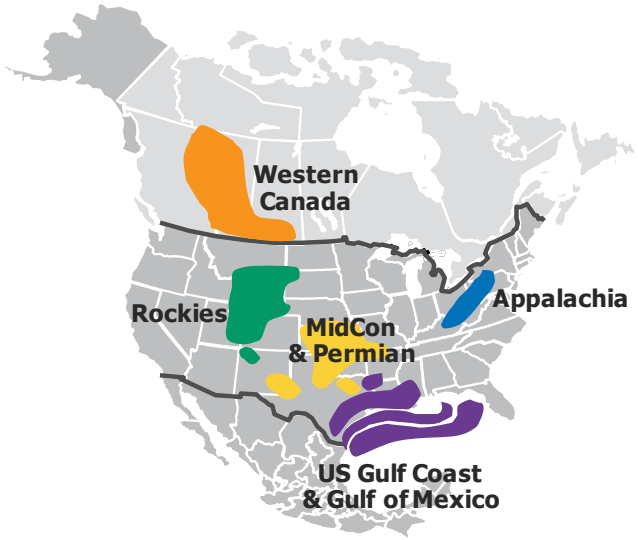
US NATURAL GAS PRODUCTION TO 2040

APRIL 2021

INTRODUCTION

The report provides Incorrys detailed gas production outlook for the major gas supply basins in the US and an overall roll-up for North American dry-gas production.



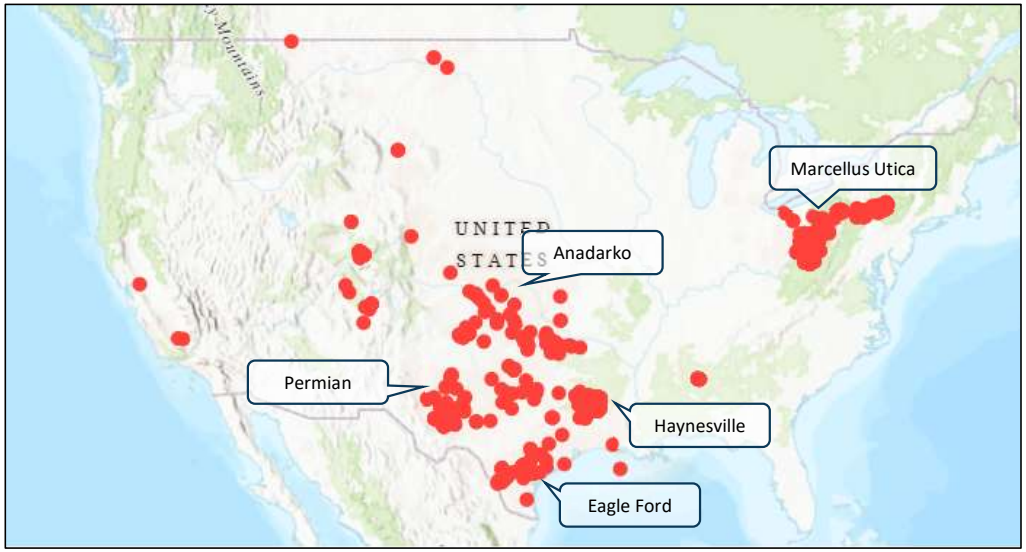
Primary natural gas basins in North America

SUMMARY

- In 2020, US natural gas production growth and development is primarily focused in two areas: Appalachia (Marcellus and Utica) – 28.7% of total North American production, and Haynesville – 9.4%.
- Associated gas production in 2020 was 27 Bcf/d or 26.6% of total North American production. Majority of associated gas production will come from Permian Basin. Other associated gas production regions include Bakken, Eagle Ford, and DJ Niobrara.
- Western Canada gas production is currently 14.8% of total production or 15 Bcf/d. It will reach 23.1 Bcf/d in 2040.
- In the 2020–2035 period, gas-production growth will occur as overall North American demand increases to 105.8 Bcf/d by 2035. After 2035 North American gas demand will drop to 103.8 Bcf/d.
- The increased maturity of tight-gas plays is forecast to continue in the Rockies and in Mid Continent (includes Arkoma and Anadarko) and gas-focused Permian. Production from Mid Continent and Rockies will decline over the forecast period.
- Activity in gas focused Permian prospects will be muted over the next decade, as relative production cost competitiveness improves post-2030 development is expected to increase.

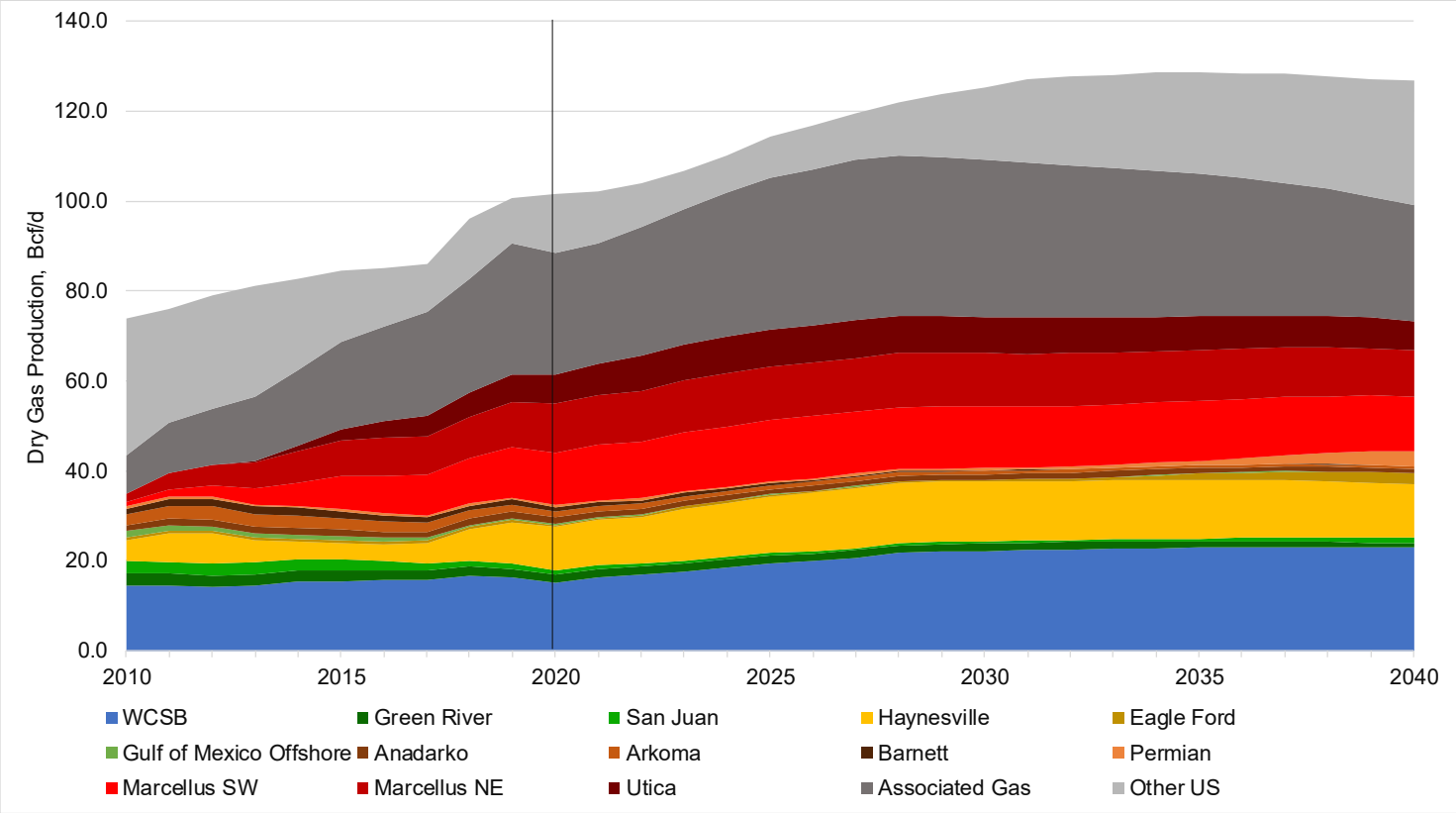
US GAS DRILLING

Gas Wells Drilled in 2020



- Most gas wells in US in 2020 are drilled in Marcellus, Utica and Haynesville. Initial well productivity grew in all three basins with Marcellus NE now reaching 20 MMcf/d.
- In 2020 average 85 gas rigs were operating in US, down from 168 rigs in 2019. At the same time US dry gas production increased to 86.4 Bcf/d in 2020 up from 84.5 Bcf/d in 2019.
- Associated gas production in 2020 dropped to 27 Bcf/d down from 29.2 Bcf/d in 2019 as oil prices in dropped in 2020.

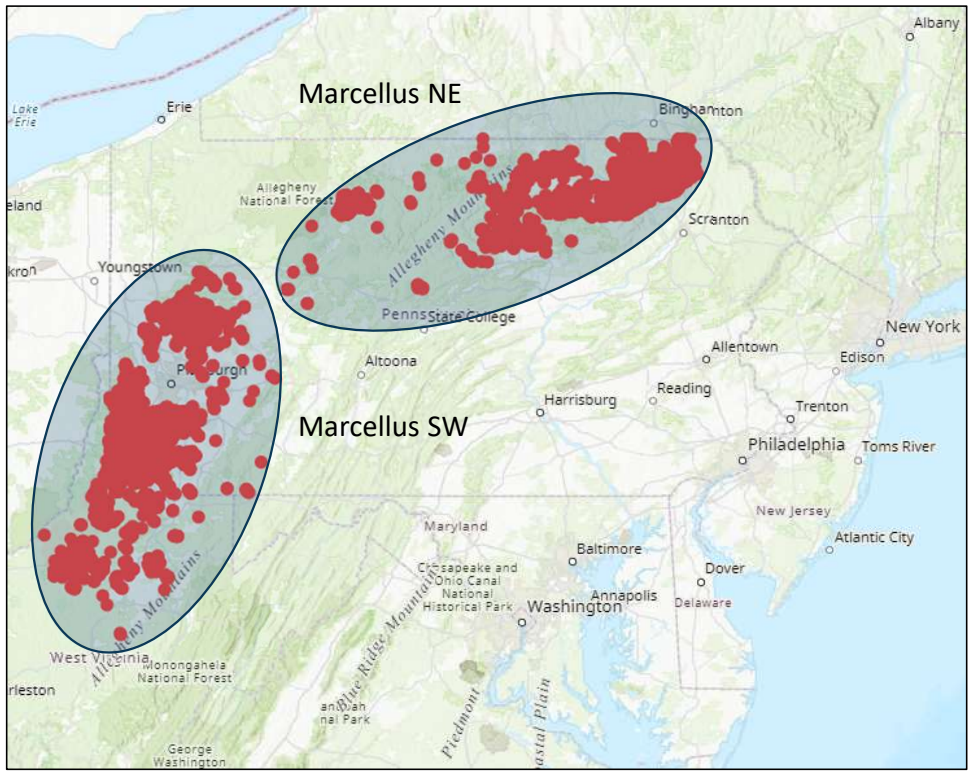
US AND WESTERN CANADIAN DRY GAS PRODUCTION FORECAST



INCORRYS

MARCELLUS

Wells drilled in since 2015



Appalachia Rig Count

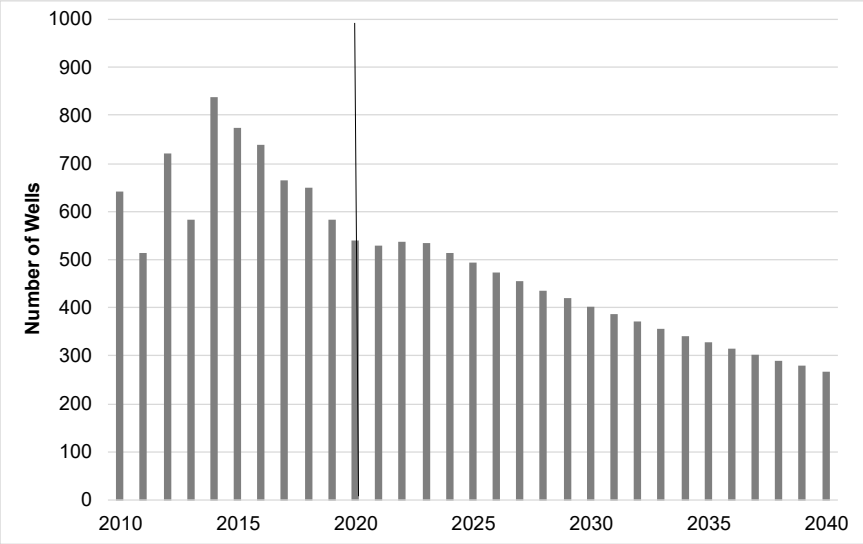
Marcellus is the major producing formation in US. Marcellus SW area produces liquids rich gas, while Marcellus NE production is dry. Marcellus development started in 2005-2006.

INCORRYS

MARCELLUS WELL COUNT

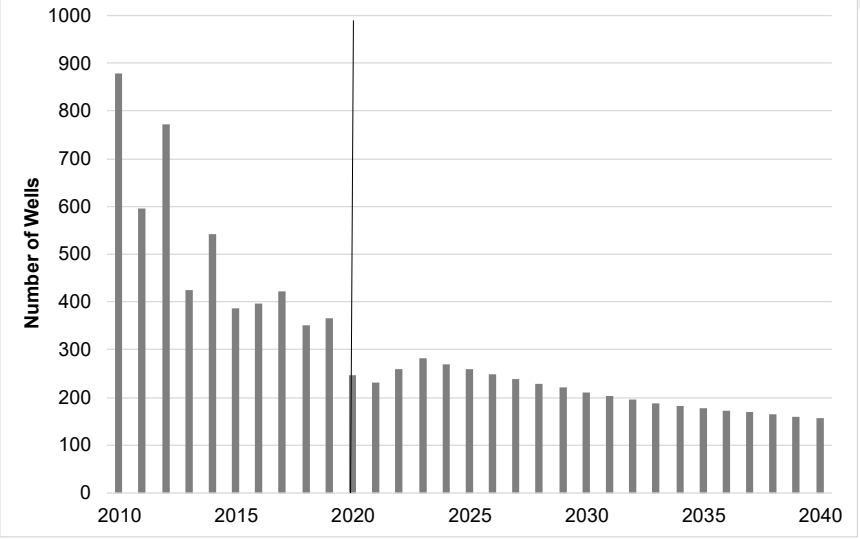
Marcellus SW

Location: Pennsylvania SW, West Virginia
Number of gas wells drilled since 2006: ~9,100
Average New Well Initial Productivity in 2020:
11.3 MMcf/d
Peak Production: 2020 (14 Bcf/d)
Average First Year Decline in 2020: 70%



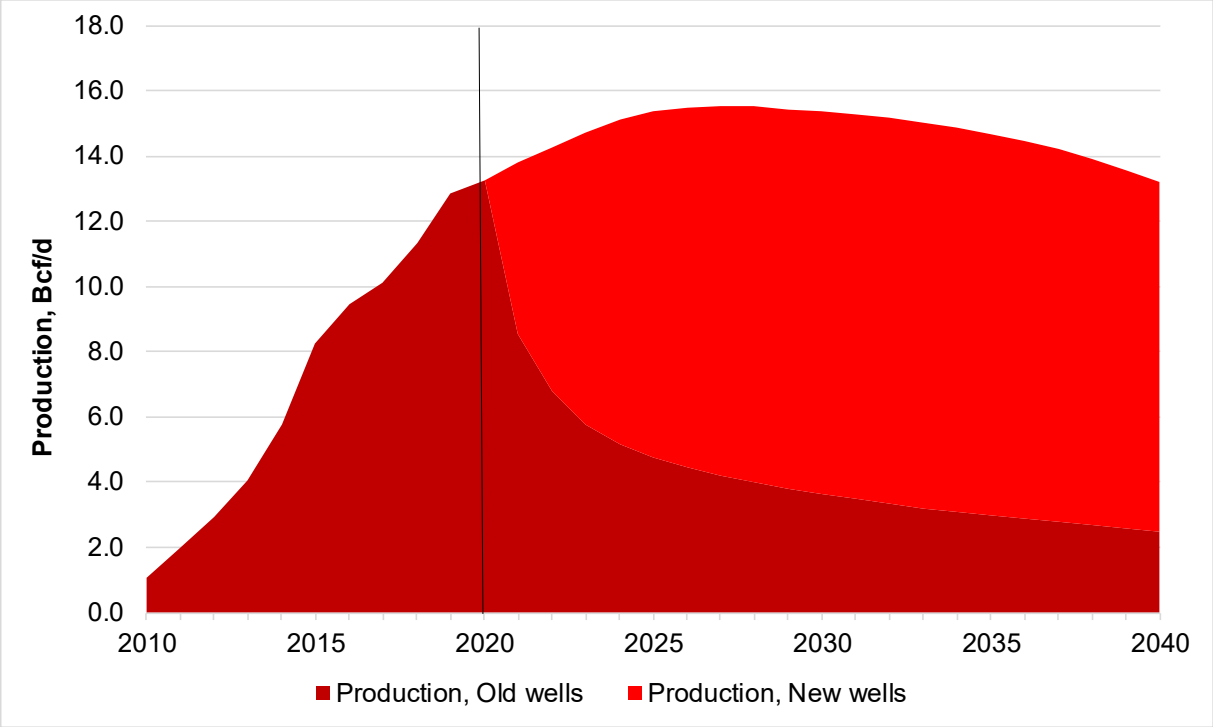
Marcellus NE

Location: Pennsylvania NE
Number of gas wells drilled since 2006: ~5,700
Average New Well Initial Productivity in 2020:
20.4 MMcf/d
Peak Production: 2020 (23 Bcf/d)
Average First Year Decline in 2020: 71%



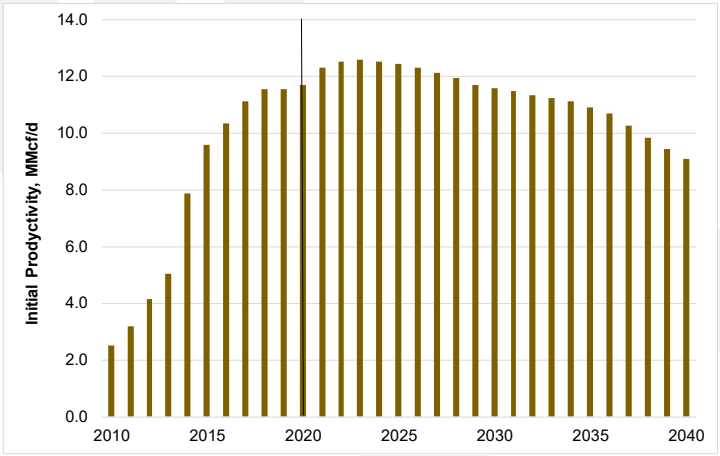
INCORRYS

MARCELLUS SW RAW GAS PRODUCTION

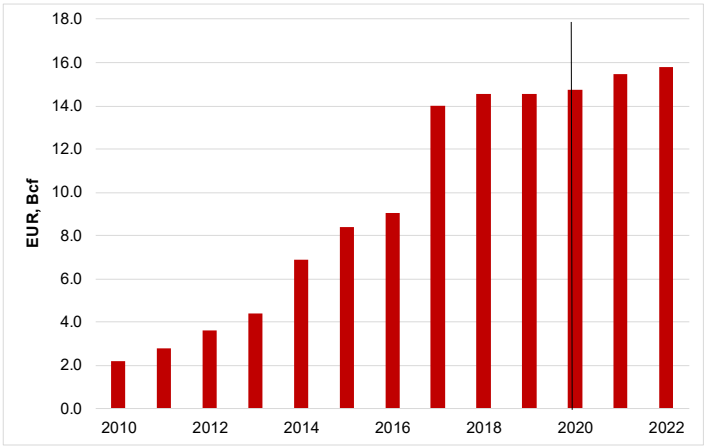


Marcellus (SW) liquid rich gas production comes Southwest Pennsylvania and West Virginia. Production is expected to reach its peak of 15 Bcf/d around 2023-24 after which it will gradually decline.

Gas Well Initial Productivity, MMcf/d

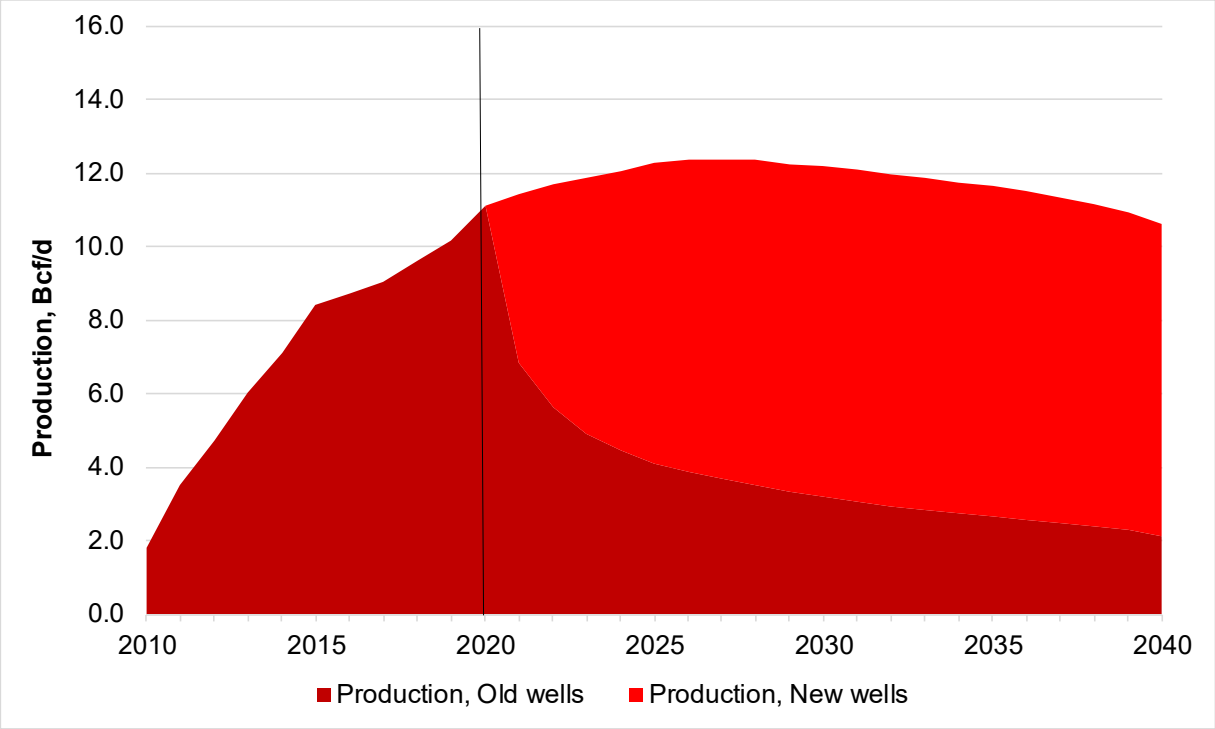


Well EUR, Bcf



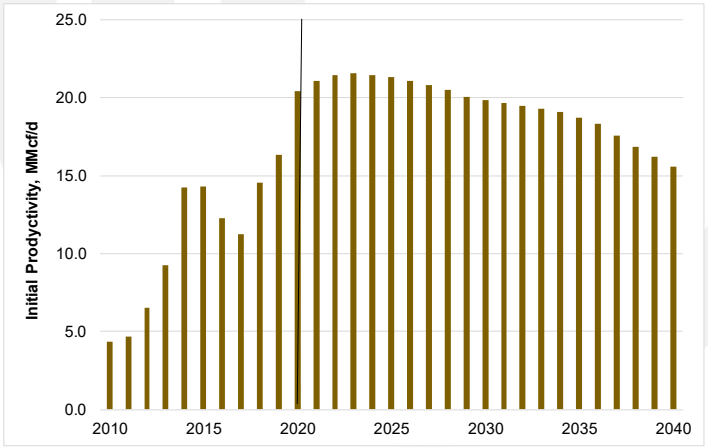
INCORRYS

MARCELLUS NE RAW GAS PRODUCTION

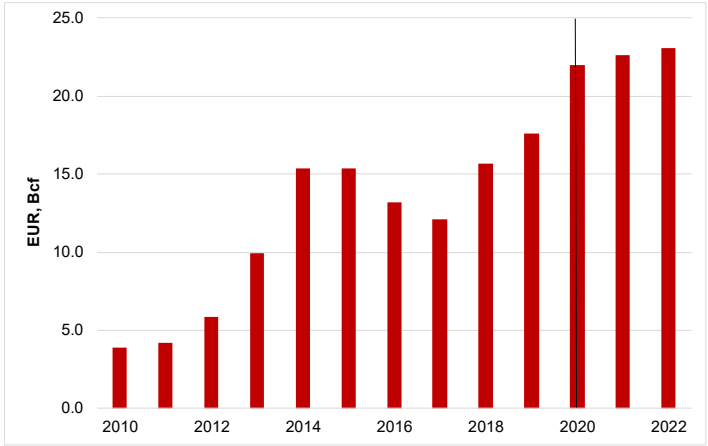


Marcellus (NE) dry gas production comes Northeast Pennsylvania. Marcellus (NE) new well initial productivity is one of the highest in US and expected to reach over 21 MMcf/d. Production is expected to reach its peak of over 12 Bcf/d around 2025-27 after which it will gradually decline.

Gas Well Initial Productivity, MMcf/d



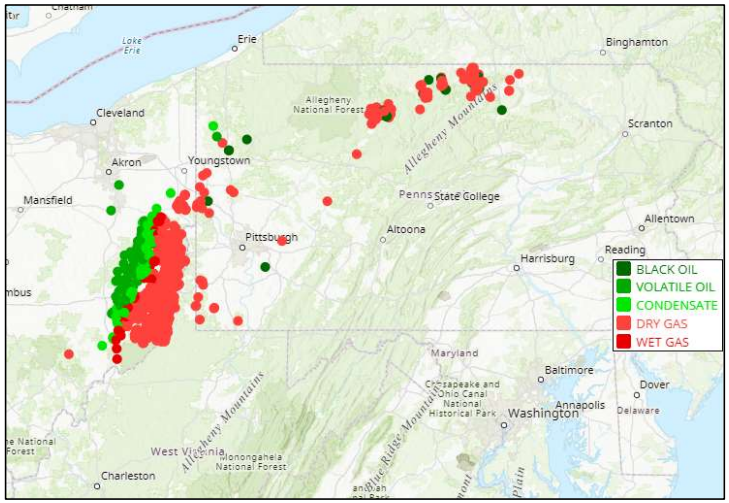
Well EUR, Bcf



INCORRYS

UTICA

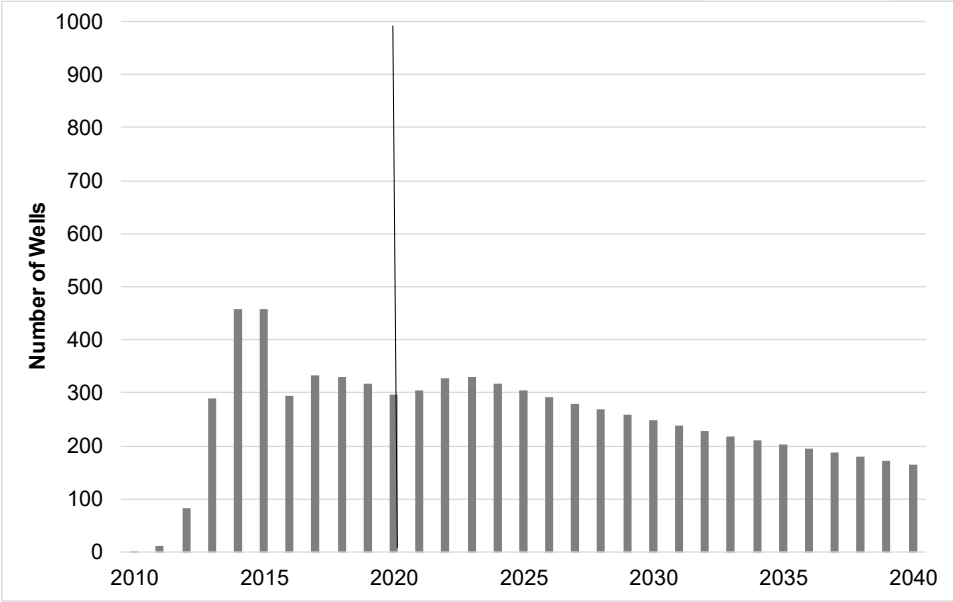
Wells drilled in since 2015



Utica development started in 2010-2011. Utica liquids-rich gas production comes from Eastern Ohio and Southwest Pennsylvania. Utica Pennsylvania-North gas production is currently limited, but production growth is expected to initiate after 2021.

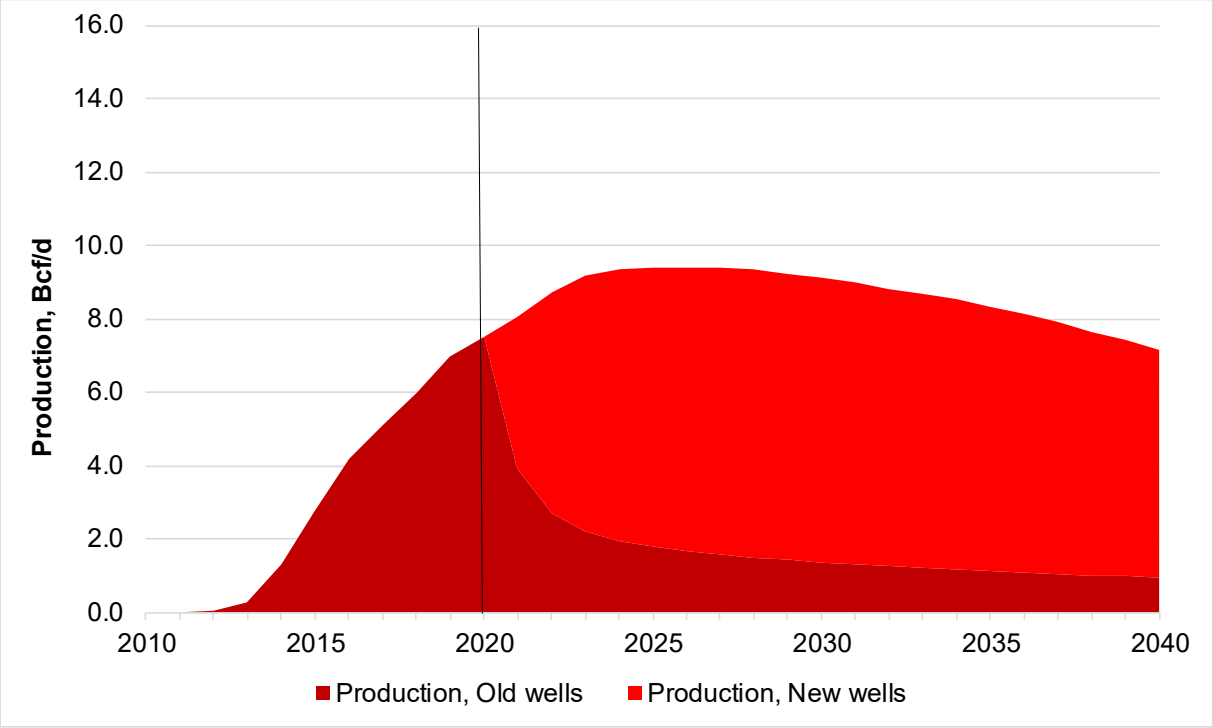
Location: East Ohio, Pennsylvania NE
Number of gas wells drilled since 2010: ~2,900
Average New Well Initial Productivity in 2020: 20 MMcf/d
Peak Production: 2020 (7.5 Bcf/d)
Average First Year Decline in 2020: 66%

Number of New Wells



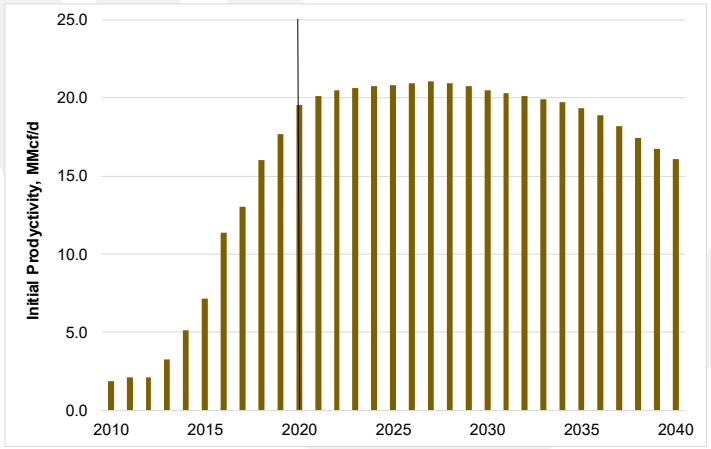
INCORRYS

UTICA

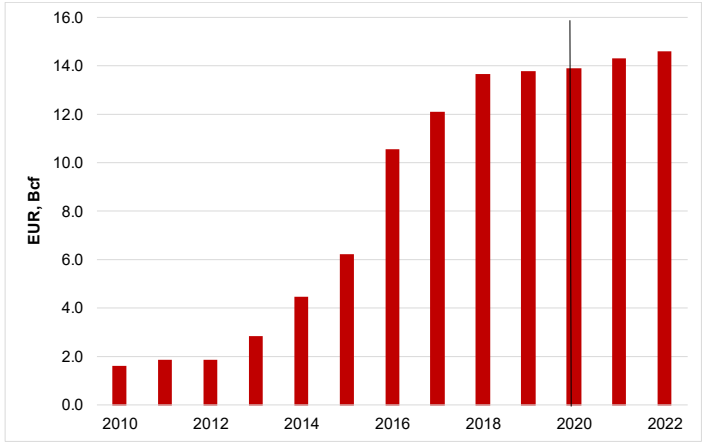


The Utica IP is expected to increase to 21 MMcf/d in 2026. Utica production is forecast to reach 8.3 Bcf/d in 2027, which is up substantially from 7.5 Bcf/d in 2020.

Gas Well Initial Productivity, MMcf/d



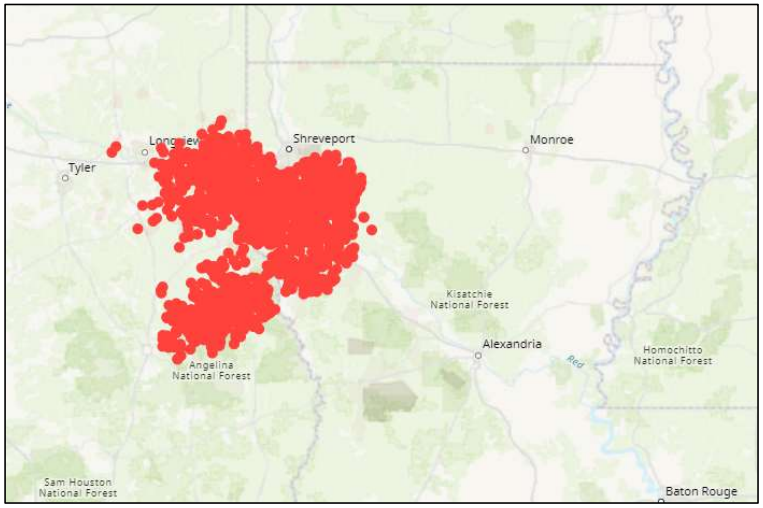
Well EUR, Bcf



INCORRYS

HAYNESVILLE

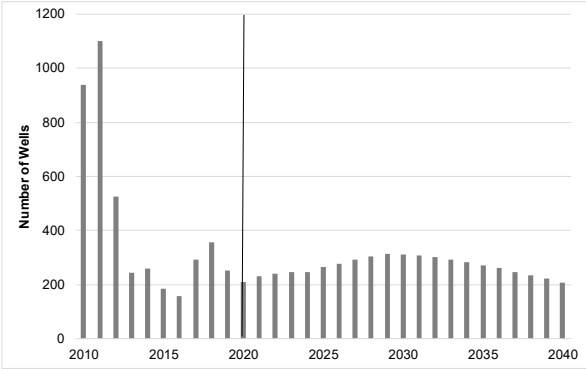
Wells drilled in since 2015



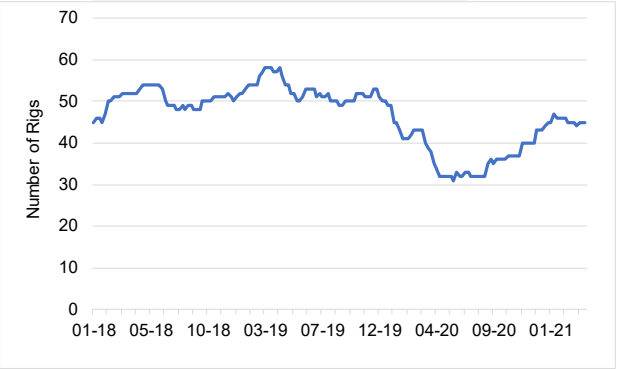
Together with Marcellus and Utica, Haynesville is one of the main producing basins in US. Haynesville production cost is one the lowest in US due to high initial well productivity.

Location: East Texas, North Louisiana
Number of gas wells drilled since 2010: ~4,500
Average New Well Initial Productivity in 2020: 23 MMcf/d
Peak Production: 2020 (9.6 Bcf/d)*
Average First Year Decline in 2020: 75%

Number of New Wells



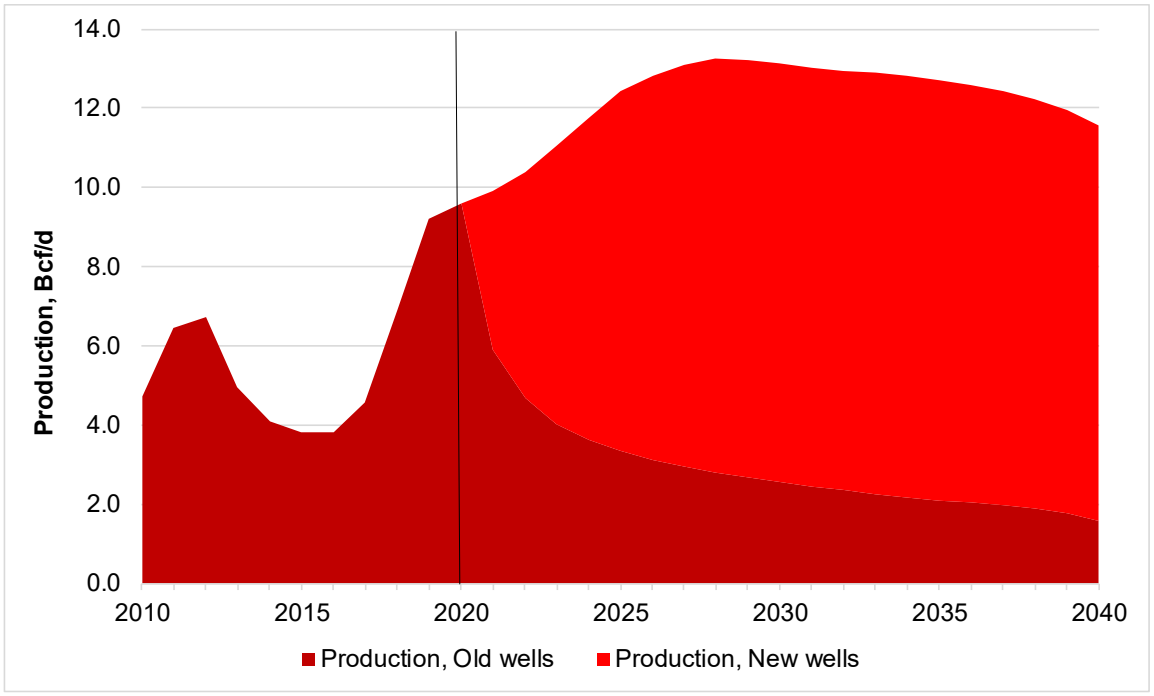
Number of Rigs



* Production from Haynesville formation only. According to EIA total raw gas production for Haynesville area is 12.02 Bcf/d

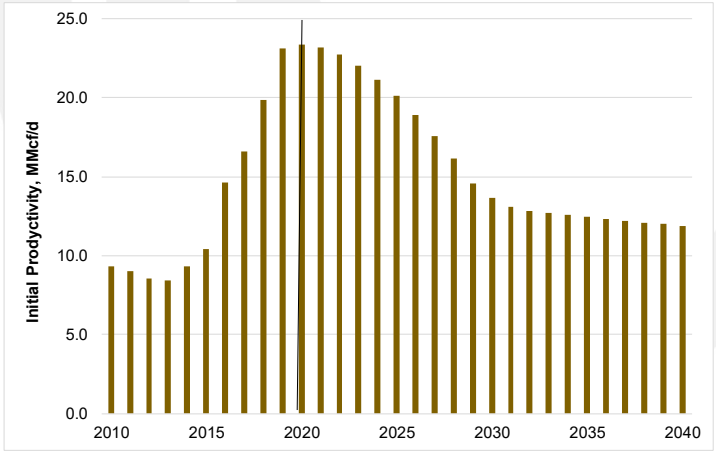
INCORRYS

HAYNESVILLE RAW GAS PRODUCTION

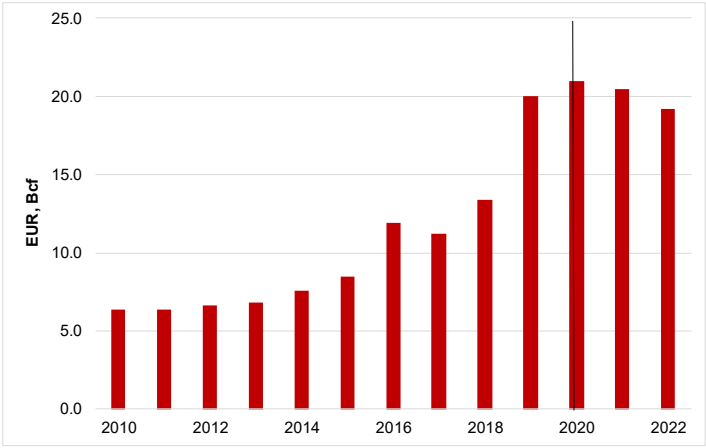


Haynesville raw has production is expected to grow and reach 13.1 Bcf/d in 2027. After this production is expected to decline due to maturity of basin. Initial well productivity is expected to decline to 12 MMcf/d from over 23 MMcf/d in 2020.

Gas Well Initial Productivity, MMcf/d



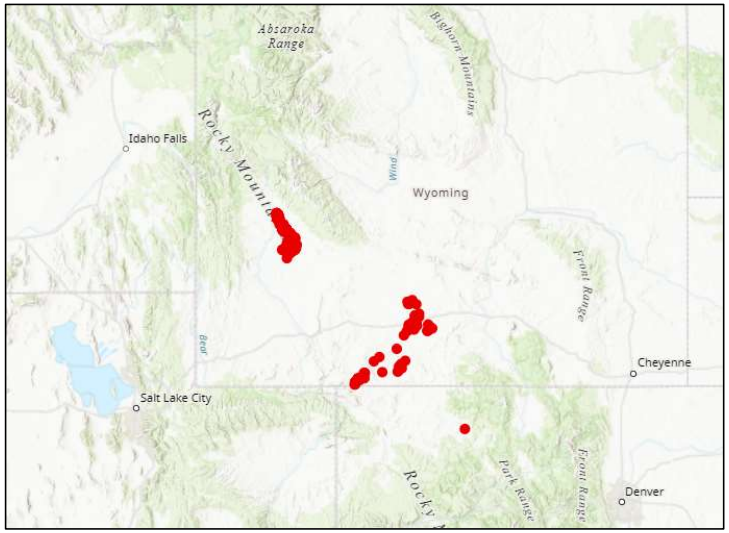
Well EUR, Bcf



INCORRYS

GREEN RIVER

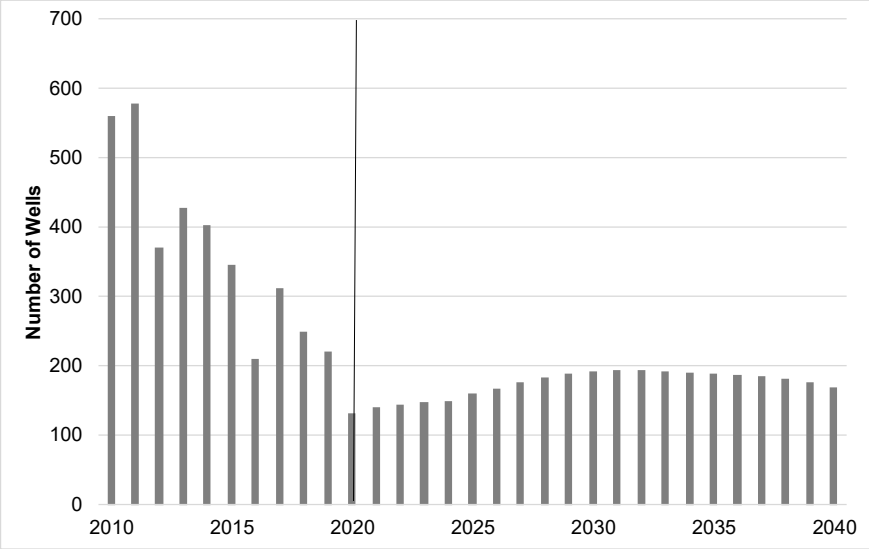
Wells drilled in since 2015



Green river is a most productive basin in Rockies. Active development of tight gas using horizontal wells and fracking started after 2005. Development slowed down after 2015 when economics of Green River became less attractive compared to other basins, such as Marcellus and Utica.

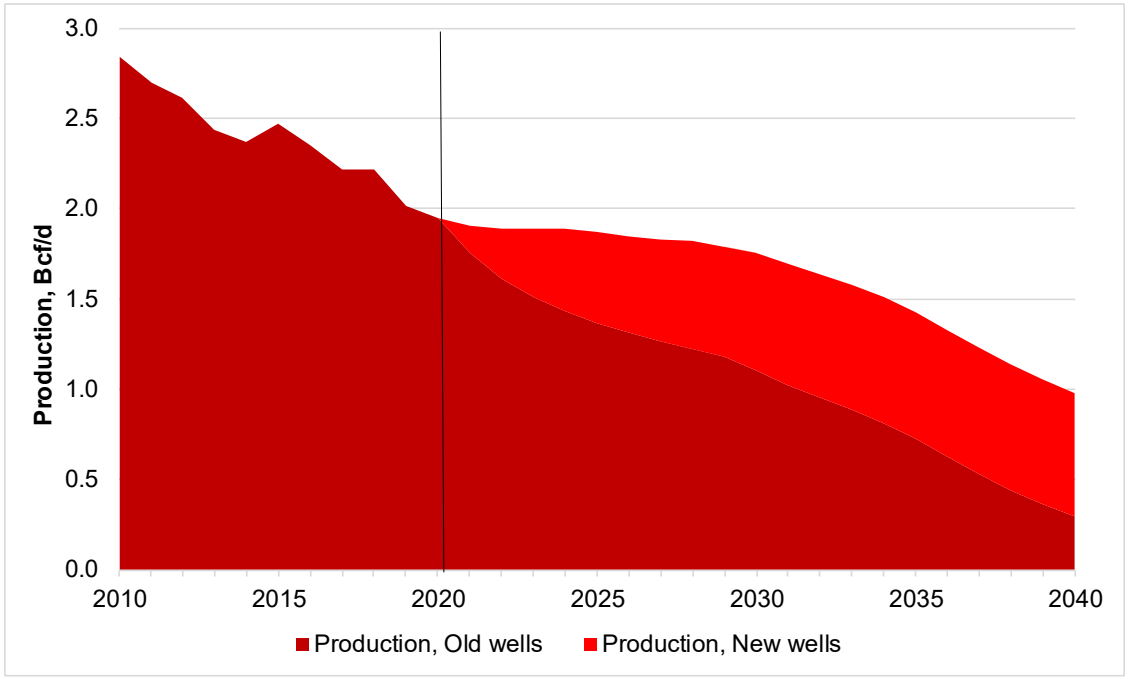
Location: Wyoming, Northern Colorado
Number of gas wells drilled since 2000: ~8,500
Average New Well Initial Productivity in 2009: 3.8 MMcf/d
Peak Production: 2009 (3.0 Bcf/d)
Average First Year Decline in 2020: 78%

Number of New Wells



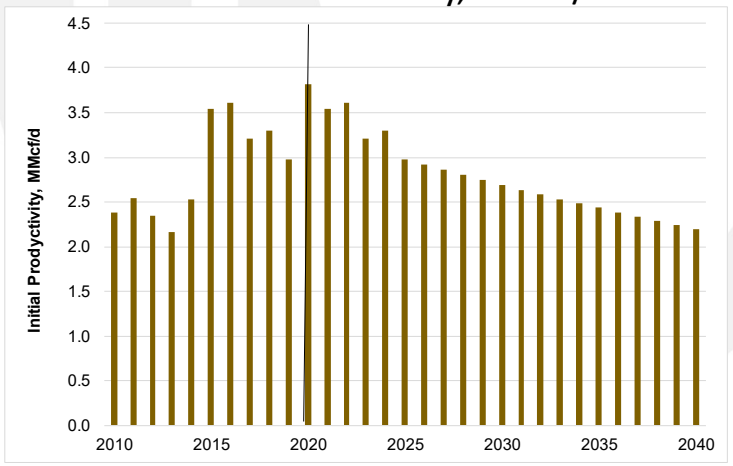
INCORRYS

GREEN RIVER RAW GAS PRODUCTION

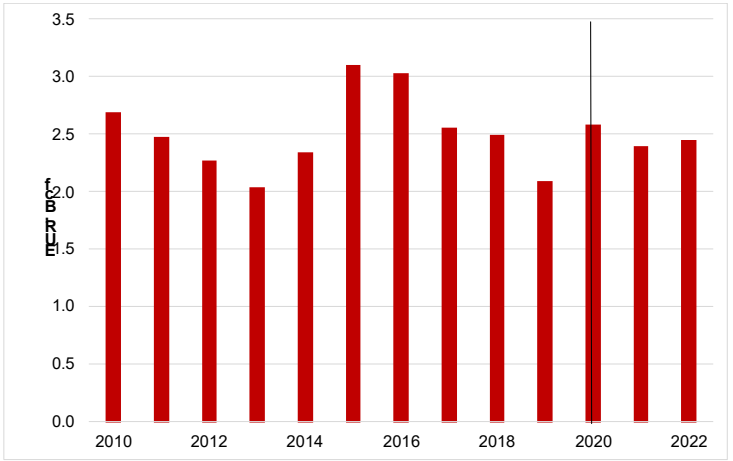


Green River raw gas production dropped from 3 Bcf/d from its peak 2009 to less than 2 Bcf/d in 2020. Production will continue to drop and reach 1 Bcf/d in 2040

Gas Well Initial Productivity, MMcf/d



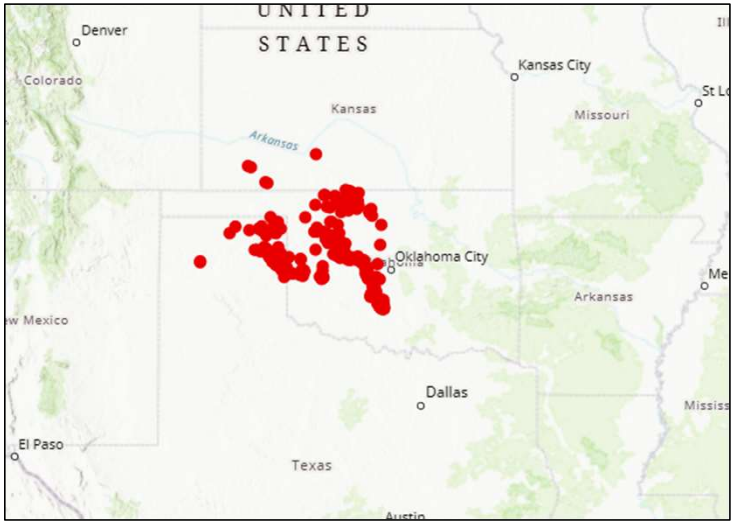
Well EUR, Bcf



INCORRYS

ANADARKO

Wells drilled in since 2015

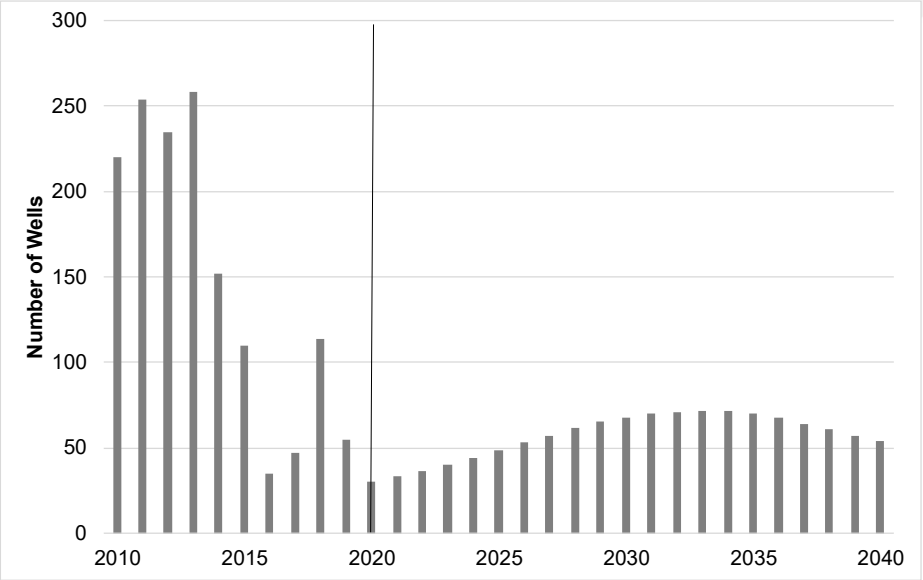


Before 2019, most Anadarko wells were drilled towards Granite Wash and Woodford. However, formation maturity has led to declines in new well productivity. Since 2019 almost no wells were drilled in Granite Wash and Woodford. Drilling continues in less productive Mississippian formations which has led to significant drop in new well initial productivity.

Location: Mostly Oklahoma, North Texas, Southern Kansas
Number of gas wells drilled since 2000: ~1,500
Average New Well Initial Productivity:
- in 2018 (mostly Granite Wash and Woodford): 10.5 MMcf/d
- In 2020 (Mississippian Basins): 7.8 MMcf/d

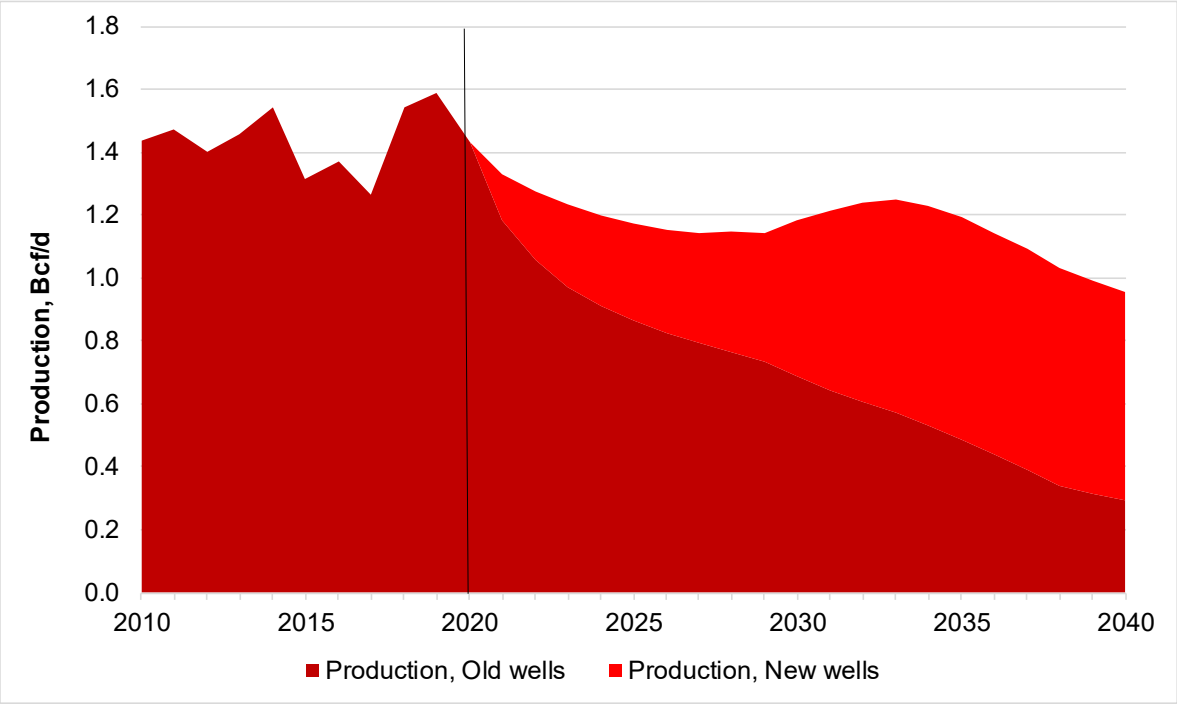
Peak Production: 2019 (1.6 Bcf/d)
Average First Year Decline in 2020: 62%

Number of New Wells



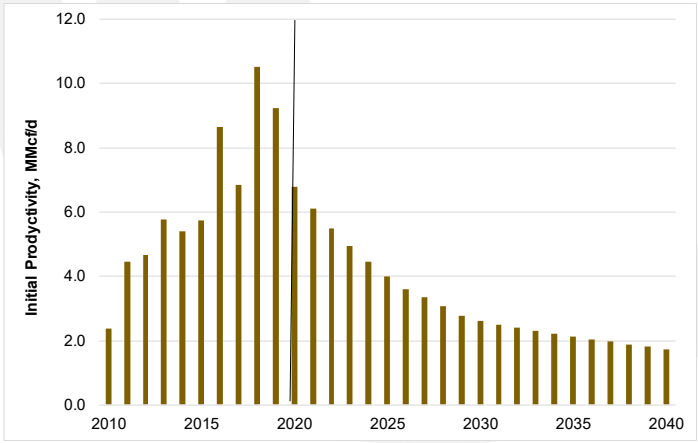
INCORRYS

ANADARKO RAW GAS PRODUCTION

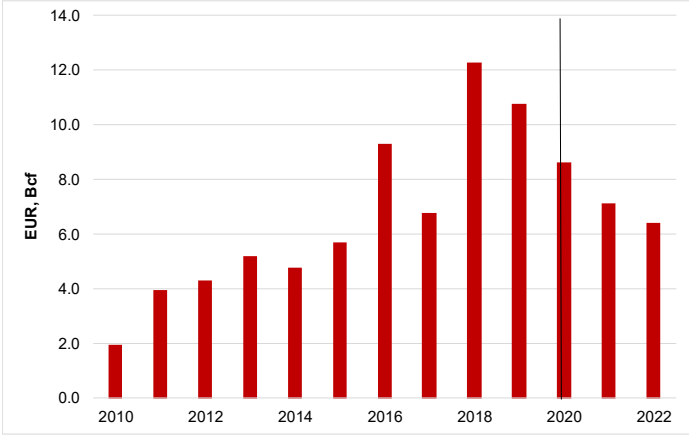


Anadarko raw gas production will continue to decline and reach less than 1.0 Bcf/d in 2040 down from its peak of 1.6 Bcf/d in 2019. New well initial productivity will drop to less than 2 MMcf/d in 2040.

Gas Well Initial Productivity, MMcf/d



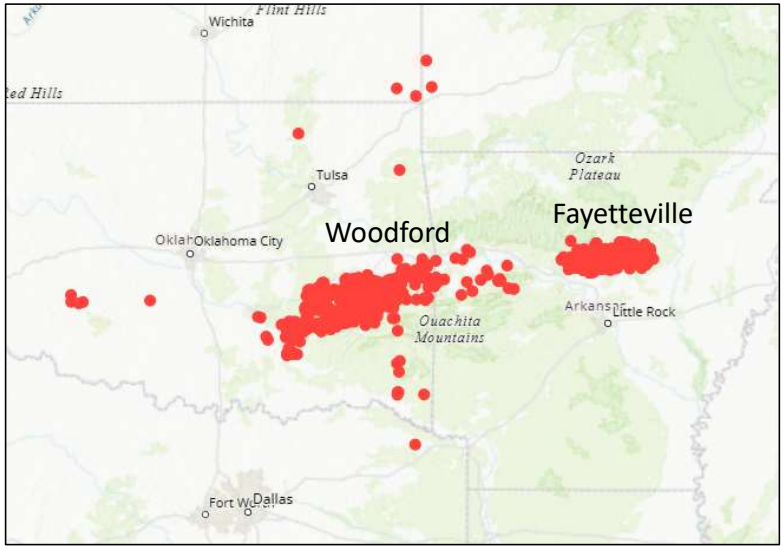
Well EUR, Bcf



INCORRYS

ARKOMA

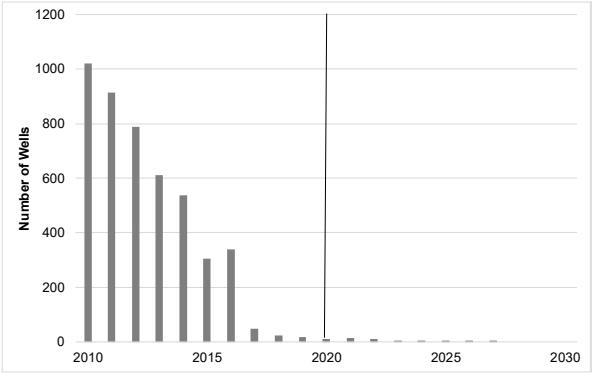
Wells drilled in since 2015



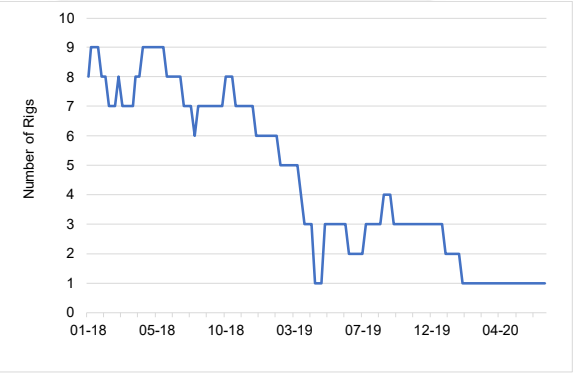
Since 2007 Arkoma production was focused on Fayetteville Shale in Arkansas and Woodford Shale in Oklahoma. Both Shales are now mature. Currently there is no drilling in Fayetteville and only one rig operates in Woodford. Incorrys does not expect any development in Arkoma after 2030.

Location: Eastern Oklahoma, Arkansas
Number of gas wells drilled since 2000: ~8,800
Average New Well Initial Productivity in 2020: 2 MMcf/d
Peak Production: 2012 (3.1 Bcf/d)
Average First Year Decline in 2020: 67%

Number of New Wells

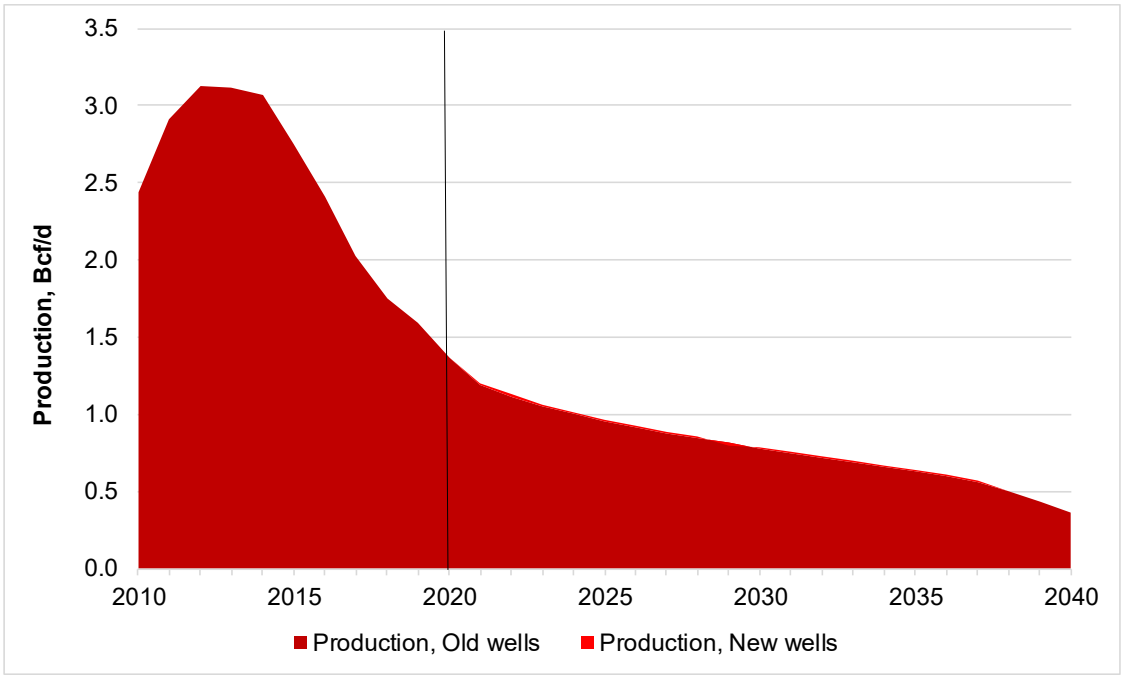


Number of Rigs - Woodford



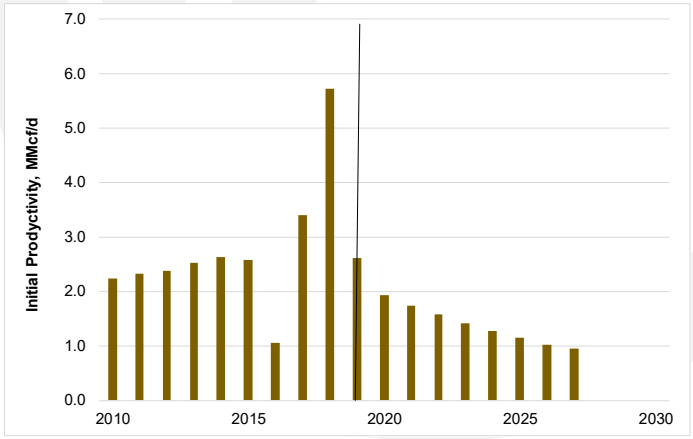
INCORRYS

ARKOMA RAW GAS PRODUCTION

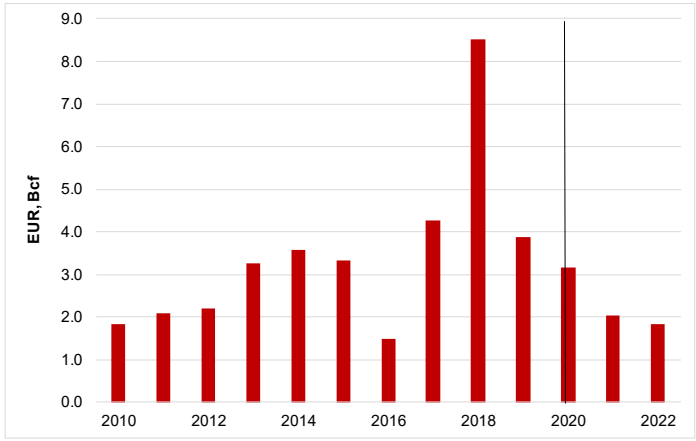


Incorrys does not expect any significant new gas production in Arkoma basin. Existing production will continue to decline and reach 0.35 Bcf/d in 2020.

Gas Well Initial Productivity, MMcf/d



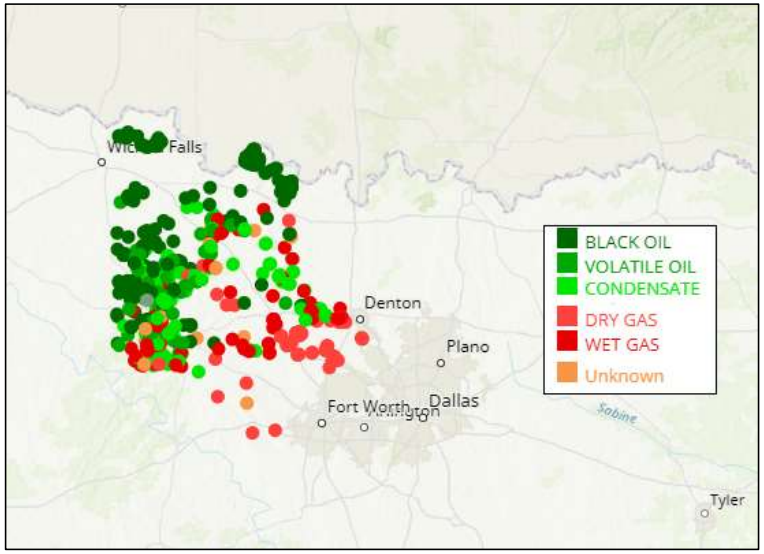
Well EUR, Bcf



INCORRYS

BARNETT

Wells drilled in since 2015 in Barnett Shale

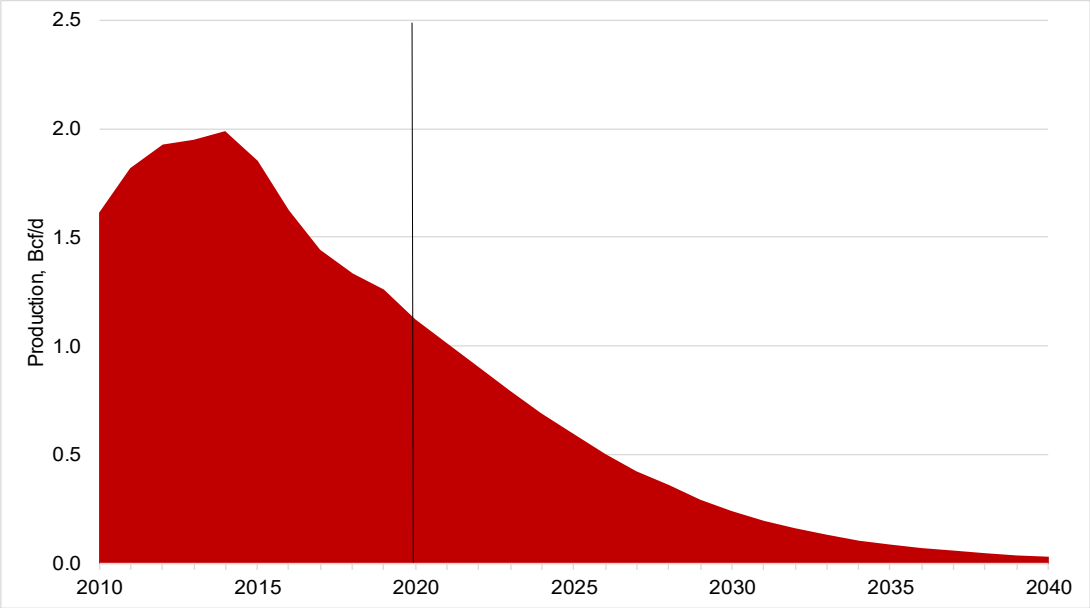


Barnett, the first basin to prove horizontal drilling and multistage fracking for Shale Gas was developed starting 2000.

Barnett consists of gas area in the south portion of the basin and oil and condensate area in the north portion.

Location: Texas, north of Dallas/Ft Worth
Number of gas wells drilled since 2010: ~2,300
Average New Well Initial Productivity in 2017: 1.2 MMcf/d
Peak Production: 2014 (2 Bcf/d)
Average First Year Decline in 2017: 62%

Barnett Shale Production

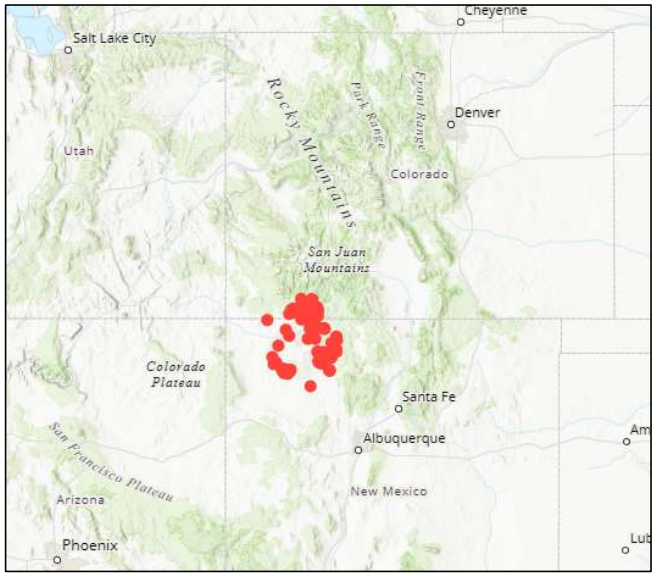


Barnett production started to decline after 2014. Only few natural gas focused wells are expected to be drilled in Barnett in 2021 and later.

INCORRYS

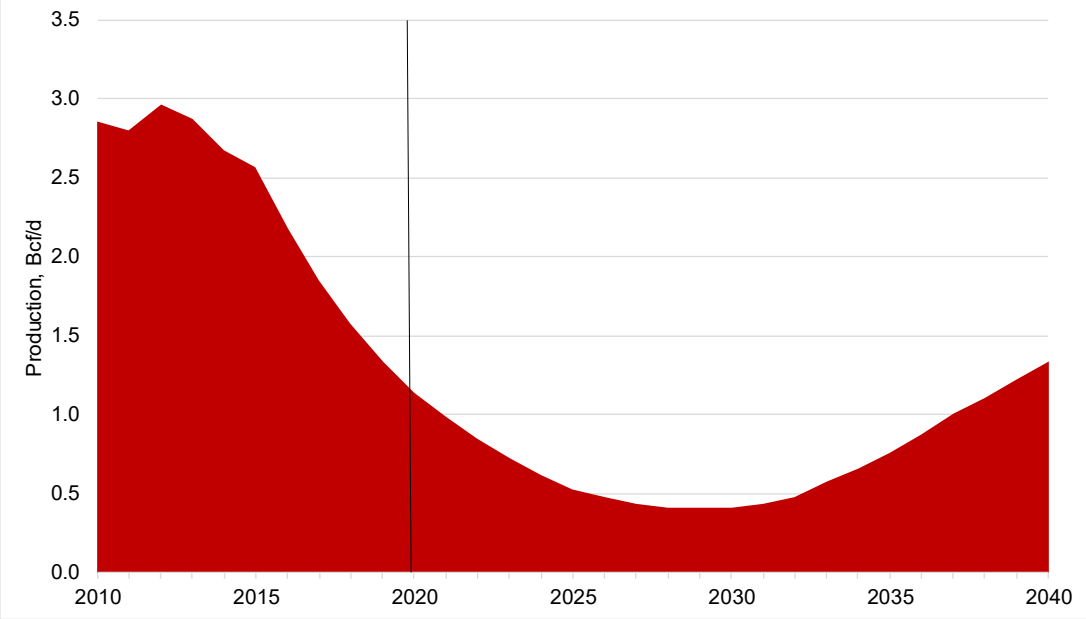
SAN JUAN

Wells drilled in since 2015



San Juan is a conventional and CBM basin which currently does have any significant development and experience declining production. San Juan basin includes Mancos Shale. In 2016 USGS estimated Mancos Shale resources 66 Tcf . Incorrys estimates that Mancos shale will be developed after 2030.

Location: North New Mexico, South Utah
Number of gas wells drilled since 2010: ~700
Average New Well Initial Productivity in 2010: 0.76 MMcf/d
Production in 2020: 1.1 Bcf/d
Average First Year Decline in 2017: 40%

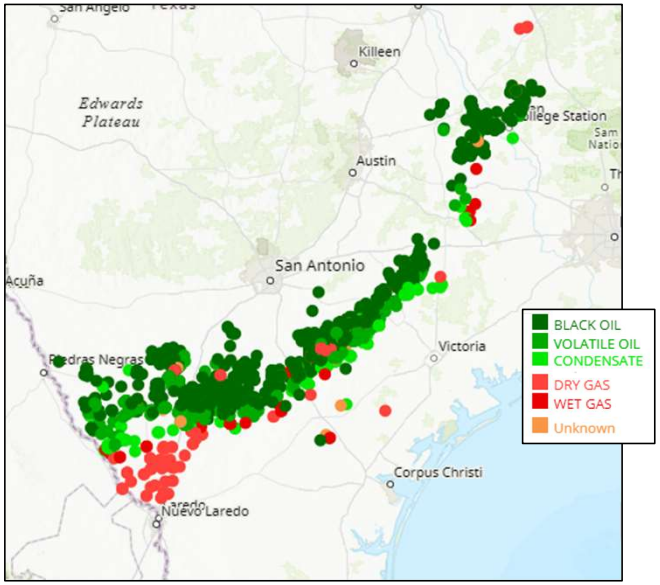


San Juan production will start growth after 2030 due to Mancos shale development. Currently relative economics of Mancos Shale is less attractive compared to other Shale basins.

INCORRYS

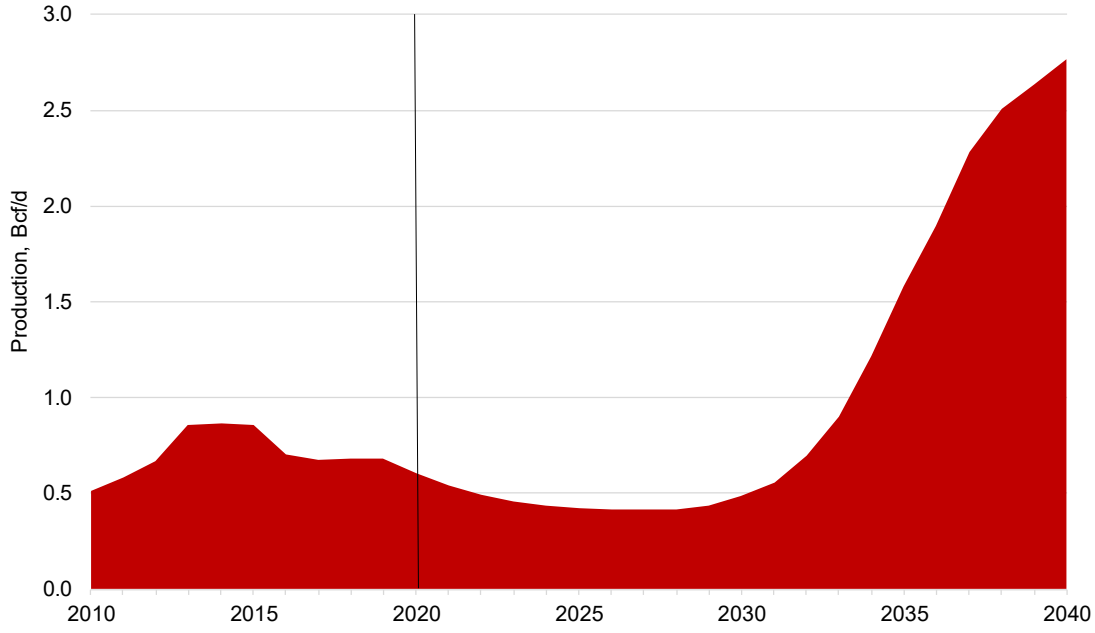
EAGLE FORD (NON-ASSOCIATED GAS PRODUCTION)

Wells drilled in since 2015



Liquids rich gas in produced in Southern area of Eagle Ford. Currently most development is focused in oil portion of the basin. Average gas well productivity in Eagle Ford is lower than in other Shale basins, such as Marcellus and Utica. Active gas development is expected when current core acreage in tier 1 Shale basins is exhausted.

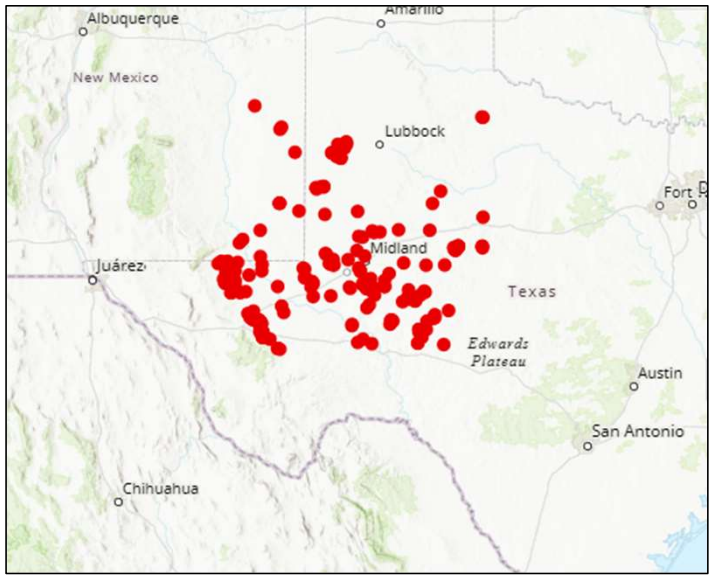
Location: Texas Gulf Coast
Number of gas wells drilled since 2010: ~1,050
Average New Well Initial Productivity in 2020: 7.5 MMcf/d
Production in 2020: 0.6 Bcf/d
Average First Year Decline in 2017: 70%



INCORRYS

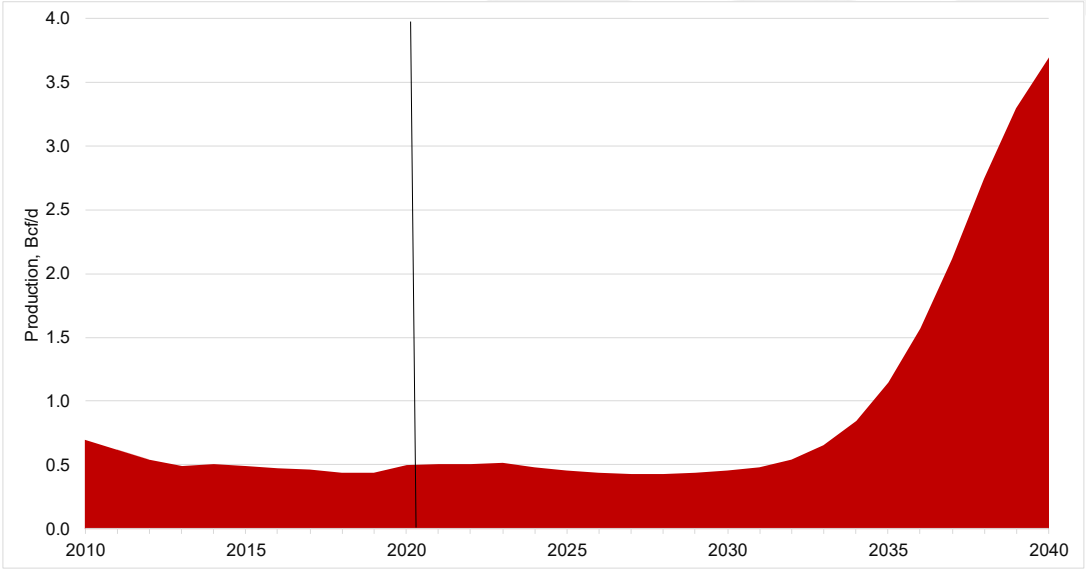
PERMIAN (NON-ASSOCIATED GAS PRODUCTION)

Wells drilled in since 2015



Most wells in Permian are classified as oil and produce significant quantities of associated gas. Currently gas production from gas wells is very limited. Active gas development is expected later in the forecast period as Tier 1 Shale Gas basins and Permian oil production begin to decline.

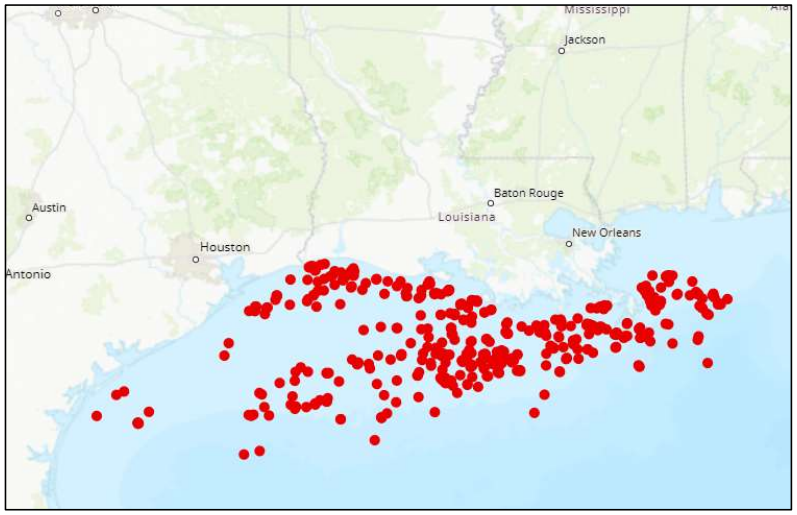
Location: West Texas, East New Mexico
Number of gas wells drilled since 2010: ~800
Average New Well Initial Productivity in 2020: 7.5 MMcf/d
Production in 2020: 0.4 Bcf/d
Average First Year Decline in 2017: 68%



INCORRYS

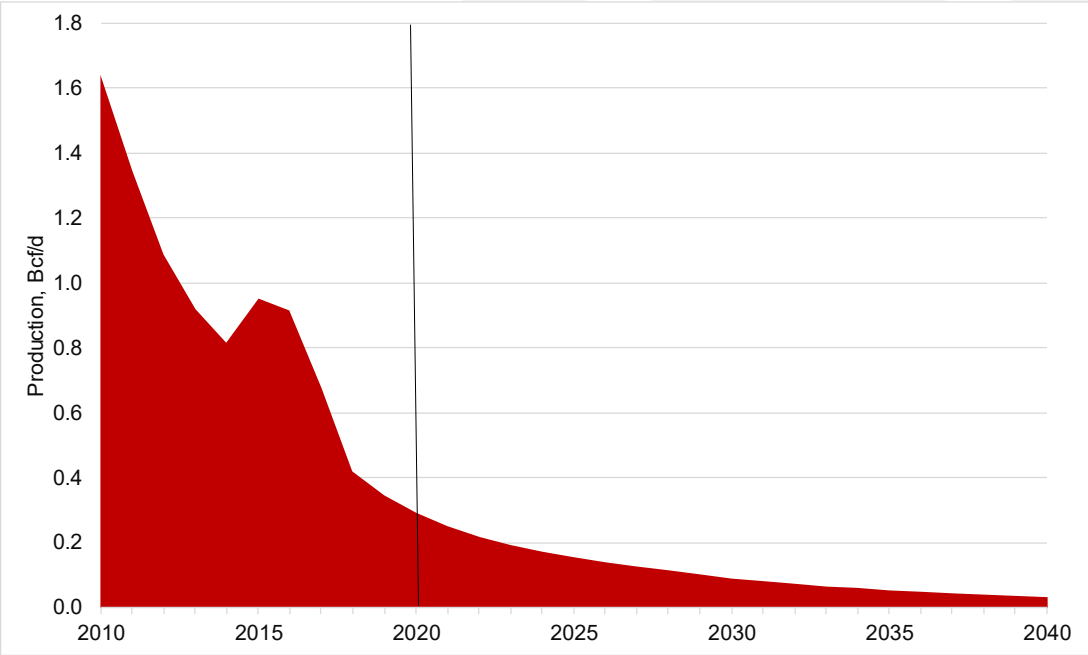
GULF OF MEXICO OFFSHORE

Wells drilled in since 2000



Gulf of Mexico 2020 gas production has declined to 0.3 Bcf/d from 4.6 Bcf/d in 2000. Current natural gas focused drilling in Gulf of Mexico is very limited due to high cost with respect to other basins. Incorrys does not expect that Gulf of Mexico gas production to recover during the forecast period.

Location: Offshore Texas and Louisiana
Number of gas wells drilled since 2010: ~110
Average New Well Initial Productivity in 2018-20: 8 MMcf/d
Production in 2020: 0.3 Bcf/d
Average First Year Decline in 2017: 53%



INCORRYS

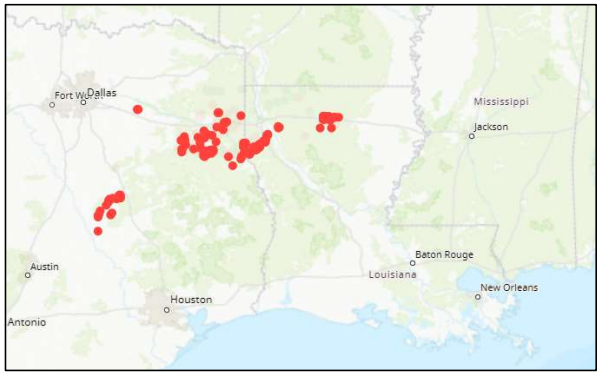
OTHER GAS BASINS AND PLAYS

US Gulf Coast Basin

Travis Peak Formation

Bossier Formation

Cotton Valley Formation: East Texas and North Louisiana. Peak production is in 2008-2009: 2.5 Bcf/d. Production in 2020: 1.5 Bcf/d



Wells drilled in Cotton Valley since 2015

Rockies

Uinta: Utah. Production in 2020: 0.5 Bcf/d. No new drilling

Piceance: Utah and Colorado. Production in 2020: 1.1 Bcf/d. Drilling continues in Cretaceous Williams Fork Formation of the Mesaverde Group

Power River: located in Wyoming. No new drilling

Paradox: Southeastern Utah and Southwestern Colorado. Exploration of Mancos, Gothic and Hovenweep Shale plays

DJ Niobrara: Colorado. Mostly Tight Oil production. Also has liquids rich gas production, which is expected to grow

WHY INCORRYS INFORMATION SYSTEM

COMPREHENSIVE DATA

Incorrys constantly collects huge amount of data from multiple public sources world wide

ADVANCE ANALYTICS

Incorrys performs data analysis to ensure quality and consistency among different industries and jurisdictions

ACCURATE FORECASTS

Incorrys employs various forecasting methodologies to ensure accurate forecasts of trends in different industries.

INCORRYS ENTERPRISE SUBSCRIPTION

Enterprise subscription allows all users with the organization not only access Information System, but also get monthly reports on different subjected related to energy markets, environment and new technology, get direct access to Incorrys's experts, receive regular newsletter, and participate in two custom debriefings per year.

sales@incorrys.com

+1 (347) 741 8219

INCORRYS