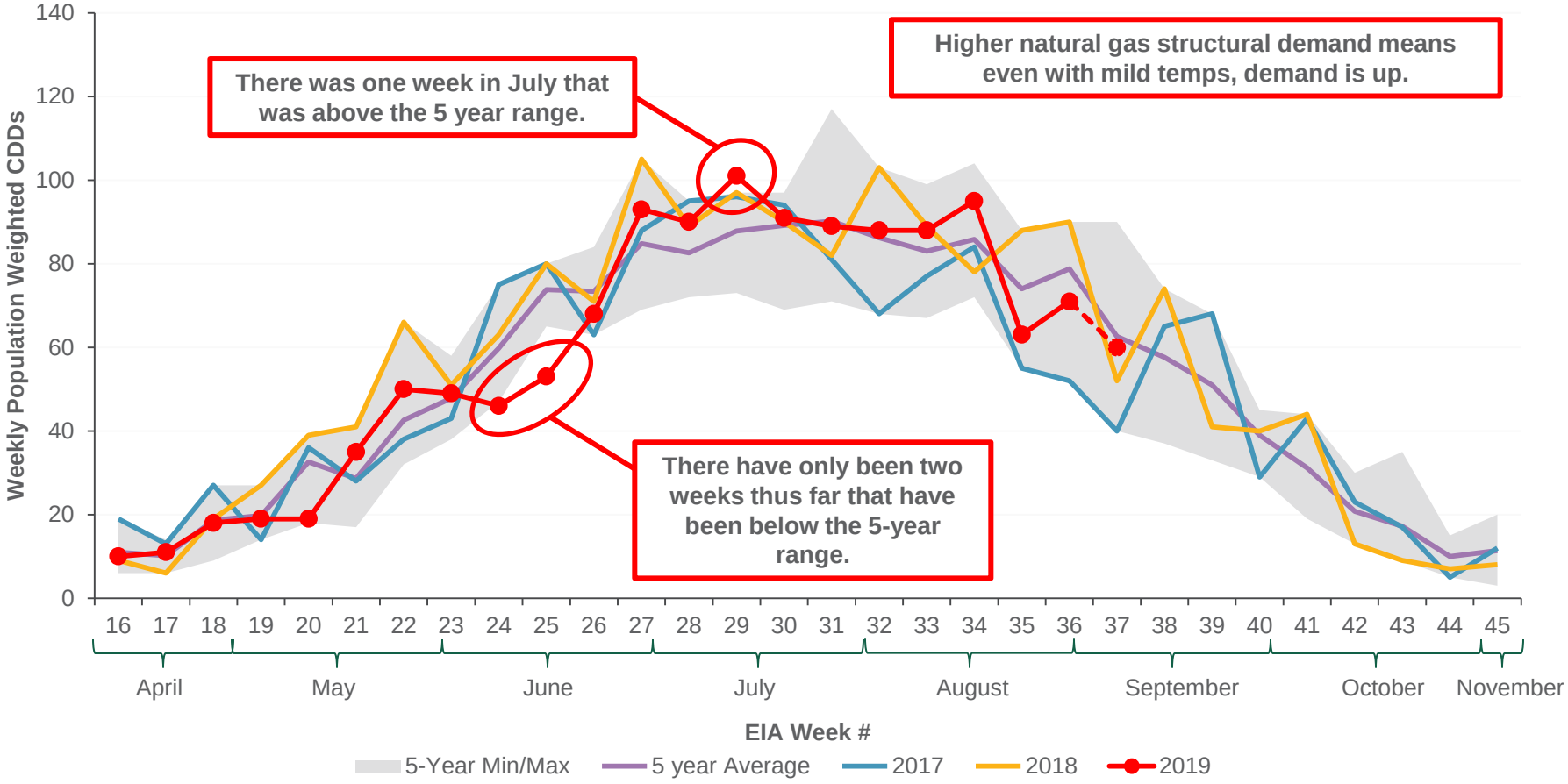
- Mexico exports have continued to increase steadily since 2018 despite the major delays on connecting downstream projects in Mexico
- Reaching a high of 5.7 Bcf/d of exports, that is ~60% of Mexico's total demand[(1)]
- The recent pipeline agreement with the Mexican government leads to additional capacity into Mexico and is expected to push exports to 6 Bcf/d this winter.



Source: S&P Global Platts
1) Assumes 9.0 Bcf/d total demand in Mexico

Historic Summer Weather Look

- **The month of July and first three weeks in August had cooling degree days (CDDs) above the 5-year average for eight weeks in a row**
- **There have only been two weeks this storage injection season where CDDs have been below the 5-year range, and that was back in June**
- **Because of the structural demand shift in power burn relying more on natural gas, weather has a more volatile effect on gas**



Source: S&P Global Platts

Key Macro Takeaways

Strong demand fundamentals combined with the sheer magnitude of the base supply decline are underappreciated by the market

1 U.S. Natural Gas Demand Growth to Remain Strong in 2019+, Led by Exports

- Total U.S. demand expected to grow by ~12 Bcf/d, or 13% from 2019 – 2023[1]
- Net exports account for 8.4 Bcf/d, or 73% of the total demand growth[1]

2 Challenges to Meet Needed Supply Growth Through 2023

- ~23 Bcf/d of new supply needed to offset the 27% base decline[2] for total U.S. supply in 2019 alone
- Another 3 Bcf/d of new supply needed to meet demand growth in 2019
- While associated gas will deliver a relatively price insensitive base load, associated gas alone cannot deliver the needed new supply; dry gas producers will require higher gas prices to incentivize drilling

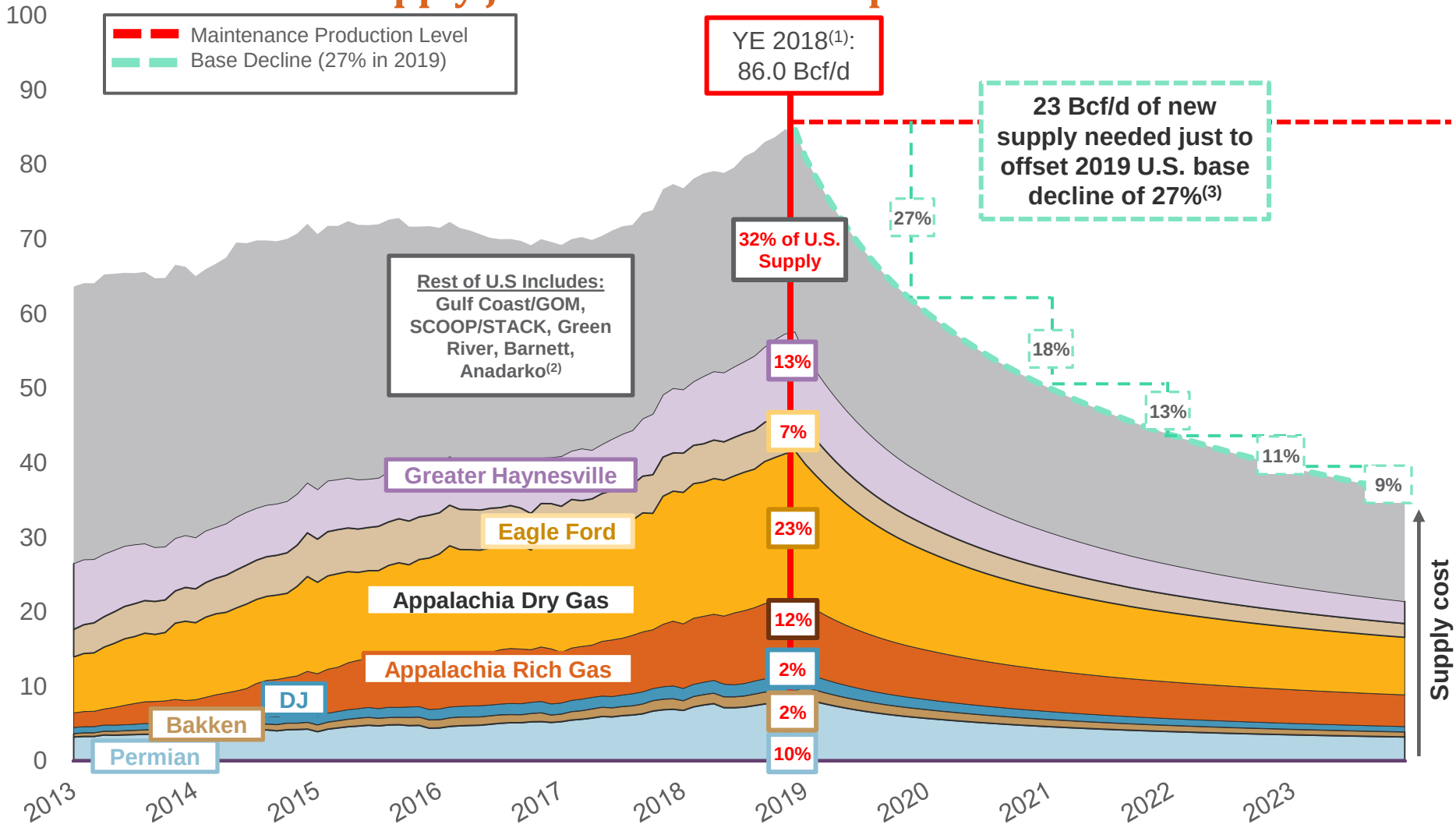
3 Near-Term Tailwinds to Natural Gas Prices

- Despite mild spring weather, average monthly power burn is nearly 1 Bcf/d higher YTD 2019 compared to the same period in 2018 and is 20% above the five year average.
- LNG export demand expected to double to nearly 8 Bcf/d by year-end 2019 as new U.S. liquefaction capacity comes online [1]
- Appalachian gas producers have reduced 2019 capital budgets by an average of 21% vs. 2018 [3]
- Supply growth in 2019 and 2020 is expected to slow substantially based on guidance updates and commentary during 2Q19 earnings calls from the top U.S. gas producers [3]
- Dry gas rig count has declined 24%, or 34 rigs, since March 15th with producers recently indicating further rig reductions against deteriorating natural gas strip
- Completion crews have declined 16% from the 2019 peak of 482 during the week of April 5th, to 405 during the week of August 23rd, as activity levels and production growth slows with lower natural gas prices

1) *Based on S&P Global Platts estimates.*
2) *Base decline calculated using 4Q over 4Q forecast production rates for all wells producing as of year-end 2018 based on Platts bottoms up well by well analysis. See appendix for detailed calculations.*
3) *Public company filings (APC, AR, BP, CNX, COG, CVX, DVN, EQT, ECR, GPOR, NFG, RRC, SWN & XOM)*

U.S. Gas Supply and Base Decline

Significant U.S. base decline requires substantial new supply just to maintain flat production

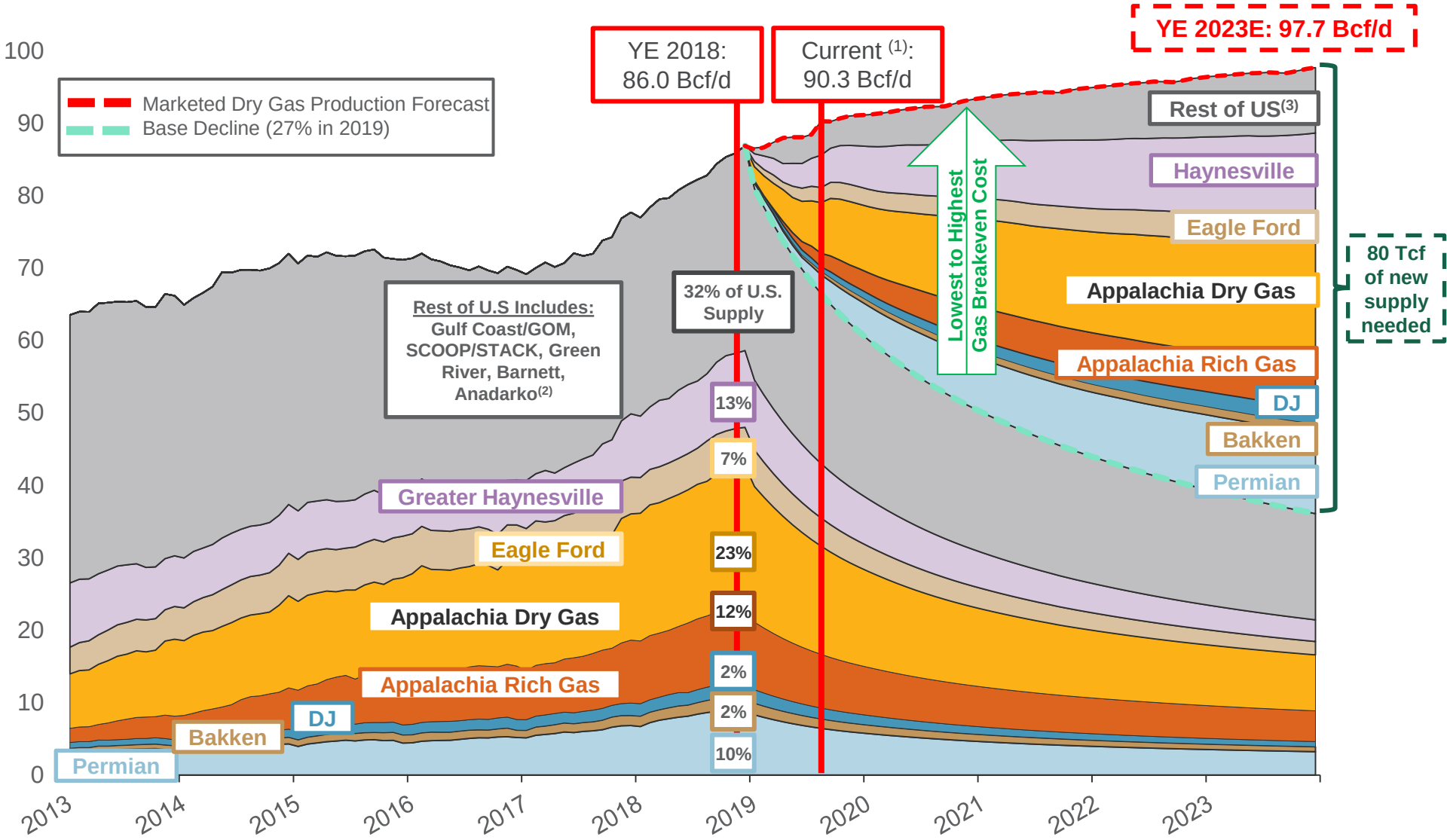


Source: S&P Global Platts. Note: Platts supply forecast through 2023 is within a 2% tolerance of EIA's supply forecast over the same period.

1) *Historical and forecasted volumes from Platts Analytics.*
2) *Top five basins/plays that are included in the Rest of U.S.*
3) *Base decline calculated using 4Q over 4Q forecast production rates for all wells producing as of year-end 2018 based on Platts bottoms up well by well analysis. See appendix for detailed calculations.*

U.S. Gas Supply and New Supply Wedge

Material demand growth through 2023 plus base decline requires 80 Tcf of new supply

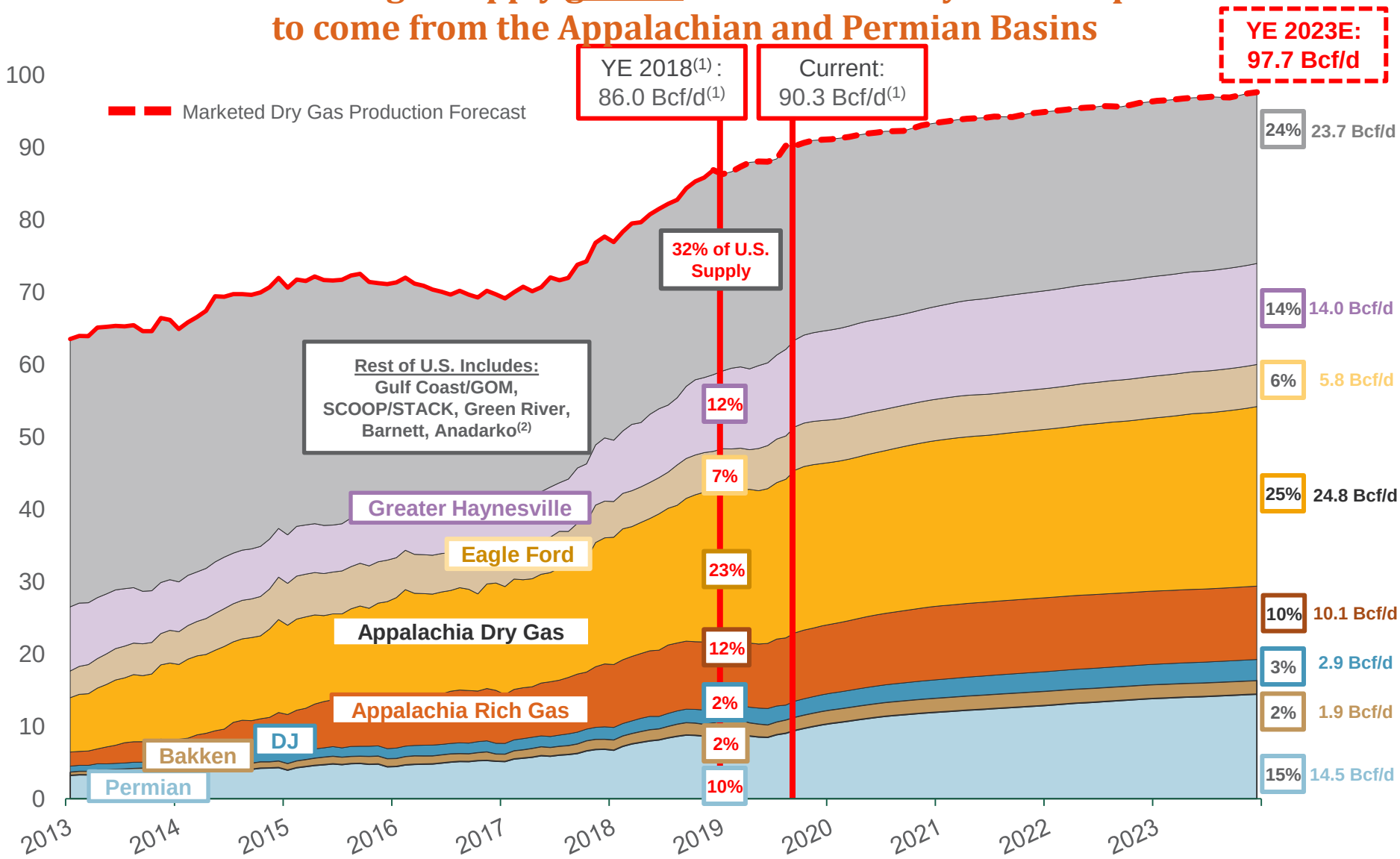


Source: S&P Global Platts. Platts supply forecast through 2023 is within a 2% tolerance of EIA's supply forecast over the same period.

1) *Historical and forecasted volumes from Platts Analytics. Current volumes as of August 2019.*
2) *Top five basins/plays that are included in the Rest of U.S. are GOM, SCOOP/STACK, Green River, Barnett and Anadarko.*
3) *Base decline calculated using 4Q over 4Q forecast production rates for all wells producing as of year-end 2018 based on Platts bottoms up well by well analysis. See appendix for detailed calculations.*

U.S. Gas Supply Growth Forecast

Almost all U.S. gas supply growth over the next 5 years is expected to come from the Appalachian and Permian Basins



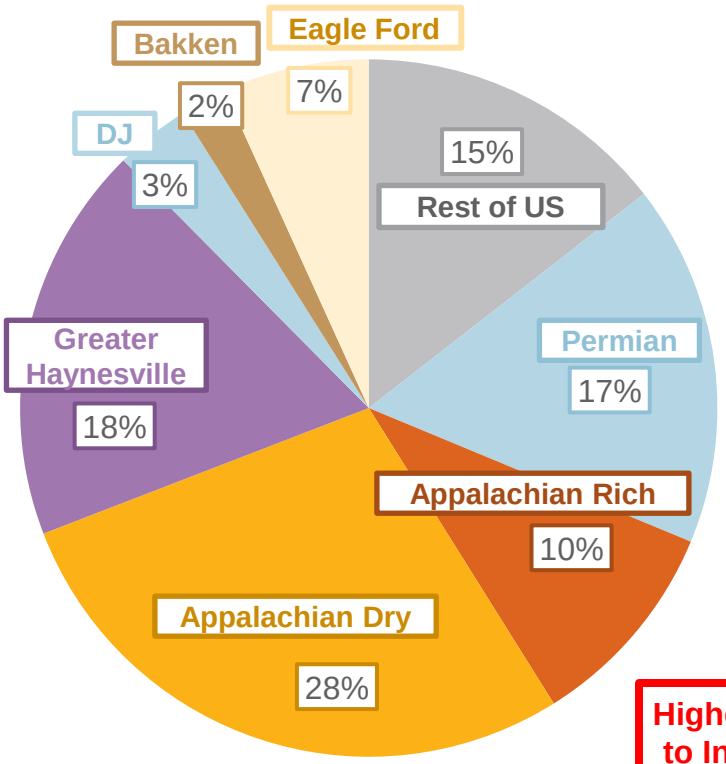
Source: S&P Global Platts. Platts supply forecast through 2023 is within a 2% tolerance of EIA's supply forecast over the same period.

1) *Historical and forecasted volumes from Platts Analytics. Current volumes as of August 2019.*
2) *Top five basins/plays that are included in the Rest of U.S.*

New Gas Supply Breakdown

45% of new gas supply needed in the 2019-2023 period is forecast to come from plays with breakeven gas prices that are higher than the long-term 2020-2023 strip ~$2.48/MMBtu

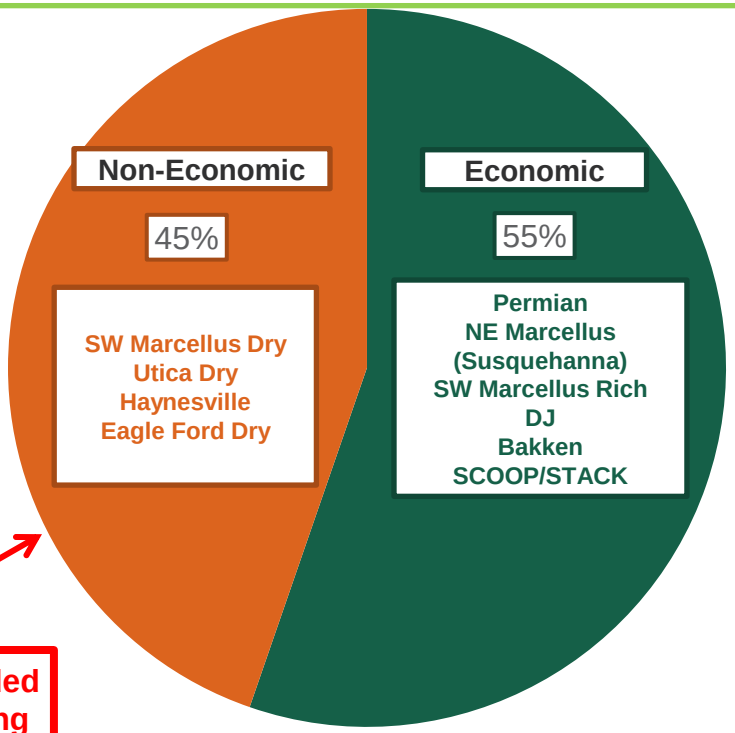
New Supply Contribution by Basin



80 Tcf New Supply Needed Through 2023 (1)

Economic vs Non-Economic New Supply

Breakeven Price Yields Pre-tax ROR of 25%(2)
Non-Economic = Breakeven Price > $2.48 Strip



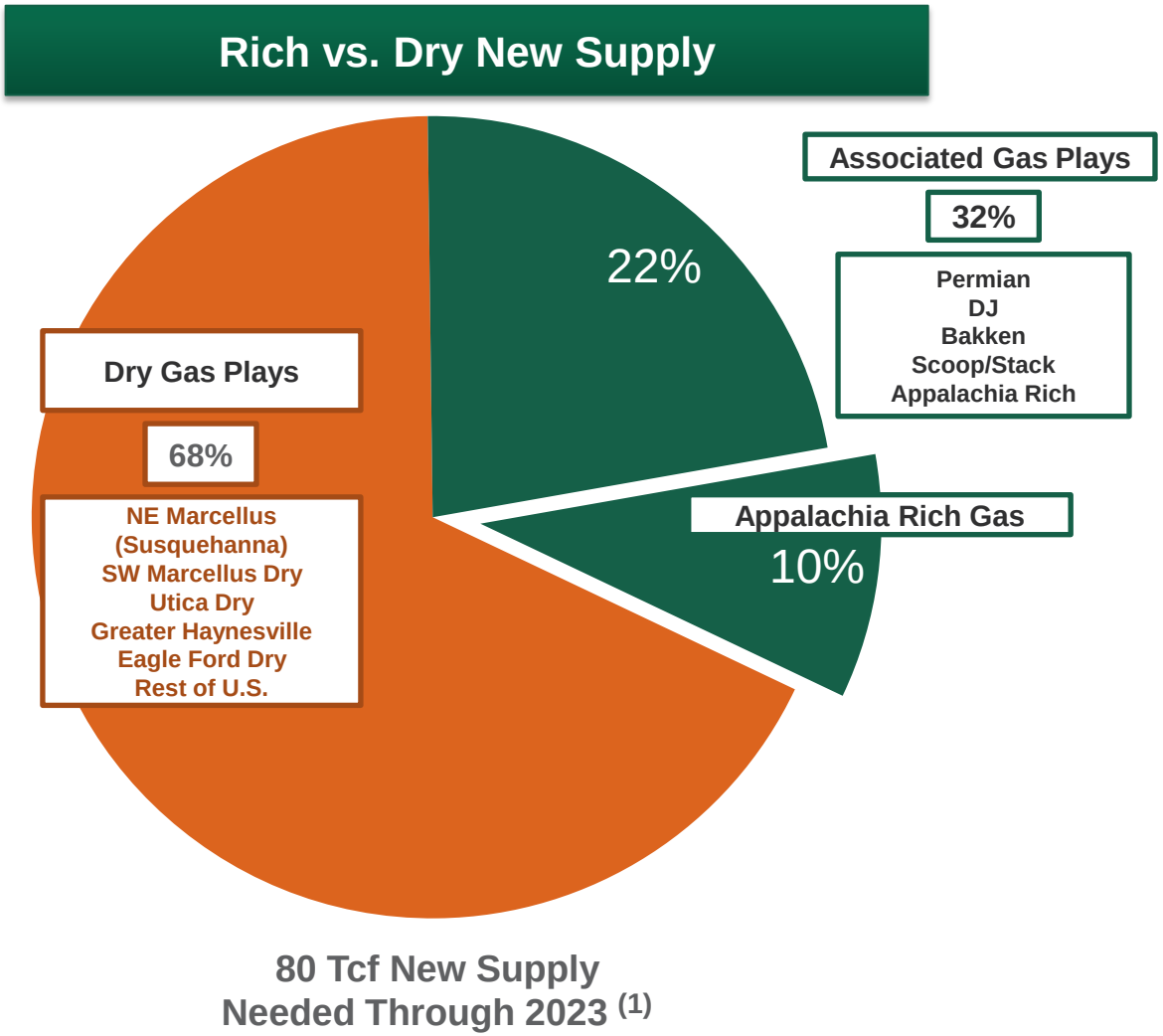
80 Tcf New Supply Needed Through 2023 (1)

Higher Gas Prices Needed to Incentivize the Drilling Required to Meet New Supply Forecasts

1) *Platts Analytics forecasted supply growth.*
2) *Breakeven analysis source: J.P. Morgan Equity Research estimates. Defined as half cycle pre-tax ROR of 25%. Assumes $50/Bbl WTI crude oil. Based on strip pricing as of 8/30/19.*

Natural Gas Prices Must Support Dry Gas Development

- **Only 32% of the new gas supply needed in the 2019 through 2023 period is forecast to come from associated gas plays where natural gas price is not the driving factor for development**
- **Remaining 68% of new gas supply must come from dry gas plays where producers generally need high-$2.00 to low-$3.00/MMBtu NYMEX natural gas prices to generate a 25% IRR on a half-cycle basis**



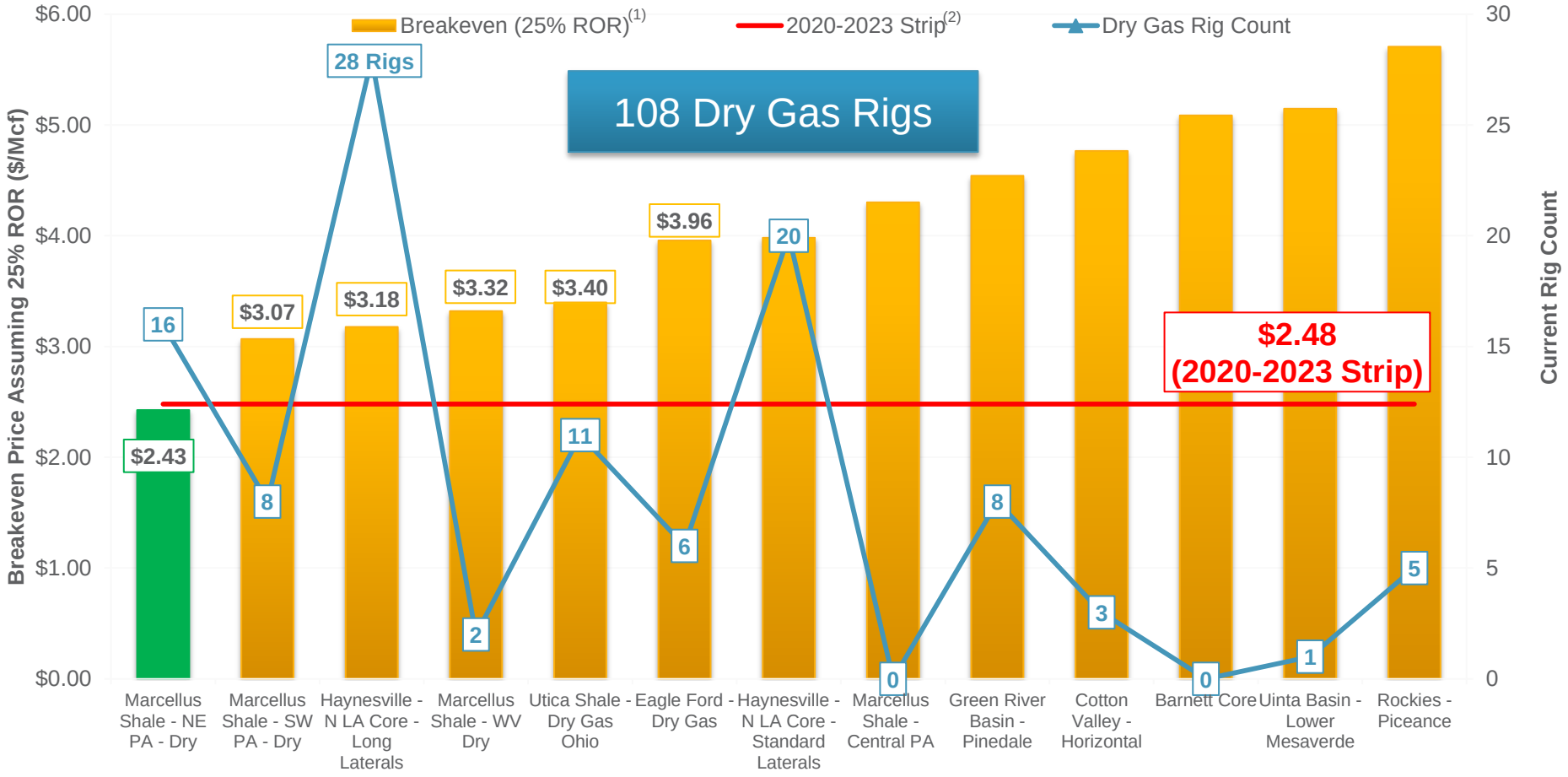
80 Tcf New Supply Needed Through 2023 (1)

1) *Platts Analytics forecasted supply growth.*

Dry Gas Basin Breakeven Analysis

Most of the dry gas plays in the U.S. have breakeven prices above the current 2020-2023 strip at $2.48/MMBtu

- Dry gas producers will require higher realized prices than the current strip to incentivize the drilling activity needed to deliver new supply
- Dry gas rig count has declined 24%, or 34 rigs, since March 15th



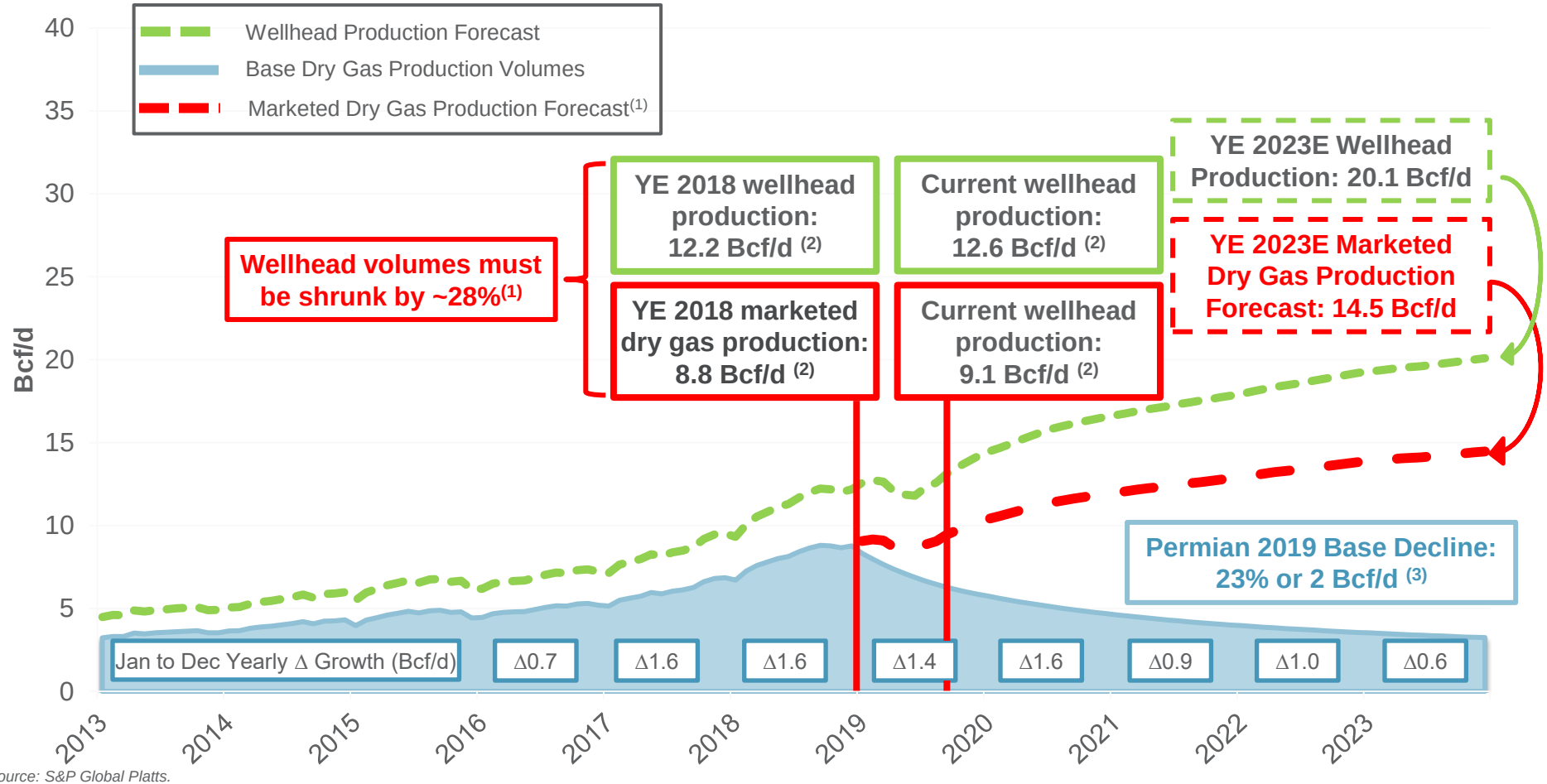
Breakeven analysis source: J.P. Morgan Equity Research estimates. RigData report dated 8/22/19.

1) *Breakeven price is defined as half cycle pre-tax ROR of 25%. Excludes rich gas basins; SW Marcellus Rich, SCOOP/STACK, DJ Basin,*
2) *2020-2023 average Nymex Henry Hub price. Strip pricing as of 8/30/19.*

Permian Gas Supply Growth

While Permian associated gas is expected to be a key contributor to U.S. gas supply growth, the Permian is not expected to dominate the 90 Bcf/d U.S. dry gas supply market

- Permian marketed dry gas production contributed 10% of U.S. gas supply in 2018 and is expected to grow to 15% by 2023
- Permian dry marketed gas makes up only 17% of the 80 Tcf of new supply needed to meet demand through 2023
- Permian wellhead gas production is highly rich gas which must be "shrunk" by ~28% both for processing to extract NGLs and for compression fuel use to get to marketed dry gas production figures (1)



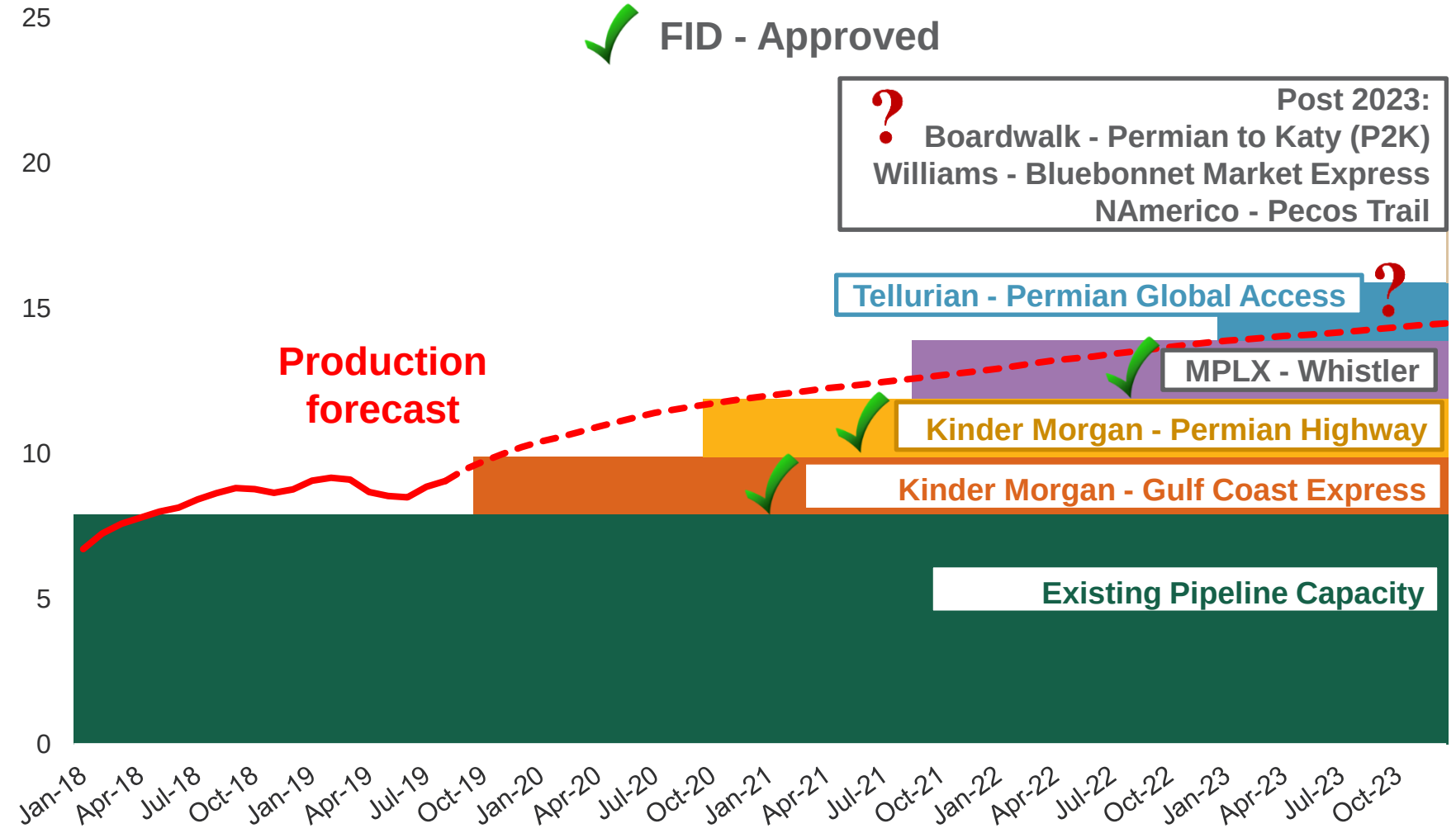
Source: S&P Global Platts.

1) *Associated gas in the Permian is highly rich gas which must be processed and compressed which reduces wellhead gas volumes by approximately 28%, the remainder being marketed dry gas production exiting the basin.*
2) *Historical and forecasted volumes from Platts Analytics and differs from pipeline data scrapes. Current volumes as of August 2019.*
3) *Base decline calculated using 4Q over 4Q forecast production rates for all wells producing as of year-end 2018 based on Platts bottoms up well by well analysis. See appendix for detailed calculations.*

Permian Associated Gas Production Growth

Permian Basin associated gas production growth is limited by pipeline constraints for the next several years despite 8.0 Bcf/d of new projects forecast to come online by end of 2023

Permian Dry Marketed Gas vs. Pipeline Takeaway

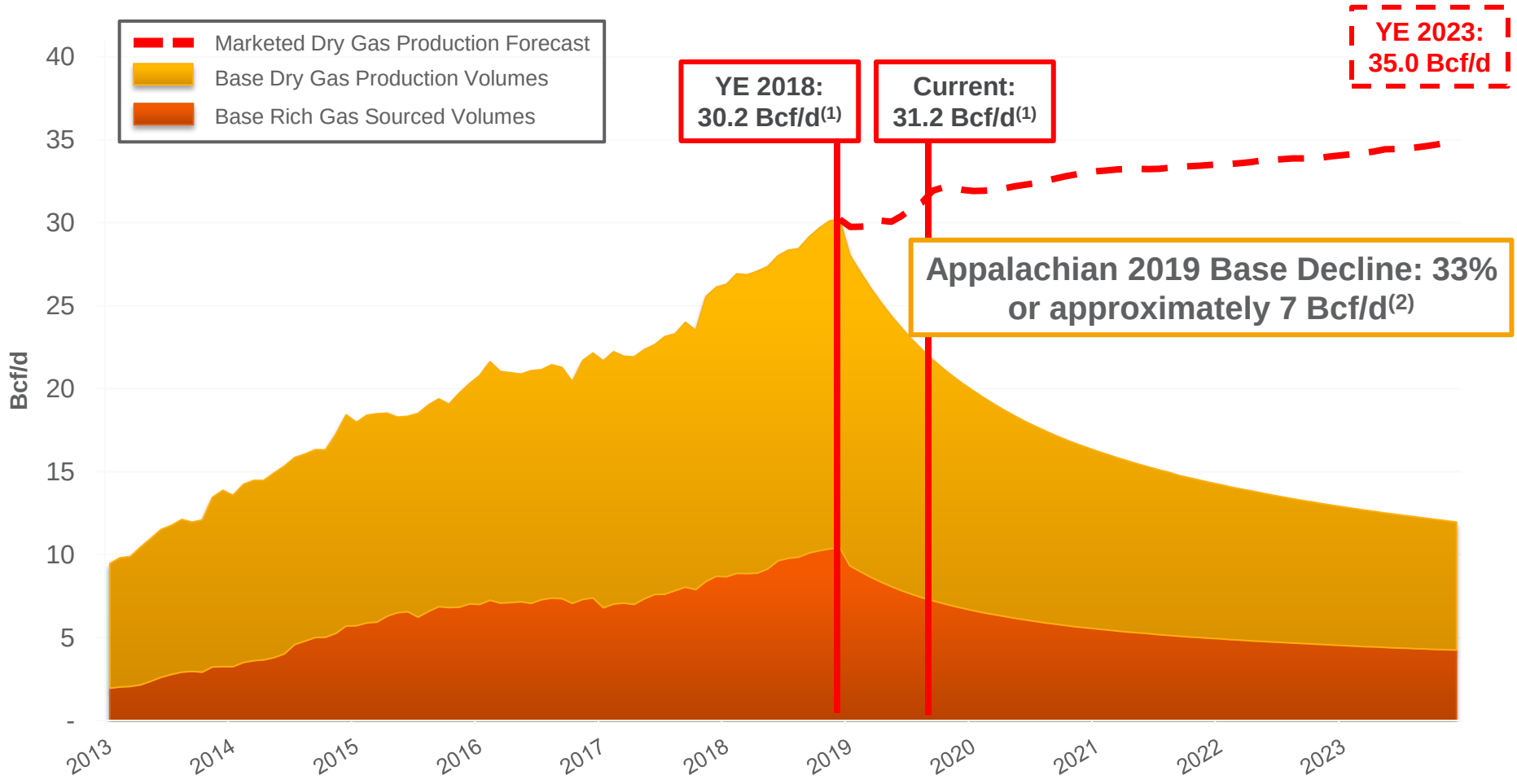


1) *Source: DrillingInfo pipeline data. Platts Analytics forecasted supply growth.*

Appalachian Gas Supply Growth

Appalachian production including the Marcellus and Utica Shales, contributes 35% of U.S. natural gas supply today and is expected to grow to 36% by 2023, or 35.0 Bcf/d

- 31.2 Bcf/d of current production is expected to grow by 3.8 Bcf/d to 35.0 Bcf/d by 2023
- An estimated 10.5 Bcf/d of Appalachian production is derived from rich gas wells and must be processed for NGLs but is less sensitive to gas prices

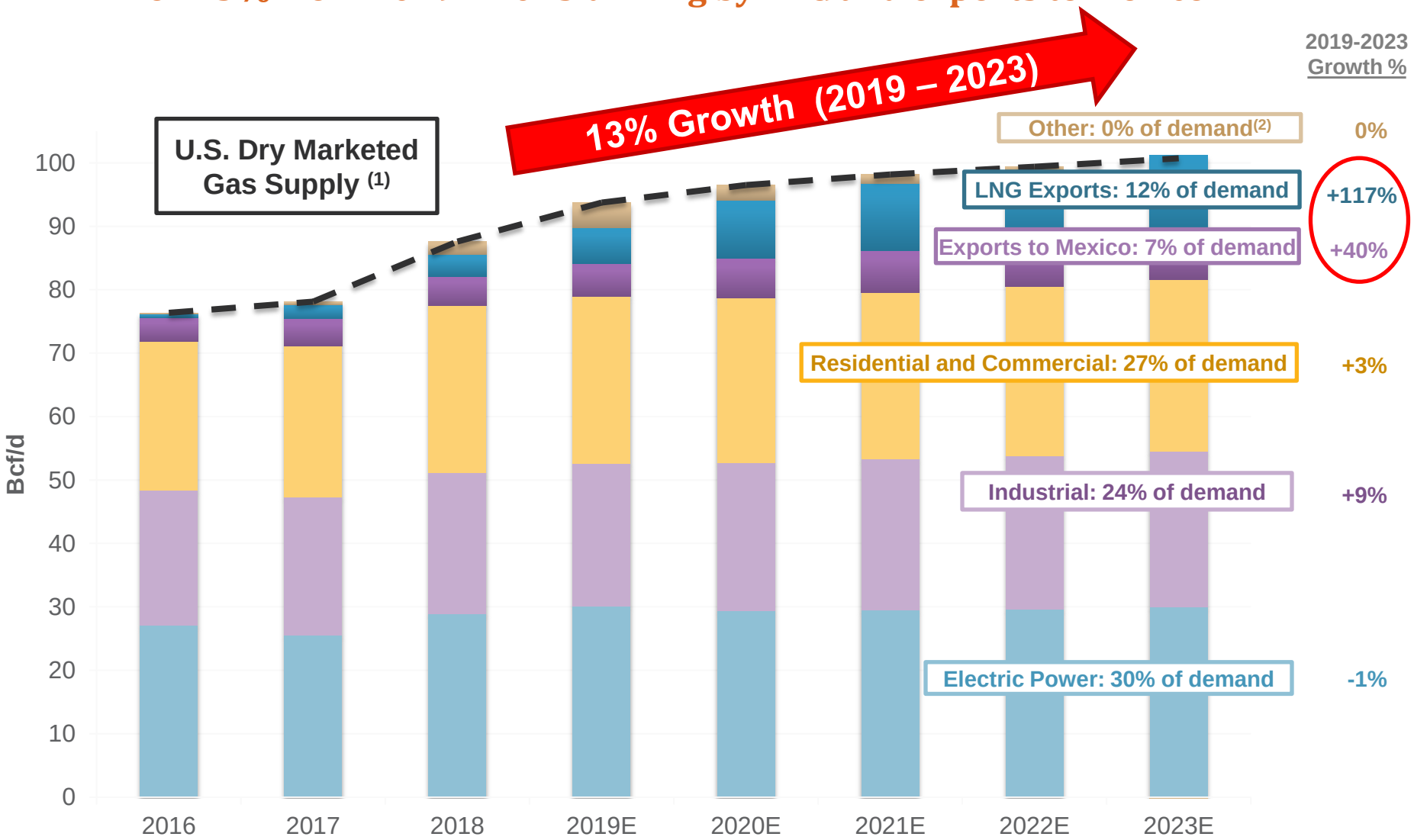


Source: S&P Global Platts

1) *Historical and forecasted volumes from Platts Analytics and differs from pipeline scrape data. Current volumes as of August 2019.*
2) *Base decline calculated using 4Q over 4Q forecast production rates for all wells producing as of year-end 2018 based on Platts bottoms up well by well analysis. See appendix for detailed calculations.*

U.S. Natural Gas Demand Forecast

Total U.S. natural gas demand is expected to grow by 11.4 Bcf/d, or 13% from 2019 – 2023 driving by LNG and exports to Mexico



Source: S&P Global Platts.

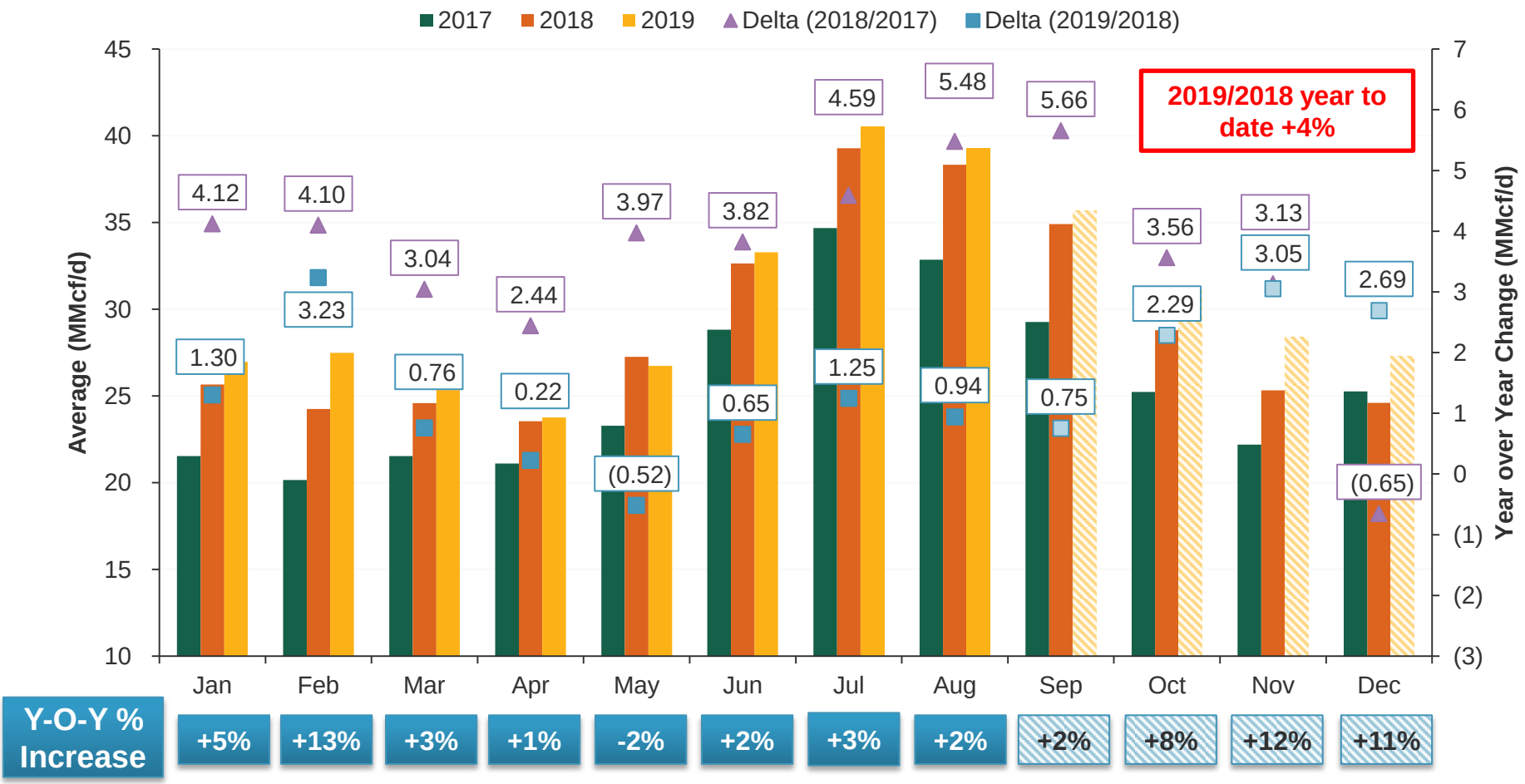
1) Note that Platts U.S. supply includes Canadian and other imports and assumes that supply balances with expected Platts demand.

2) Other includes gas in pipeline, loss of gas from fuel, etc.

Near Term Natural Gas Fundamentals – Power Burn

Average monthly power burn increased 0.98 Bcf/d from 2018 to 2019 year to date, despite negative heating/cooling degree day comparisons, and is 20% above the five year average

U.S. Natural Gas Demand From Power Burn (2017-2019)



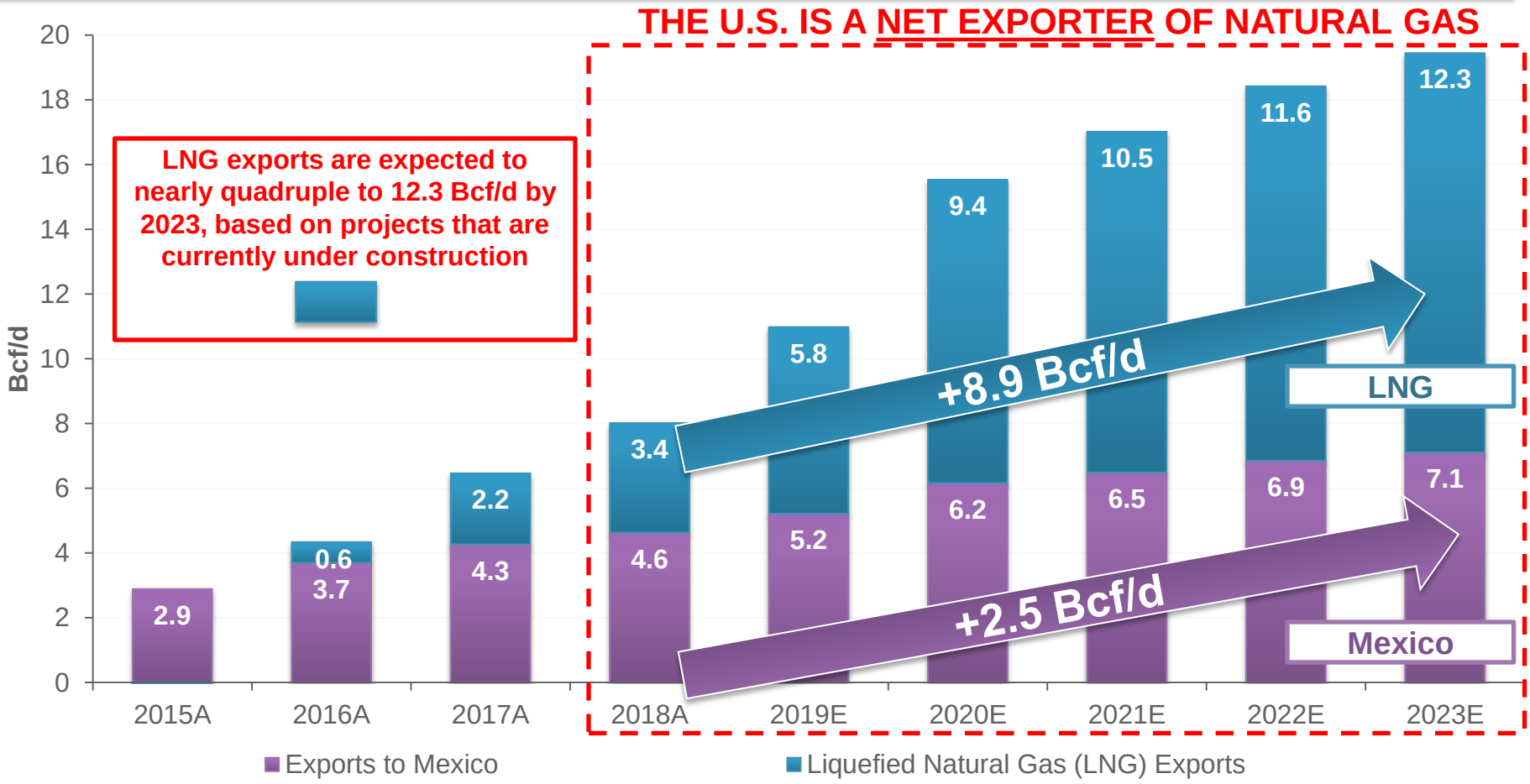
Source: S&P Global Platts.

Exports Drive Demand Growth

>11 Bcf/d expected increase in U.S. natural gas exports from 2018-2023

LNG projects under construction and exports to Mexico will drive U.S. demand

U.S. Natural Gas Exports (Bcf/d)



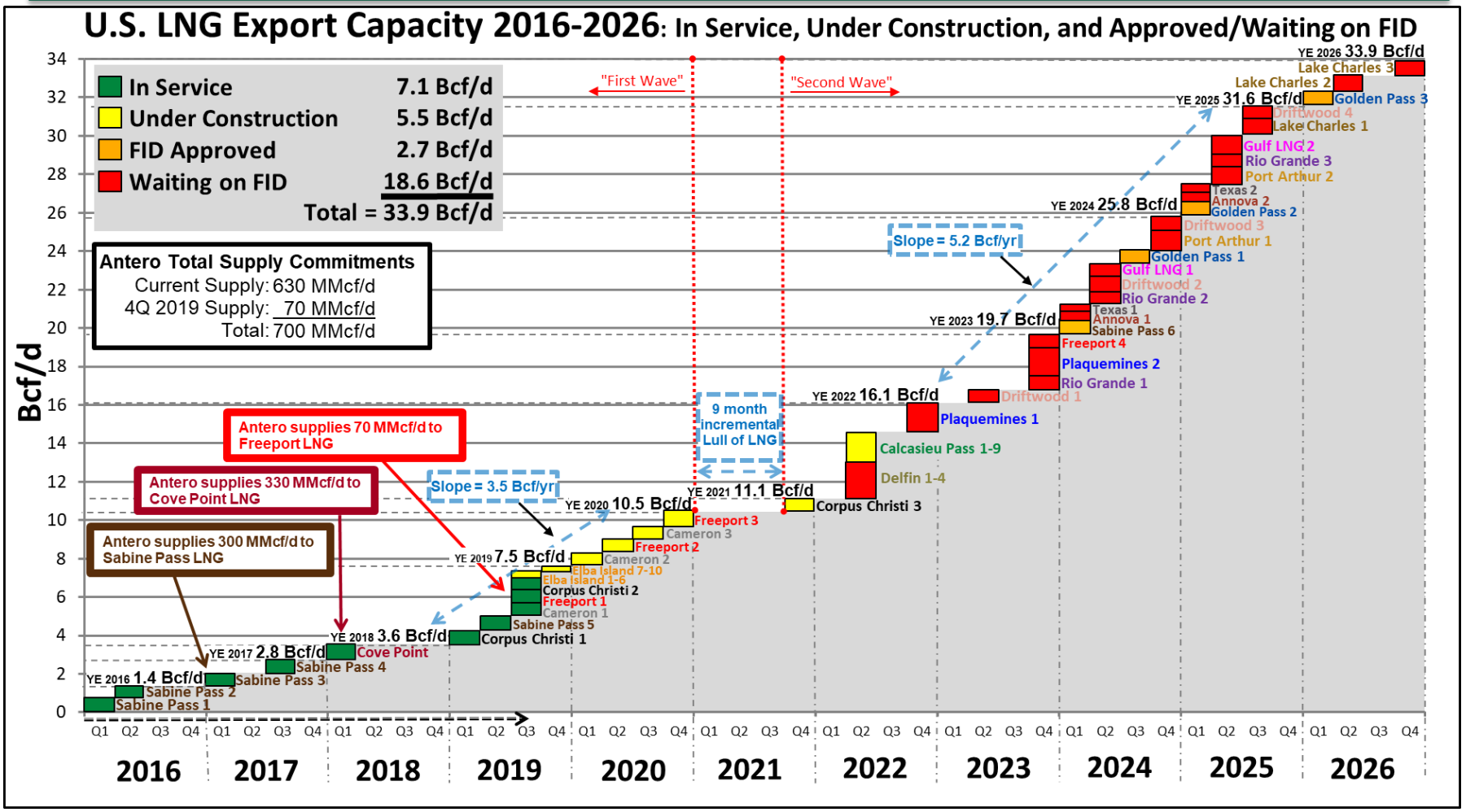
Source: S&P Global Platts.

Growing LNG Market

3.9 Bcf/d of LNG capacity growth expected in 2019 with multiple "2nd wave" projects seeking FID

AR is a top U.S. LNG supplier with commitments expected to reach 700 MMcf/d by YE 2019

U.S. LNG Export Capacity (2016-2026)



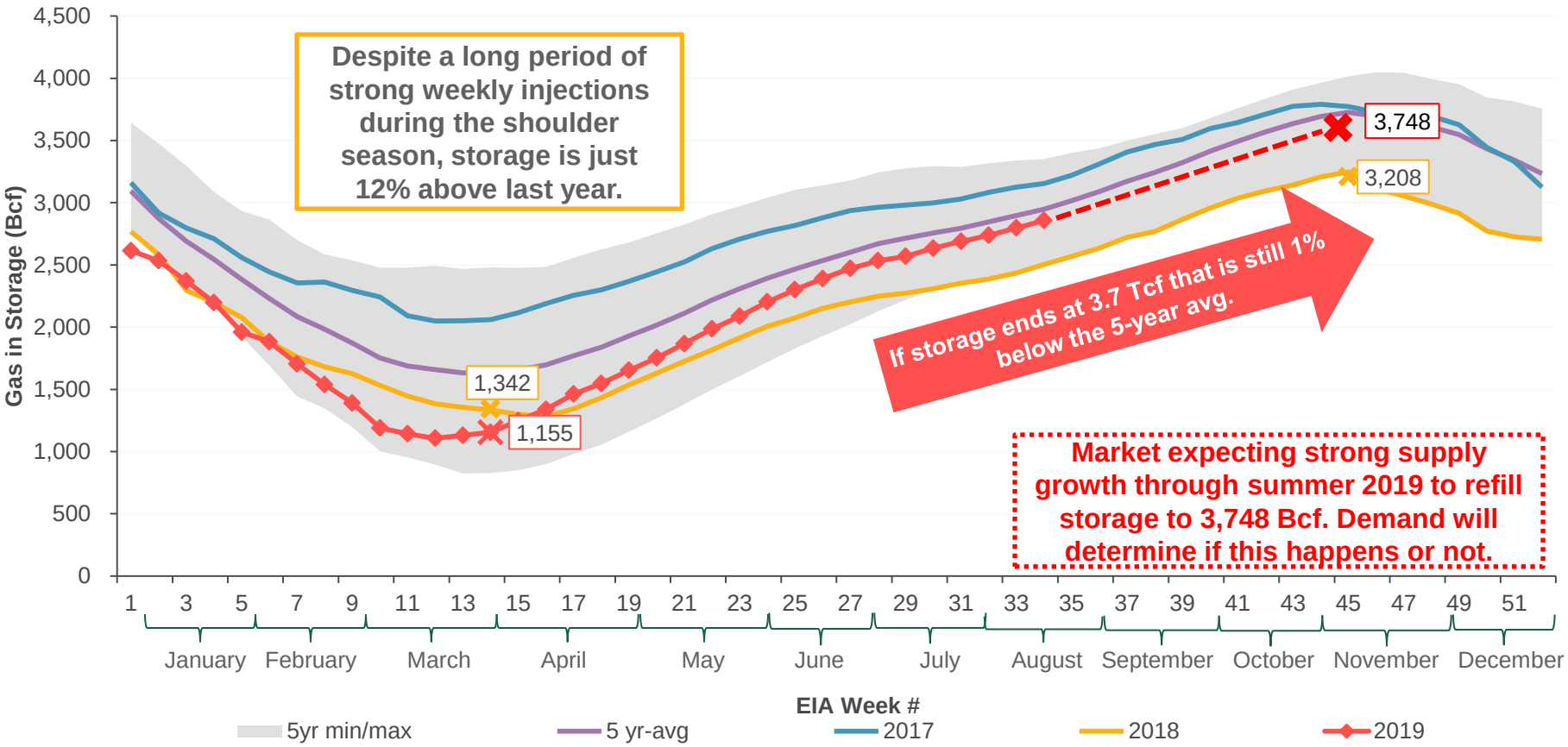
Source: S&P Global Platts.

Strong Near-Term Natural Gas Fundamentals

Current 2,857 Bcf storage level is 5% below 5-year average despite 7.6 Bcf/d year over year production growth

2019 end of injection is currently trading at 3,748 Bcf which is only 1% below the 5-yr average

Total Natural Gas Storage (Bcf)



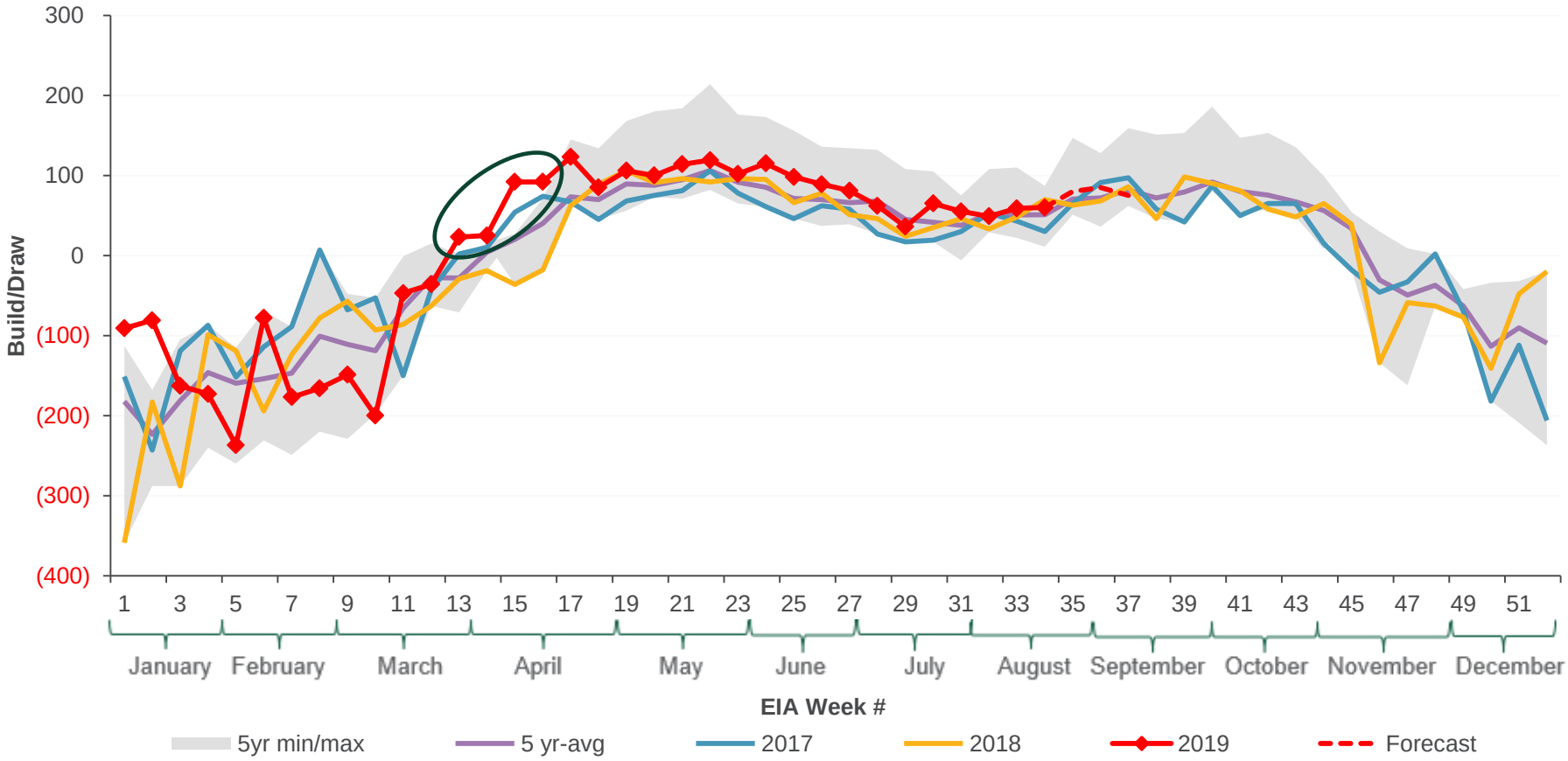
Minimal supply growth and a structural shift in demand could underwhelm the remainder of injection season

Source: EIA Natural Gas Storage Report dated 8/29/2019 and ICE Trading Data 8/29/2019.

Storage Fundamentals Build/Draw 2019

After a strong start to injections this season (four weeks outside of 5 year range), weekly injections have moderated and have been close to the 5-year average.

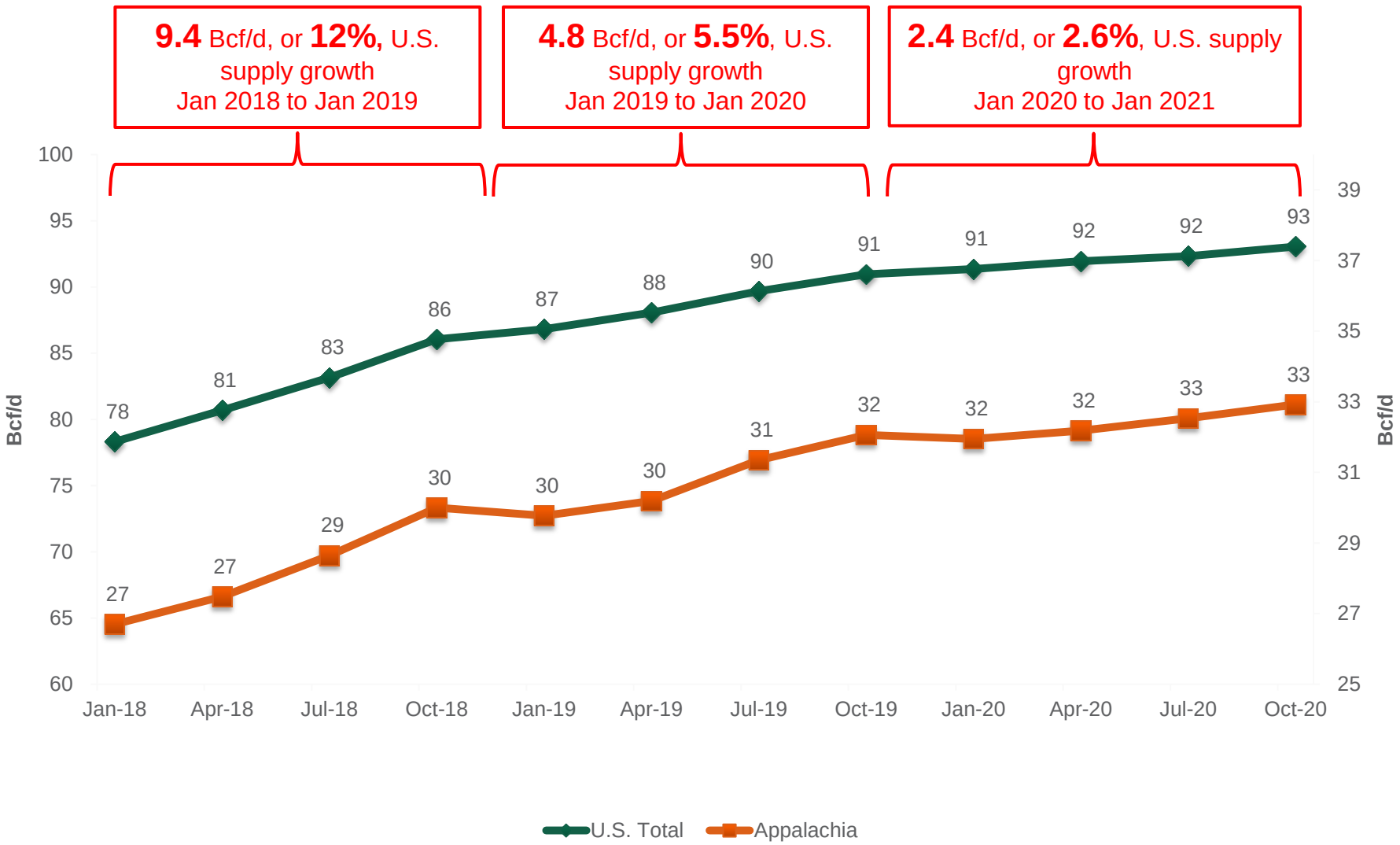
Weekly Storage Build/Draw



Source: EIA Natural Gas Storage Report dated8/29/2019 and ICE Trading Data 8/29/2019.

Dry Gas Production Trend

Exit-to-exit U.S. supply growth is expected to slow dramatically to 2.4 Bcf/d or 2.6% in 2020

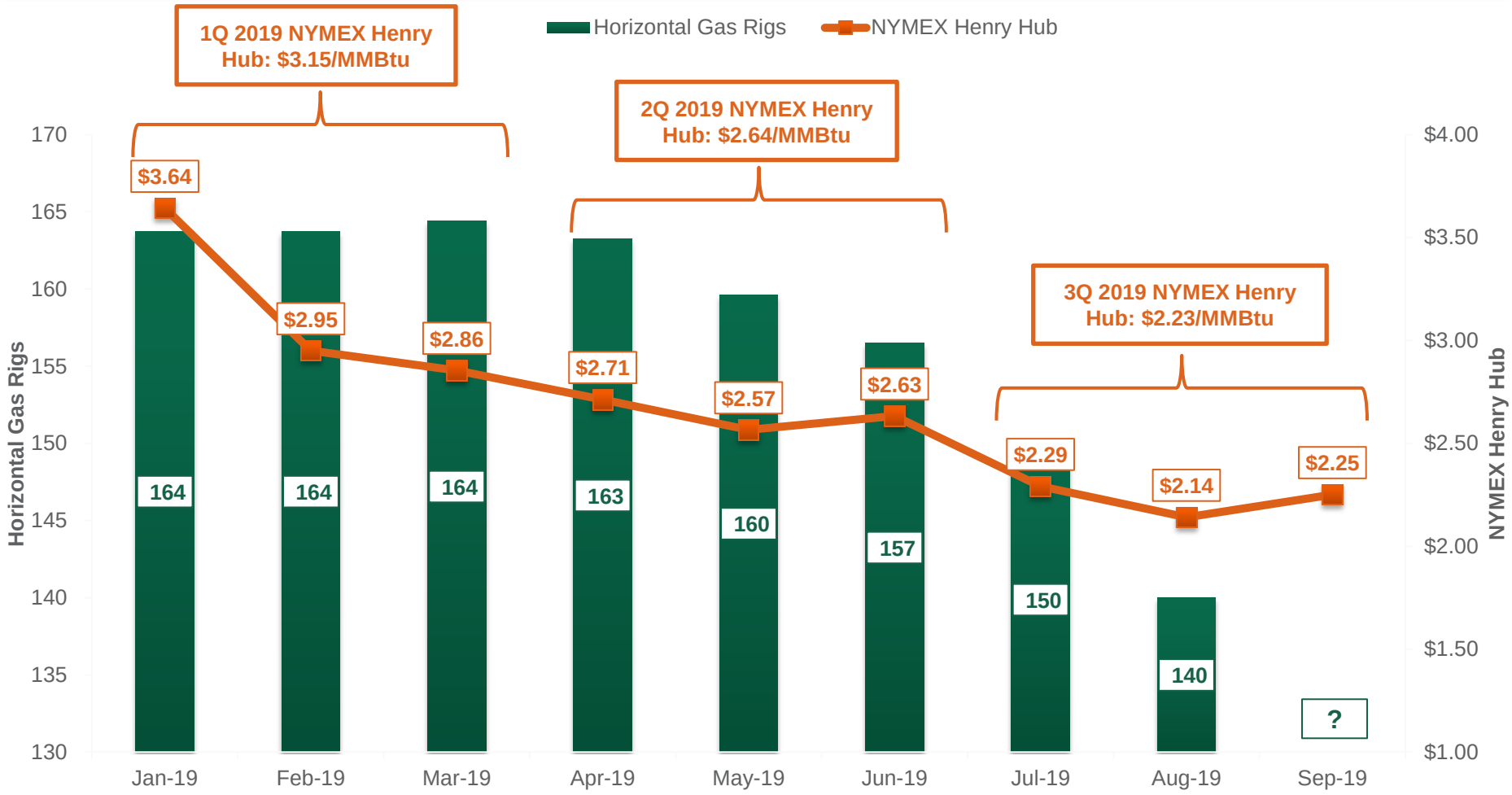


Source: S&P Global Platts.

Natural Gas Rig Count is Responding to Price

Gas rig count is responding to lower natural gas prices with a 14% reduction in horizontal gas rigs since March

Horizontal Gas Rig Counts vs NYMEX Henry Hub

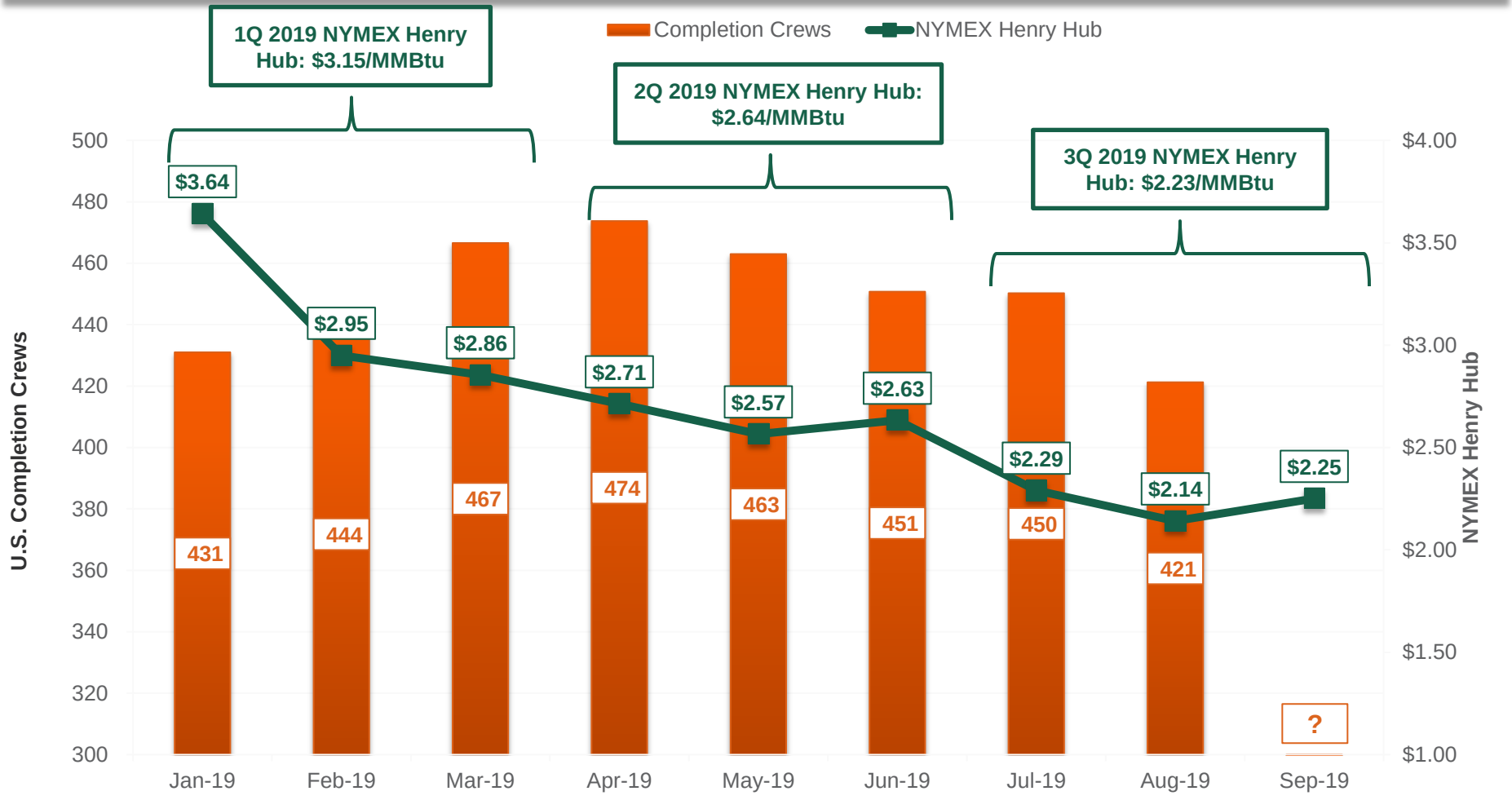


Source: U.S. Rig Counts from Baker Hughes 8/30/2019.
Note: NYMEX Henry Hub price represents natural gas front month futures settlement history.

Completion Crew Count is Responding to Price

Completion crew has recently responded to lower natural gas and oil prices with an 11% reduction in active completion crews since April

Monthly Average U.S. Completion Crews



Source: Completion crews from Primary Vision.
Note: NYMEX Henry Hub price represents natural gas futures settlement history.

Strong Demand Growth and Challenges to New Supply Are Underappreciated by the Market

- Exports Lead Strong U.S. Natural Gas Demand Growth Through 2023
- LNG Exports Expected to Double in 2019 to ~5.8 Bcf/d; Doubling again by 2023 to 11.6 Bcf/d
- U.S. Base Decline Alone (27% in 2019) Expected to Require 23 Bcf/d of New Supply in 2019
- Associated Gas Alone Not Expected to Deliver the New Supply Needed to Address Base Decline + Demand Growth
- Current Natural Gas Strip Prices Not Expected To Incentivize the Drilling Activity Required by Dry Gas Producers to Address Base Decline + Demand Growth

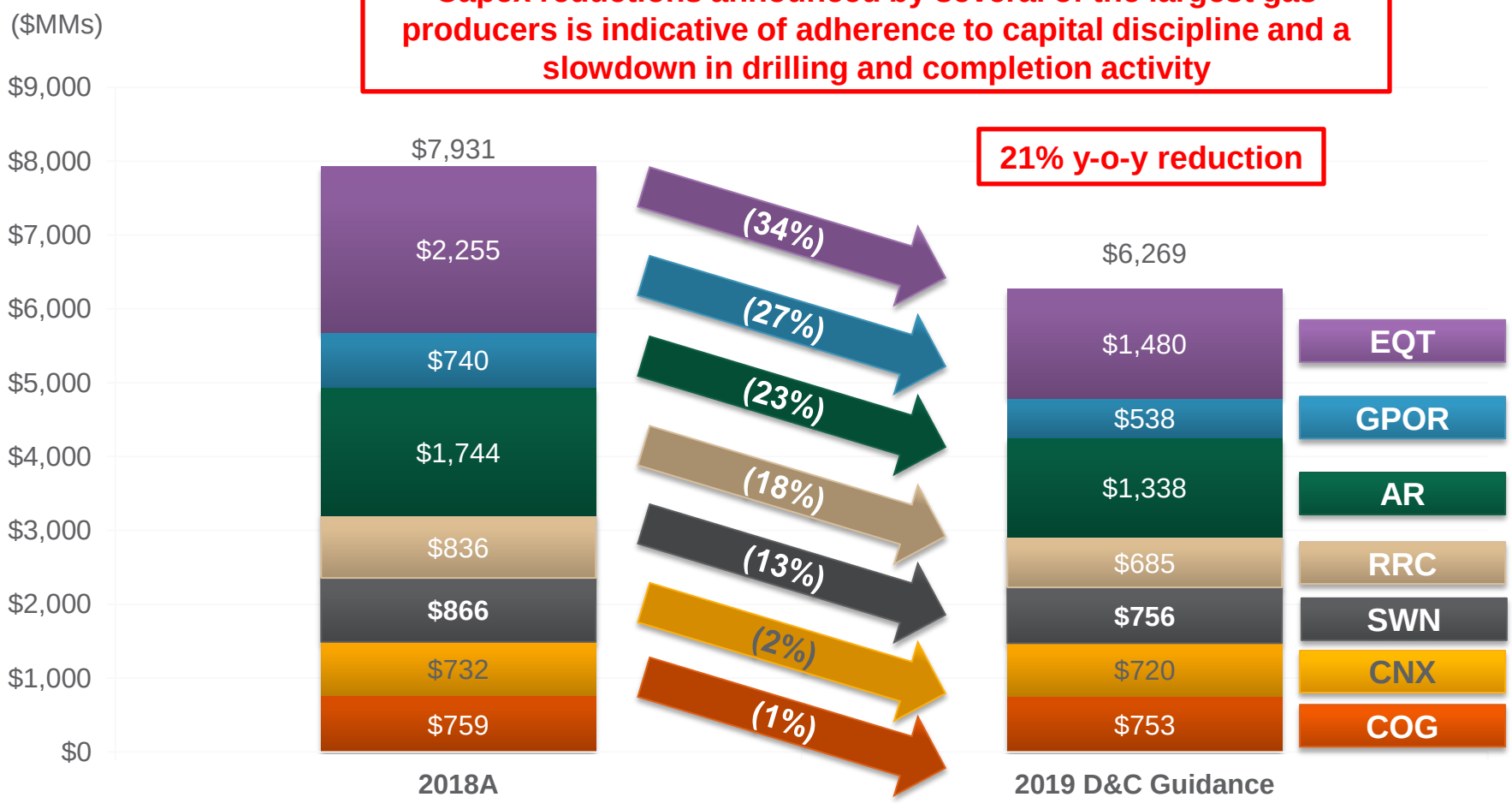
Appendix

D&C Capital Reductions…

Appalachian peers announced an average 21% reduction in their 2019 drilling and completion capital spending relative to 2018 levels, moderating supply growth expectations

Appalachian Peer D&C Capital Guidance Comparison (2019 vs 2018)

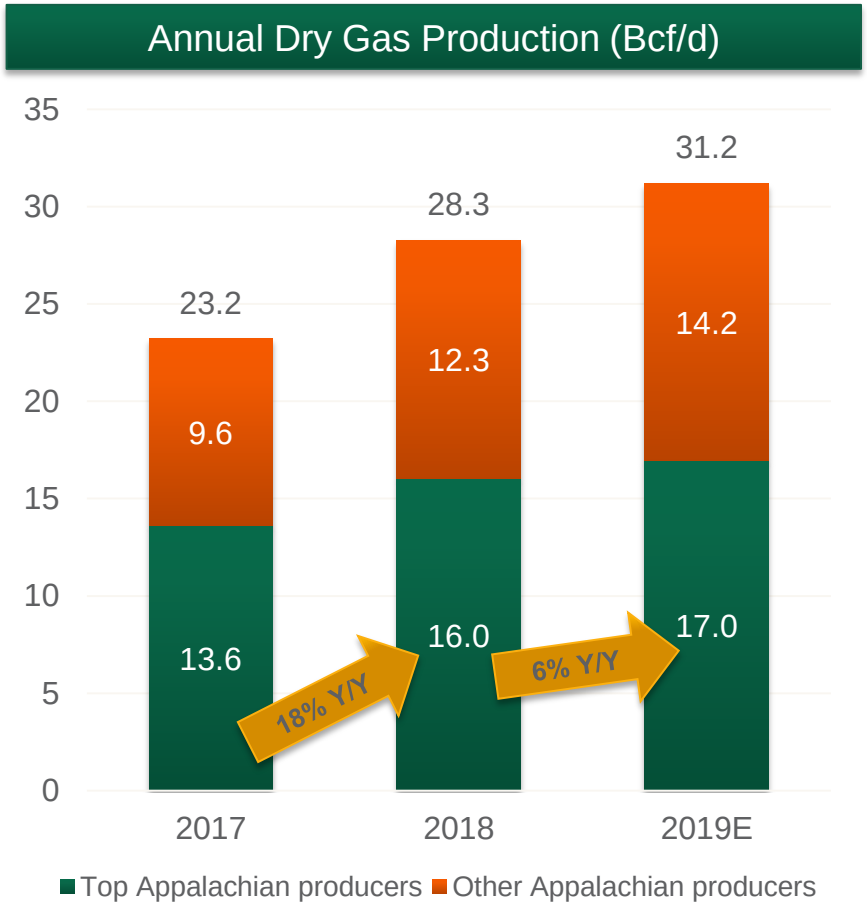
Capex reductions announced by several of the largest gas producers is indicative of adherence to capital discipline and a slowdown in drilling and completion activity

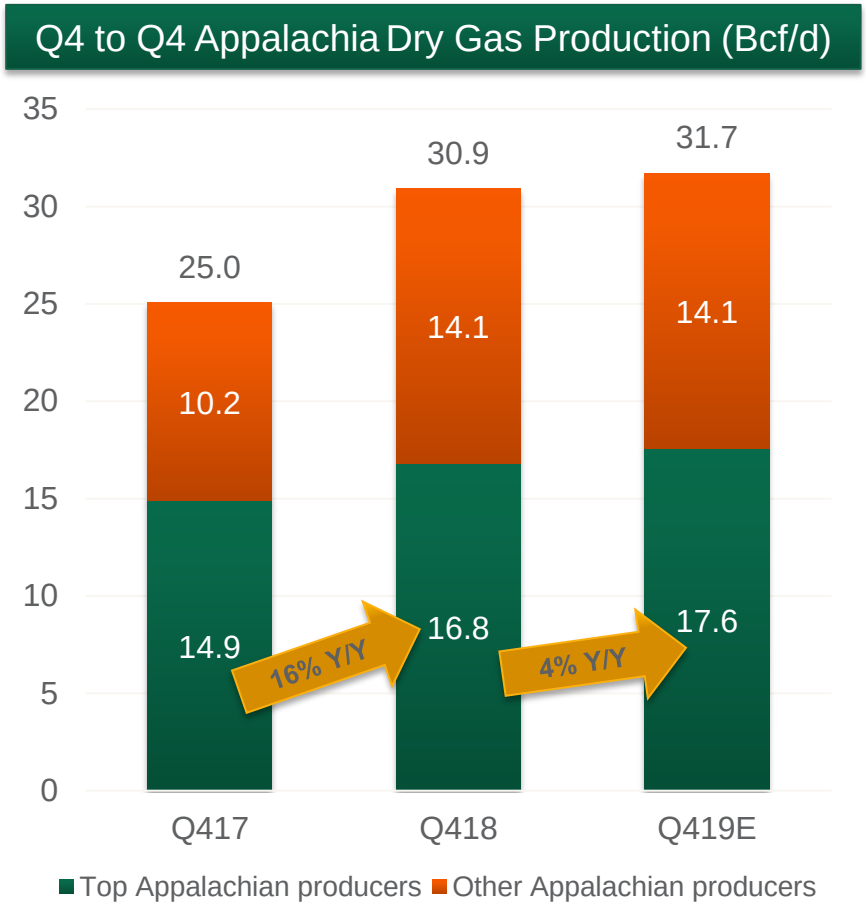


Note: COG 2018 actual D&C capital percent contribution to total capital applied to 2019 total capital on a pro rata basis. CNX D&C capital percent contribution from original 2018 guidance release applied to 2018A total capital spend on a pro rata basis.

…Results in Moderated Supply Growth

- The top Appalachia producers[1] made up ~57% of total Appalachia[2] dry gas production in 2018
- Those top producers are expected to slow annual growth from 18% in 2018 to 6% in 2019





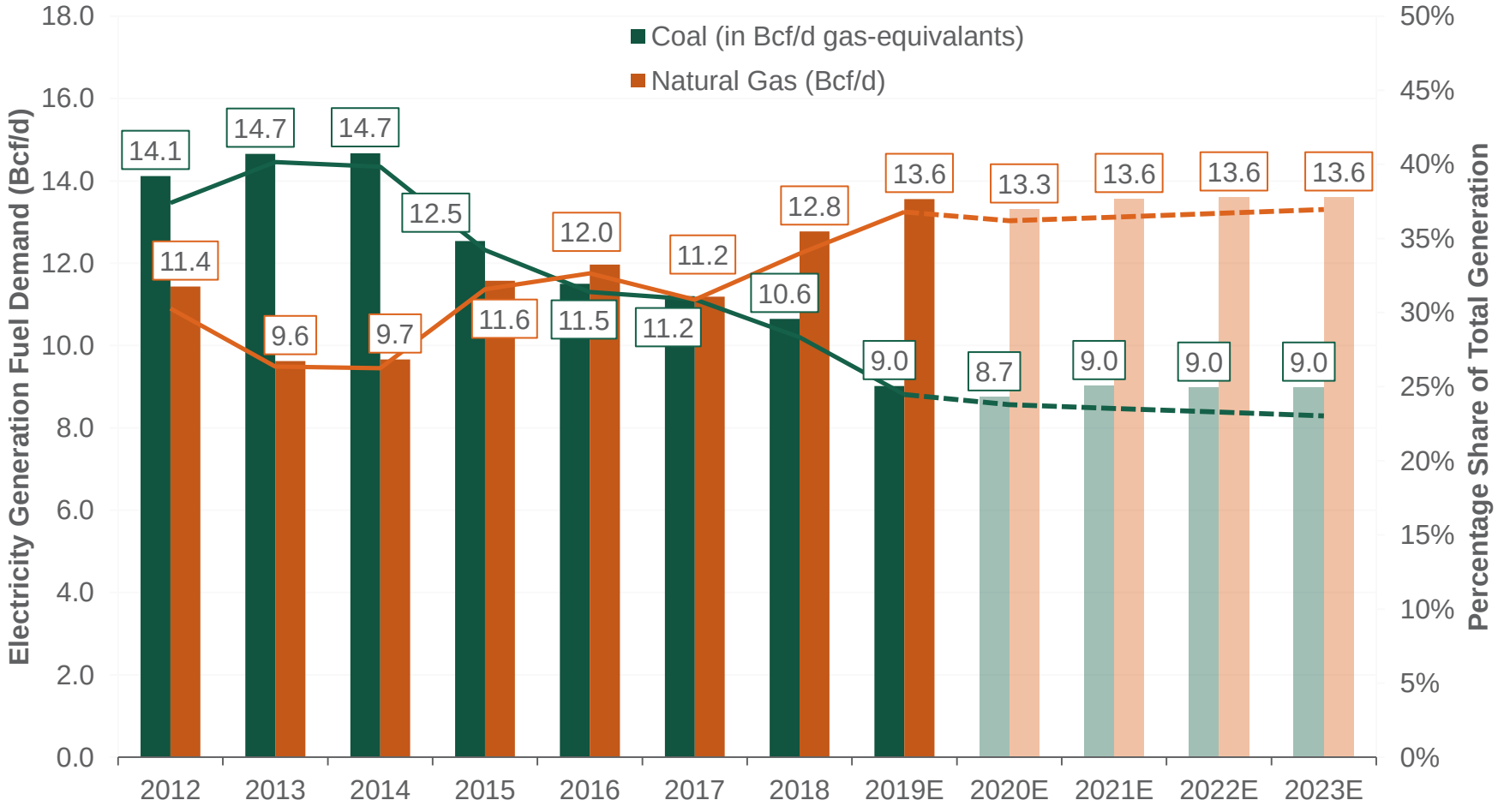
Source: Platts & Bloomberg estimates adjusted for pro-forma numbers where applicable. Consensus estimates for top Appalachia producers as of August 26, 2019. Platts estimates as of August 26, 2019.

1) *Top Appalachia producers reflect Bloomberg estimates for the 2019 period and include AR, CHK, CNX, COG, EQT, GPOR, NFG, RRC & SWN.*
2) *Total Appalachia dry gas production reflects Platts estimates (Marcellus/Utica); Other Appalachian producers represents Platts total Appalachia dry gas production estimates less top Appalachian producers as defined in note 1.*

U.S. Coal to Gas Switching: Momentum Continues

- Since 2015, natural gas has been the more economic fuel source, a trend that is expected to continue
- The gap between natural gas and coal electricity generation is expected to continue over the next 4 years

U.S. Coal vs Gas: Electricity Generation



Source: EIA Short Term Energy Outlook (8/6/2019).

Base Decline Calculations

U.S. Overall Decline Rate Detail		
Time	**Average (Bcf/d)**	**Year-Over-Year Decline Rate (%)**
Q4 2018	85.28	-
Q4 2019	62.42	(27%)
Q4 2020	51.38	(18%)
Q4 2021	44.65	(13%)
Q4 2022	39.95	(11%)
Q4 2023	36.37	(9%)

Permian Decline Rate Detail		
Time	**Average (Bcf/d)**	**Year-Over-Year Decline Rate (%)**
Q4 2018	7.76	-
Q4 2019	5.98	(23%)
Q4 2020	4.76	(20%)
Q4 2021	4.04	(15%)
Q4 2022	3.58	(11%)
Q4 2023	3.26	(9%)

Appalachia Overall Decline Rate Detail		
Time	**Average (Bcf/d)**	**Year-Over-Year Decline Rate (%)**
Q4 2018	30.91	-
Q4 2019	20.77	(33%)
Q4 2020	16.70	(20%)
Q4 2021	14.49	(13%)
Q4 2022	13.07	(10%)
Q4 2023	12.04	(8%)

Note: Base decline calculated using 4Q over 4Q forecast production rates for all wells producing as of year-end 2018 based on Platts bottoms up well by well analysis.