

AEO2019 Review and AEO2020 Plans



For

Annual Energy Outlook 2020 PNGBA 1st Working Group

June 5, 2019 | Washington, DC

By

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Office of Petroleum, Natural Gas, and Biofuels Analysis

Oil and Gas Supply

Outline

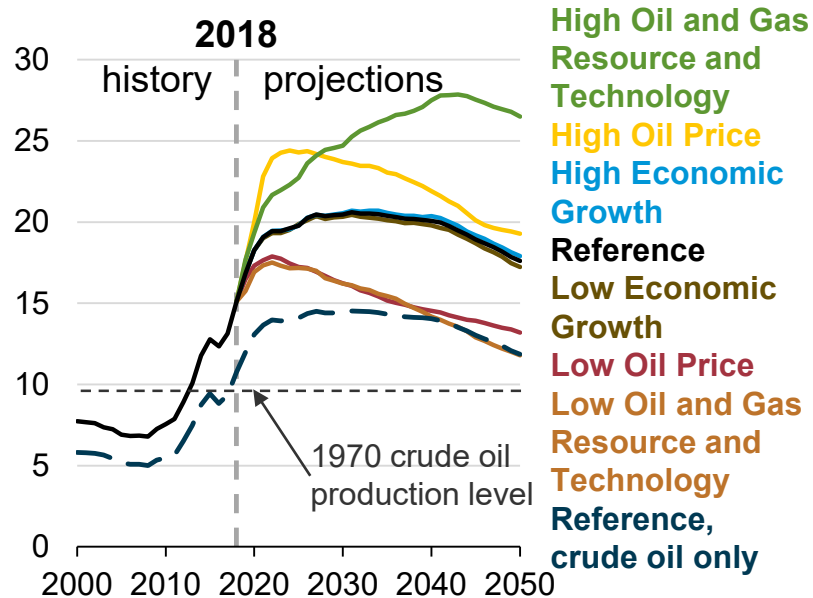
- Evaluation and discussion of results from the *Annual Energy Outlook 2019* (AEO2019)
- Review of changes to the short-term outlook
- Current plans for AEO2020

Outline

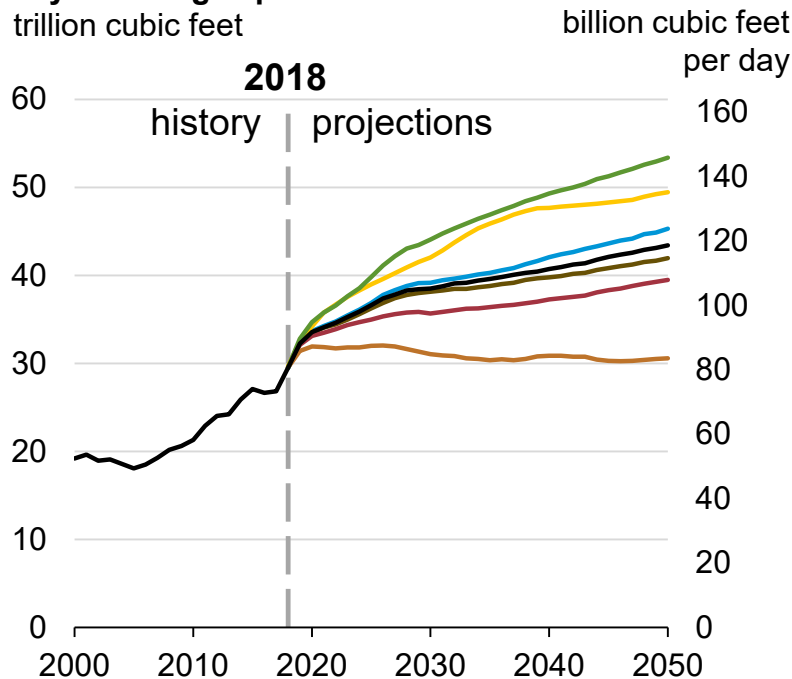
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U.S. crude oil and natural gas production are sensitive to resource availability and technological improvements

U.S. crude oil and natural gas plant liquids production
million barrels per day



Dry natural gas production
trillion cubic feet

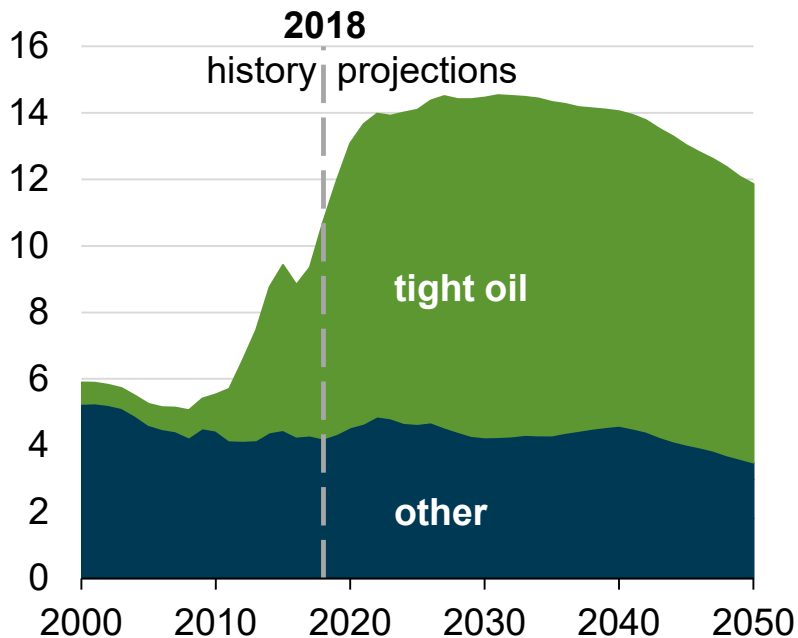


Source: U.S. Energy Information Administration, *Annual Energy Outlook 2019*

Growth in supply from tight and shale resources continues to drive U.S. crude oil and natural gas production

U.S. crude oil production

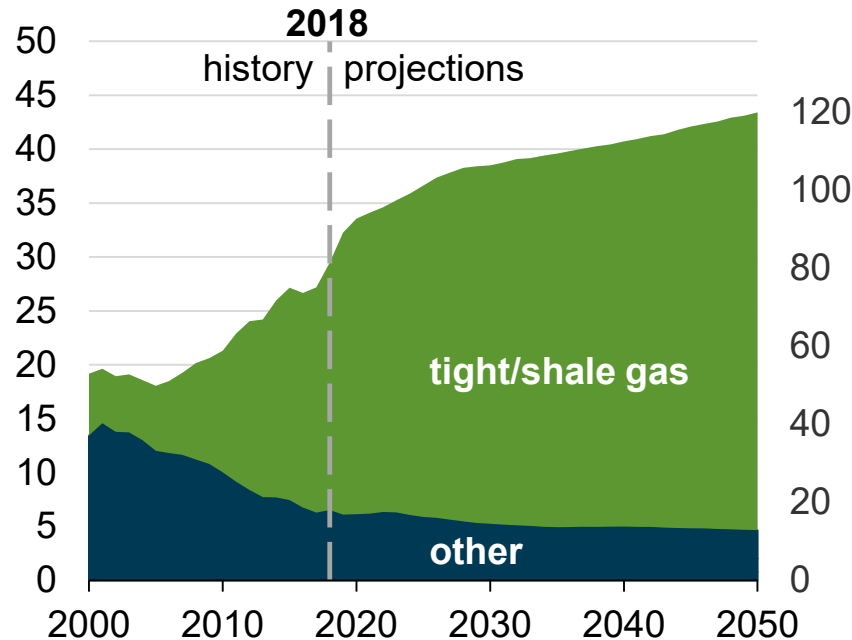
million barrels per day



U.S. dry natural gas production

trillion cubic feet

billion cubic feet per day

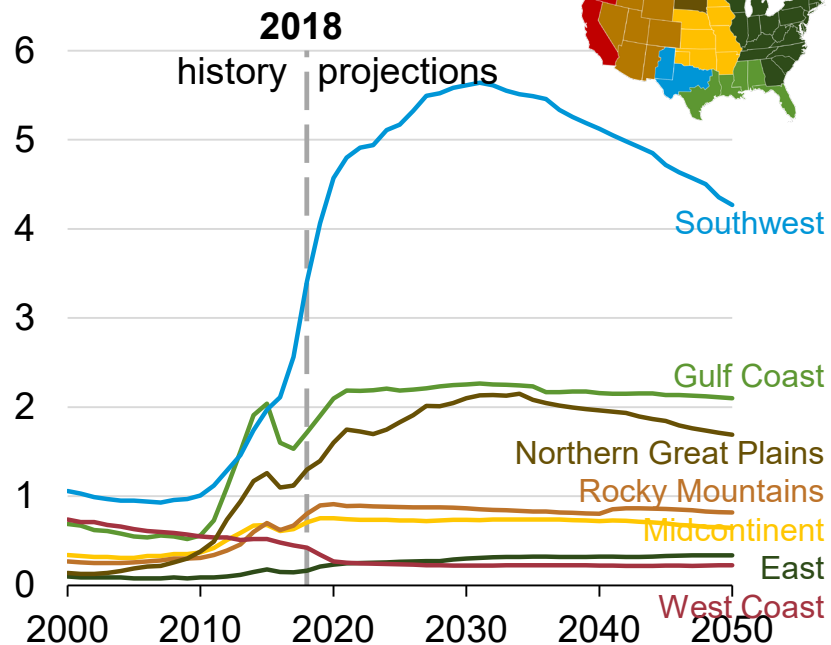


Source: U.S. Energy Information Administration, *Annual Energy Outlook 2019* Reference case

The Southwest region leads growth in U.S. crude oil production and the East region leads growth in natural gas in the Reference case

Lower 48 onshore crude oil production by region

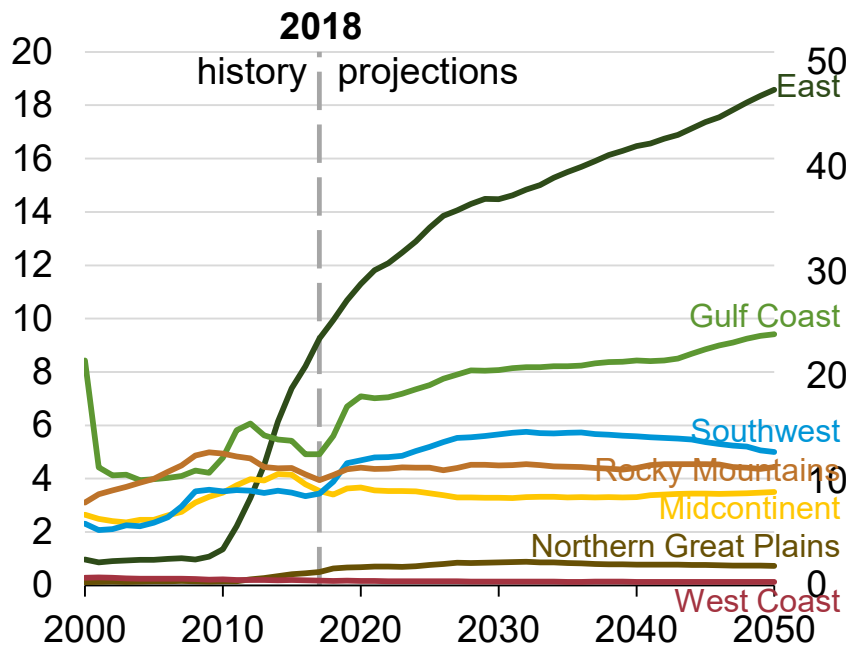
million barrels per day



Lower 48 onshore dry natural gas production by region

trillion cubic feet

billion cubic feet per day

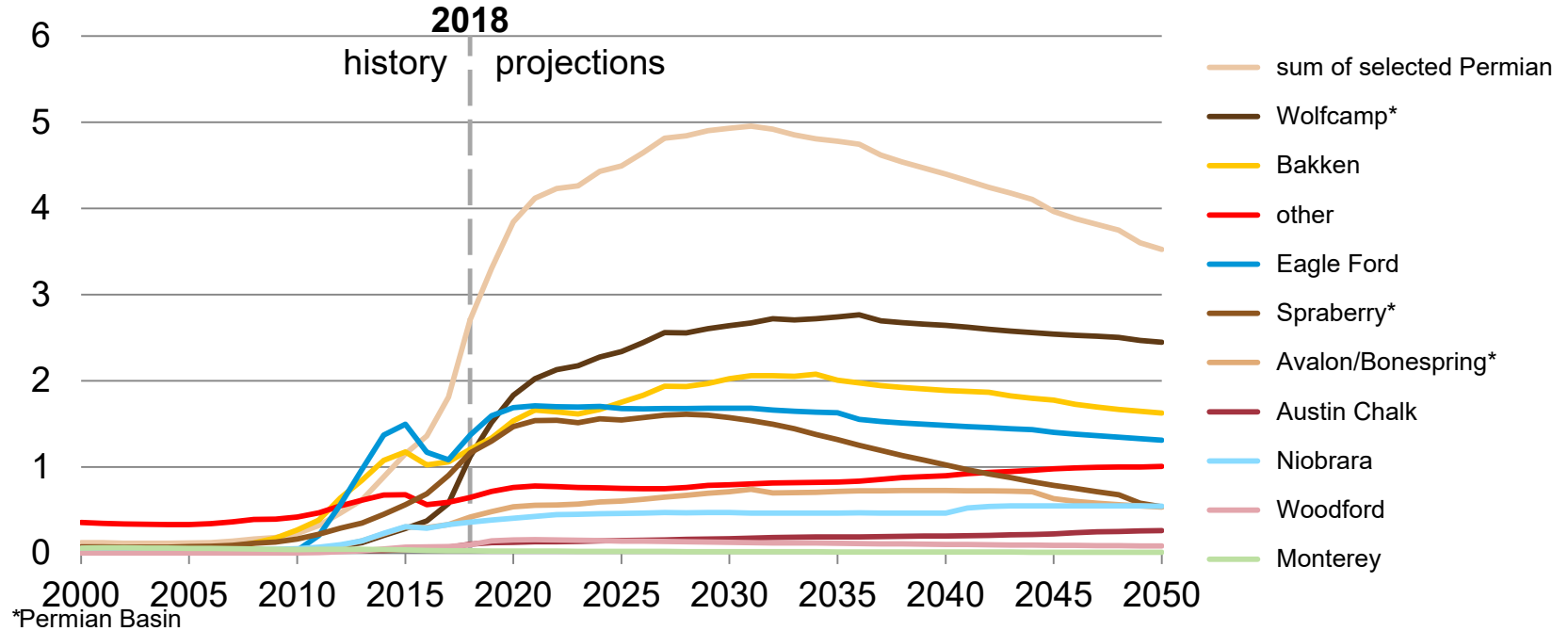


Source: U.S. Energy Information Administration, *Annual Energy Outlook 2019* Reference case

Bakken and Wolfcamp lead growth in tight oil production

U.S. tight oil production

million barrels per day

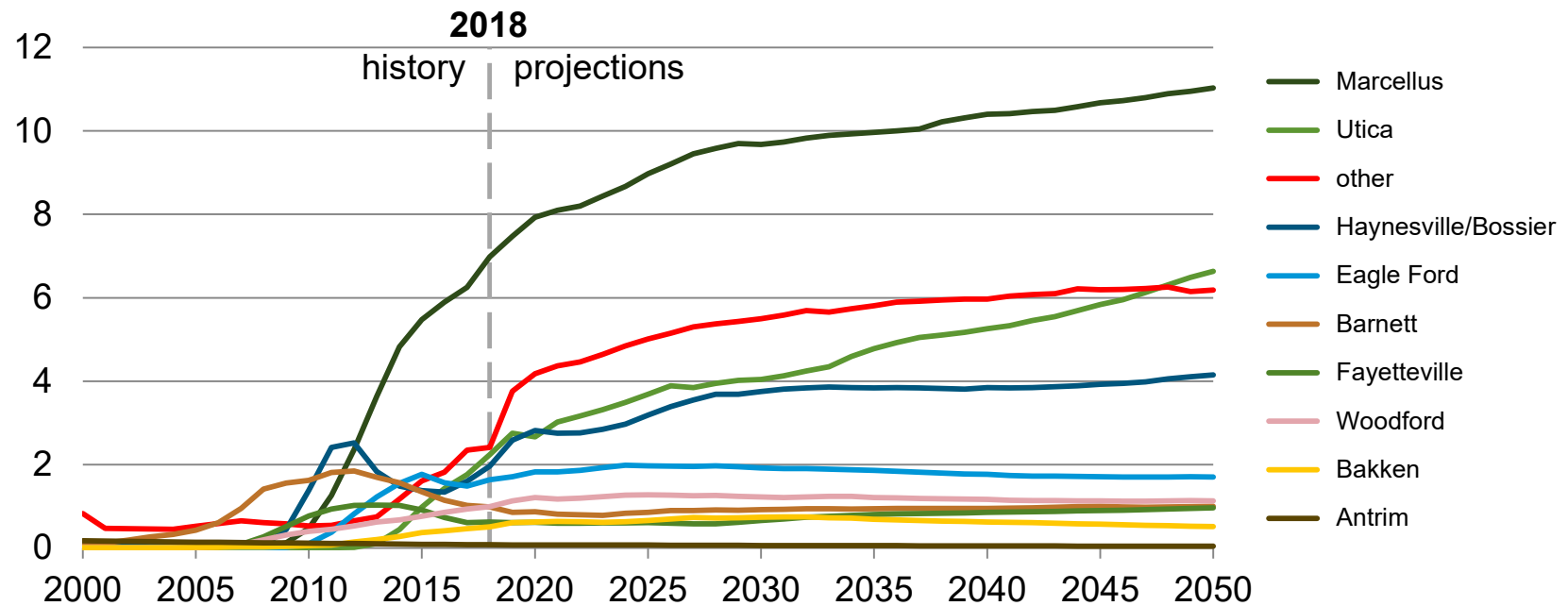


Source: U.S. Energy Information Administration, *Annual Energy Outlook 2019* Reference case

Marcellus, Utica, and Permian tight oil plays lead growth in production of shale gas

U.S. dry shale gas production

trillion cubic feet

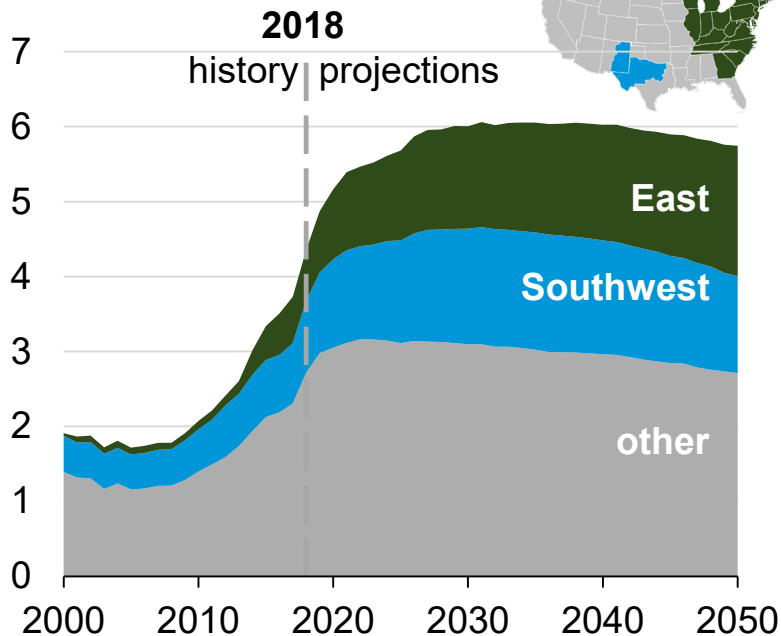


Note: Other includes natural gas production in tight oil plays.

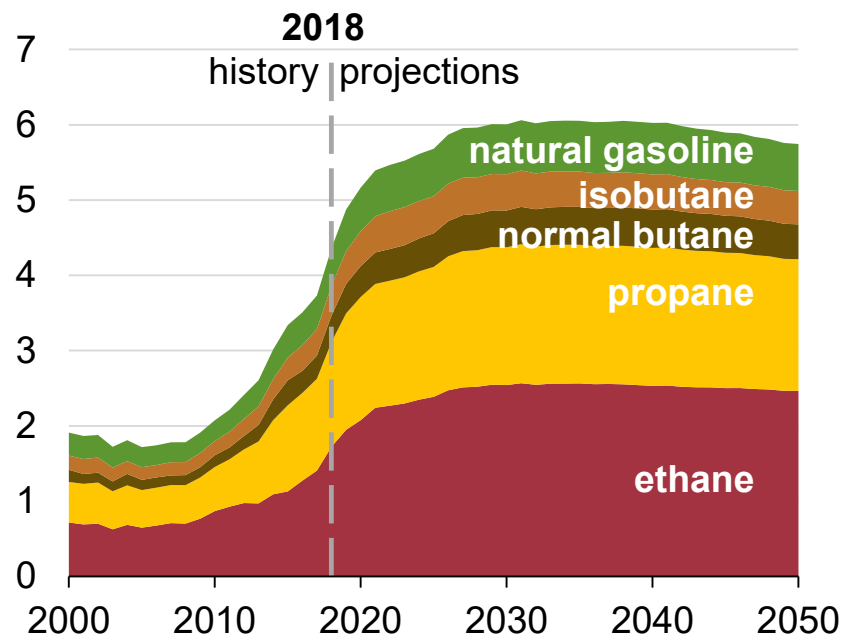
Source: U.S. Energy Information Administration, *Annual Energy Outlook 2019* Reference case

The East and Southwest regions lead the production of natural gas plant liquids in the Reference case

U.S. natural gas plant liquids production by region
million barrels per day



U.S. natural gas plant liquids production by fuel
million barrels per day



Source: U.S. Energy Information Administration, *Annual Energy Outlook 2019* Reference case

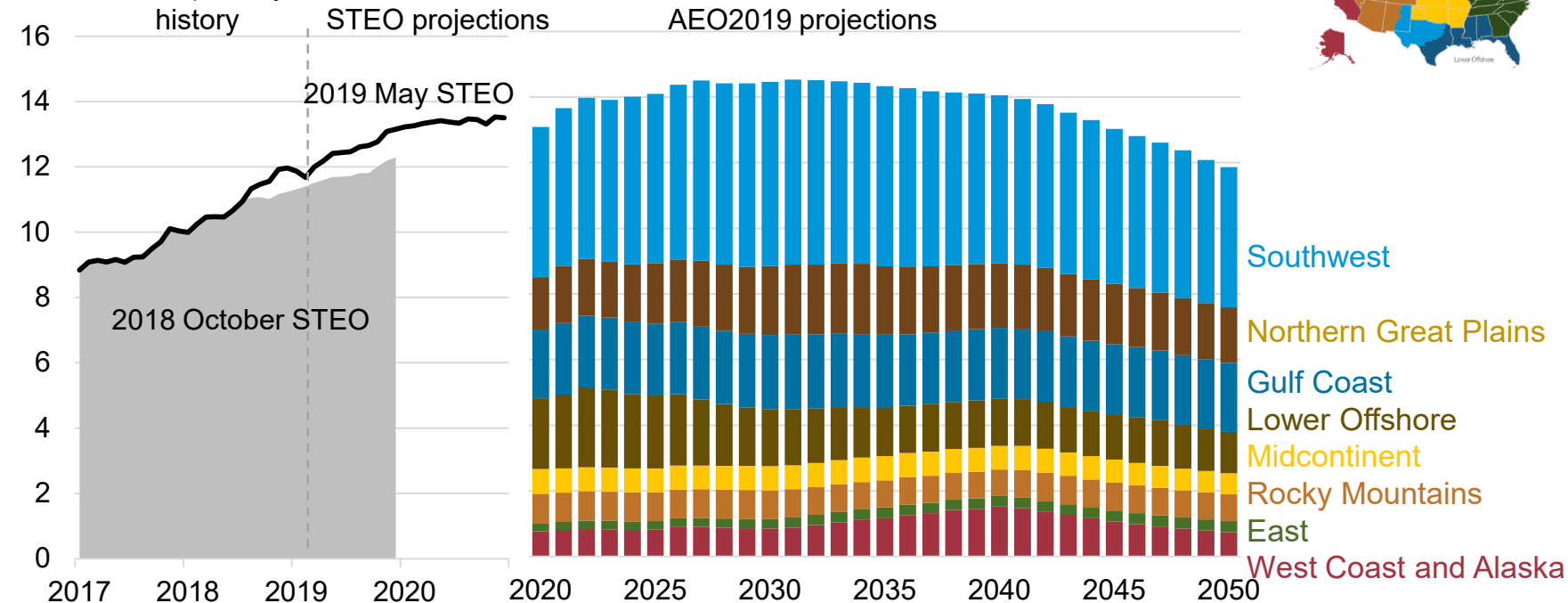
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EIA's 2019 May *Short-Term Energy Outlook* (STEO) projects stronger growth in crude oil production than in the 2018 October STEO

U.S. crude oil production by region

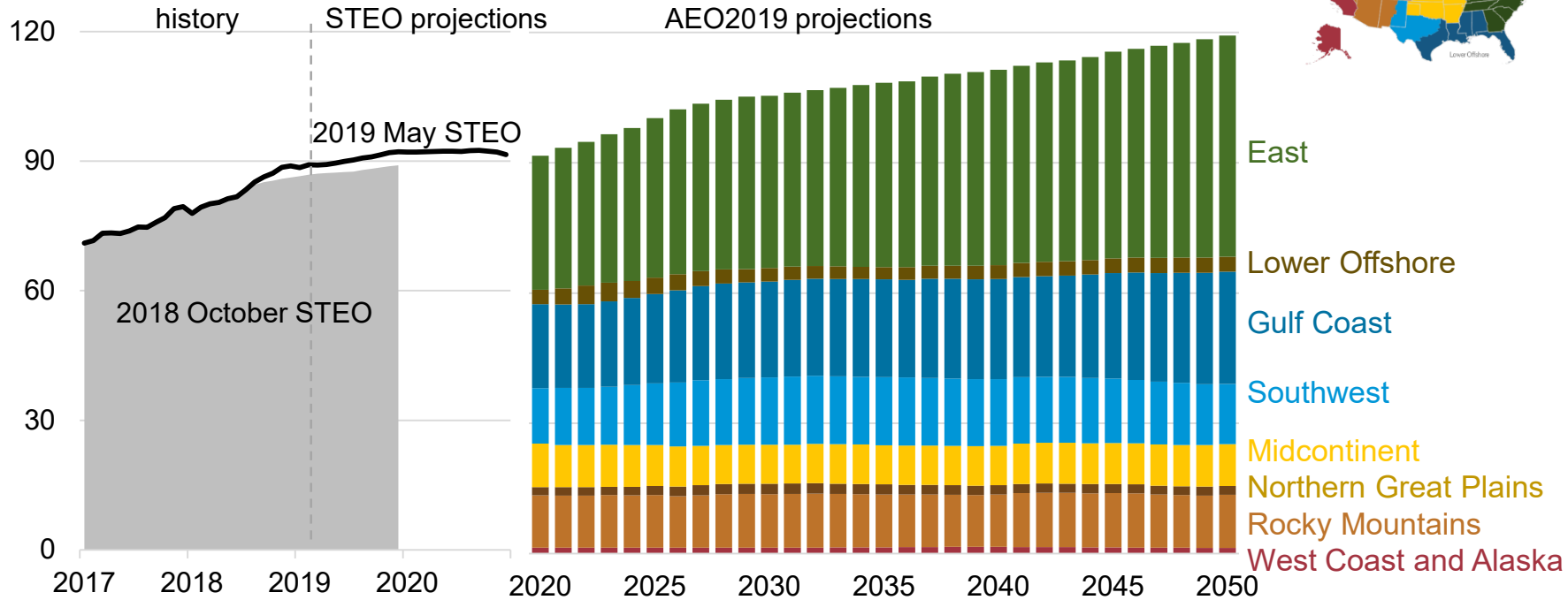
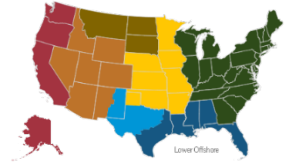
million barrels per day



Source: U.S. Energy Information Administration, *Short-Term Energy Outlooks* and *Annual Energy Outlook 2019* Reference case

EIA's 2019 May *Short-Term Energy Outlook* (STEO) projects stronger growth in natural gas production than in the 2018 October STEO

U.S. dry natural gas production by region
billion cubic feet per day (Bcf/d)



Source: U.S. Energy Information Administration, *Short-Term Energy Outlooks* and *Annual Energy Outlook 2019* Reference case

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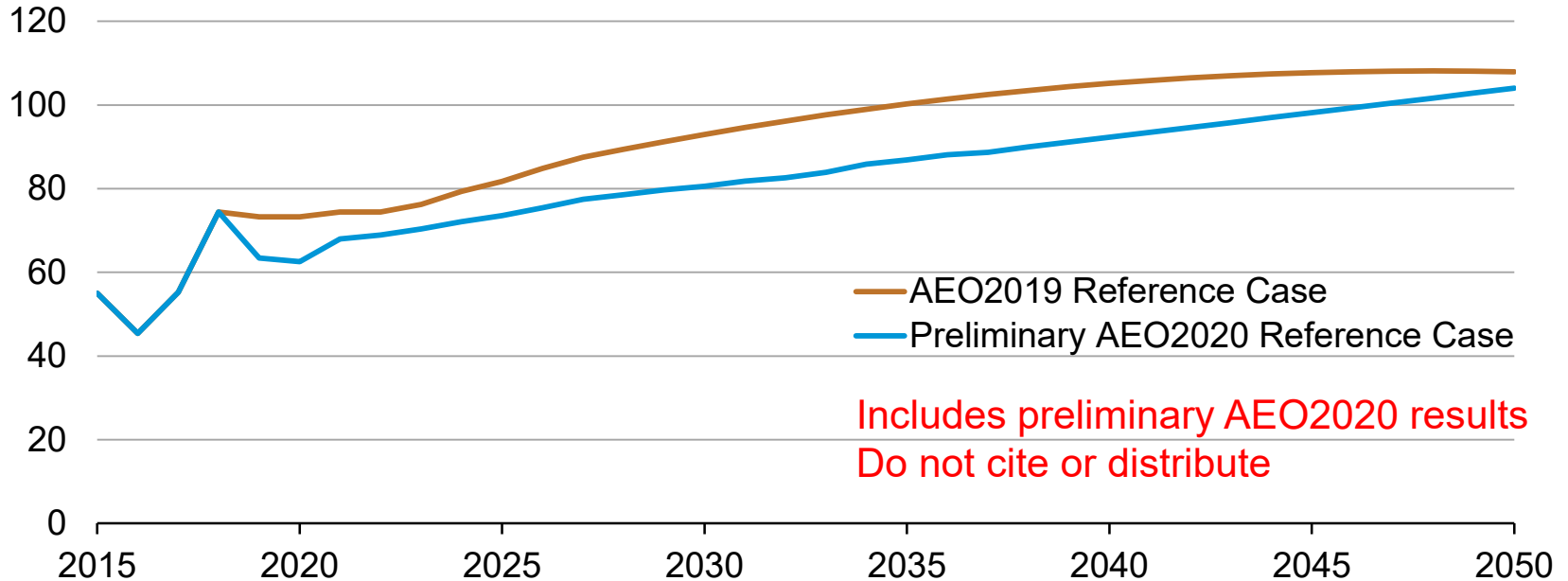
Current plan for AEO2020 updates/enhancements

- Update estimated ultimate recovery (EUR) for tight and shale wells
 - Expand play areas as needed
 - Determine target zone for wells in the Permian Basin
- Incorporate 45Q federal tax credits for carbon capture and sequestration
- Update Alaska and Lower 48 offshore announced discoveries

Liquid Fuels Market Module (LFMM) and International Energy Module (IEM)

Crude oil prices are expected to be lower in the AEO2020 Reference case relative to AEO2019

Brent price, 2018 \$/b



— AEO2019 Reference Case
— Preliminary AEO2020 Reference Case

Includes preliminary AEO2020 results
Do not cite or distribute

Source: U.S. Energy Information Administration, *Annual Energy Outlook 2019* Reference case and preliminary *Annual Energy Outlook 2020* Reference case

Expected updates to international petroleum market representation

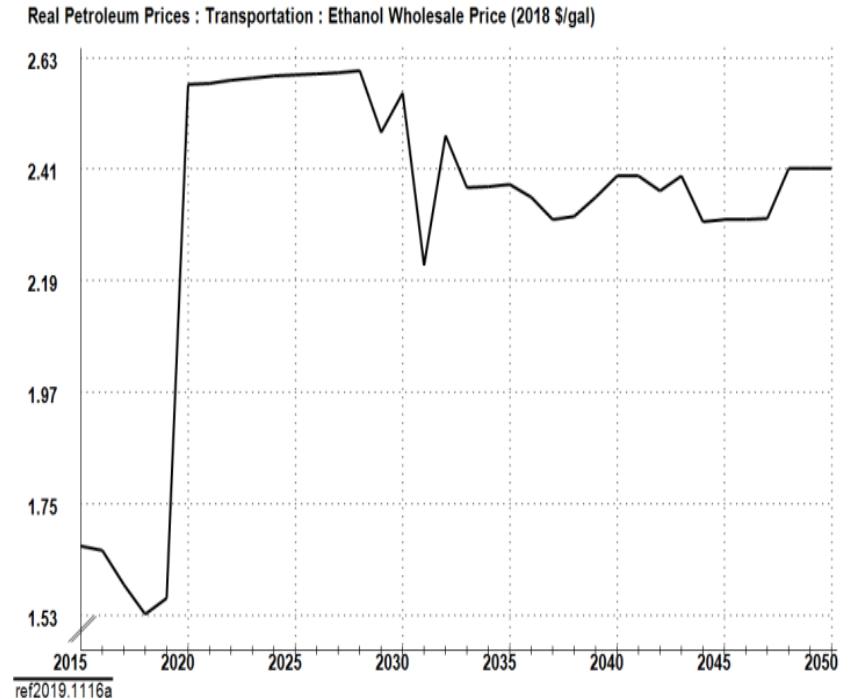
- Revisit assumptions on how the U.S. crude oil and petroleum product market interacts with the international market
- Specifically consider how the IEO can potentially inform international crude oil supply/demand curves in the AEO
- Expect that there will be changes to crude oil imports and exports



Source: U.S. Energy Information Administration, *Annual Energy Outlook 2019* Reference case

Expected biofuel updates for AEO2020

- Revisit assumptions related to biofuel feedstock quantities and prices
- Use more data from EIA's agricultural model (POLYSYS)
- Anticipate that using more POLYSYS data will lead to changes in ethanol prices, imports, and exports
- Updated RFS obligation levels to at least reflect 2018 rulemaking



Source: U.S. Energy Information Administration, *Annual Energy Outlook 2019* Reference case

Other annual updates for AEO2020

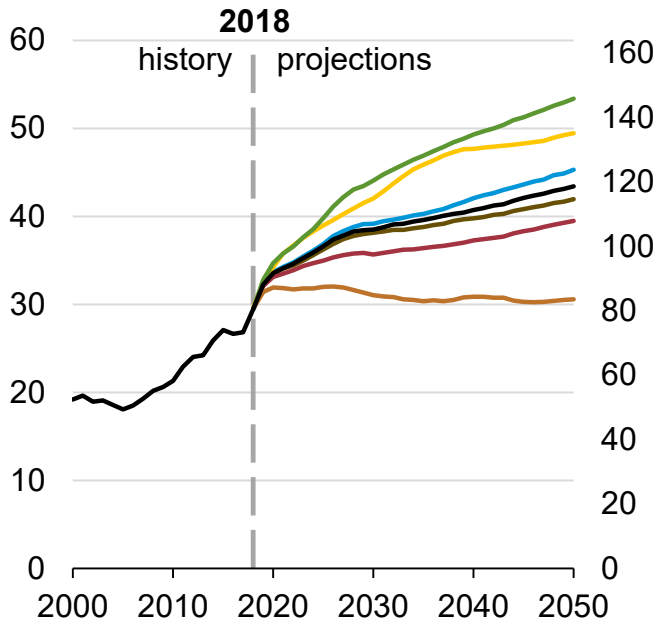
- Use EIA's new database for crude oil and petroleum product pipelines to update pipeline capacities in LFMM
- Update U.S. refinery capacity based on the *Petroleum Supply Annual*
- Update state taxes for gasoline, diesel, and jet fuel
- Consider new distribution cost markups for gasoline, diesel, and jet fuel based on price data from EIA and public sources
- Adjust refinery fuel consumption (such as cat coke, still gas, natural gas) to better match historical levels
- Continue to monitor developments in marine fuel markets related to the International Maritime Organization's (IMO) 2020 sulfur limit and adjust our model assumptions accordingly.

Natural Gas Market Module (NGMM)

U.S. natural gas consumption and production increase in most cases with production growth outpacing natural gas consumption in all cases

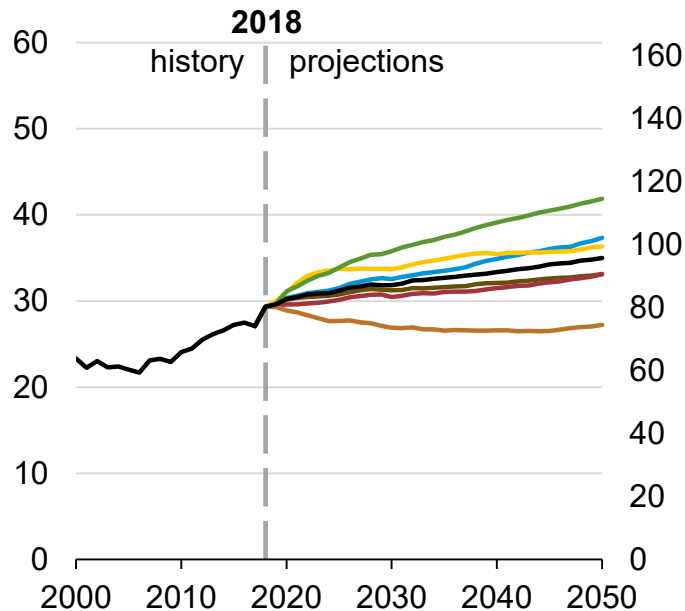
Dry natural gas production

trillion cubic feet billion cubic feet per day



Natural gas consumption

trillion cubic feet billion cubic feet per day



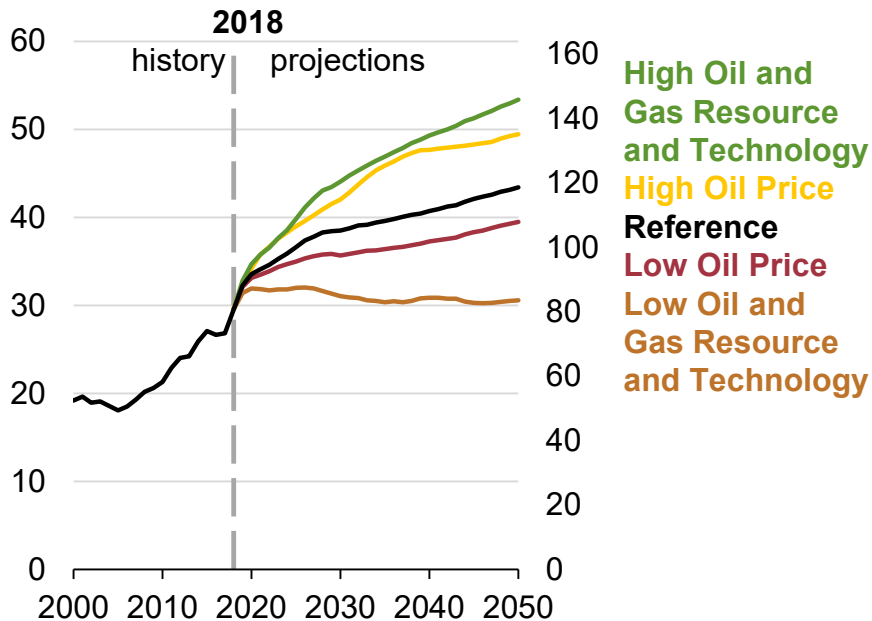
High Oil and Gas Resource and Technology
High Oil Price
High Economic Growth
Reference
Low Economic Growth
Low Oil Price
Low Oil and Gas Resource and Technology

Source: U.S. Energy Information Administration, *Annual Energy Outlook 2019*

Oil and natural gas prices are affected by assumptions about international supply and demand and the development of U.S. shale resources

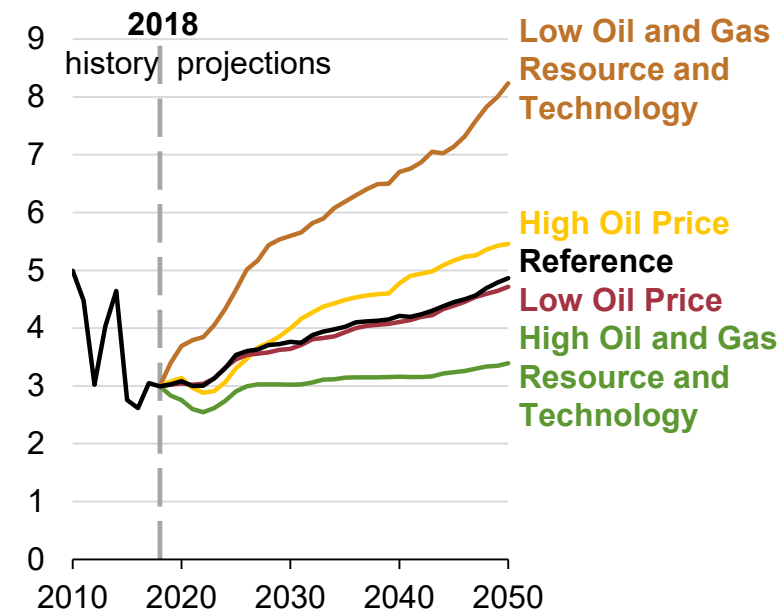
Dry natural gas production

trillion cubic feet billion cubic feet per day



Natural gas price at Henry Hub

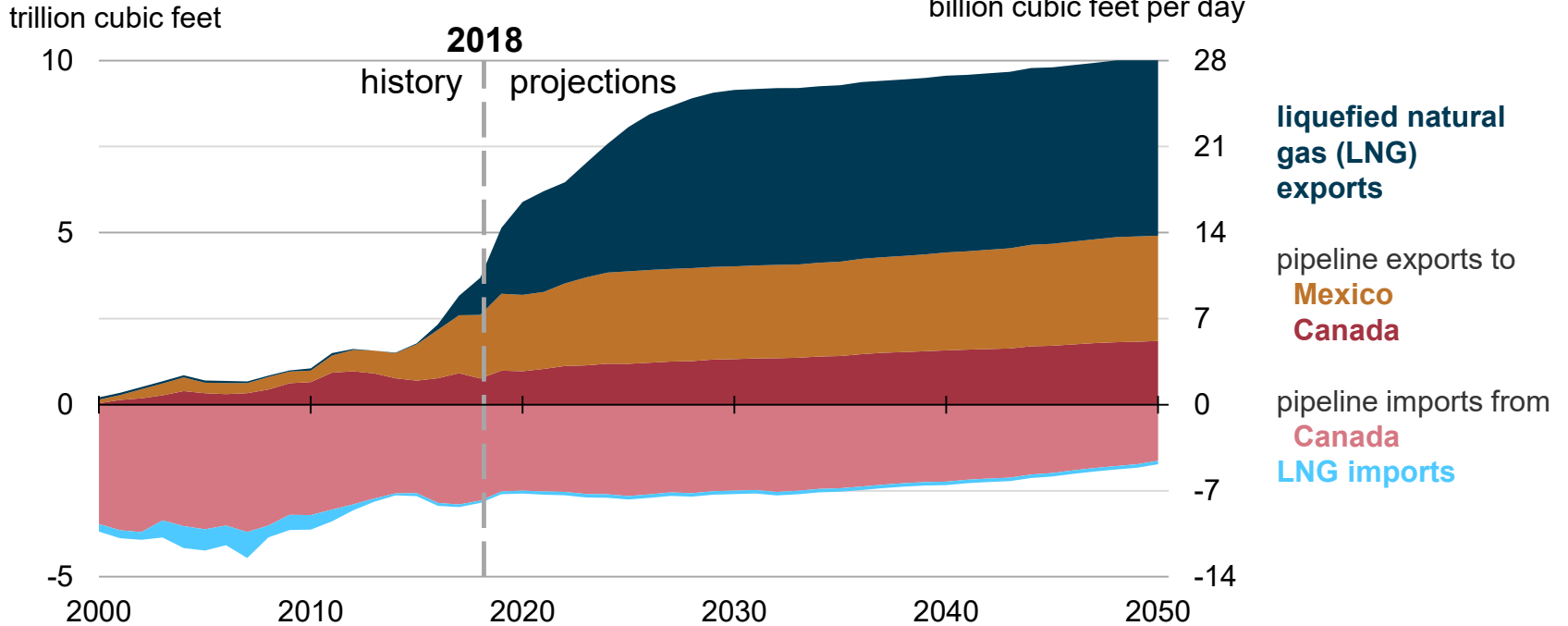
2018 dollars per million British thermal unit



Source: U.S. Energy Information Administration, *Annual Energy Outlook 2019*

U.S. net exports of natural gas continue to grow in the Reference case, led by growth in LNG exports to overseas markets

Natural gas trade (Reference case)



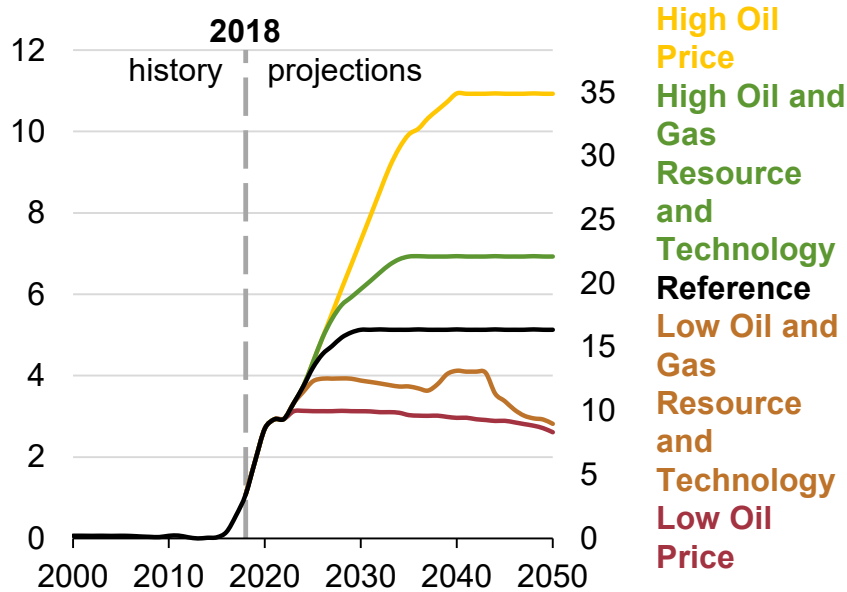
Source: U.S. Energy Information Administration, *Annual Energy Outlook 2019*

AEO2019 projected 14 Bcf/d of LNG exports in 2030 in Reference case

Liquefied natural gas exports

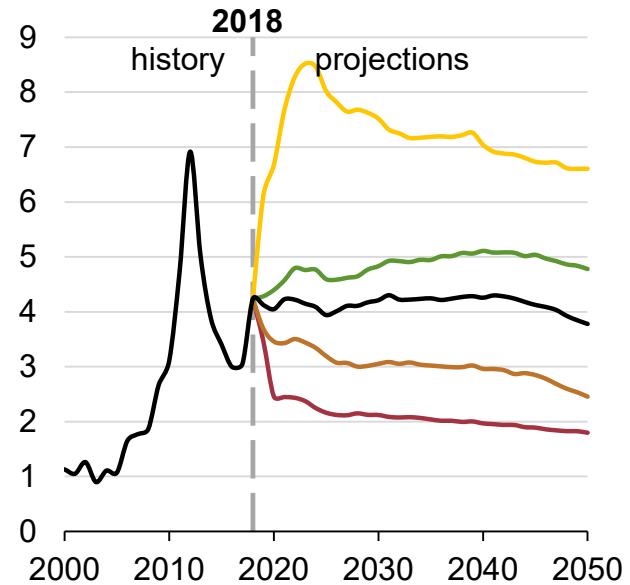
trillion cubic feet

billion cubic feet per day



Brent crude oil price to Henry Hub natural gas price ratio

energy-equivalent terms



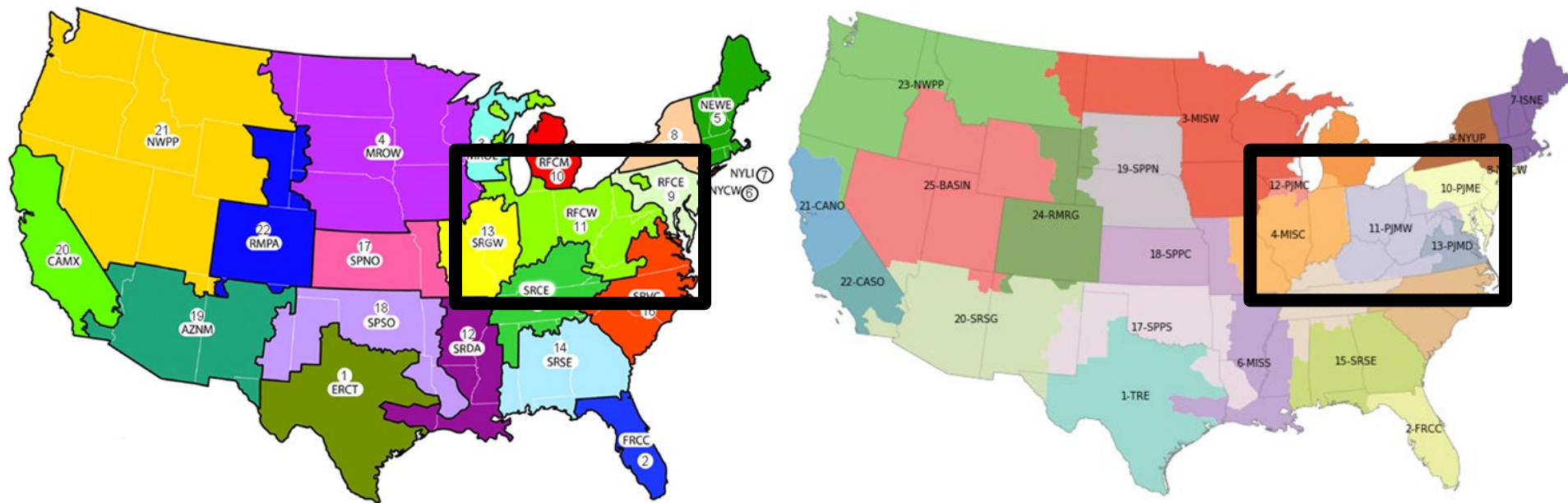
Source: U.S. Energy Information Administration, *Annual Energy Outlook 2019*

LNG export assumptions are being reevaluated

Assumption	AEO2019	AEO2020
Phase-in Years	3	2
Utilization Year 1	33%	50%
Utilization Year 2	67%	90%
Maximum trains per year	3	3
Years to build	4	4
% Liquefaction fuel	10%	10%

- Dates of projects under construction in AEO 2019 updated
- New projects receiving FID are assumed to be built
 - Golden Pass LNG (February 2019): 3 trains, 2.04 Bcf/d, 2024-2025
 - Sabine Pass Train 6 (June 2019): 0.7 Bcf/d, 2023
 - **Calcasieu Pass (construction, no FID): 10 trains, 1.32 Bcf/d, 2023-2024**

Electricity Market Module regionality changes are expected to result in changes to regional natural gas use in power generation/improved convergence

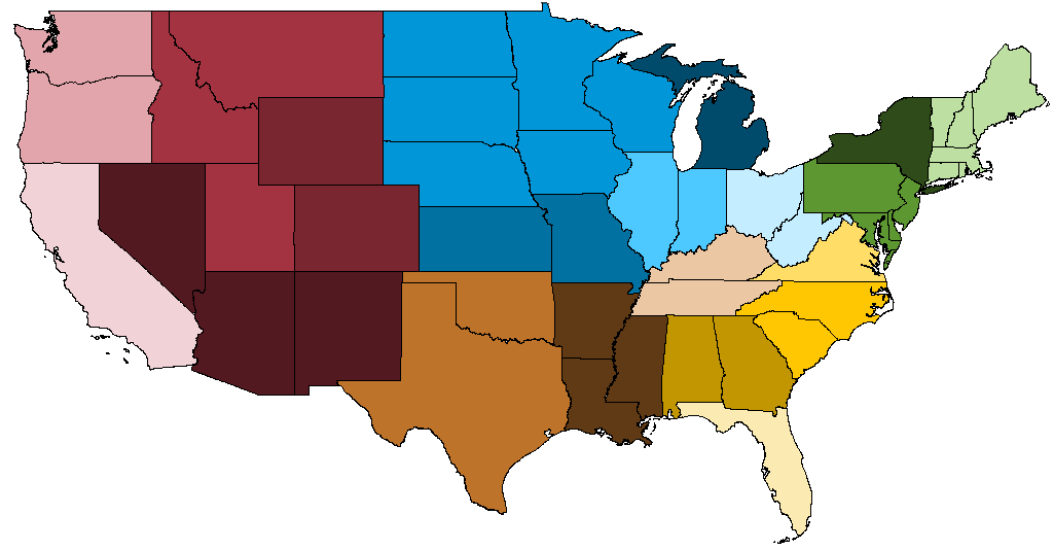
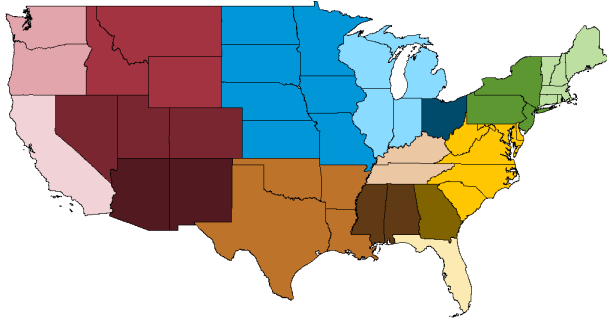


Source: Electricity Market Module documentation, AEO2020 Electricity Working Group 1

Planned changes in the regional mapping between EMM and NGMM

Proposed AEO2020 NGEMM regions

AEO2019 NGEMM regions

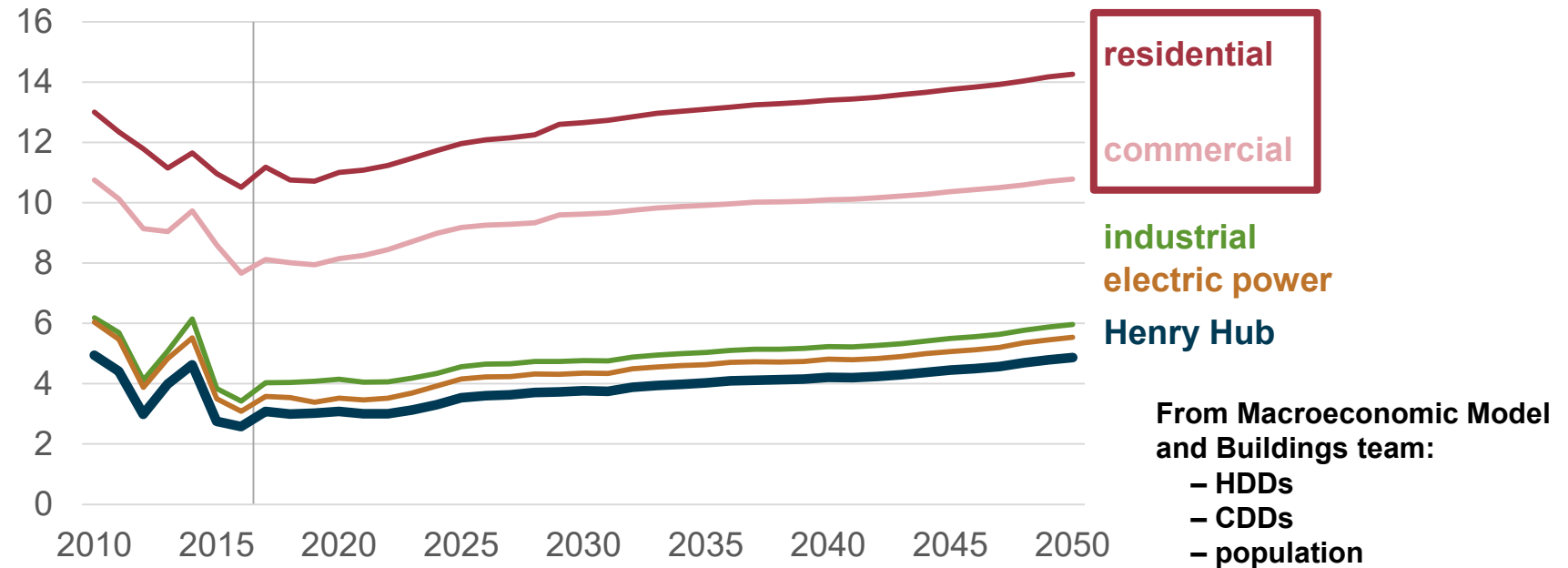


- Realign Mountain region states - source of convergence issues
- Realign South Atlantic region states to match more closely with NERC-based regions
- Realign Southeast/Gulf Coast states to NERC-based regions, not Census divisions

Delivered end-use natural gas price markups to be reevaluated, accounting for projected regional population and climate

Natural gas delivered end-use prices by sector (Reference case)

2018 dollars per thousand cubic feet



Source: U.S. Energy Information Administration, *Annual Energy Outlook 2019 Reference case*

Expectations of changes and additional model developments

- LNG export assumptions: Expectation of higher LNG exports
- Electricity Market Module incorporating new regions into AEO2020; impacts unknown at this point, but changes are expected in terms of regional natural gas use in power generation
- Delivered end-use natural gas price updates: Some regional changes, but minimal impact at national, annual level
- Model calibration efforts are still ongoing; any impacts are expected to be at the regional level (state-to-state monthly flows)

We welcome feedback on our assumptions and documentation

- Working group meetings <http://www.eia.gov/forecasts/aeo/workinggroup/>
- The AEO *Assumptions* report <http://www.eia.gov/forecasts/aeo/assumptions/>
- NEMS model documentation
 - Oil and gas supply (OGSM)
[https://www.eia.gov/outlooks/aeo/nems/documentation/ogsm/pdf/m063\(2018\).pdf](https://www.eia.gov/outlooks/aeo/nems/documentation/ogsm/pdf/m063(2018).pdf)
 - Liquid Fuels Market Module (LFMM)
[https://www.eia.gov/outlooks/aeo/nems/documentation/lfmm/pdf/m059\(2018\).pdf](https://www.eia.gov/outlooks/aeo/nems/documentation/lfmm/pdf/m059(2018).pdf)
 - International Energy Module (IEM)
[https://www.eia.gov/outlooks/aeo/nems/documentation/international/pdf/m071\(2018\).pdf](https://www.eia.gov/outlooks/aeo/nems/documentation/international/pdf/m071(2018).pdf)
 - Natural Gas Market Module (NGMM)
[https://www.eia.gov/outlooks/aeo/nems/documentation/ngmm/pdf/ngmm\(2018\).pdf](https://www.eia.gov/outlooks/aeo/nems/documentation/ngmm/pdf/ngmm(2018).pdf)

For more information

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Short-Term Energy Outlook | www.eia.gov/forecasts/steo

International Energy Outlook | www.eia.gov/forecasts/ieo

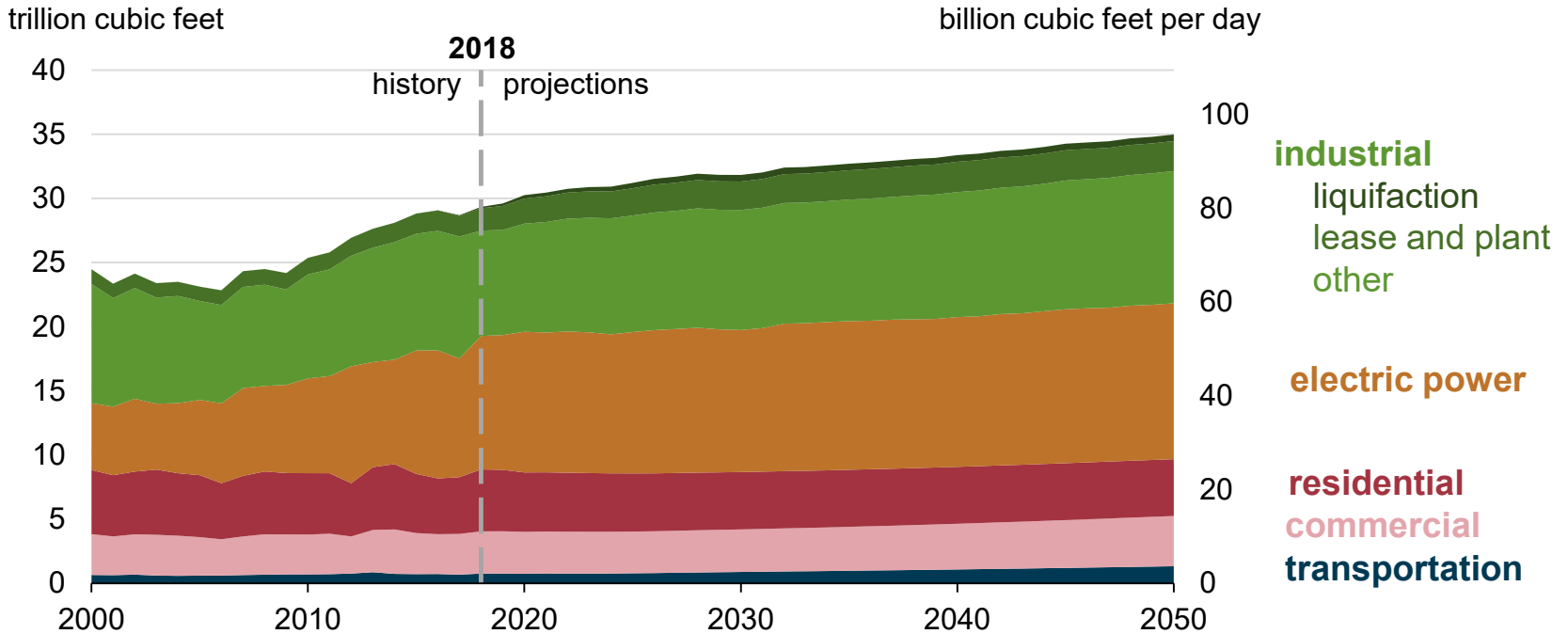
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The industrial sector, followed by the electric power sector, drives U.S. natural gas consumption growth

Natural gas consumption by sector (Reference case)



Source: U.S. Energy Information Administration, *Annual Energy Outlook 2019*