

Annual Energy Outlook 2022 Working Group

Preliminary results for oil, natural gas, and liquid fuels



for

Oil and Gas Supply, Natural Gas Markets, & Liquid Fuels Markets Working Group
September 29, 2021 | Washington, DC

By

Petroleum & Natural Gas Modeling Team
Office of Long-Term Energy Modeling

Oil and natural gas supply

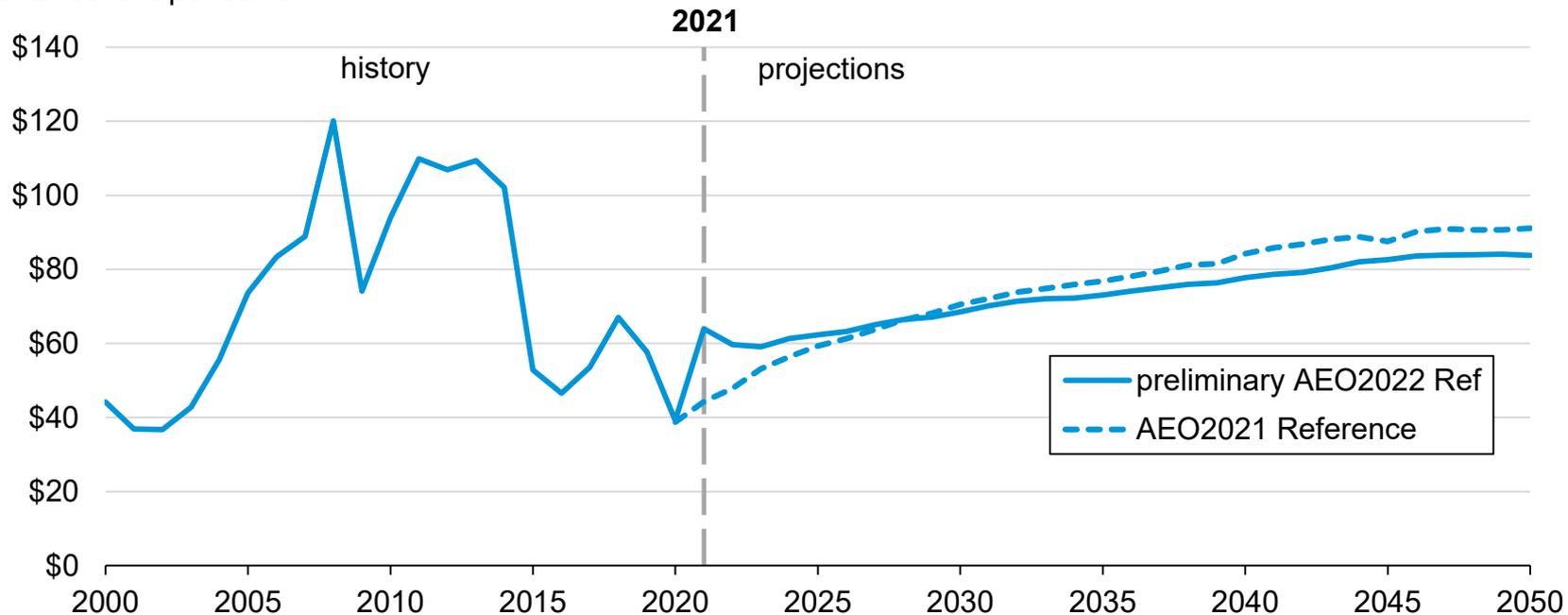
AEO2022 OGSM updates

- Data updates
 - Tight and shale estimated ultimate recovery per well (EUR)
 - Lower 48 states offshore and Alaska announced discoveries
 - Historical production through 2020 and estimated 2021
 - Natural gas plant liquids (NGPL) factors for plays in the Denver-Julesburg Basin
 - Canadian natural gas supply (legacy declines, EURs, and wells equations)
- Recent laws and executive orders
 - Revision to oil and natural gas permitting rules in Colorado
 - Increased drilling setbacks from homes and business from 500 feet to 2,000 feet
 - Applies to new permit applications and still-pending applications submitted under the previous rules—does not affect approved permits
 - **AEO2022 change:** Still evaluating whether to reduce the acreage that can be drilled, increase average lateral length, or both
 - Pause on leasing of federal lands and waters
 - Preliminary injunction issued June 15, 2021

West Texas Intermediate (WTI) crude oil prices are lower after 2027 than last year's AEO

WTI crude oil price

2020 dollars per barrel

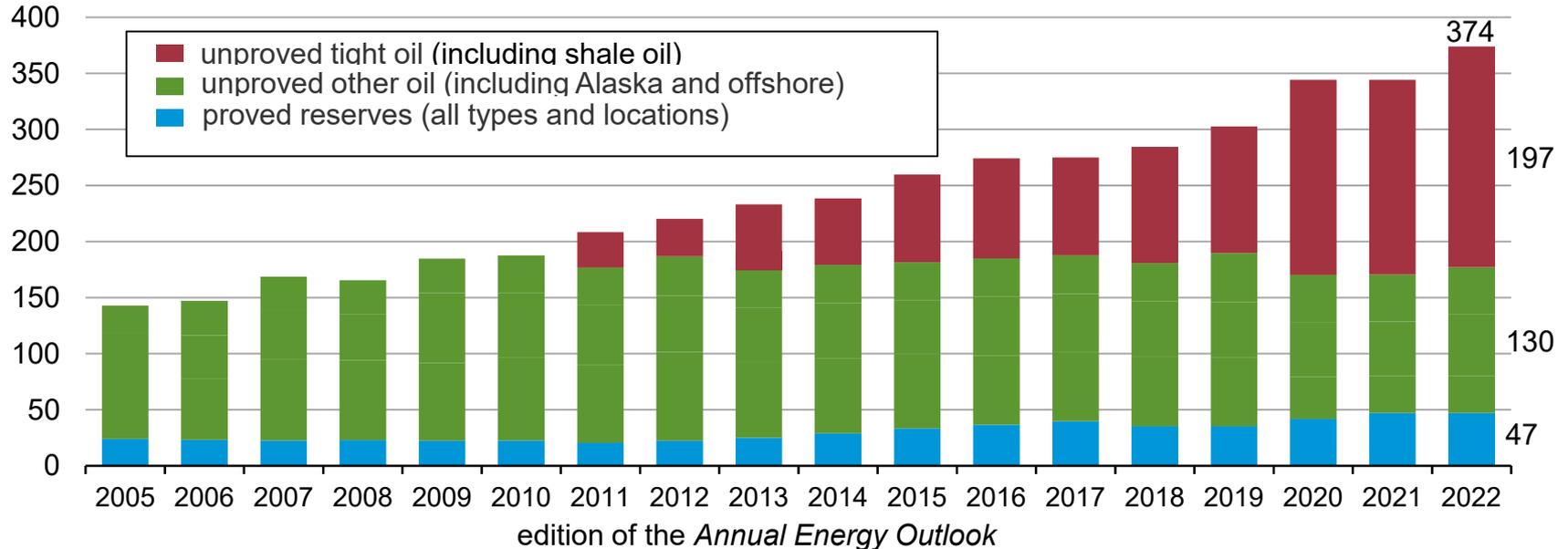


Source: Preliminary AEO2022 runs, dated September 27, 2021

Multiple factors have contributed to crude oil resource estimate increases over the years, with tight oil the primary contributor recently

U.S. crude oil and lease condensate resources

billion barrels



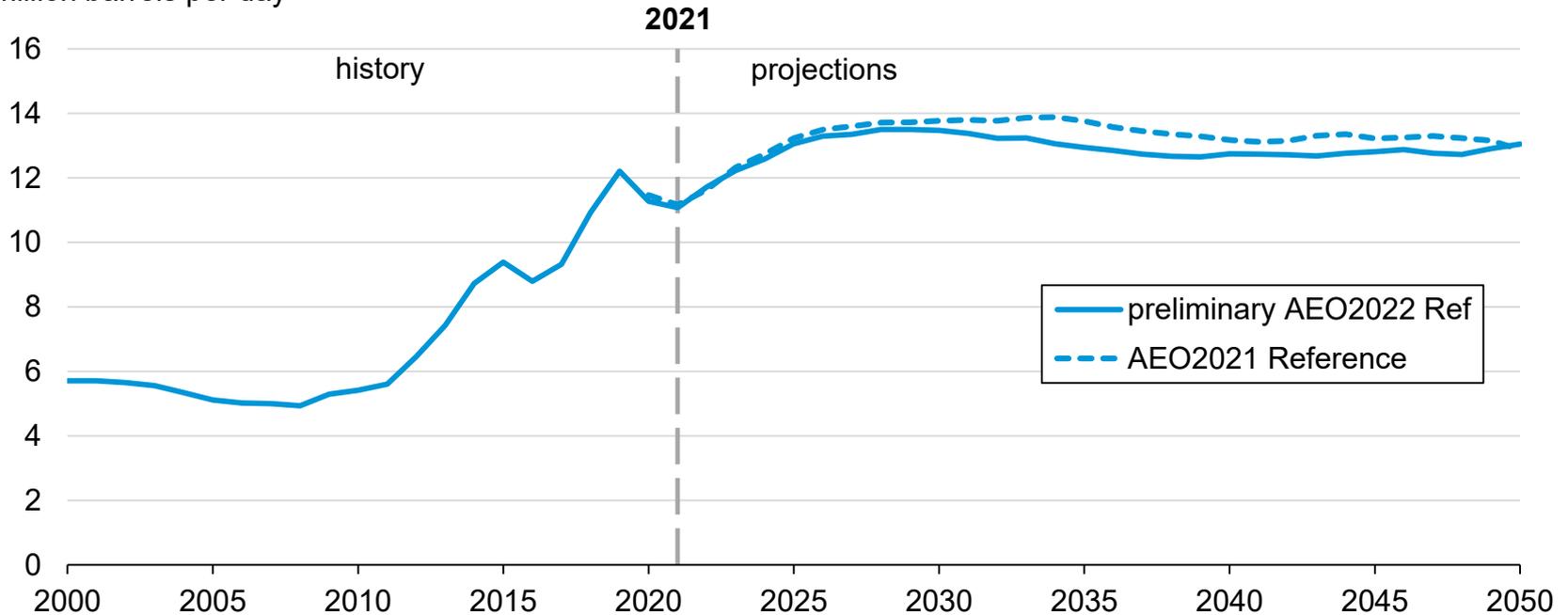
Source: U.S. Energy Information Administration, *Annual Energy Outlook* 2022 and previous editions

Note: Resources are as of January 1 of two years prior to the edition year of the AEO (for example, AEO2022 is January 1, 2020).

U.S. crude oil production is generally lower than last year's AEO

U.S. crude oil production

million barrels per day

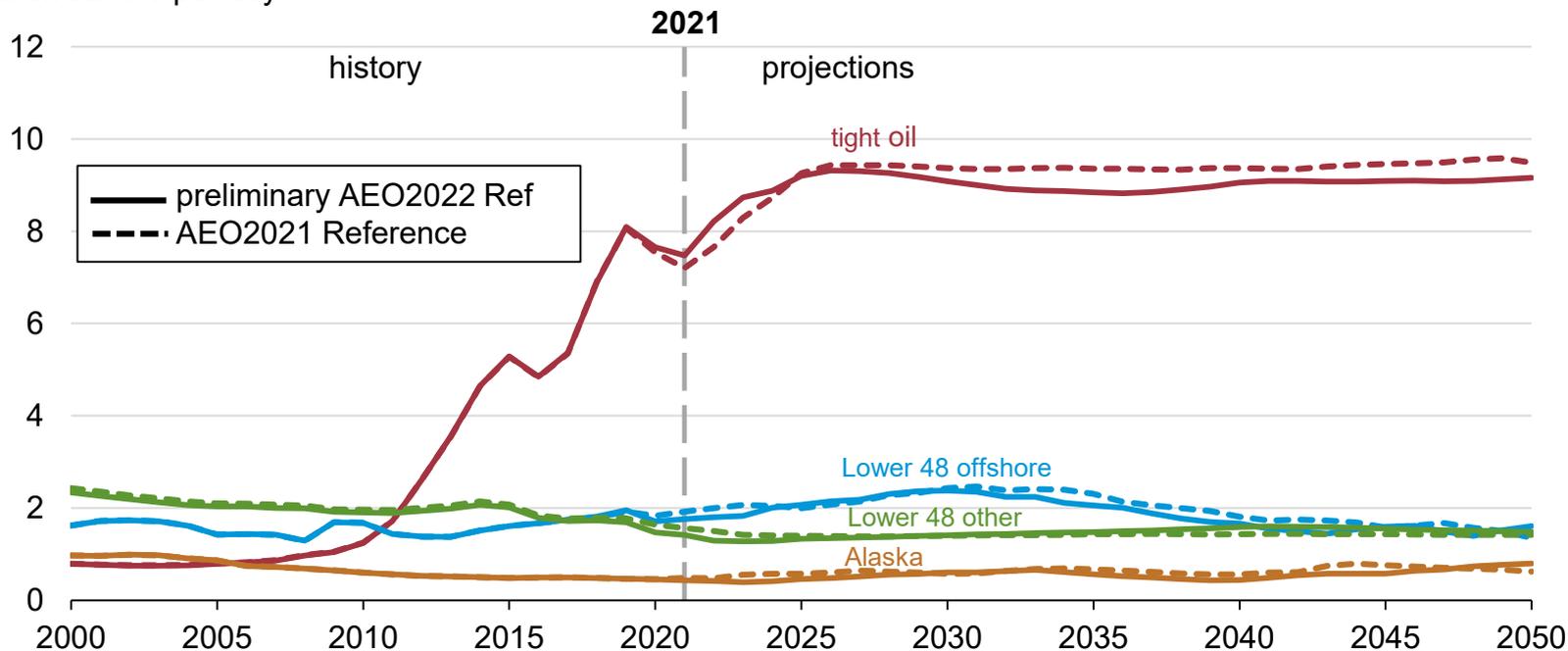


Source: Preliminary AEO2022 runs, dated September 27, 2021

Tight oil leads growth in U.S. crude oil production in AEO2022

U.S. crude oil production by type

million barrels per day

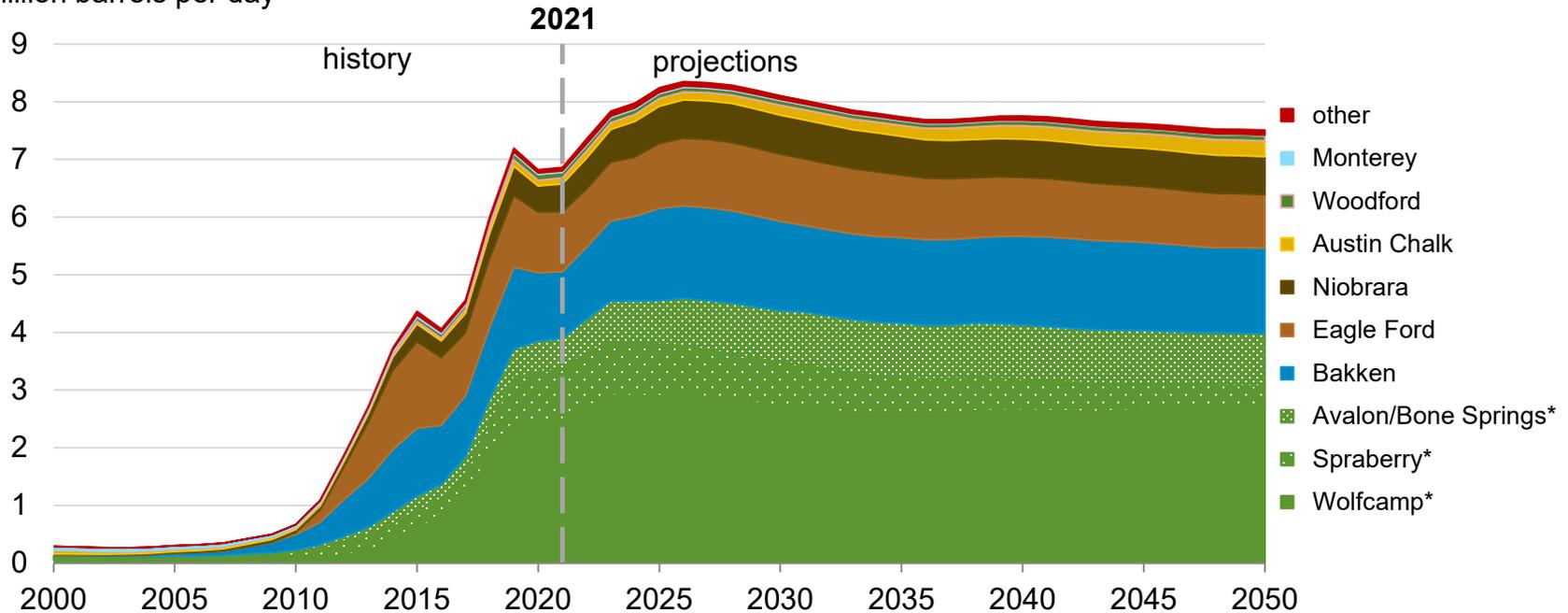


Source: Preliminary AEO2022 runs, dated September 27, 2021

Bakken and Wolfcamp lead growth in tight oil production

Crude oil production by selected tight oil plays

million barrels per day



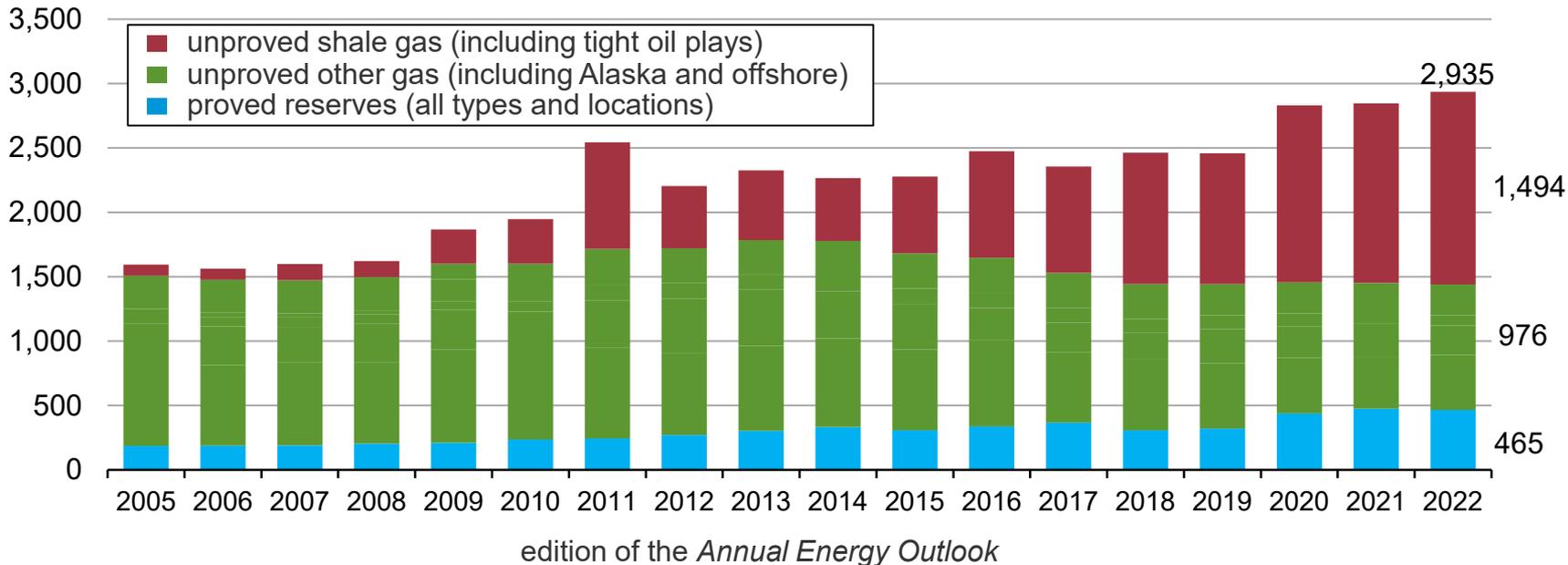
*Permian Basin

Source: Preliminary AEO2022 runs, dated September 27, 2021

Technically recoverable natural gas resources reflect new information, a combination of assessments and EIA updates based on analysis of well-level production

U.S. dry natural gas resources

trillion cubic feet



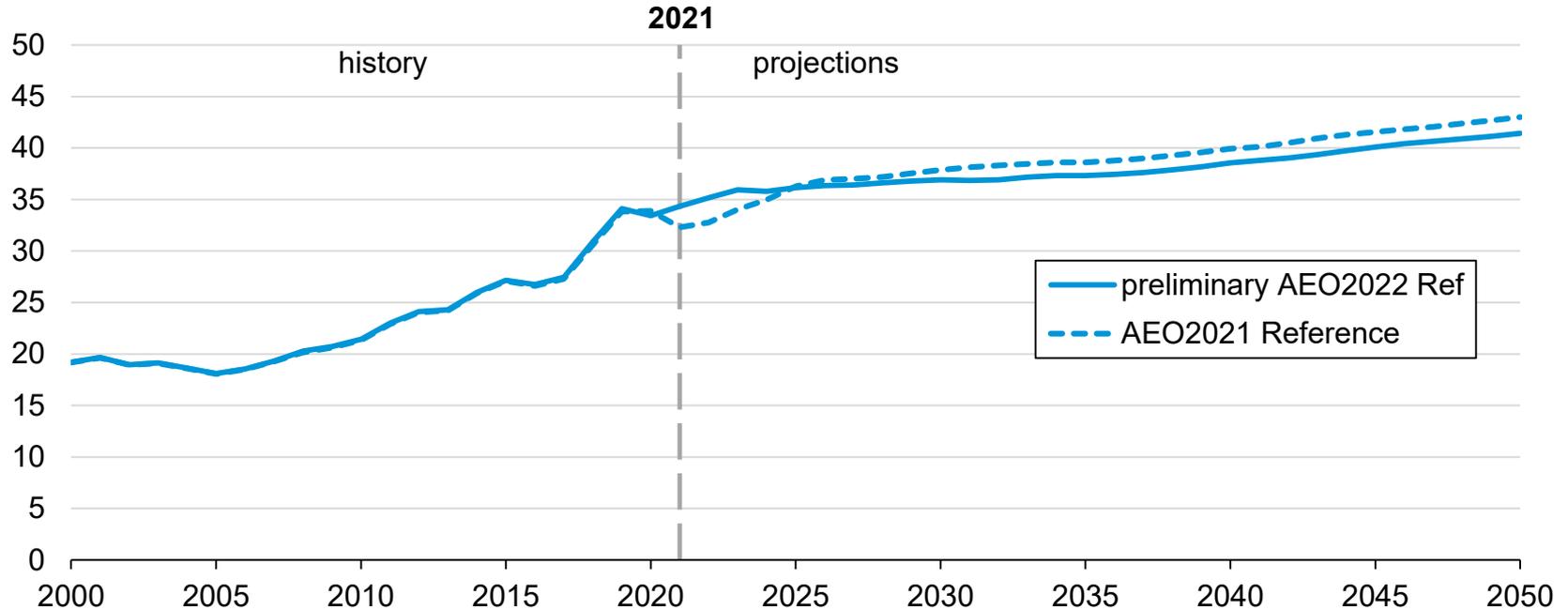
Source: U.S. Energy Information Administration, *Annual Energy Outlook* 2022 and previous editions

Note: Resources are as of January 1 of two years prior to the edition year of the AEO (for example, AEO2022 is January 1, 2020).

U.S. dry natural gas production after 2025 is lower than in last year's AEO

U.S. dry natural gas production

trillion cubic feet

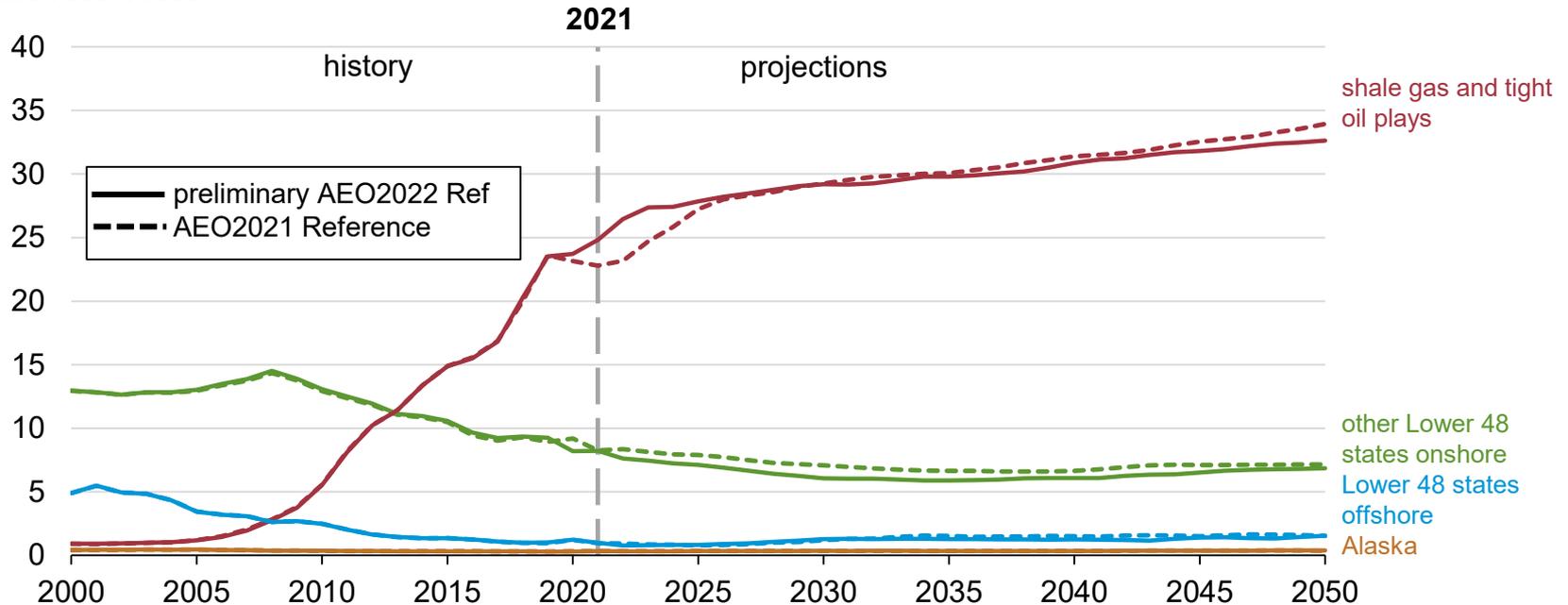


Source: Preliminary AEO2022 runs, dated September 27, 2021 (1 trillion cubic feet = 2.74 billion cubic feet per day)

Shale gas leads growth in U.S. dry natural gas production in AEO2021

U.S. dry natural gas production by type

trillion cubic feet

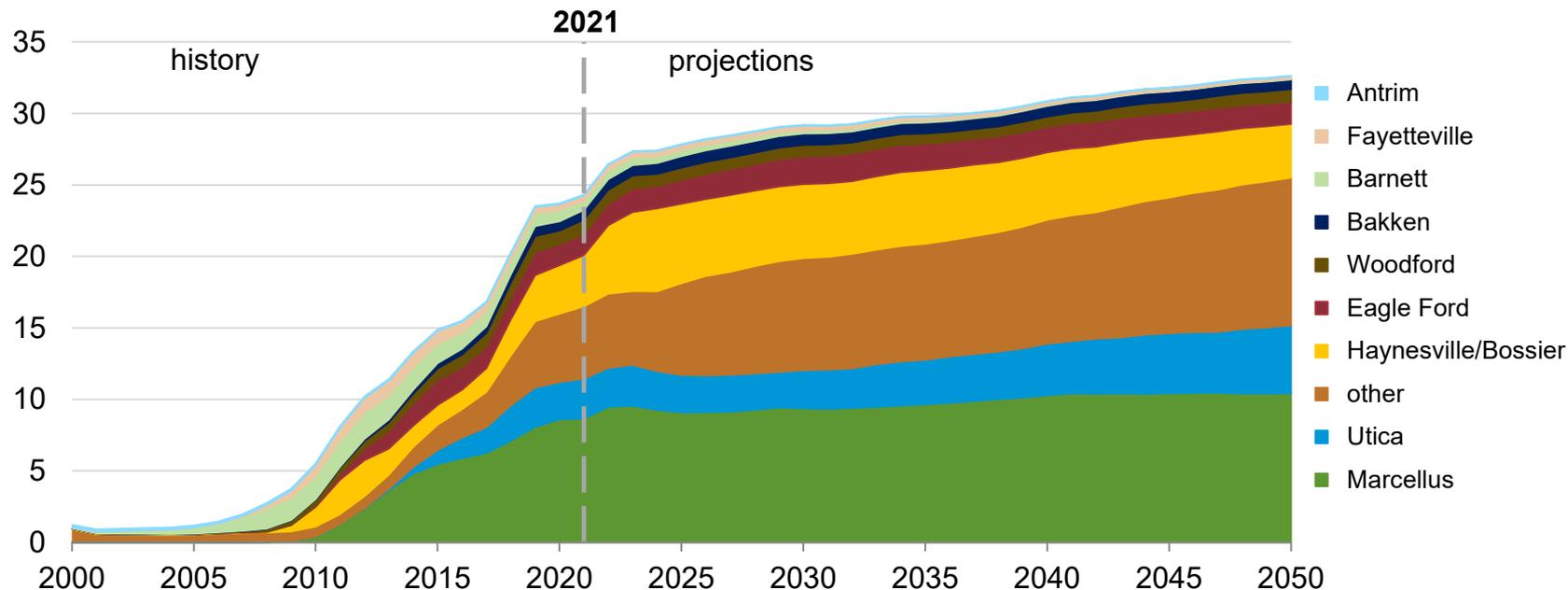


Source: Preliminary AEO2022 runs, dated September 27, 2021

Marcellus, Haynesville, Utica, and tight oil plays are the major contributors to U.S. shale gas production

Dry natural gas production by selected shale play

trillion cubic feet



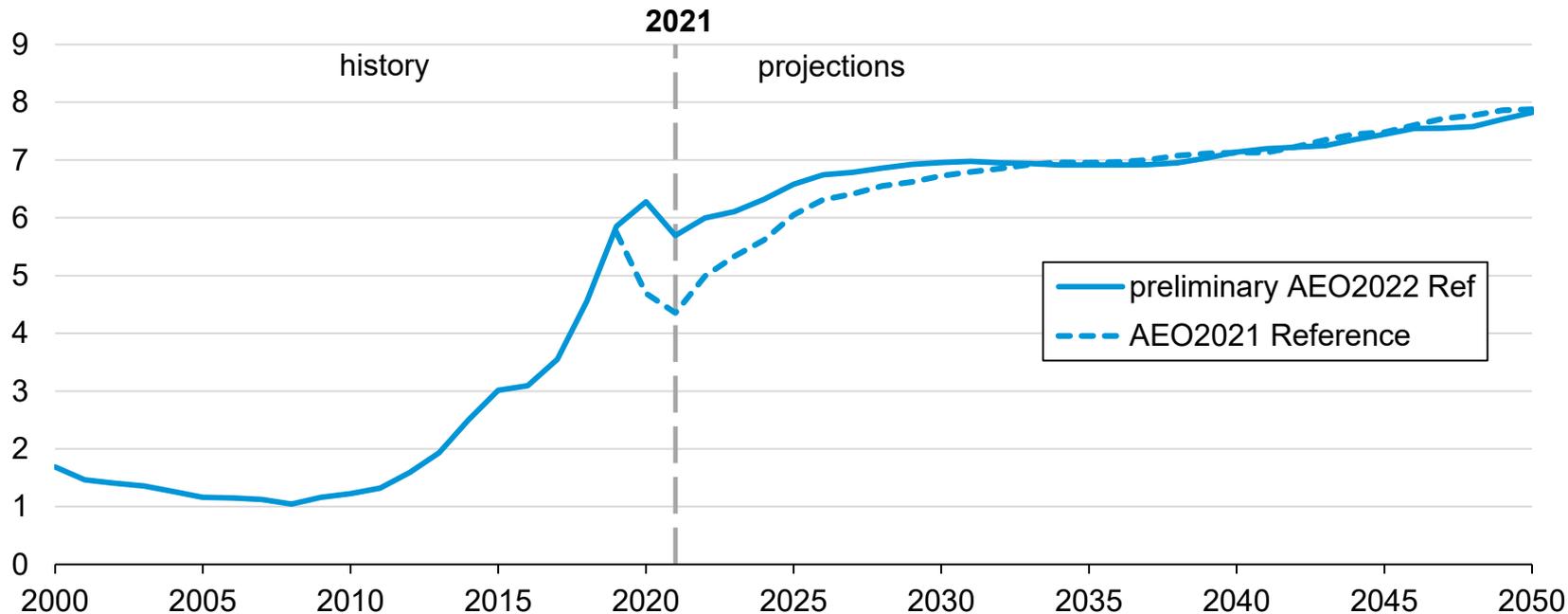
Source: Preliminary AEO2022 runs, dated September 27, 2021

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

U.S. dry natural gas production from oil formations is higher than in last year's AEO

U.S. dry natural gas production

trillion cubic feet

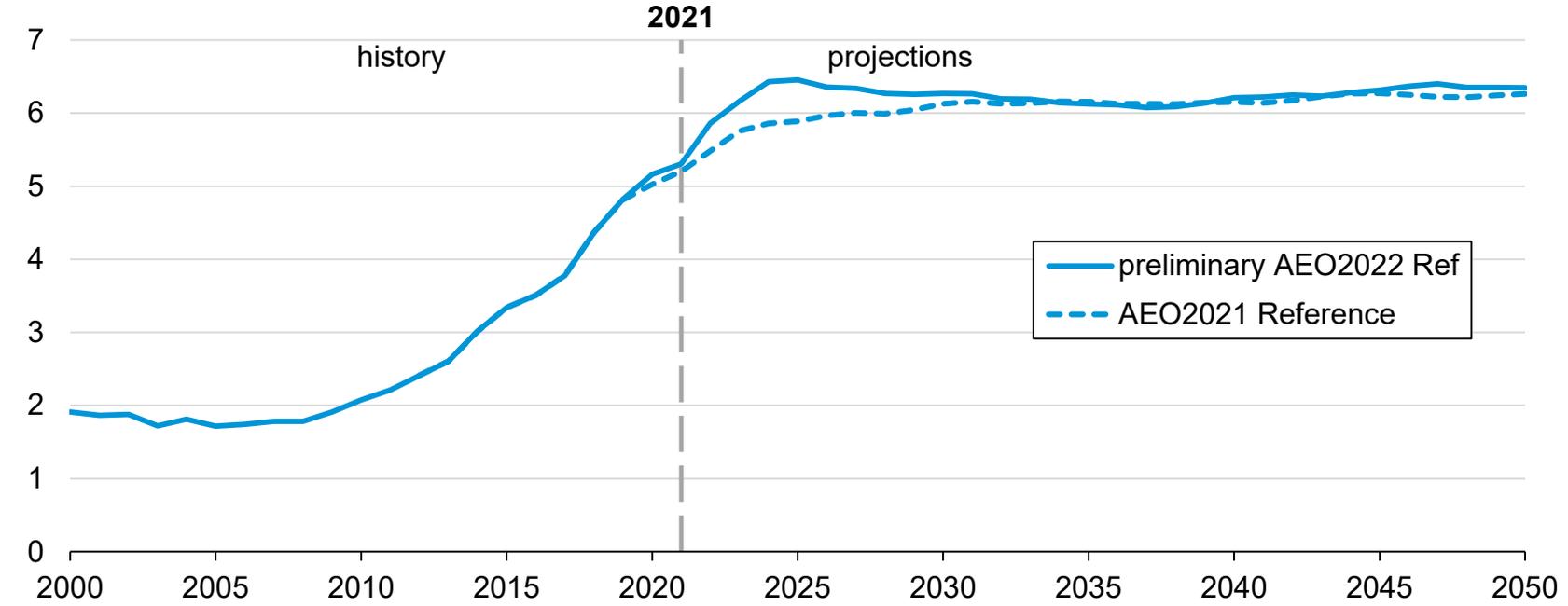


Source: Preliminary AEO2022 runs, dated September 27, 2021 (1 trillion cubic feet = 2.74 billion cubic feet per day)

Natural gas plant liquids (NGPL) production is generally higher than in last year's AEO

NGPL production

million barrels per day



Source: Preliminary AEO2022 runs, dated September 27, 2021



Liquid fuels markets

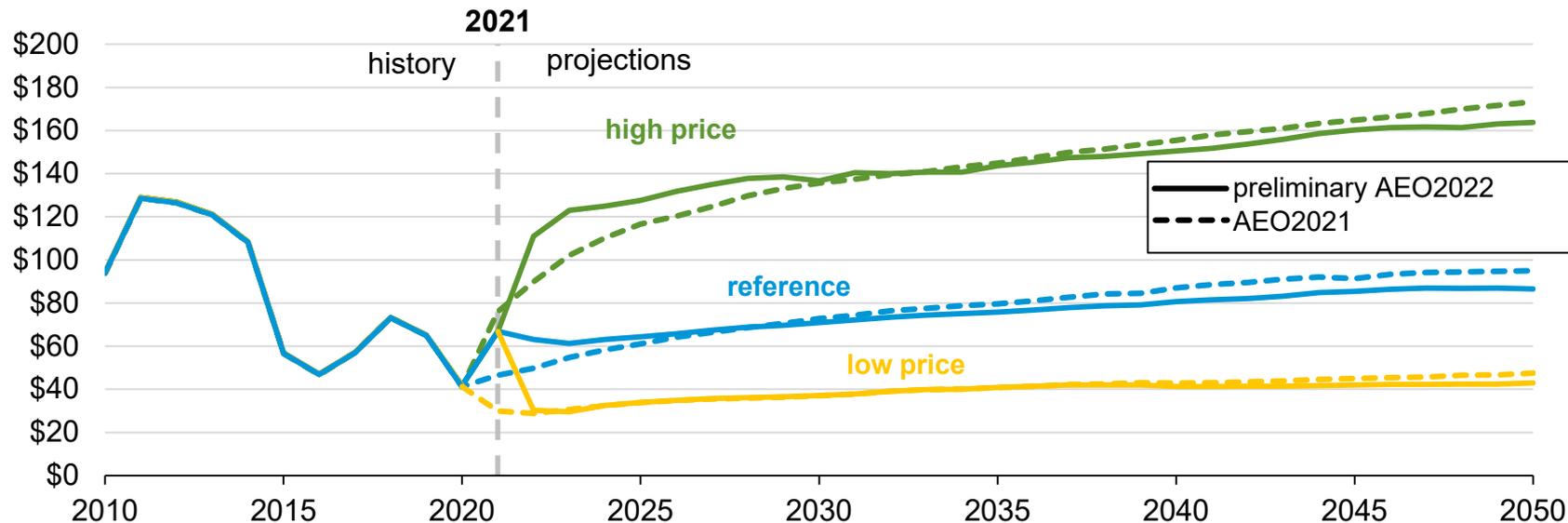
AEO2022 Liquid Fuels Market Module and International Energy Module updates

- International crude oil and petroleum product import and export curves
- Crude oil price differentials by crude type
- Pipeline capacity and transport costs
- State and federal fuel taxes
- Historical and *Short-Term Energy Outlook* (STEO) liquid fuels data
- Capacity updates for refinery, biofuels, and cogeneration
 - Refinery capacity closures and planned capacity delays
 - Increase in planned renewable diesel capacity and drop in biodiesel capacity
- Renewable Fuels Standard (RFS) mandate
 - We do not expect the U.S. EPA to release its final renewable volume obligations (RVO) for 2021 (delayed) and 2022 in time for publication
 - Therefore, we used the STEO estimate for RVO for years 2021 and 2022

Brent crude oil prices are higher in early projection years, then lower compared with AEO2021

Brent crude oil spot price

2020 dollars per barrel

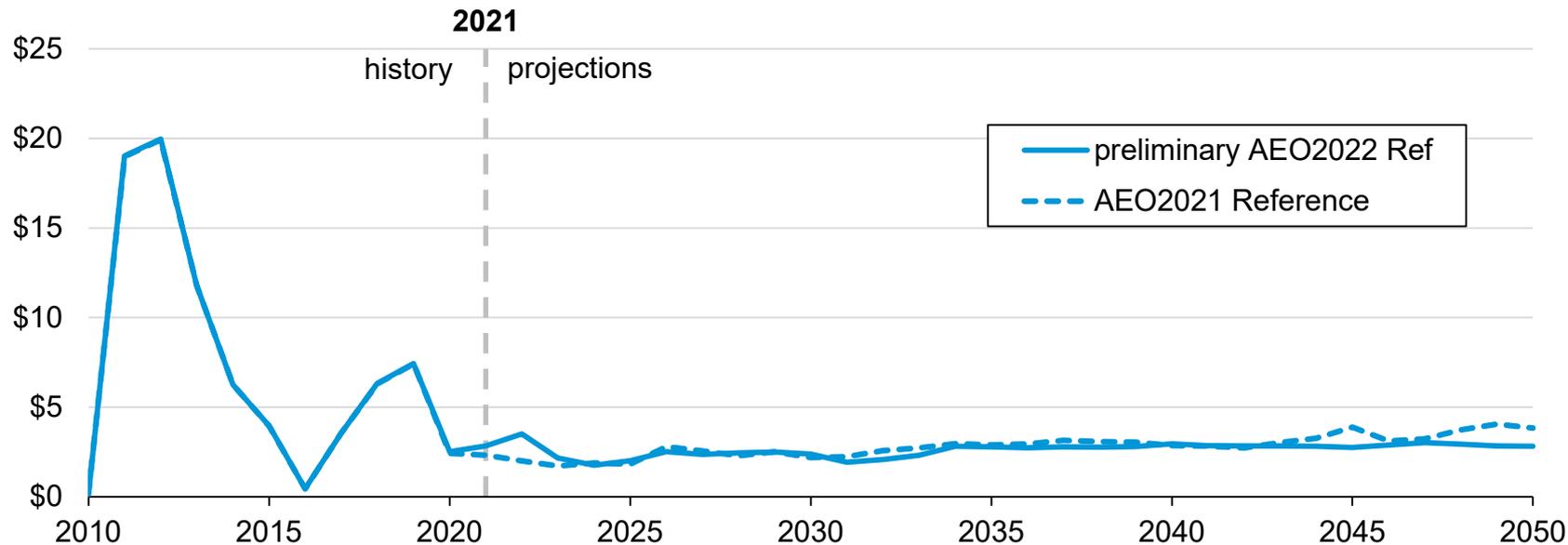


Source: Preliminary AEO2022 runs, dated as of September 27, 2021

The Brent-WTI price spread rises slightly based on *Short-Term Energy Outlook* forecasts and then remains between \$2 per barrel and \$3 per barrel in the projection period, similar to AEO2021

Brent-WTI price spread

2020 dollars per barrel

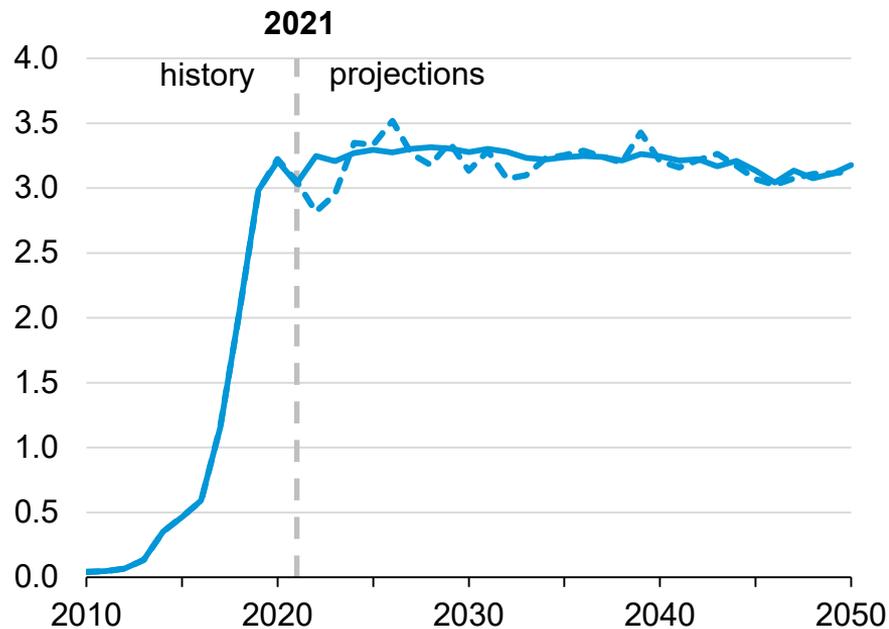


Source: Preliminary AEO2022 runs, dated as of September 27, 2021

Crude oil exports decline a little over the projection period, and they are projected to remain around 25% of total crude oil production

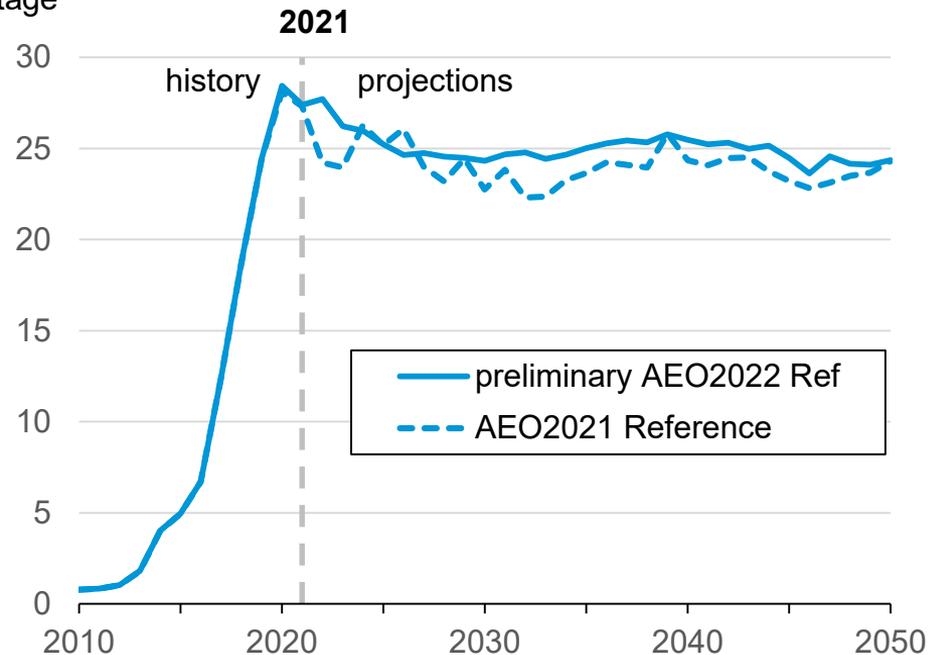
Gross crude oil exports

million barrels per day



Crude oil exports as fraction of total domestic crude oil production

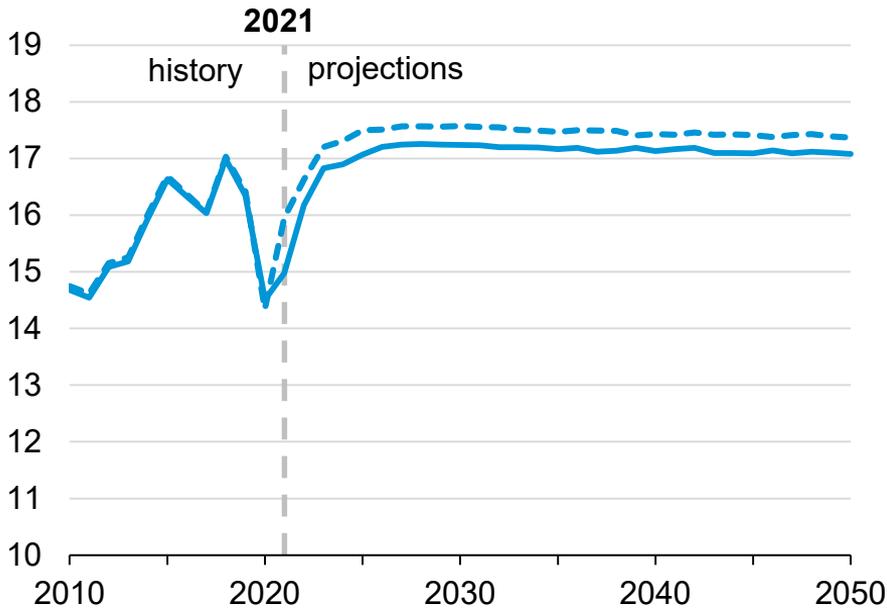
percentage



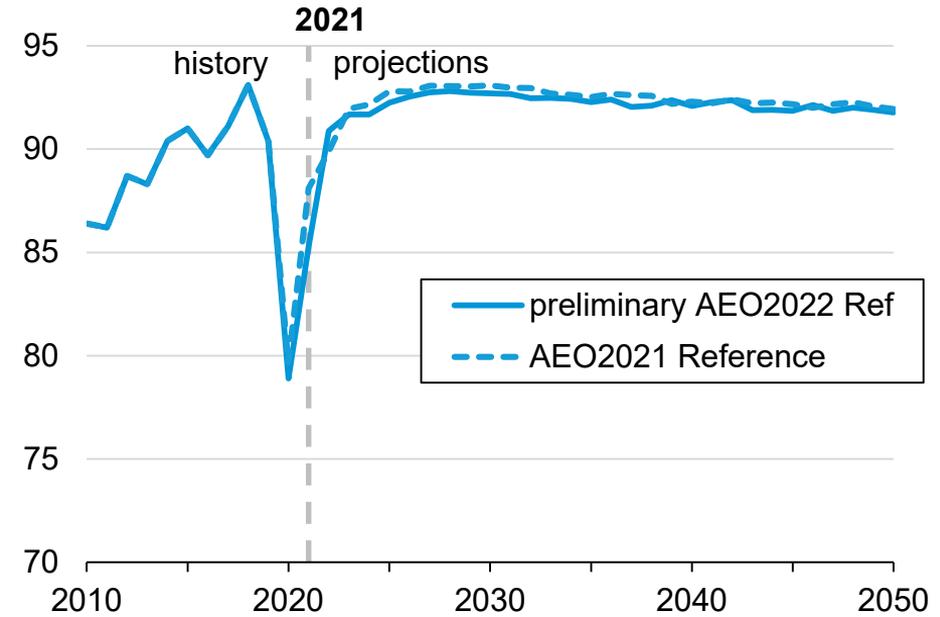
Source: Preliminary AEO2022 runs, dated as of September 27, 2021

Total crude supply to U.S. refineries reflects lower atmospheric distillation capacity starting in 2021 because of a project delay while maintaining strong utilization levels over the projection period

Total crude supply to U.S. refineries
million barrels per day



Average U.S. refinery utilization
percentage

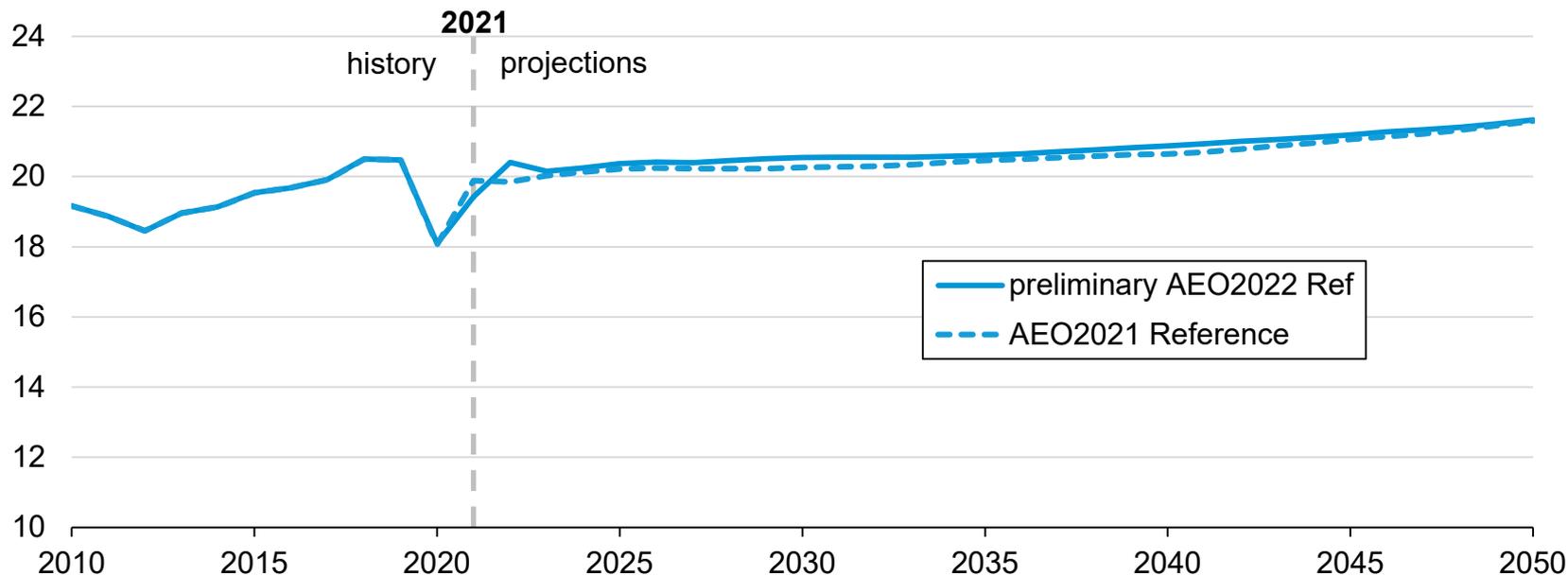


Source: Preliminary AEO2022 runs, dated as of September 27, 2021

Domestic petroleum product consumption is met through a combination of domestic production and net imports of both crude oil-based and biofuels-based products

Domestic petroleum product consumption

million barrels per day

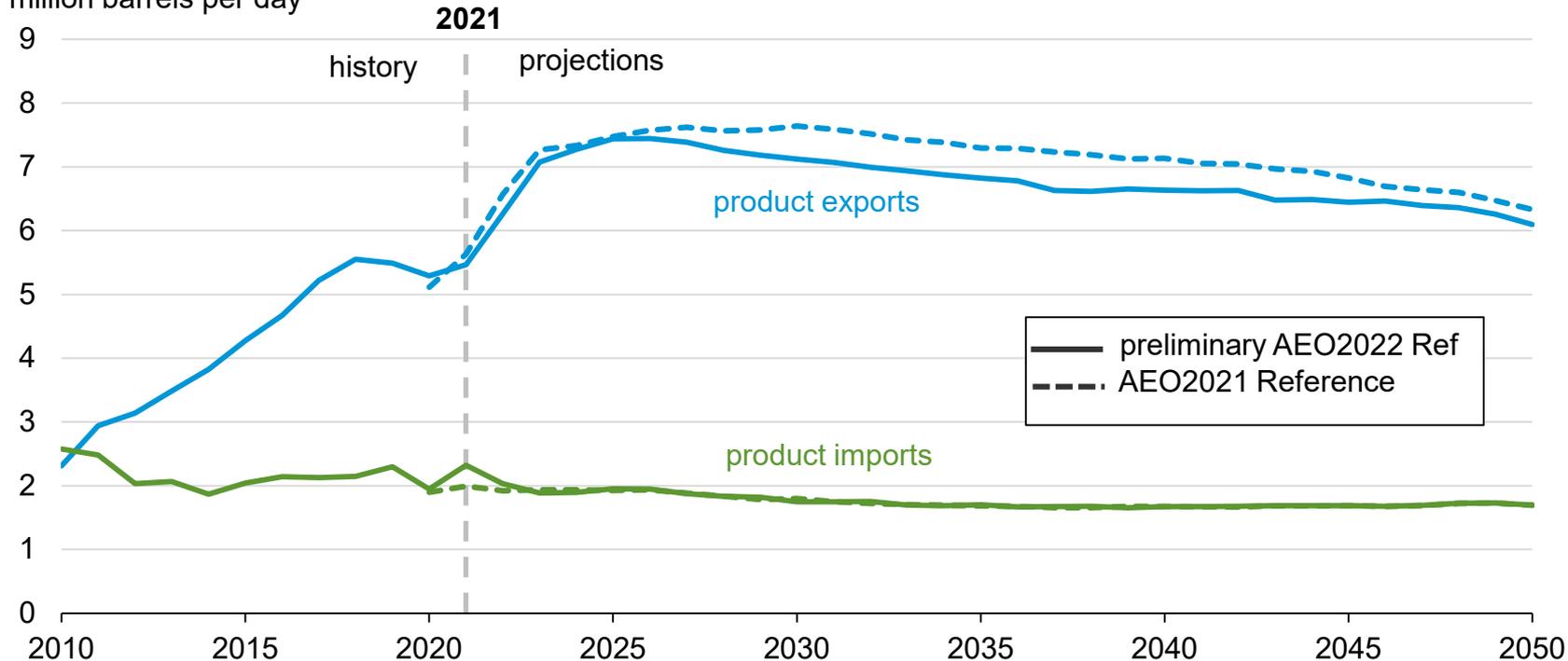


Source: Preliminary AEO2022 runs, dated as of September 27, 2021

Gross product exports are projected to be lower compared with AEO2021 to meet higher domestic product consumption levels. Gross product imports remain unchanged

Gross product imports and gross product exports

million barrels per day

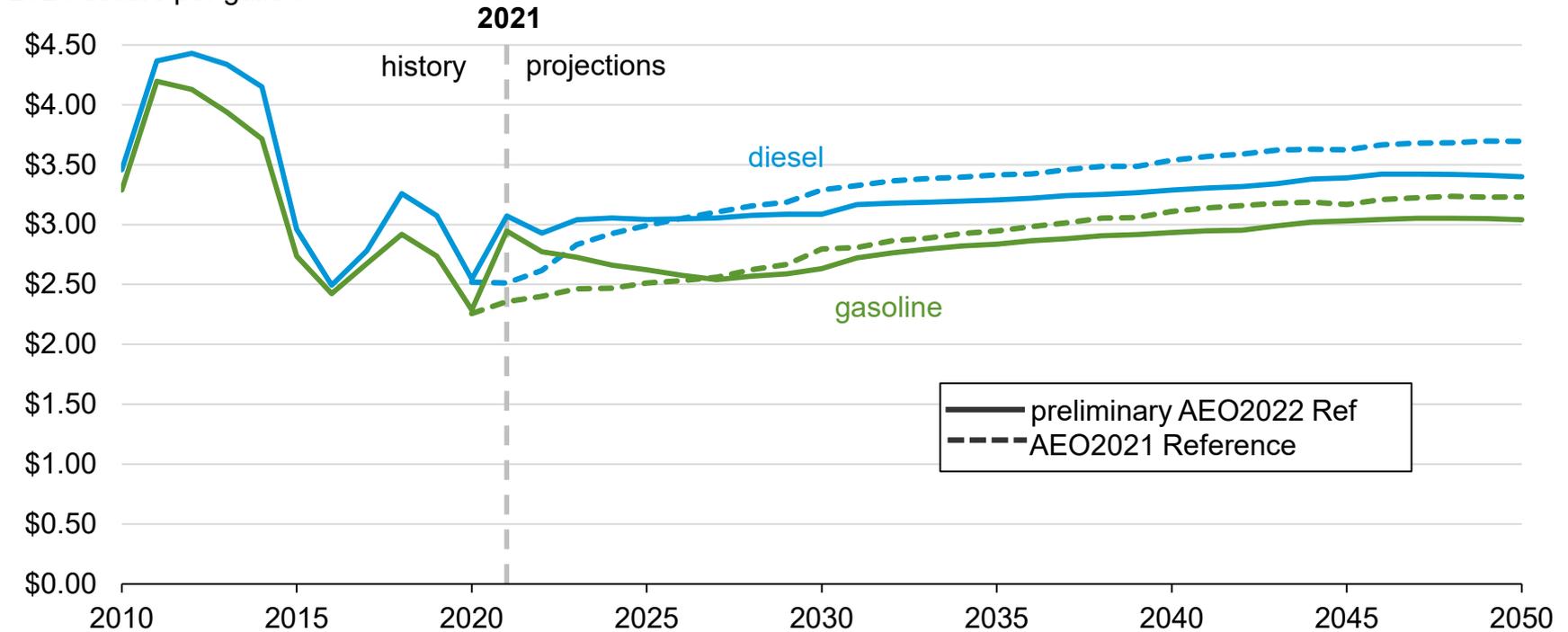


Source: Preliminary AEO2022 runs, dated as of September 27, 2021

For AEO2022, the spread between gasoline and diesel prices will be lower in the near term before evening out to a slightly narrower price spread compared with AEO2021

Diesel and gasoline end-use prices

2020 dollars per gallon

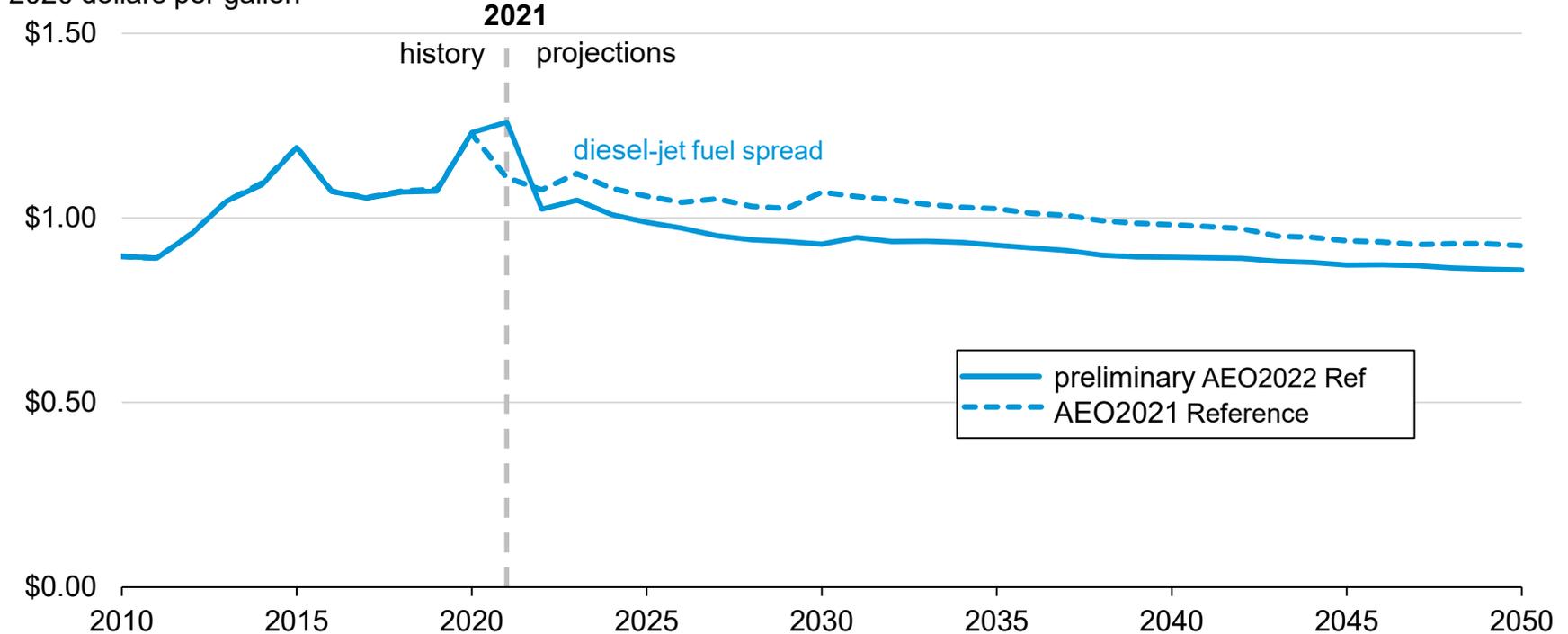


Source: Preliminary AEO2022 runs, dated as of September 27, 2021

Diesel-jet fuel spread narrows almost every year through 2050, indicating a higher price for jet relative to diesel

Diesel-jet prices

2020 dollars per gallon

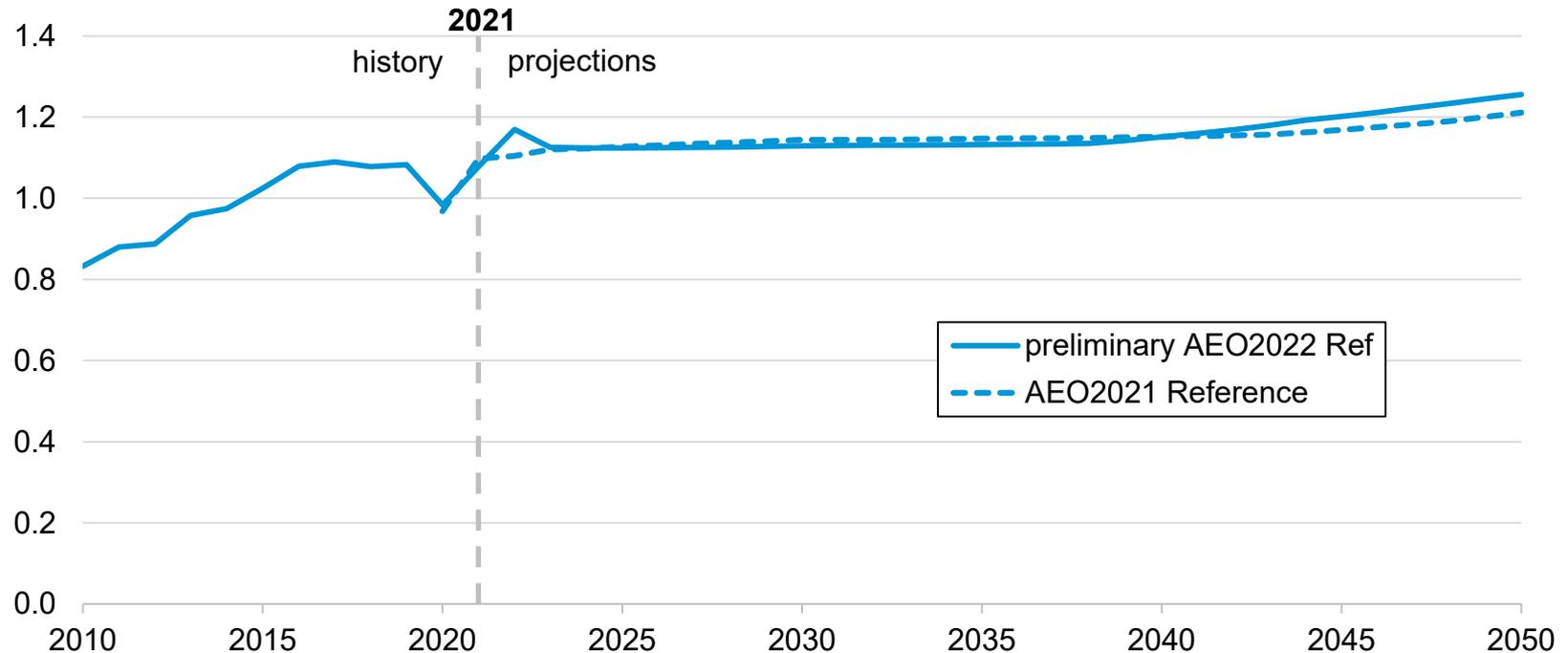


Source: Preliminary AEO2022 runs, dated as of September 27, 2021

Biofuels supply is projected to recover quickly after 2020, maintain the same level as AEO2021 through 2040, and then grow a little faster than AEO2021

Biofuels supply

million barrels per day

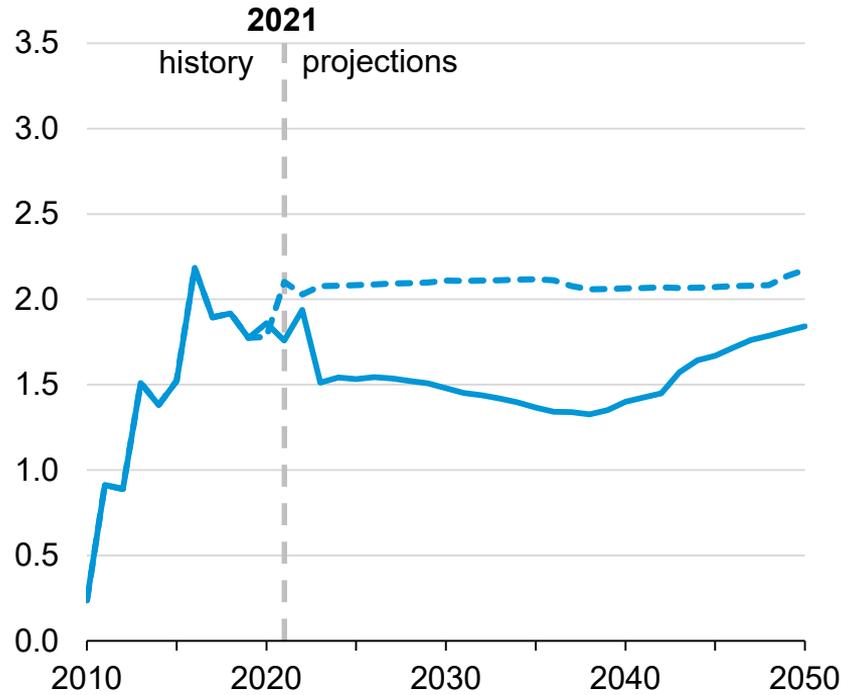


Source: Preliminary AEO2022 runs, dated as of September 27, 2021

Supply = domestic production plus net imports

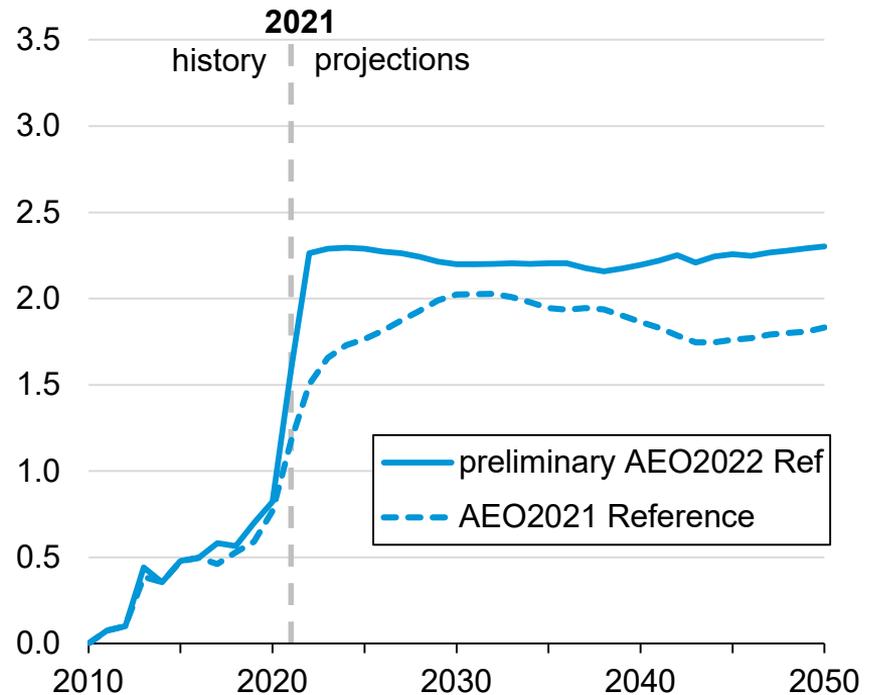
Renewable diesel supply outpaces biodiesel supply as a result of updated current and planned capacity

Biodiesel supply
billion gallons



Source: Preliminary AEO2022 runs, dated as of September 27, 2021

Renewable diesel supply
billion gallons



Supply = domestic production plus net imports

Natural gas markets

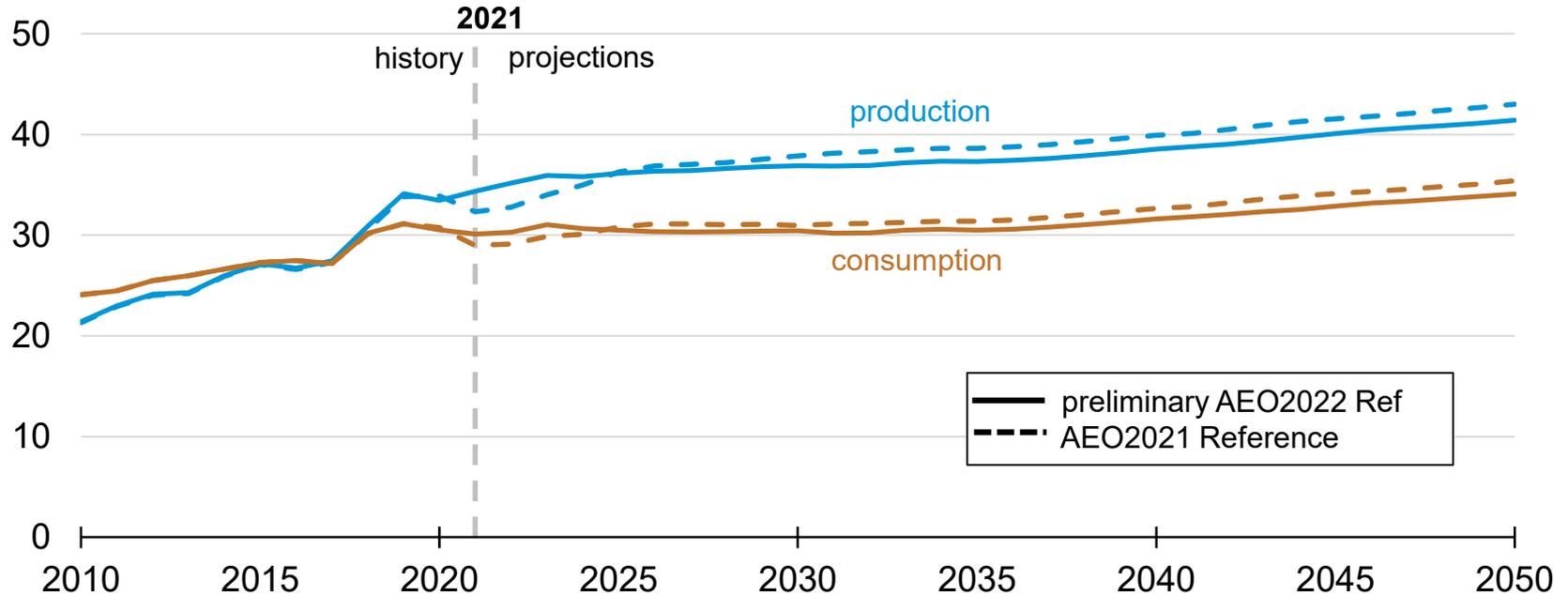
Data updates and changes for AEO2022

- *Natural Gas Annual* released November 2020 (2019 annual data)
- *Natural Gas Monthly* through April 2021 (complete 2020 history)
- Mexican and Canadian historical data through 2020
- Pipeline capacity, pipeline projects tracked by EIA
- Updates to natural gas spot price data
- However, these changes between AEO2021 and preliminary AEO2022 projections are driven by external changes in assumptions:
 - World oil price assumptions
 - Economic recovery from COVID-19 and the related consumption changes
 - *Short -Term Energy Outlook* forecast

U.S. natural gas consumption and production are higher in the short term. In the long term, consumption and production are slightly lower than in AEO2021

U.S. dry natural gas production and consumption in the Reference case

trillion cubic feet

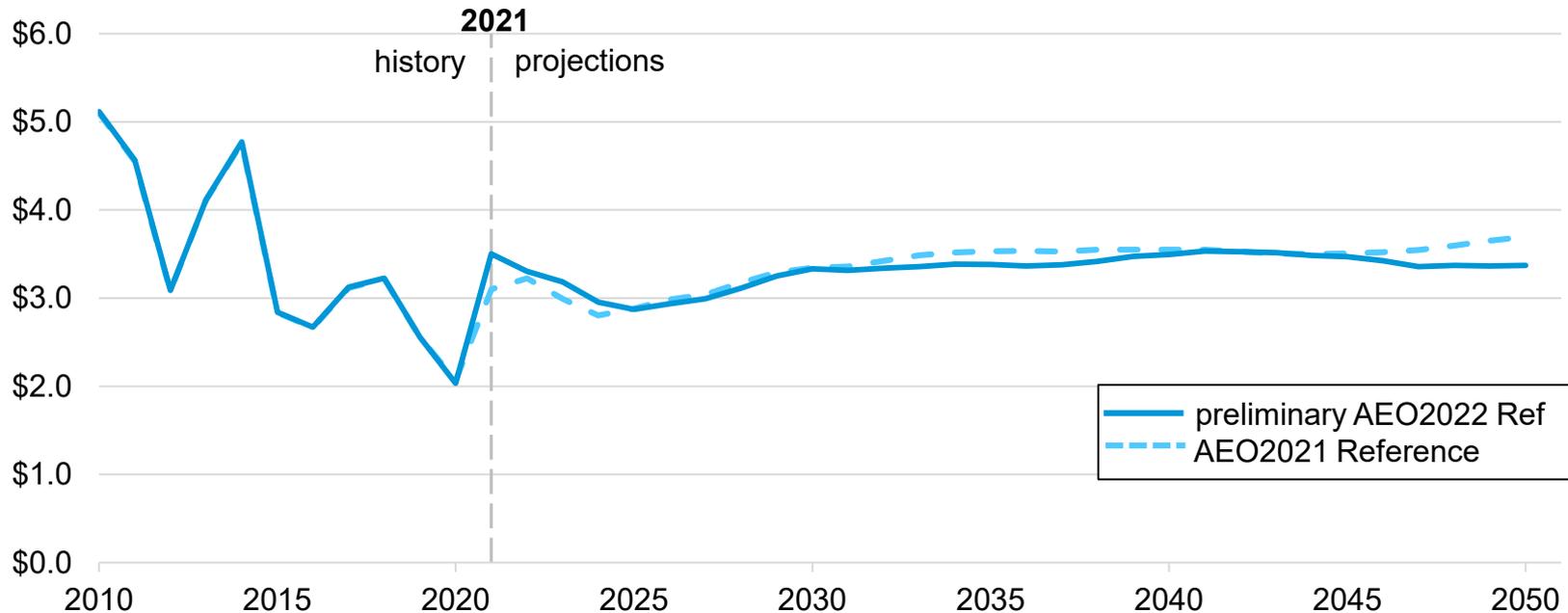


Source: Preliminary AEO2022 run dated September 27, 2021, EIA *Annual Energy Outlook 2021*

In AEO2022, U.S. Henry Hub natural gas spot prices are higher in the near term; however, long-term price trends move slightly lower, approaching \$3.40 per million British thermal units in 2050

Henry Hub natural gas spot price in the Reference case

2020 dollars per million British thermal units

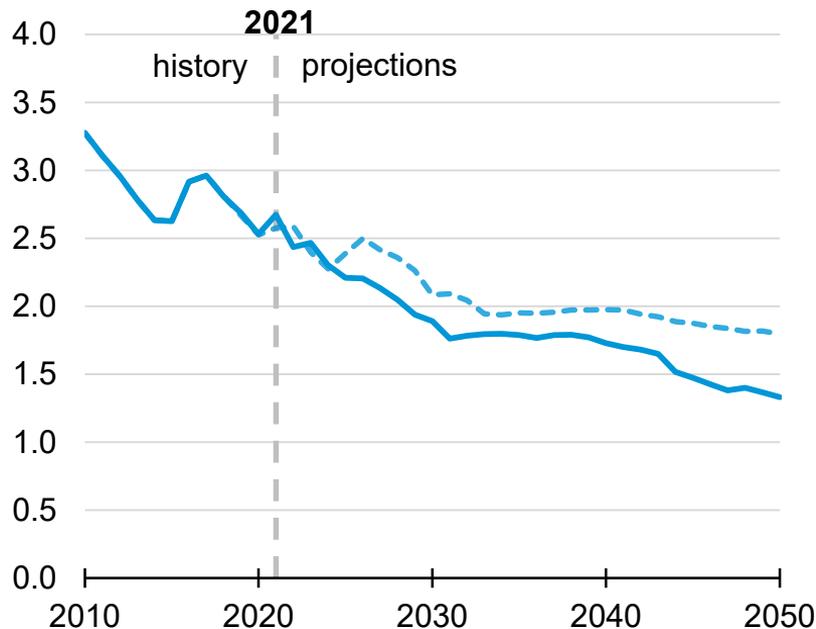


Source: Preliminary AEO2022 run dated September 27, 2021, EIA *Annual Energy Outlook 2021*

Imports from Canada are expected to decline, while exports to Canada are projected to be relatively unchanged compared with AEO2021

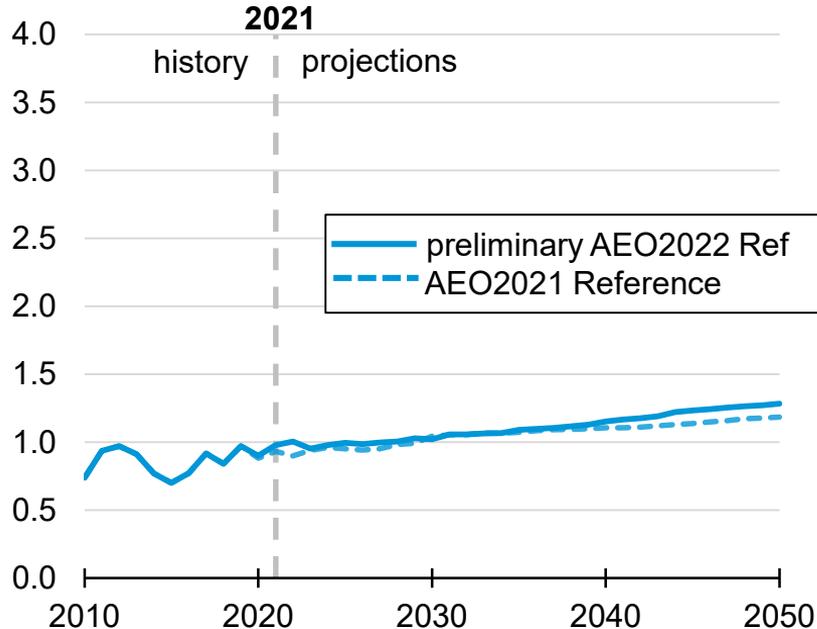
U.S. natural gas imports from Canada

trillion cubic feet



U.S. natural gas exports to Canada

trillion cubic feet

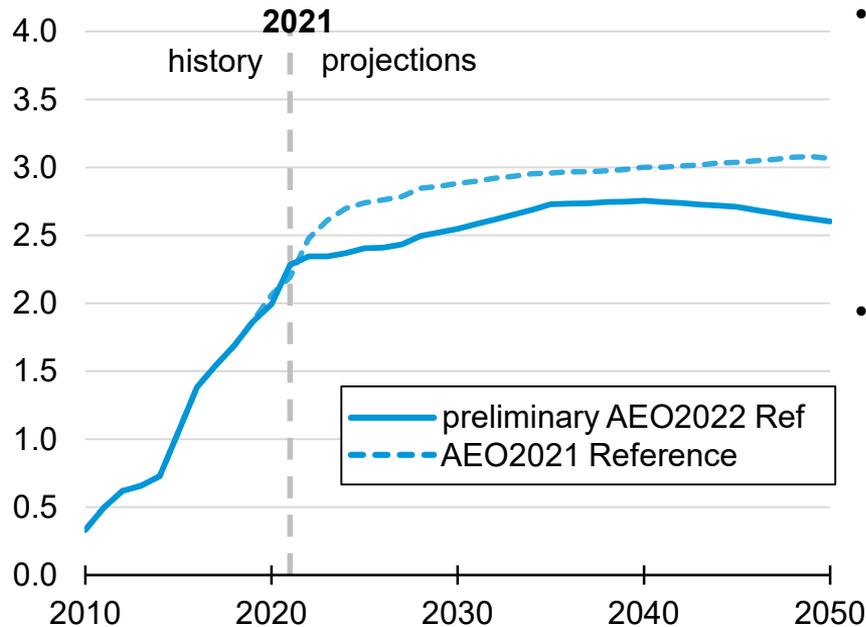


Source: Preliminary AEO2022 run dated September 27, 2021, EIA *Annual Energy Outlook 2021*

Pipeline exports to Mexico are lower than in AEO2021 and are projected to grow in the near term and ultimately projected to peak near 2035

U.S. pipeline exports to Mexico

trillion cubic feet



- Factors affecting projected exports to Mexico:
 - Domestic production declines
 - Downward revision to Mexico's natural gas generating capacity in the second half of the projection period
- The proposed Costa Azul LNG project is currently not assumed in the model, but it could have significant impacts on pipeline trade

Source: Preliminary AEO2022 run dated September 27, 2021, EIA *Annual Energy Outlook 2021*

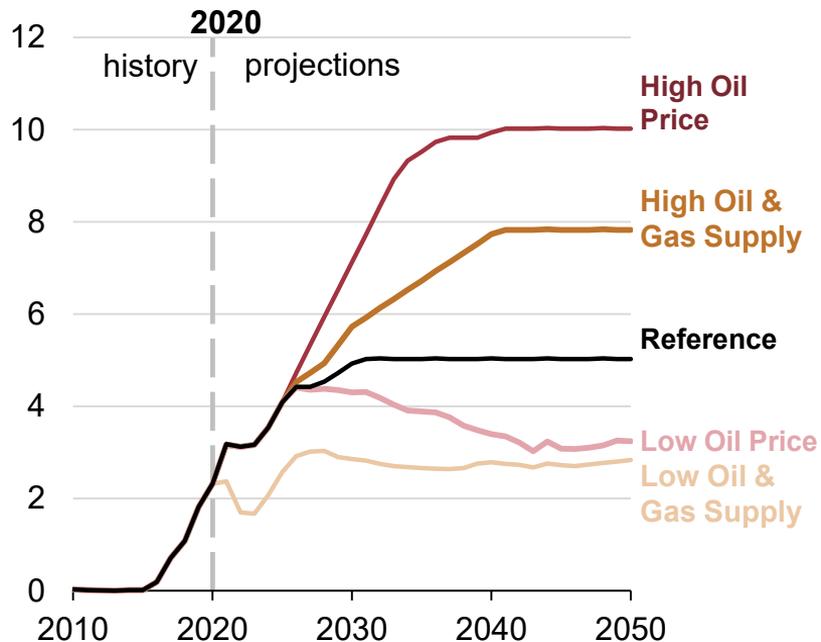
Updated LNG export assumptions

- Updated dates of projects under construction in AEO2022
- Updated in-service dates:
 - Sabine Pass Train 6: December 2021
 - Calcasieu Pass Trains 1–5: December 2021
 - Calcasieu Pass Trains 6–10: May 2022
 - Golden Pass still assumed to enter service in 2024 (first train)
- Assumed percentage of feedgas used for liquefaction changed to 8.1% based on Form EIA-176 data
- Considered additional potential updates
 - Updated world LNG price projections for Asia and Europe
 - Updated shipping costs from U.S. Gulf Coast and East Coast to Asia and Europe

LNG export assumptions are still being reviewed, but preliminary results suggest no additional capacity will be built in Reference case beyond what is already under construction

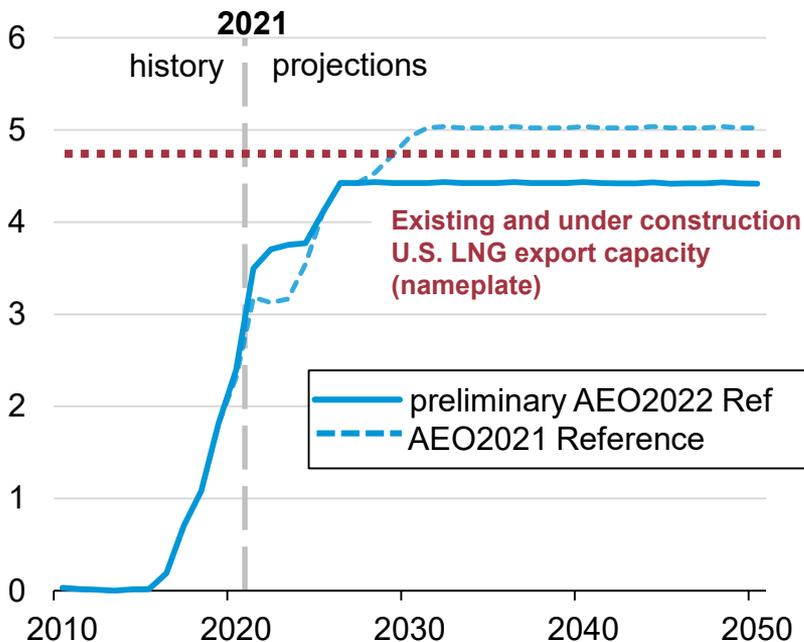
AEO2021 U.S. LNG exports by side case

trillion cubic feet



U.S. LNG exports in Reference case

trillion cubic feet



Source: Preliminary AEO2022 run dated September 27, 2021, EIA Annual Energy Outlook 2021

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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\(2020\).pdf](https://www.eia.gov/outlooks/aeo/nems/documentation/ogsm/pdf/m063(2020).pdf)
 - Natural gas market (NGMM)
[https://www.eia.gov/outlooks/aeo/nems/documentation/ngmm/pdf/mgmm\(2020\).pdf](https://www.eia.gov/outlooks/aeo/nems/documentation/ngmm/pdf/mgmm(2020).pdf)
 - Liquid fuels market (LFMM)
[https://www.eia.gov/outlooks/aeo/nems/documentation/lfmm/pdf/m059\(2020\).pdf](https://www.eia.gov/outlooks/aeo/nems/documentation/lfmm/pdf/m059(2020).pdf)
 - International energy (IEM)
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- Trends and Expectations Surrounding the Outlook for Energy Markets
https://www.eia.gov/outlooks/aeo/trends_expectations.php/

For more information

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