

Assumptions and Expectations for *Annual Energy Outlook 2016*: Oil and Gas Working Group



AEO2016 Oil and Gas Supply Working Group Meeting

Office of Petroleum, Gas, and Biofuels Analysis

February 29, 2016/ Washington, DC

<http://www.eia.gov/forecasts/aeo/workinggroup/>

WORKING GROUP PRESENTATION FOR DISCUSSION PURPOSES

DO NOT QUOTE OR CITE AS RESULTS ARE SUBJECT TO CHANGE

Overview

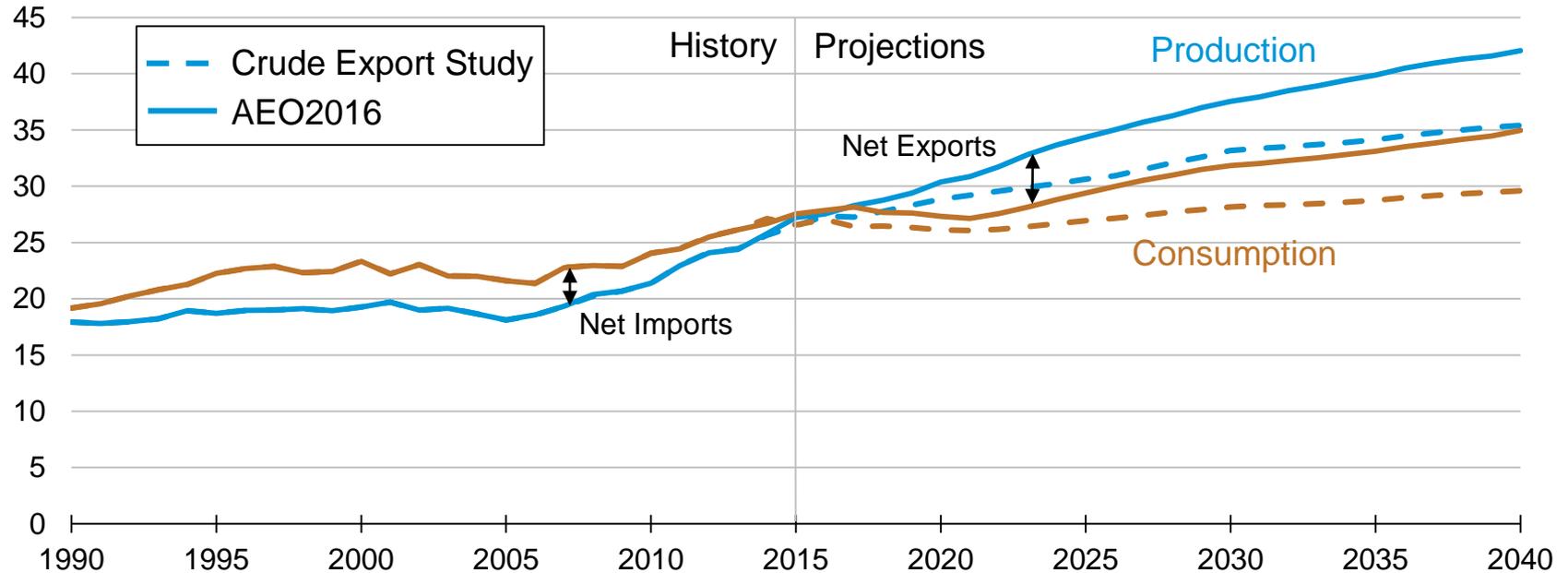
- Natural gas markets
 - Natural gas supply and delivered prices
 - Natural gas consumption
 - Pipeline imports/exports
 - LNG exports
- Upstream
 - Resources and technology
 - Production
 - Oil and natural gas
 - Liquids imports

Natural Gas Markets

Natural gas consumption, production, and trade, 1990-2040

Dry natural gas

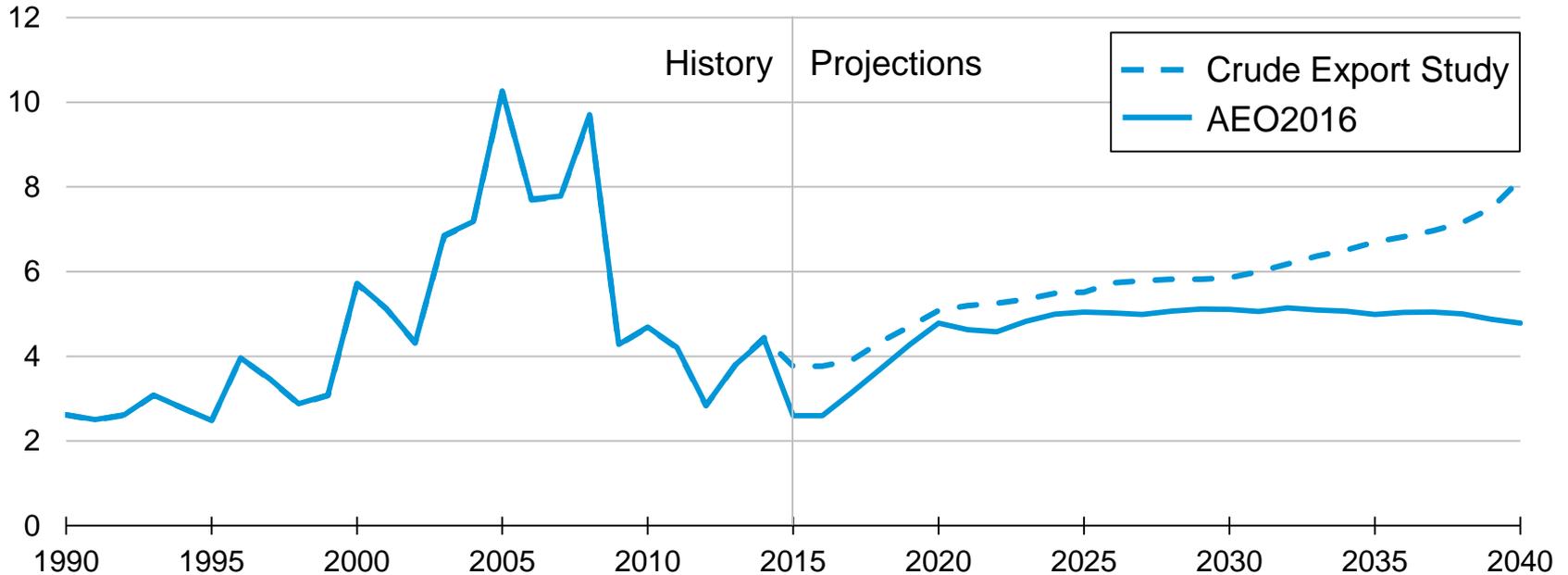
Trillion cubic feet per year



Source: Preliminary AEO2016 runs, dated as of 02/25/16

Henry Hub Natural Gas Spot Prices, 1990-2040

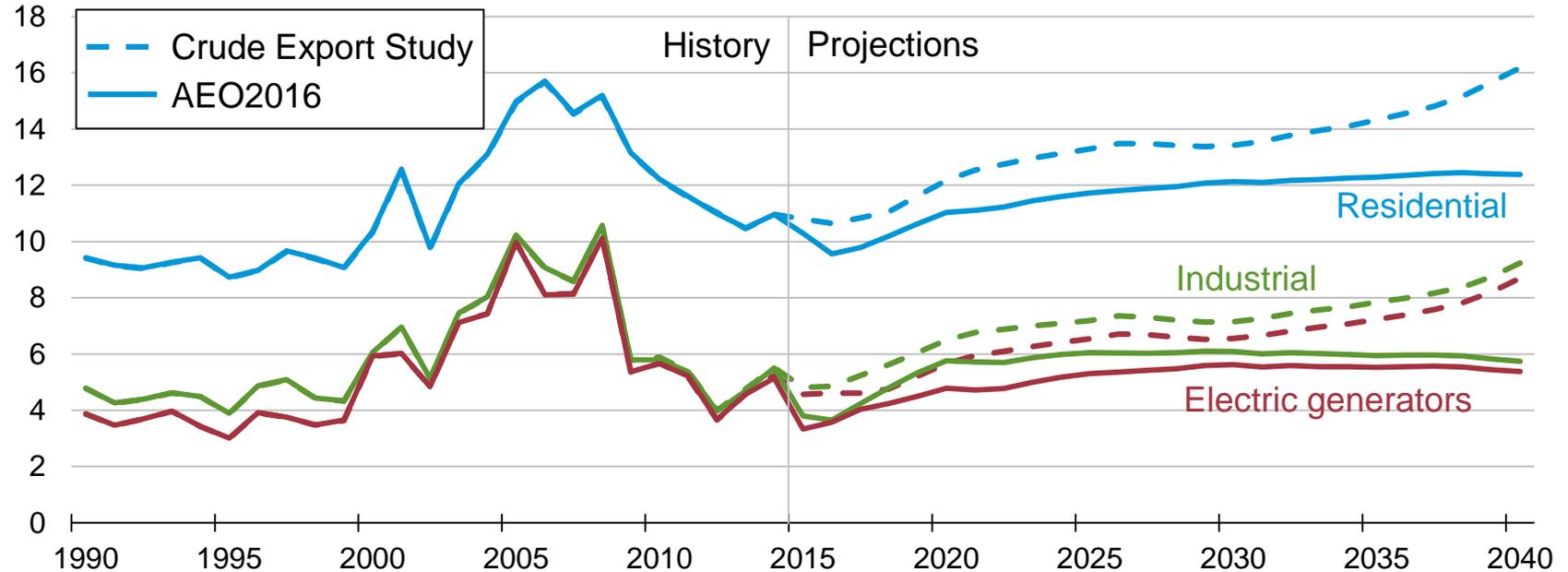
Henry Hub Natural Gas Spot Prices
2014 dollars per million Btu



Source: Preliminary AEO2016 runs, dated as of 02/25/16

Natural Gas End-User Prices, 1990-2040

Natural Gas End-User Prices
2014 dollars per million Btu

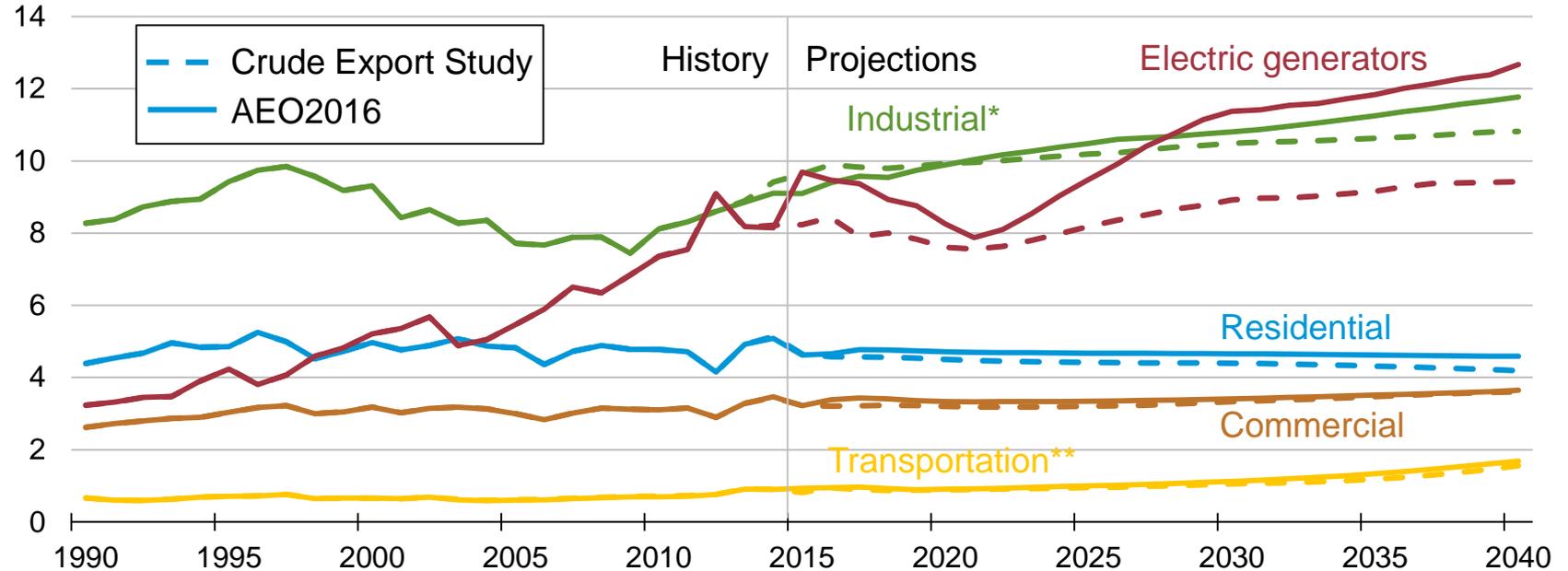


Source: Preliminary AEO2016 runs, dated as of 02/25/16

Natural gas consumption by sector, 1990-2040

Dry natural gas
Trillion cubic feet per year

Source: Preliminary AEO2016 runs, dated as of
02/25/16



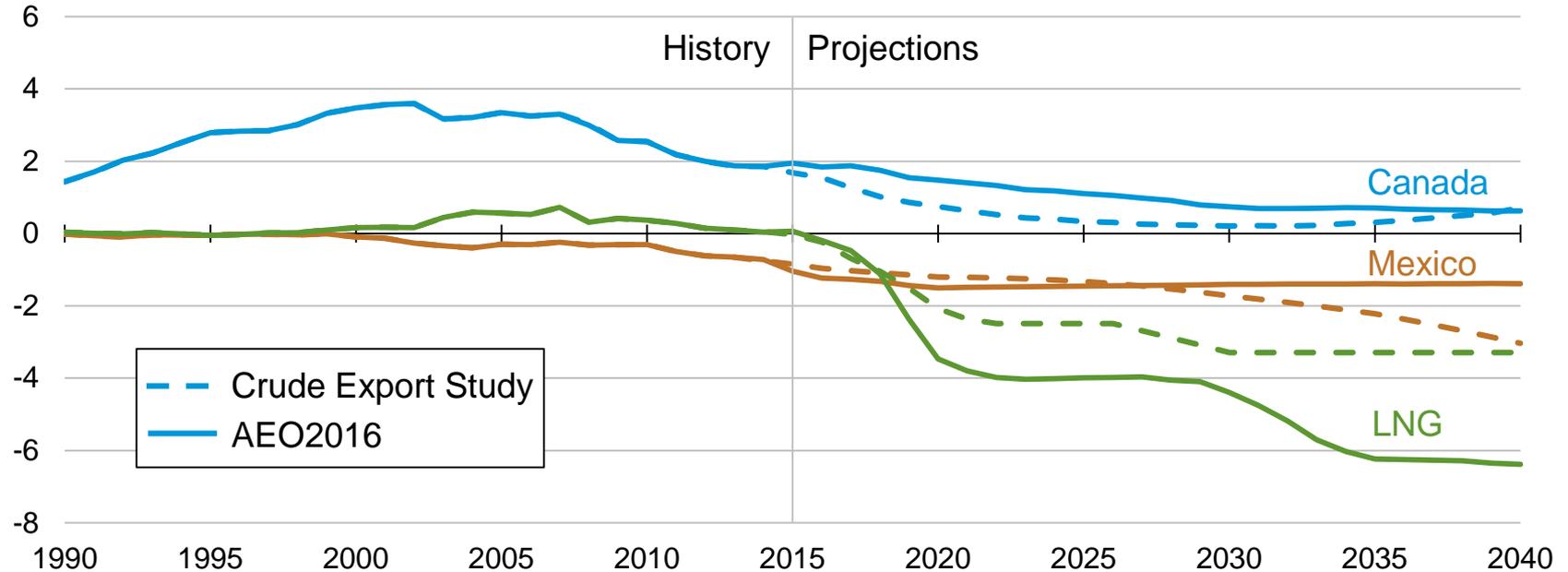
* Includes lease and plant fuel, and natural gas-to-liquids heat, power, and production

** Includes pipeline fuel

Net U.S. imports by source, 1990-2040

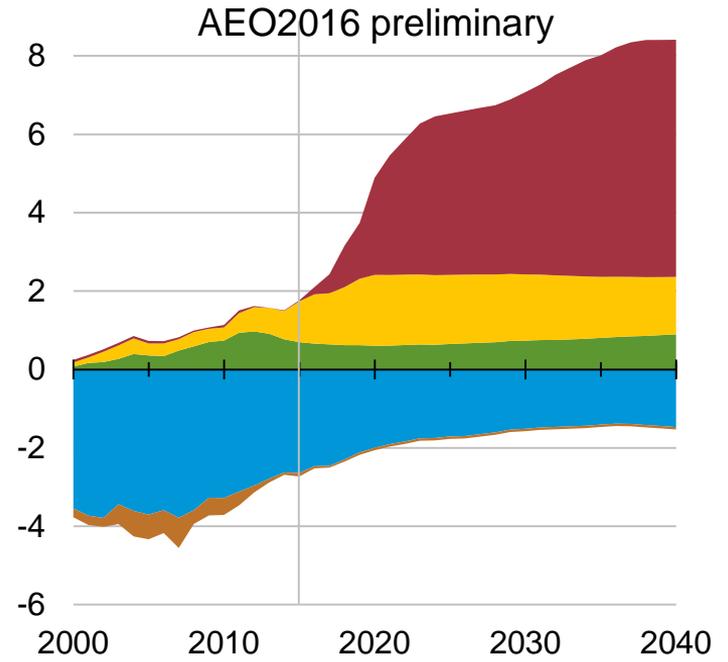
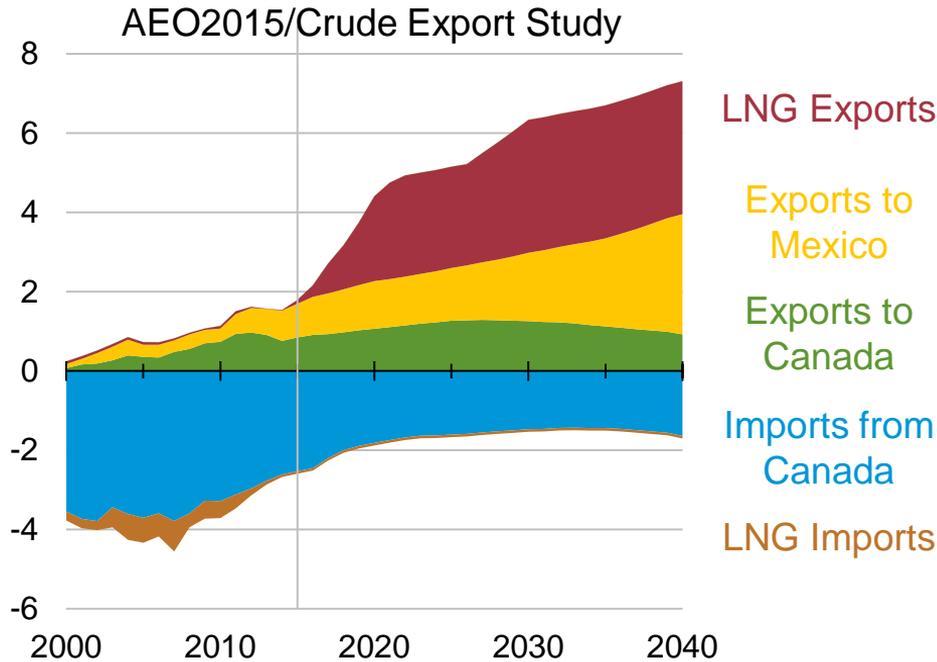
Dry natural gas

Trillion cubic feet per year



Source: Preliminary AEO2016 runs, dated as of 02/25/16

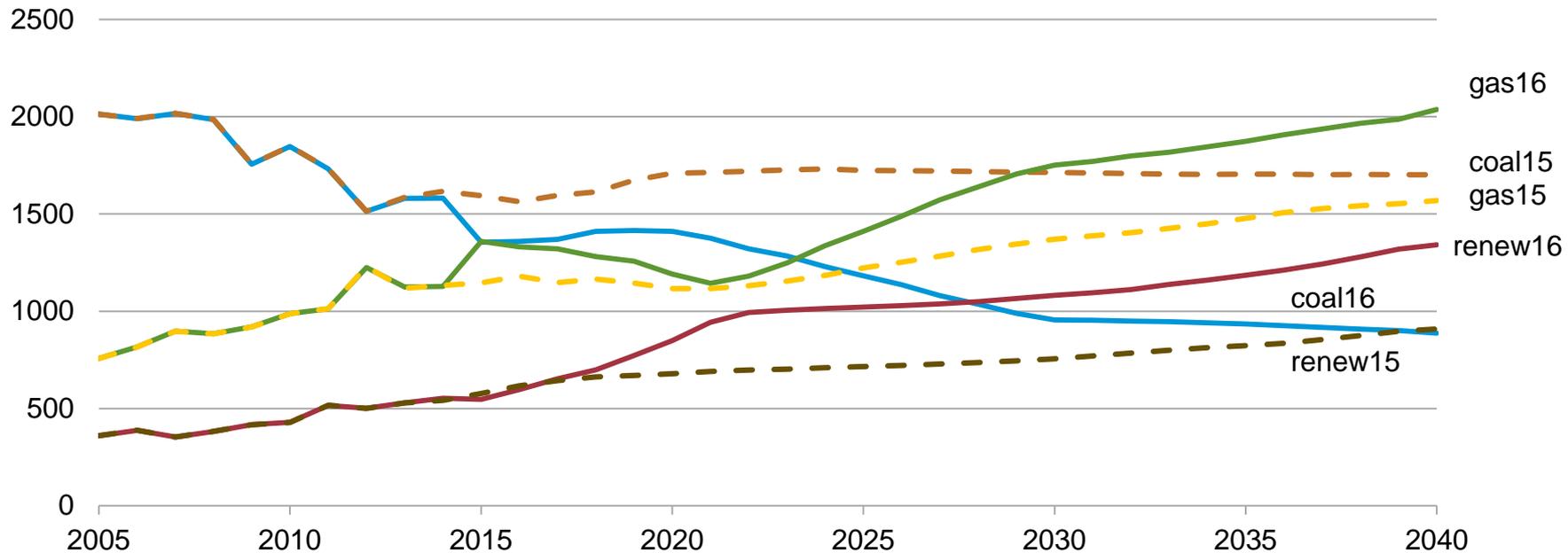
U.S. natural gas gross exports exceed 6 tcf in 2025



U.S. natural gas imports and exports
trillion cubic feet per year

Source: Preliminary AEO2016 runs, dated as of 02/25/16

electric generation by fuel
billion kwh



Source: Preliminary AEO2016 runs, dated as of 02/25/16

OGSM / Upstream

Resources and technology – knowns and unknowns –

There are two tiers of resource-technology plays which we assume will have different technology change rates

1. Actively developing area in plays like the Barnett, Marcellus, etc. will be called “Tier 1” and the EUR given a 1% annual growth rate
2. Area not yet at prime time will be called “Tier 2” and the EUR given a 3% annual growth rate until development begins then converts to “Tier 1”
 - Large areas of the Marcellus, Utica, etc.
 - Devonian has been produced with tiny vertical wells for 100+ years

categories, AAGR%	Drilling cost	Operating cost	EUR Tier 1	EUR Tier 2
Conv Oil & Gas	-0.25%	-0.25%	0.25%	0.25%
EOR	-0.25%	-0.25%	0.25%	0.25%
CBM	-0.25%	-0.25%	0.25%	0.25%
Tight oil	-1%	-0.5%	1%	3%
Tight gas	-1%	-0.5%	1%	3%
Shale gas	-1%	-0.5%	1%	3%

Natural gas resources plus cumulative production has exhibited an AAGR of 3.3% between AEO1990 and AEO2015, and...

Natural gas Technically Recoverable Resources by AEO Year

Trillion cubic feet

	1990	2005	2015	1990 - 2015 % change	1990-2005 AAGR %	1990-2015 AAGR %	2005-2015 AAGR %
Proved Reserves	187	187	308	65%	0.0%	2.0%	5.1%
Unproved Resources	1,040	1,407	1,968	89%	2.0%	2.6%	3.4%
Shale Gas	12	86	596	4685%	13.7%	16.7%	21.4%
Tight Gas			354				
Coalbed Methane	47	80	120	157%	3.7%	3.8%	4.1%
Other			323				
Conventional Unproved	691	952					
L-48 offshore NA			305				
Alaska	291	289	271	-7%	0.0%	-0.3%	-0.6%
Subtotal Resources	1,228	1,594	2,277	85%	1.8%	2.5%	3.6%
Production	18	18	27	53%	0.1%	1.7%	4.2%
Cumulative Production	18	298	522				
TRR + Production	1,245	1,612	2,798	125%	1.7%	3.3%	5.7%
y/y Change in TRR + Production, %		3.6%	1.4%				

Oil has exhibited a nearly identical AAGR of 3.2%. This is a combination of discoveries and technology advancement.

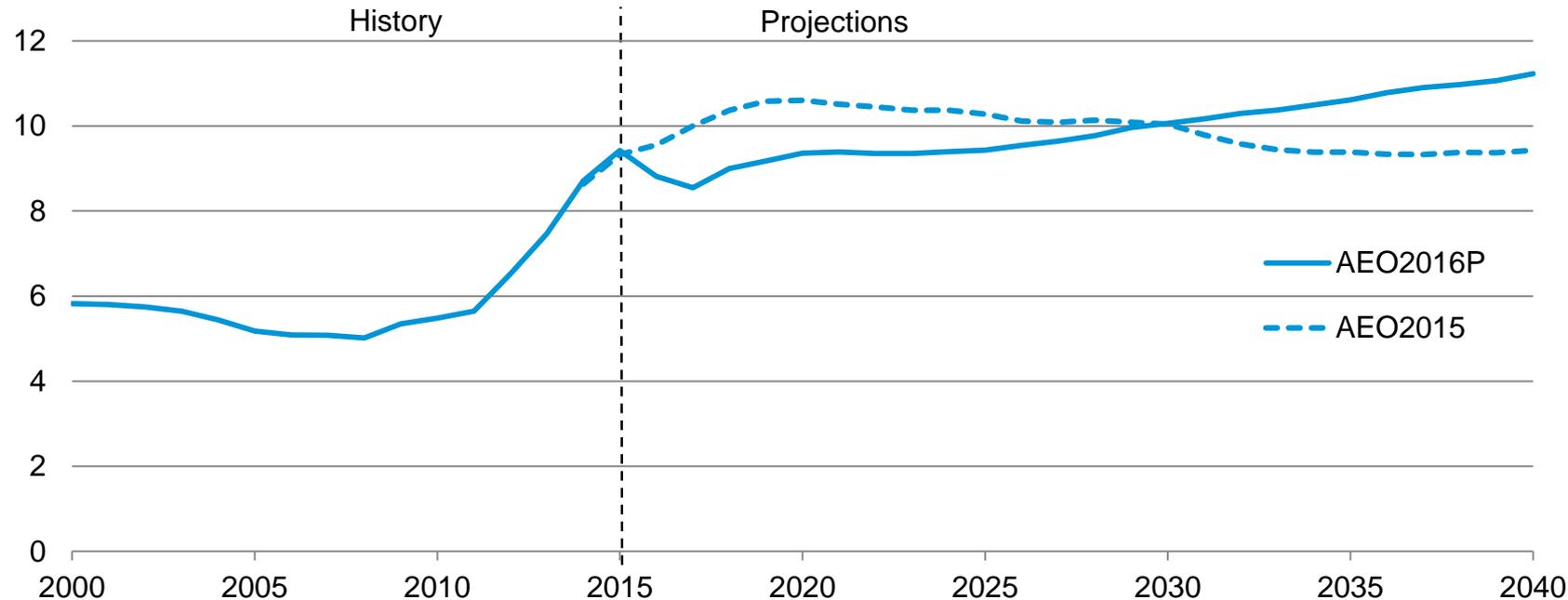
Crude oil Technically Recoverable Resources by AEO Year
billion barrels

	1990	2005	2015	1990 - 2015 % change	1990-2005 AAGR %	1990-2015 AAGR %	2005-2015 AAGR %
Proved Reserves	27	22	33	24%	-1.3%	0.9%	4.3%
Unproved Resources	116	119	226	95%	0.2%	2.7%	6.7%
Unproved Other L48 Onshore	71	56	67				
Unproved L48 Offshore (1)	34	39	48	39%	0.8%	1.3%	2.1%
Unproved Alaska	11	24	34	223%	5.7%	4.8%	3.4%
Unproved Tight Oil (reclassified from onshore)							
Unproved Tight Oil (2)			78				
Subtotal Resources	143	141	260	82%	-0.1%	2.4%	6.3%
Production	2.7	1.9	3.4	28%	-2.3%	1.0%	6.2%
Cumulative Production	3	37	60				
TRR + Production	145	177	320	120%	1.3%	3.2%	6.1%
Change in TRR + Production, %		-5.2%	7.8%				

Note: AEO1990 values highlighted in yellow are AEO2000 values as place holder estimates.

Lower prices pull production down in the earlier years and improved technologies push production up in the long-term

Crude oil production
million barrels per day

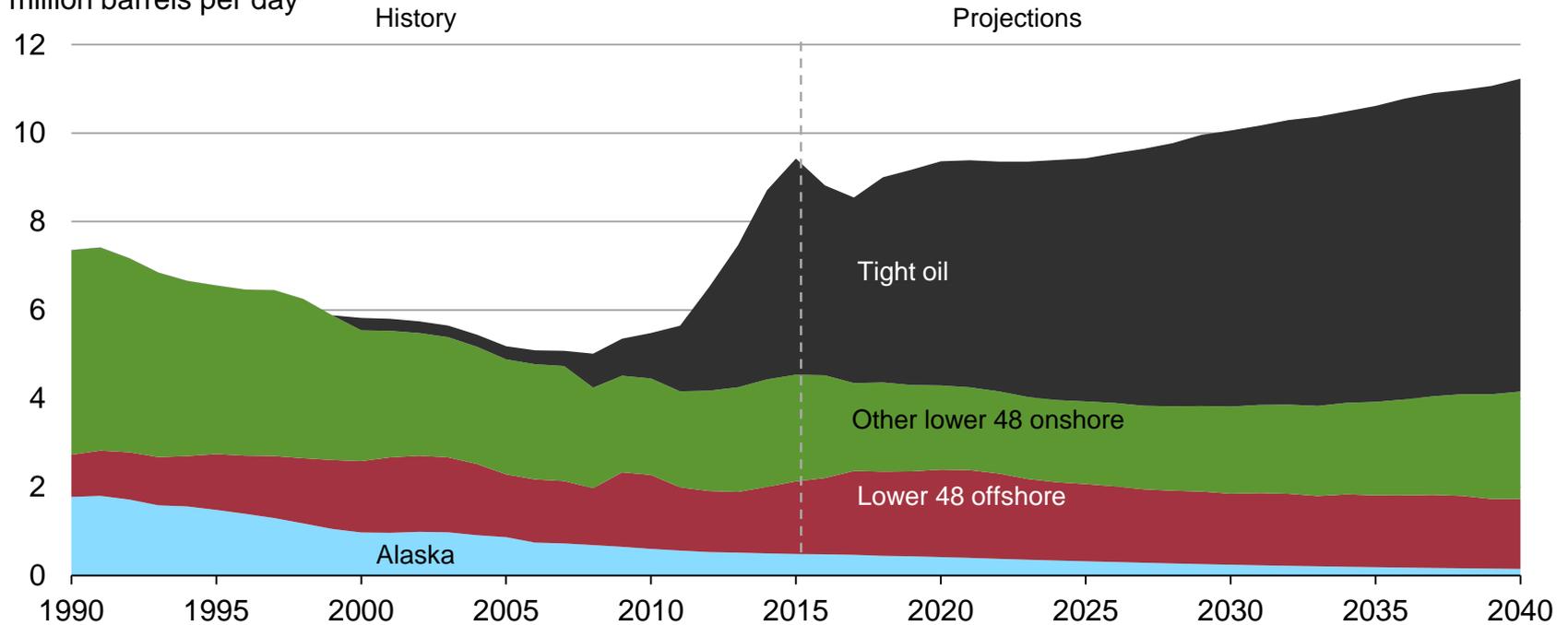


Source: Preliminary AEO2016 runs, dated as of 02/25/16

U.S. tight oil production leads a growth in domestic production to over 11 mmbd in 2040

U.S. crude oil production

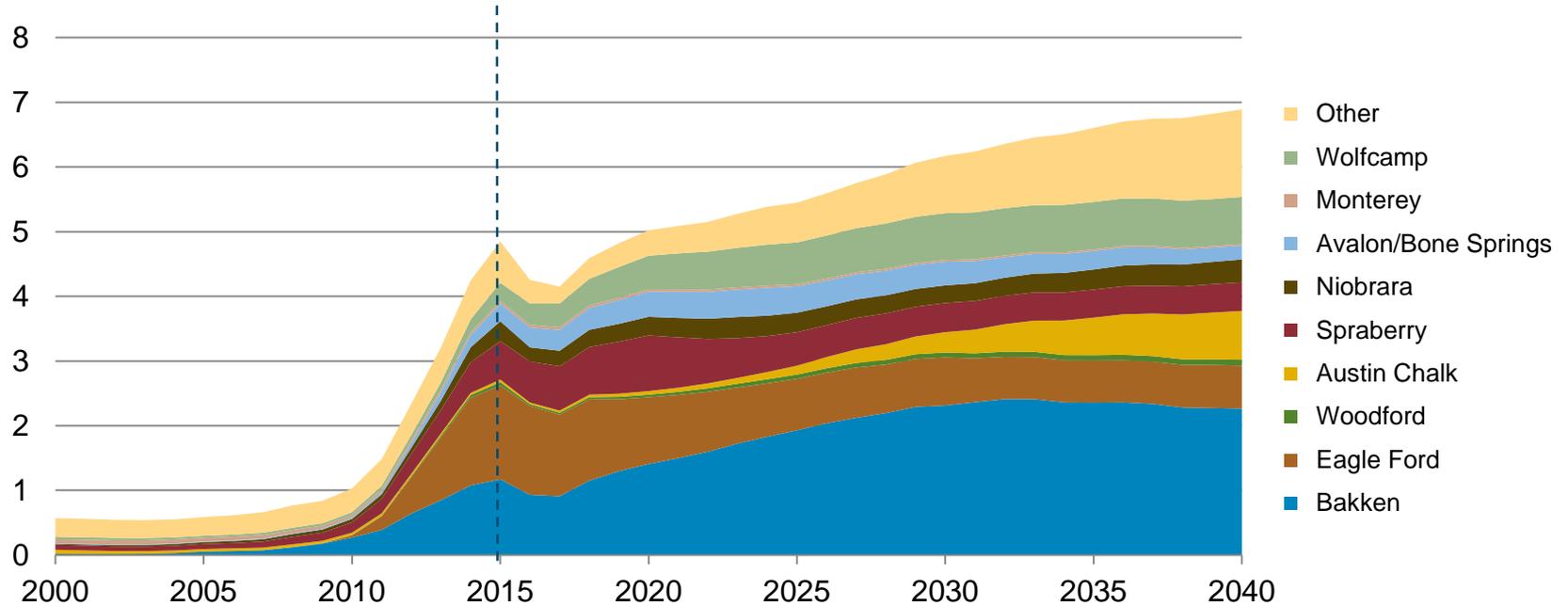
million barrels per day



Source: Preliminary AEO2016 runs, dated as of 02/25/16

Projected crude oil production from tight oil plays in Reference case

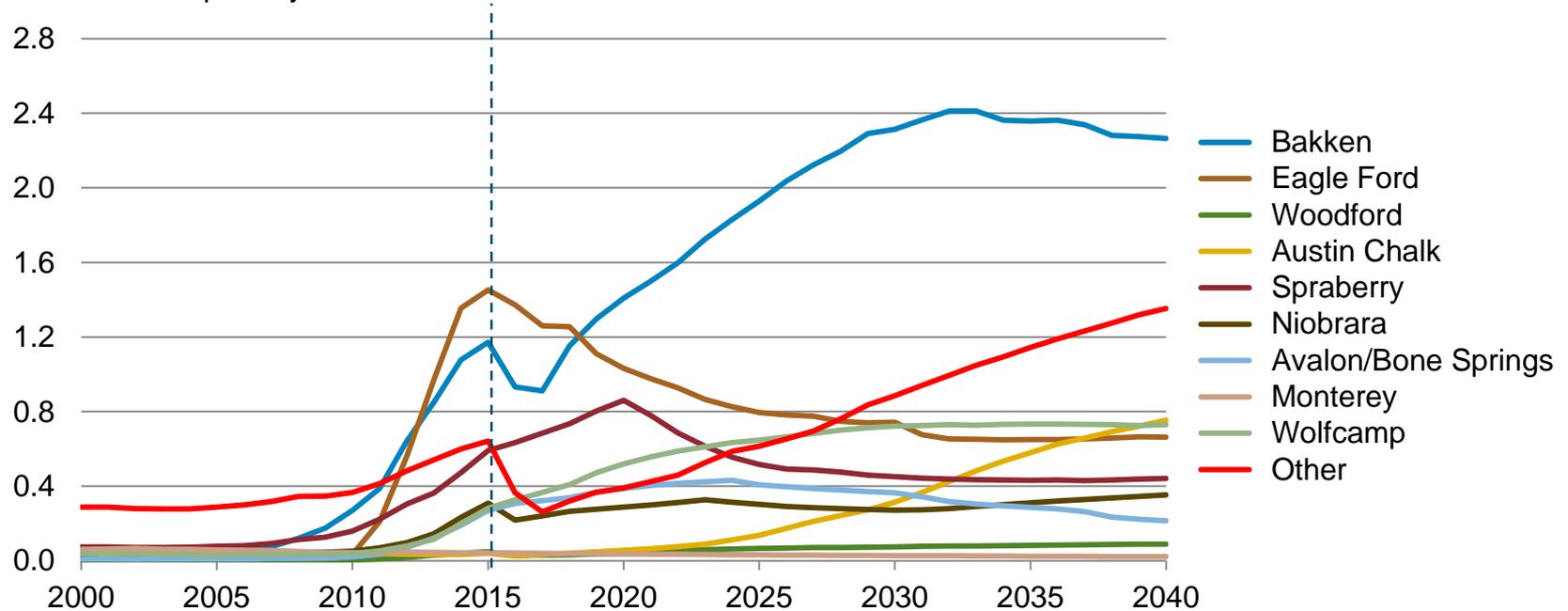
Crude oil production
million barrels per day



Source: Preliminary AEO2016 runs, dated as of 02/25/16

Crude oil production by selected tight oil plays

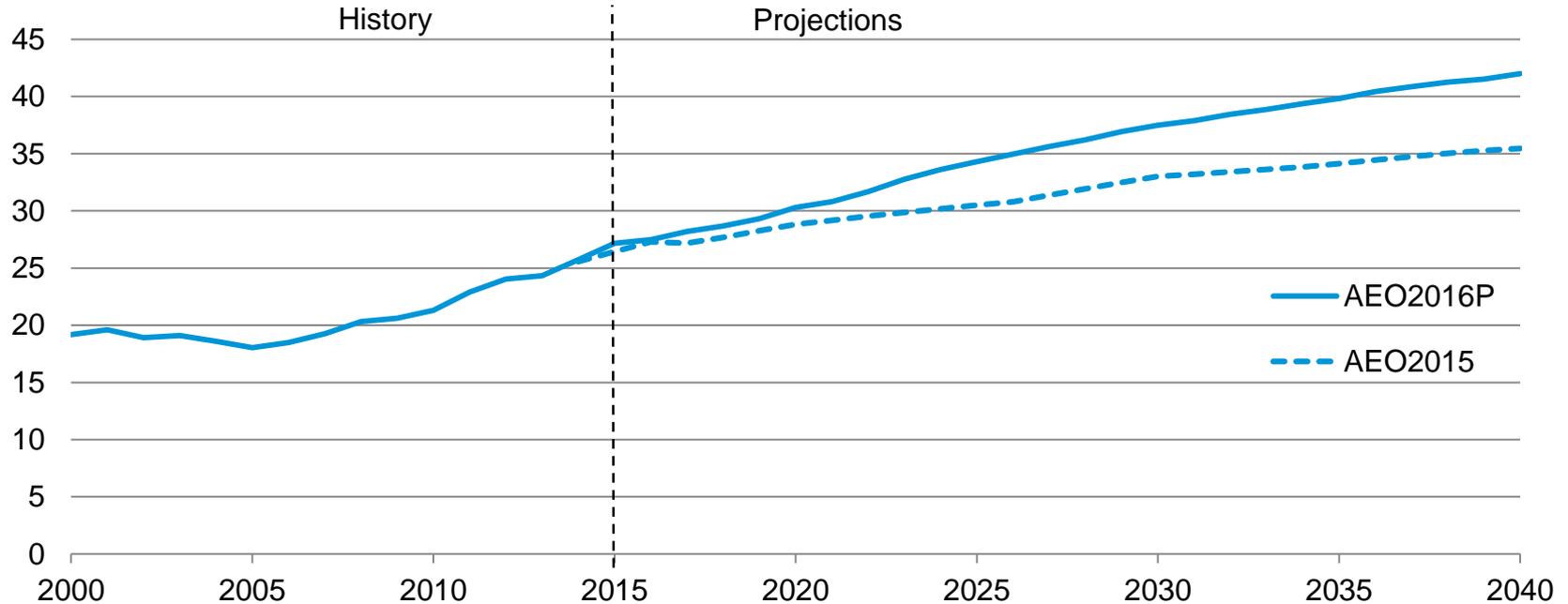
Crude oil production
million barrels per day



Source: Preliminary AEO2016 runs, dated as of 02/25/16

AEO2016 has higher supply: more production, lower costs

Dry natural gas production
trillion cubic feet

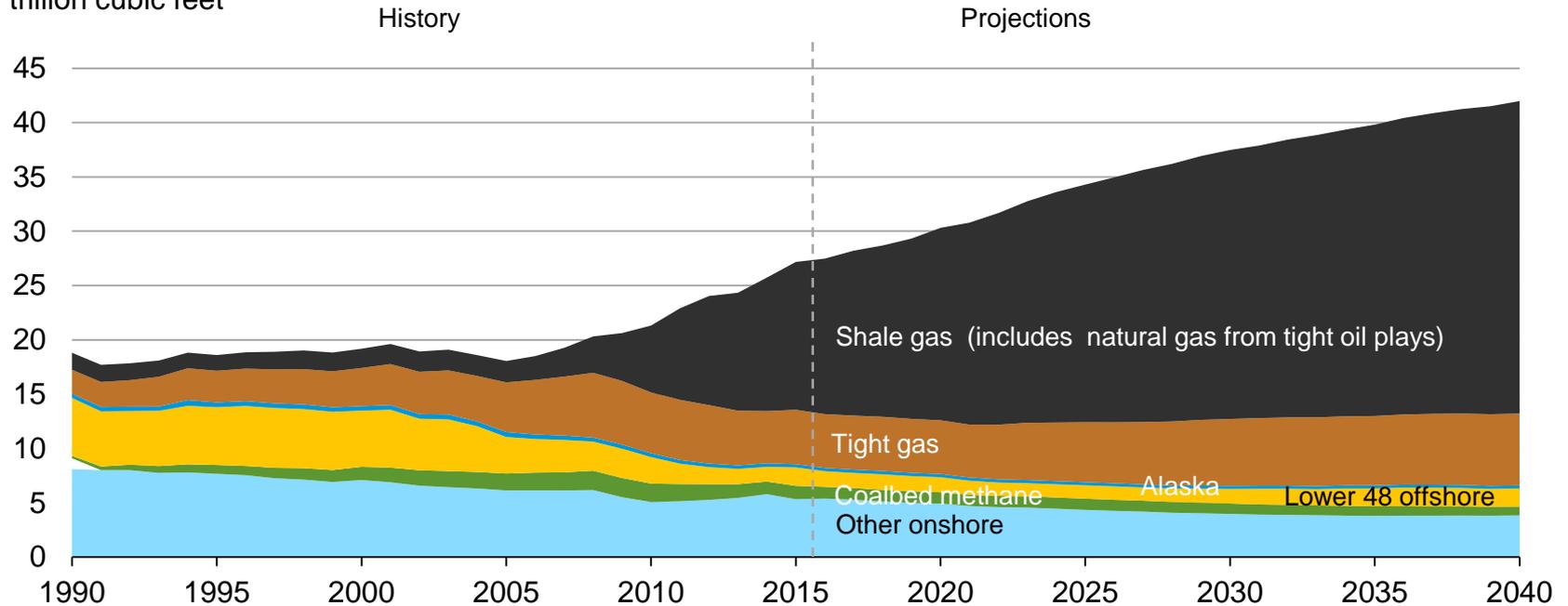


Source: Preliminary AEO2016 runs, dated as of 02/25/16

Shale gas production leads growth in production through 2040

U.S. dry natural gas production

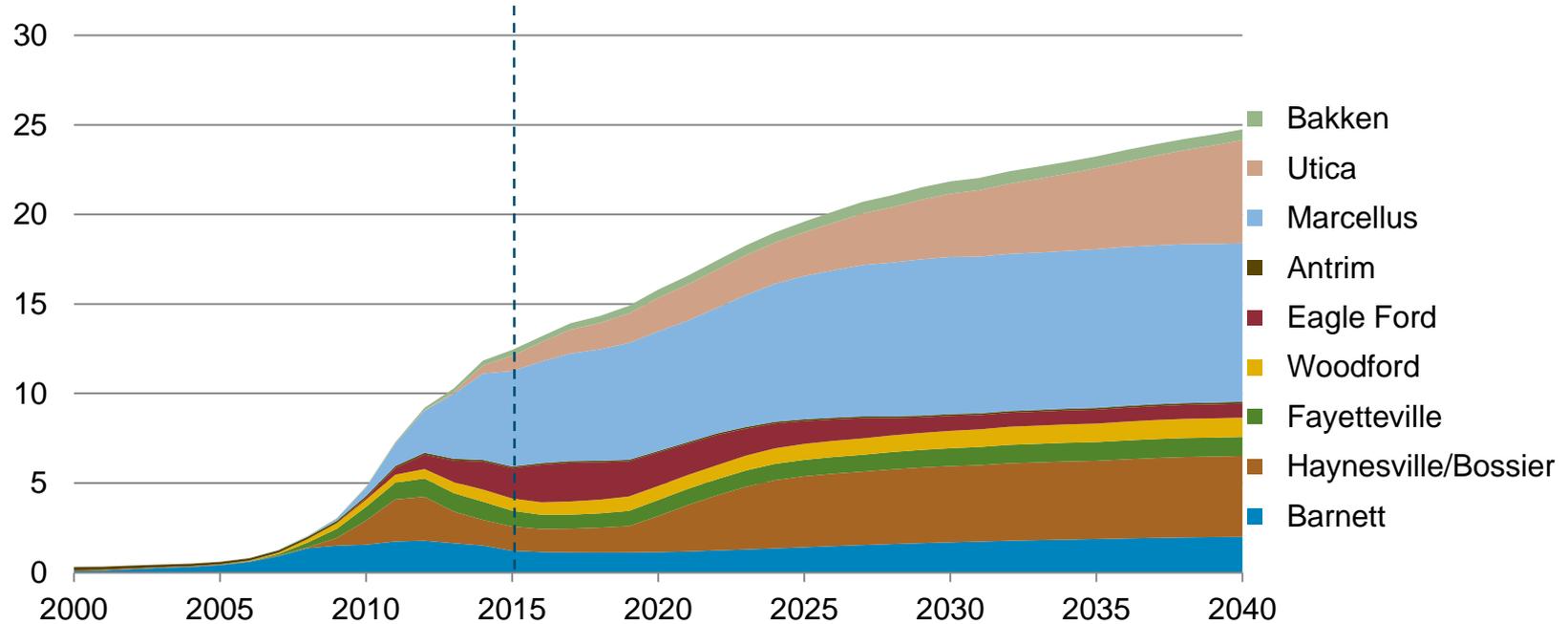
trillion cubic feet



Source: Preliminary AEO2016 runs, dated as of 02/25/16

Shale gas production by play

Natural gas production
trillion cubic feet

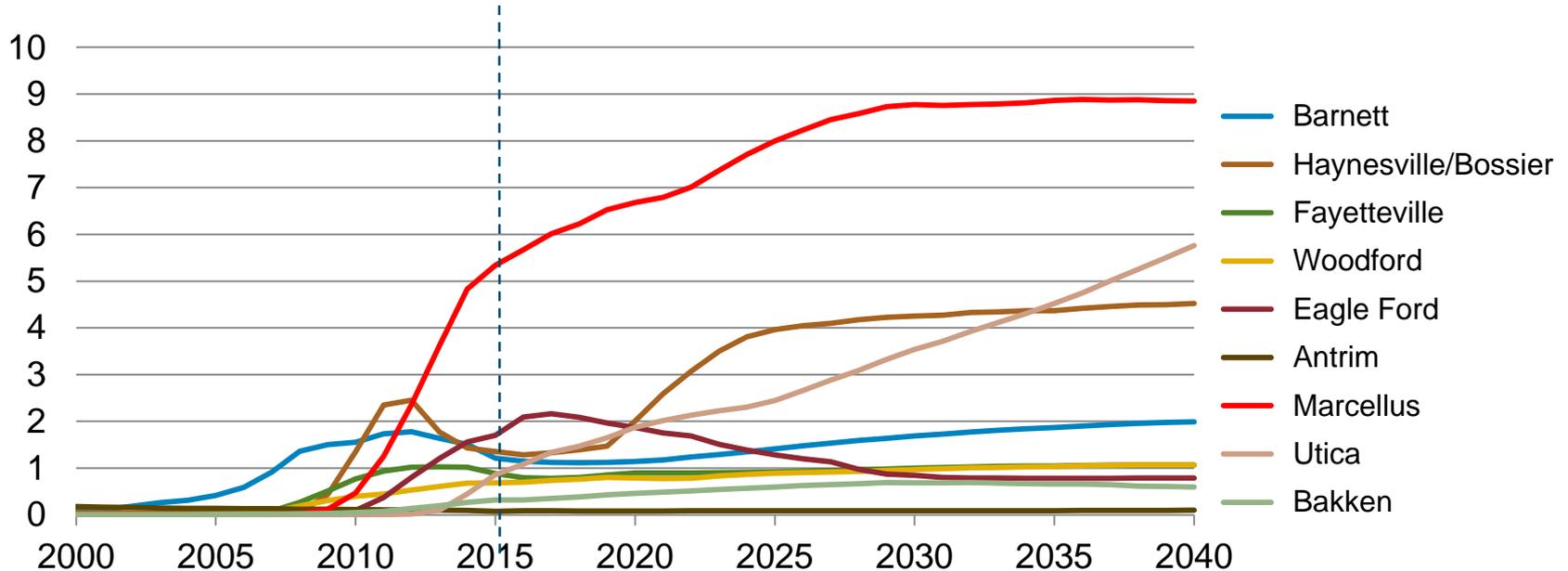


Source: Preliminary AEO2016 runs, dated as of 02/25/16

Natural gas production by selected shale play

Natural gas production
trillion cubic feet

Source: Preliminary AEO2016 runs, dated as of
02/25/16

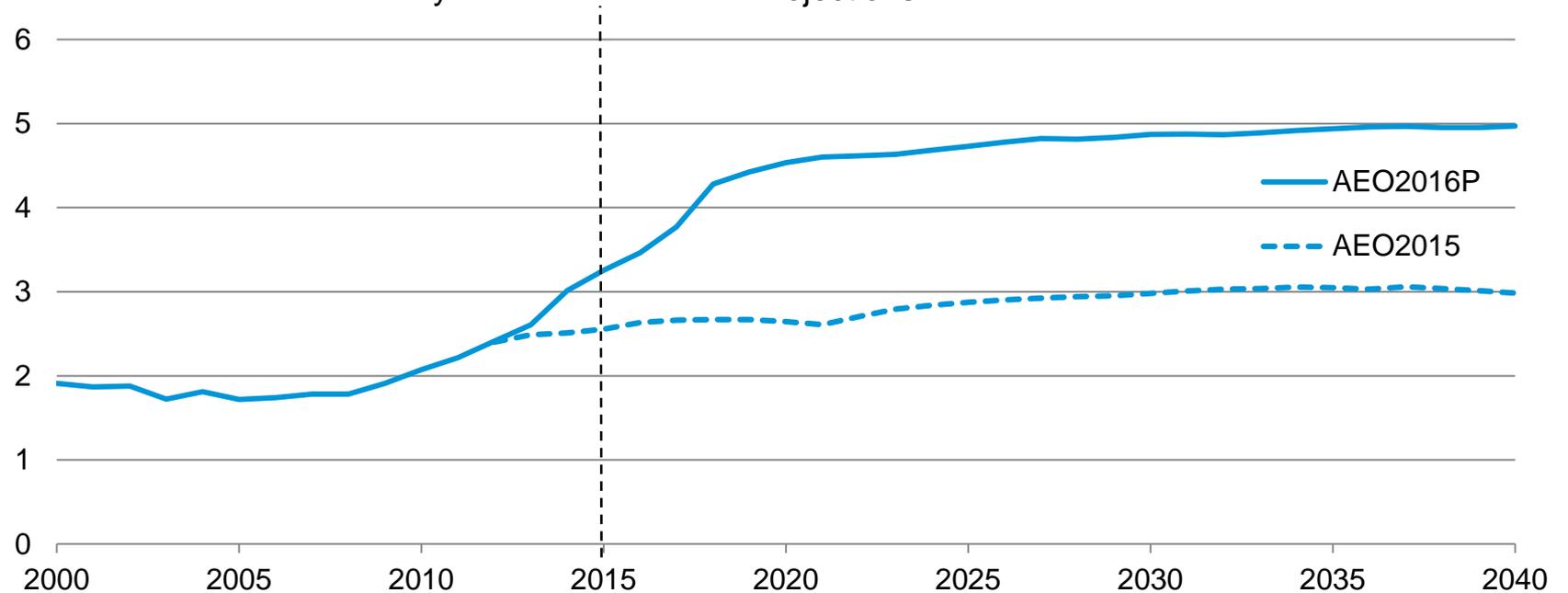


Source: Preliminary AEO2016 runs, dated as of 02/25/16

NGPL production is significantly higher than last year's AEO

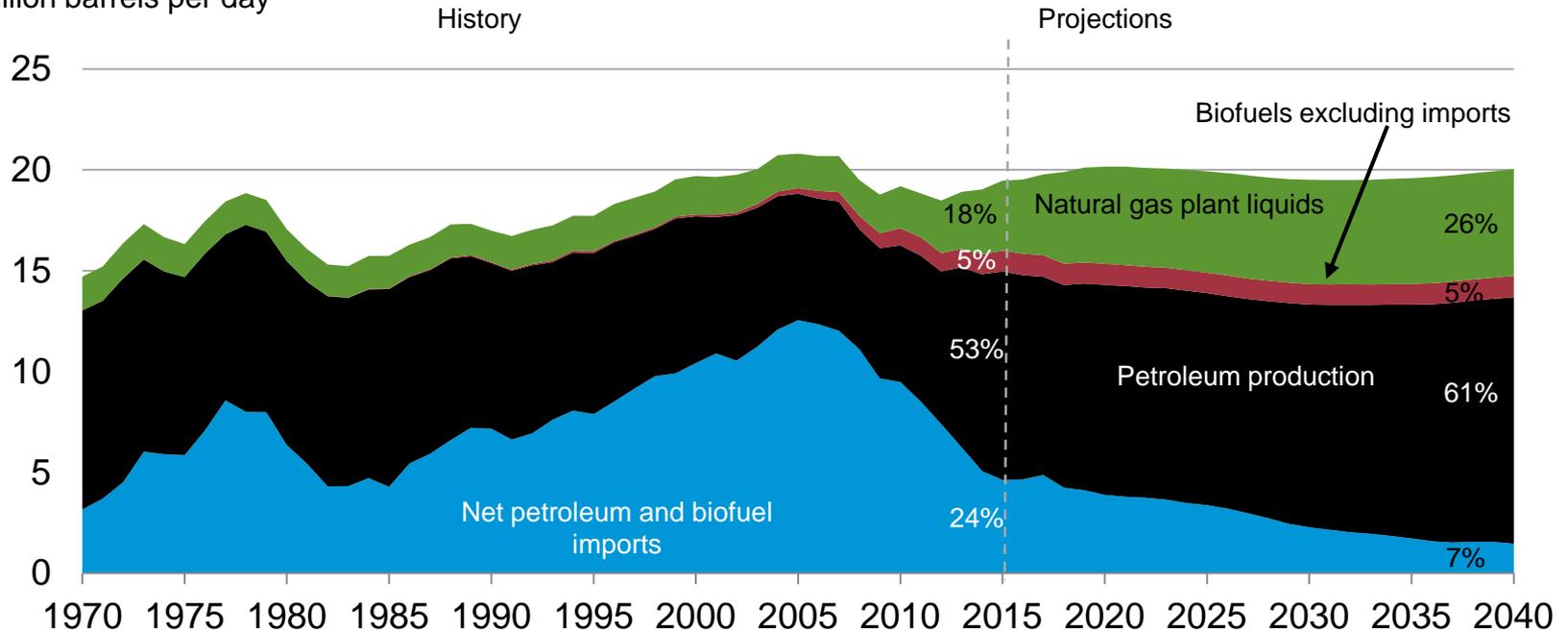
Natural gas plant liquids production
million barrels per day

Source: Preliminary AEO2016 runs, dated as of
02/25/16



U.S. import share of liquid fuels declines due to increased production of tight oil and gas liquids, and greater fuel efficiency

U.S. liquid fuels supply
million barrels per day

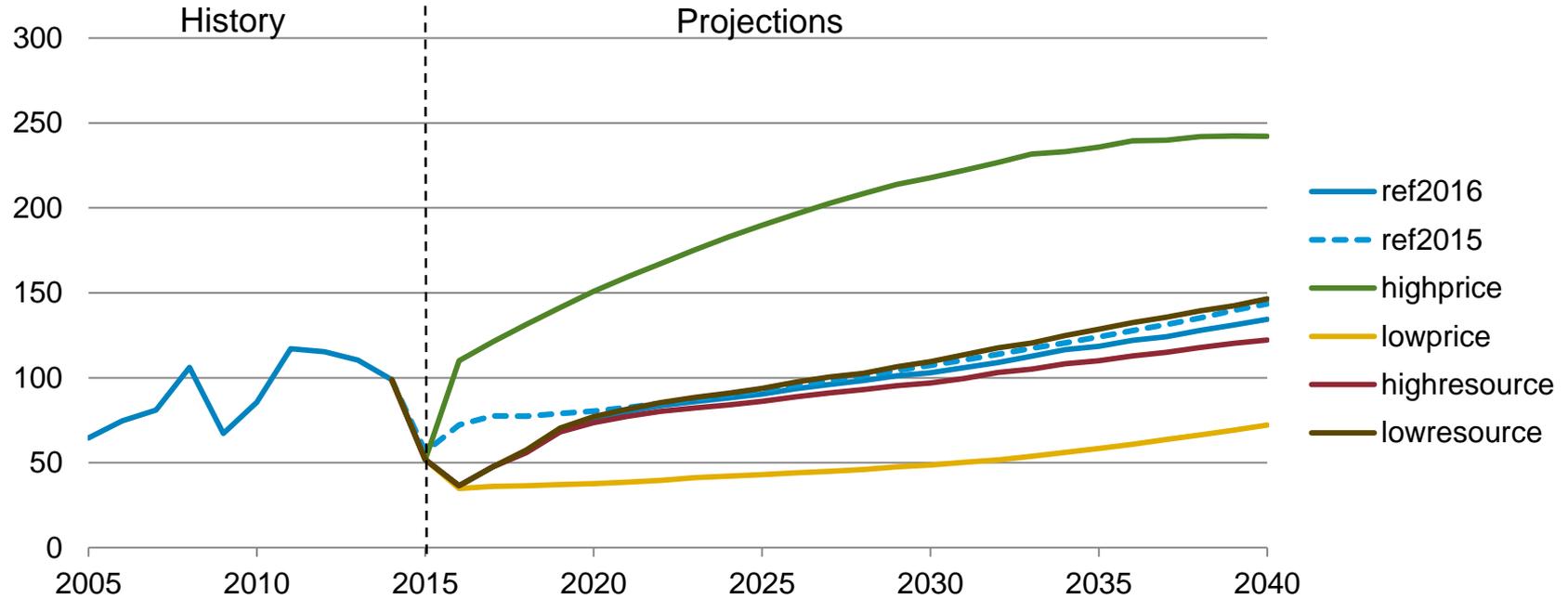


Source: Preliminary AEO2016 runs, dated as of 02/25/16

Brent spot price by case

Brent spot price

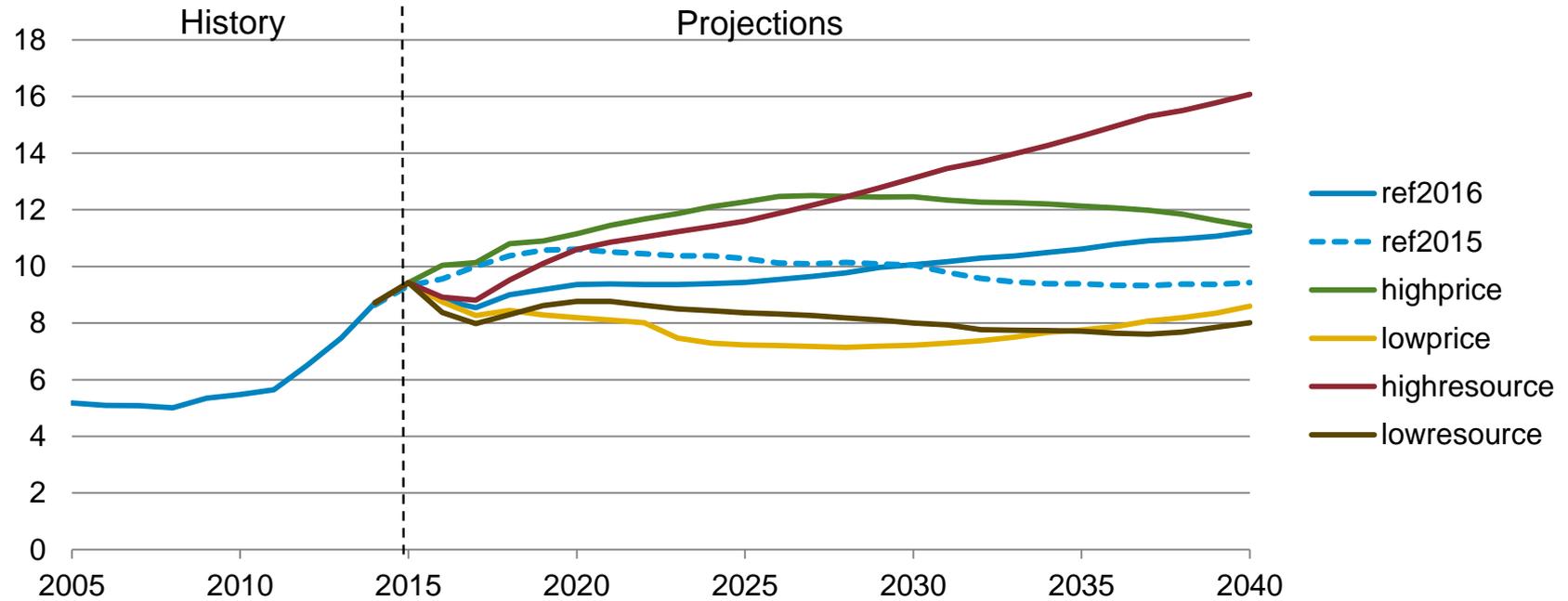
2014\$ per barrel



Source: Preliminary AEO2016 runs, dated as of 02/25/16

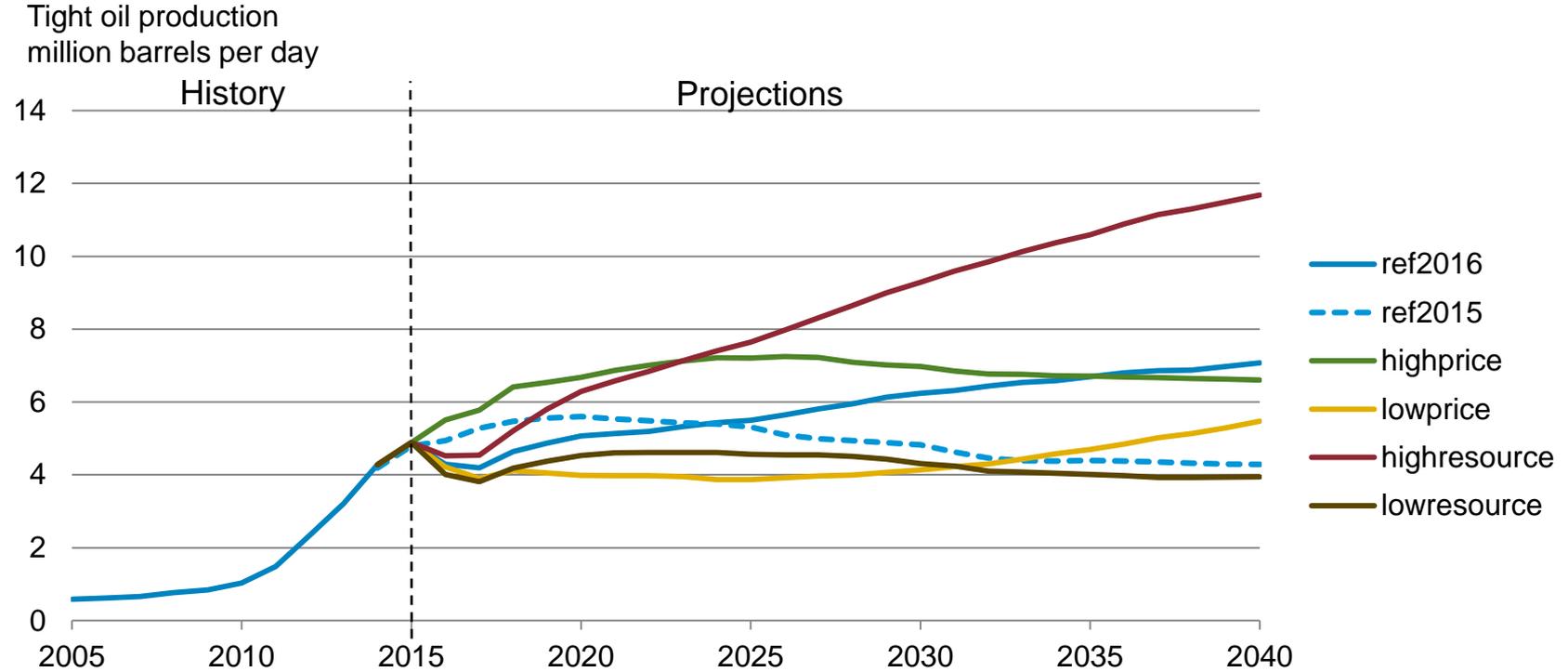
U.S. crude oil production by case

U.S. crude oil production
million barrels per day



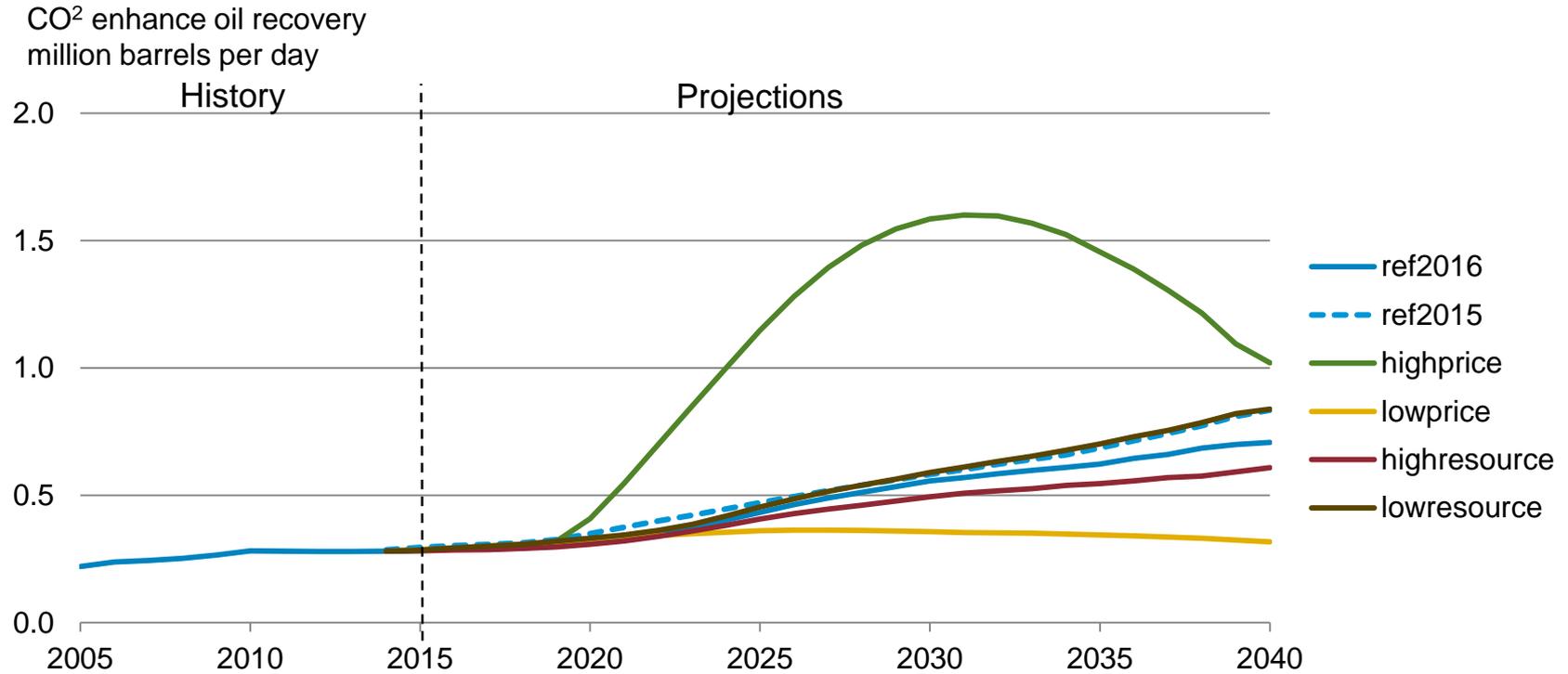
Source: Preliminary AEO2016 runs, dated as of 02/25/16

Tight oil production by case



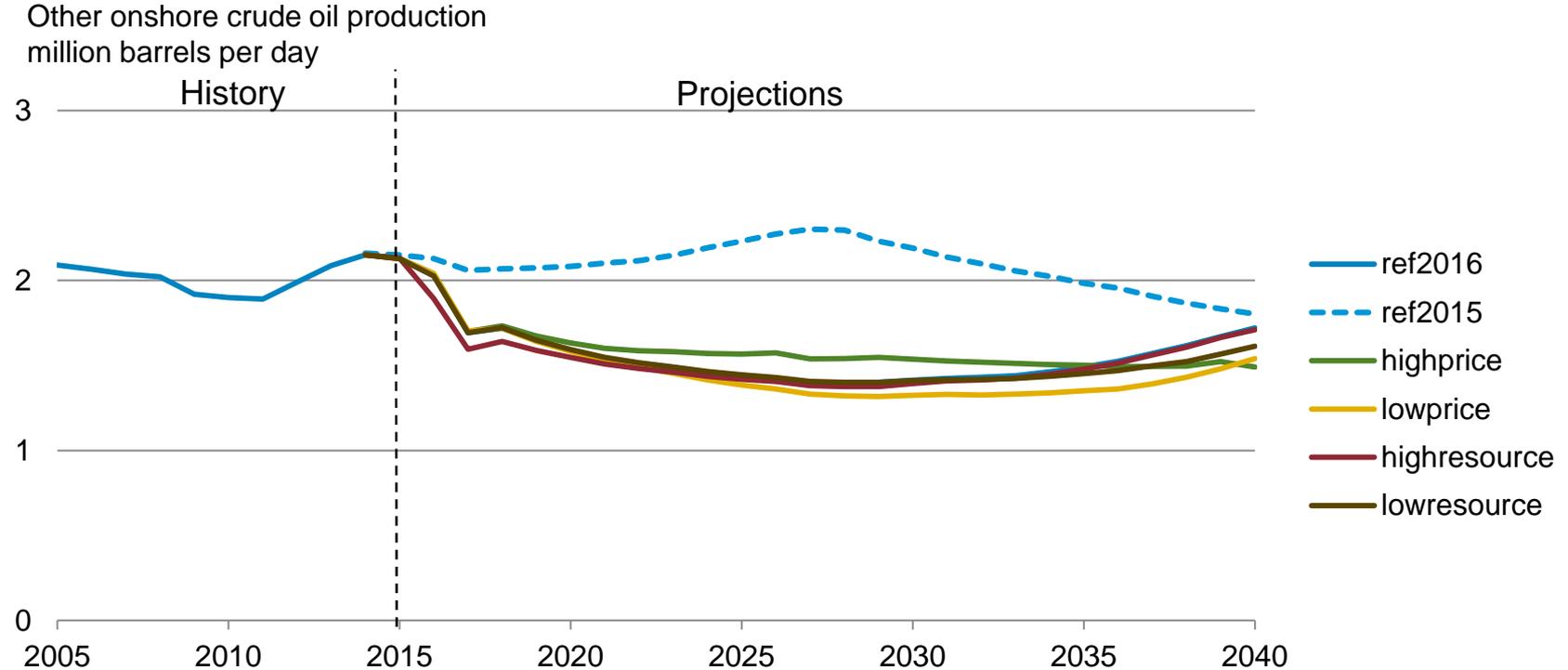
Source: Preliminary AEO2016 runs, dated as of 02/25/16

Carbon dioxide enhanced oil recovery by case



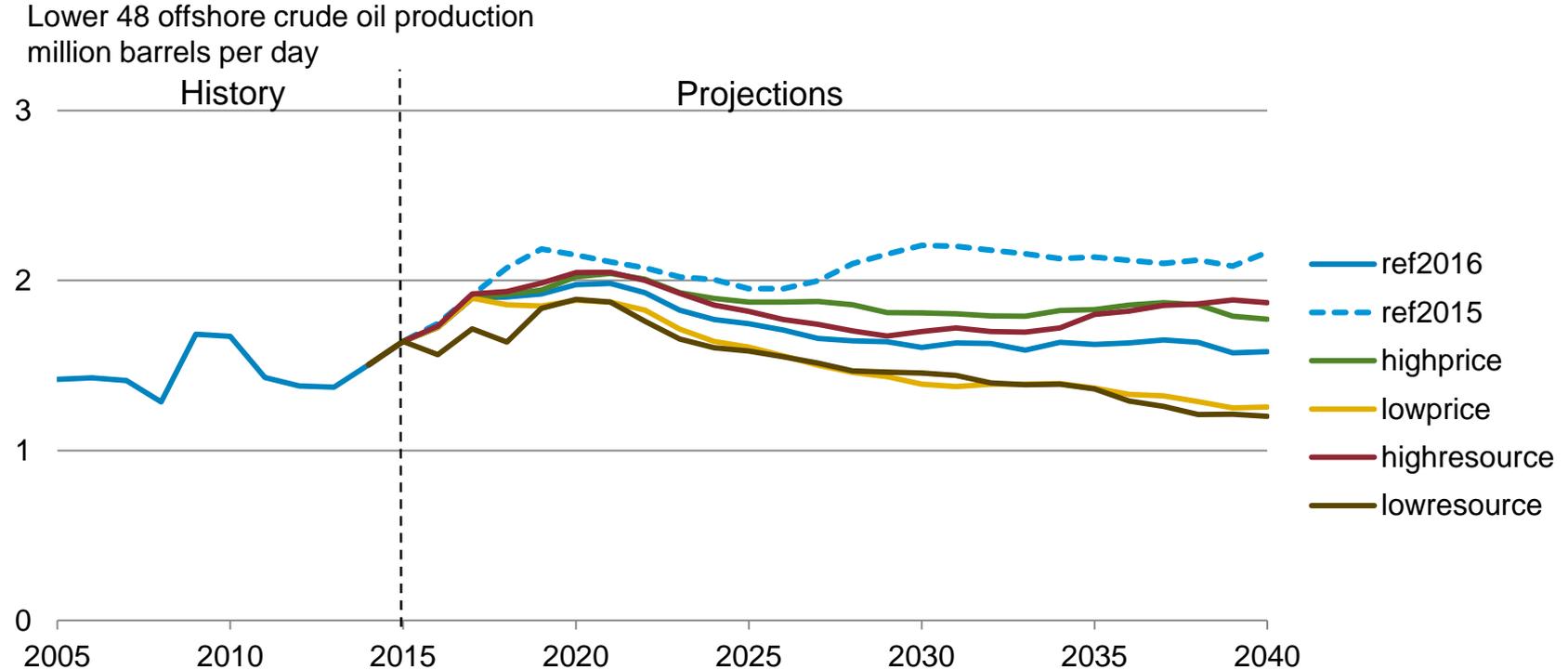
Source: Preliminary AEO2016 runs, dated as of 02/25/16

Other onshore crude oil production by case



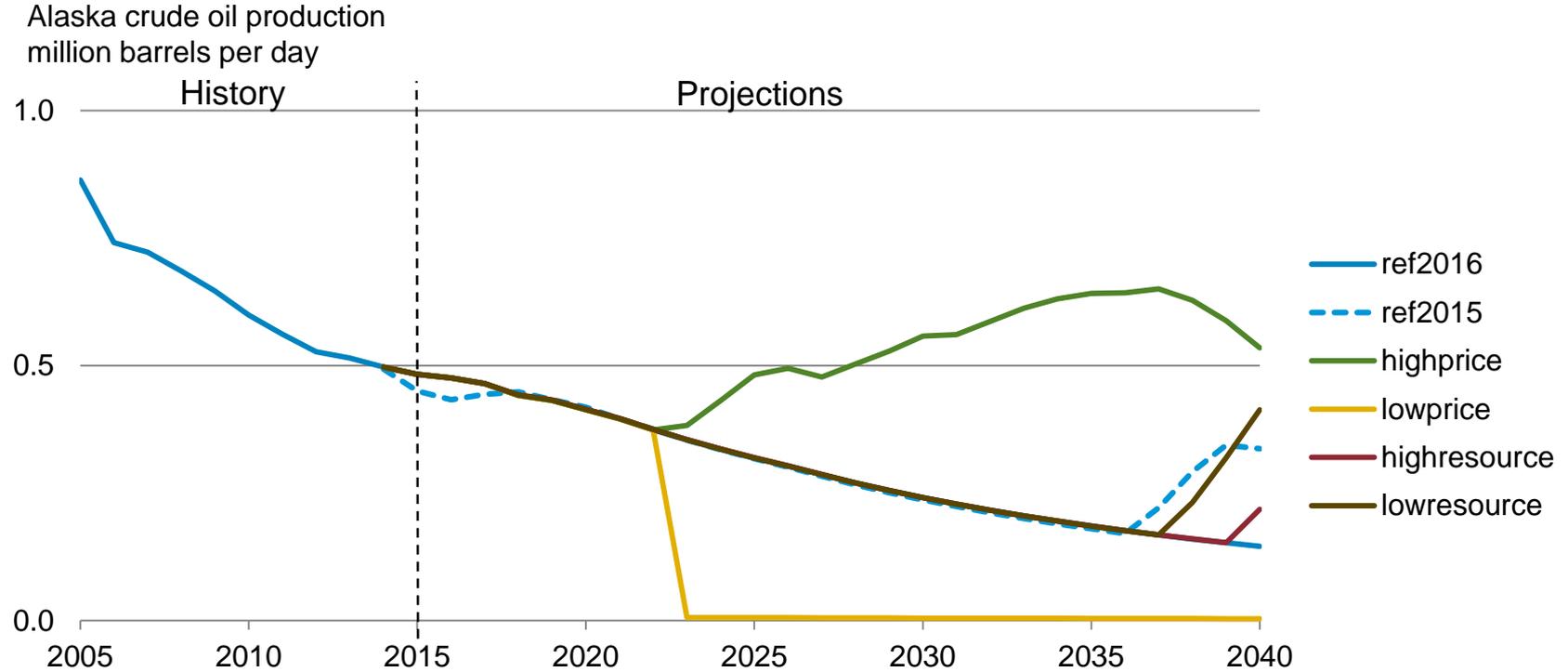
Source: Preliminary AEO2016 runs, dated as of 02/25/16

Lower 48 offshore crude oil production by case



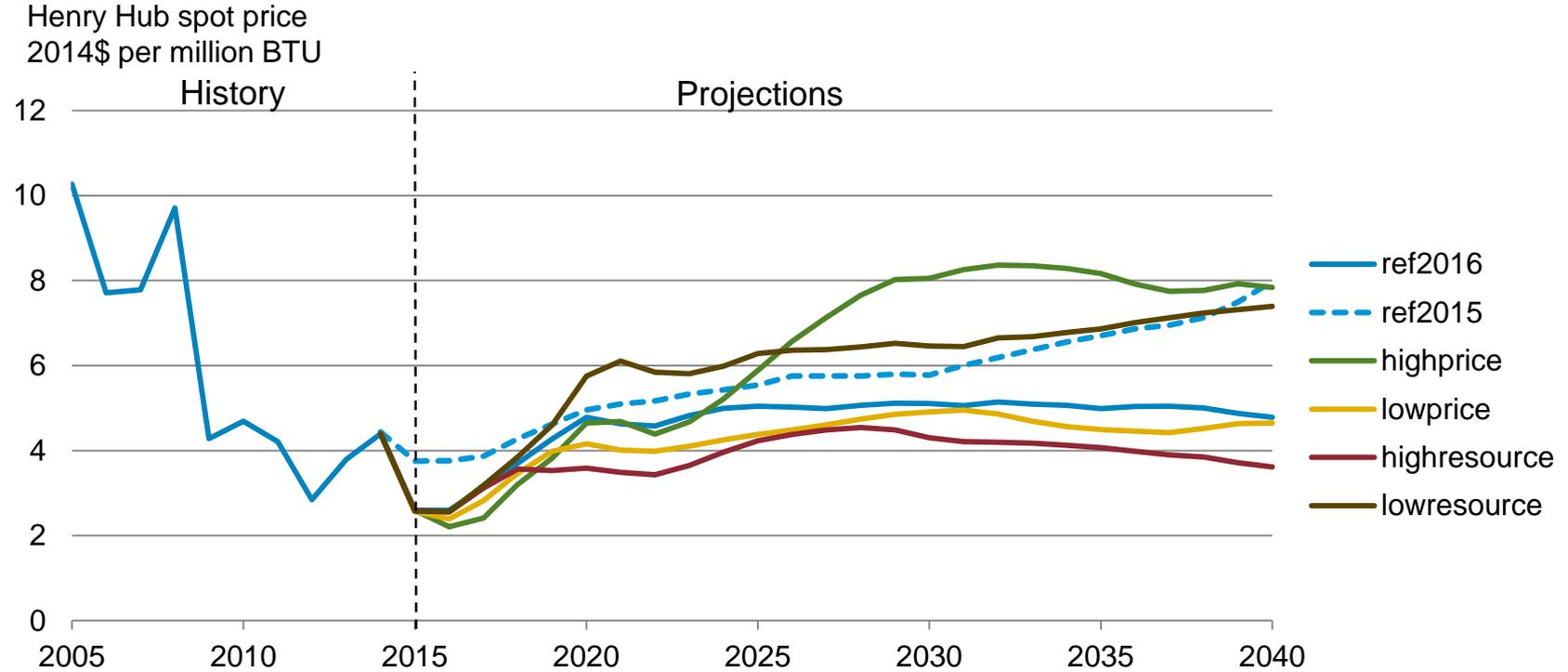
Source: Preliminary AEO2016 runs, dated as of 02/25/16

Alaska crude oil production by case



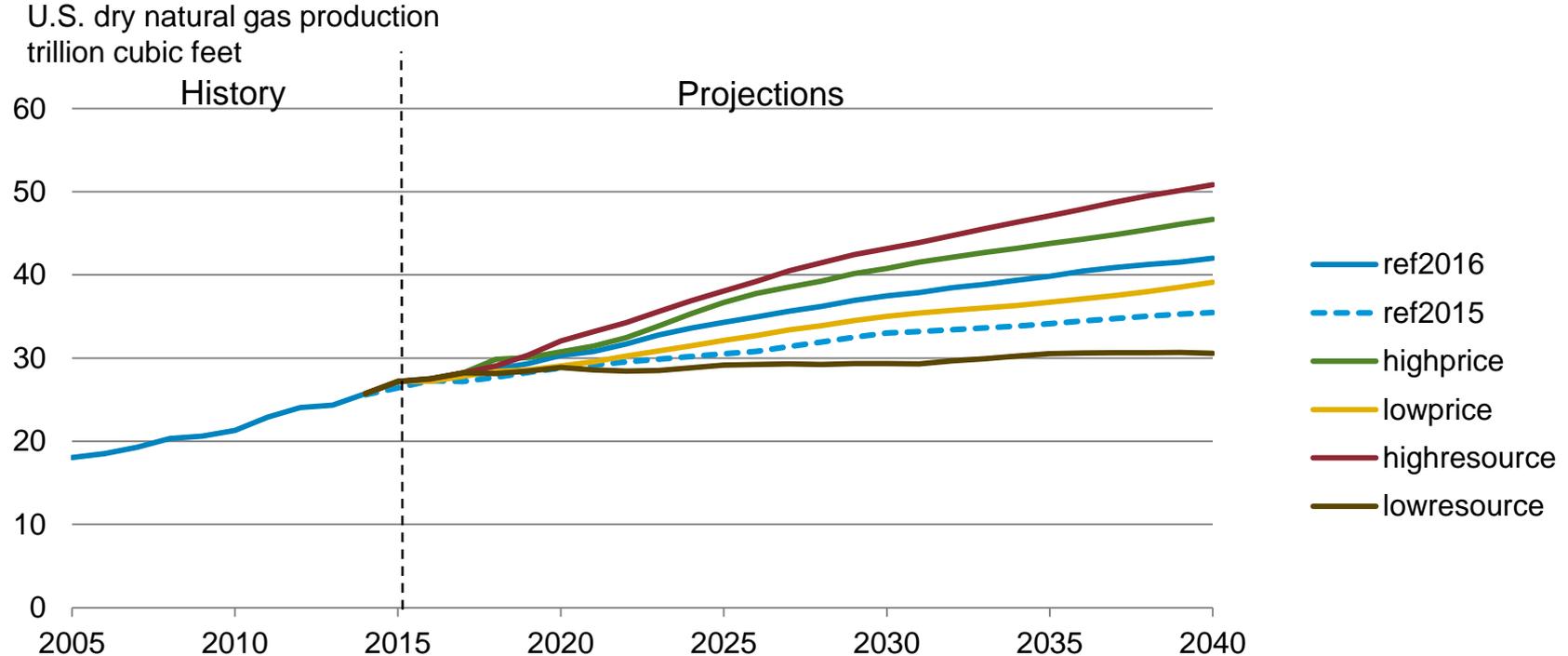
Source: Preliminary AEO2016 runs, dated as of 02/25/16

Henry Hub spot price by case



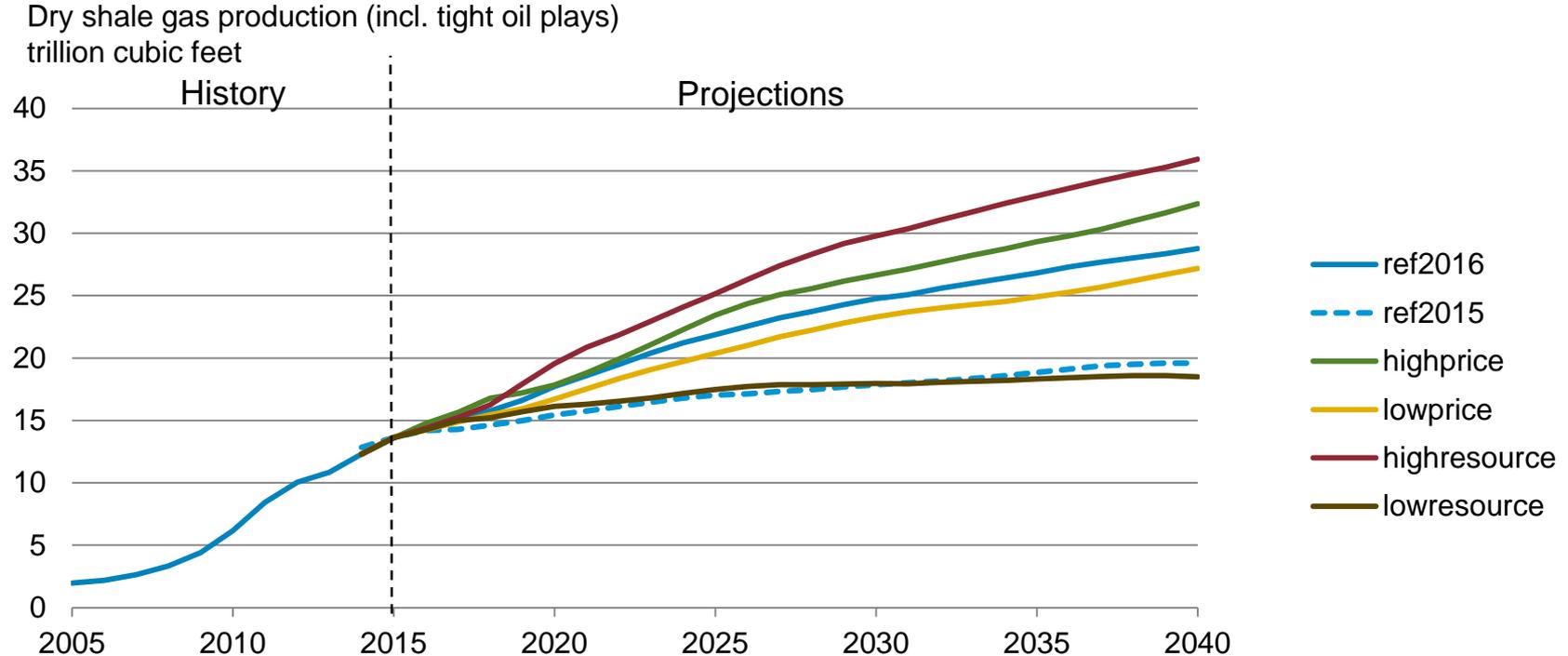
Source: Preliminary AEO2016 runs, dated as of 02/25/16

U.S. dry natural gas production by case



Source: Preliminary AEO2016 runs, dated as of 02/25/16

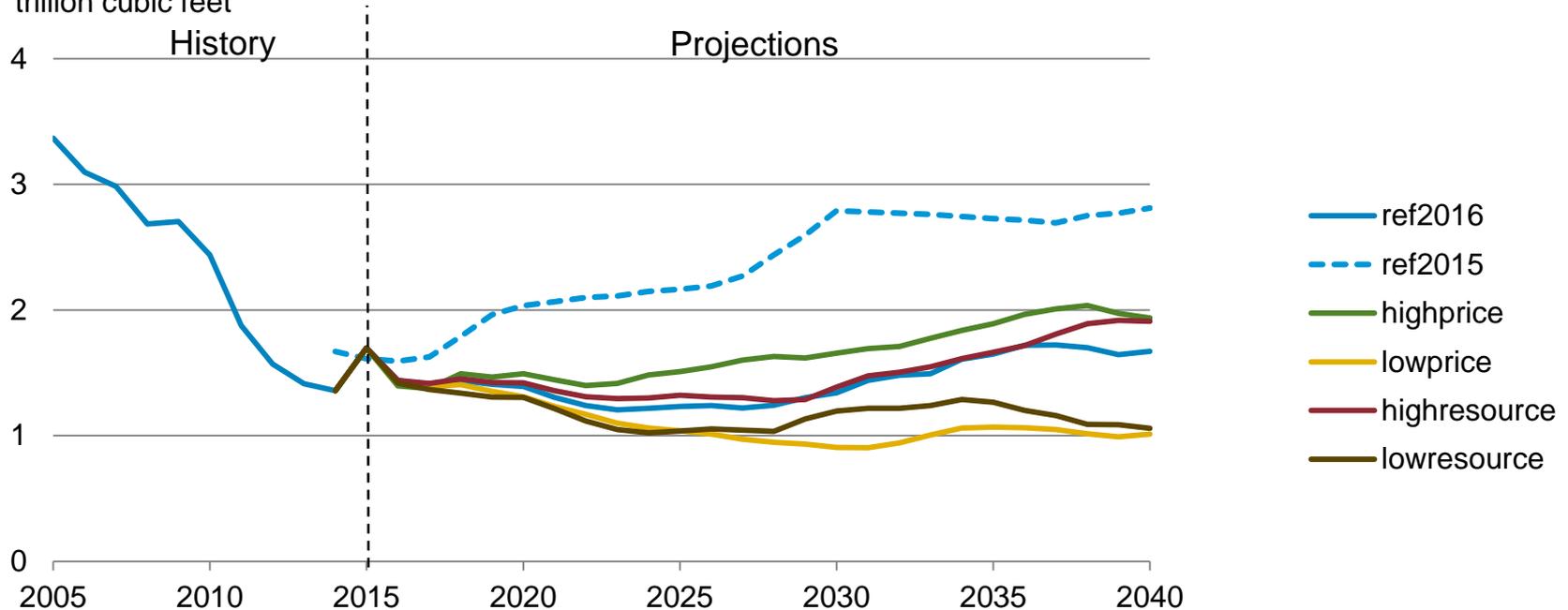
Dry shale gas production by case



Source: Preliminary AEO2016 runs, dated as of 02/25/16

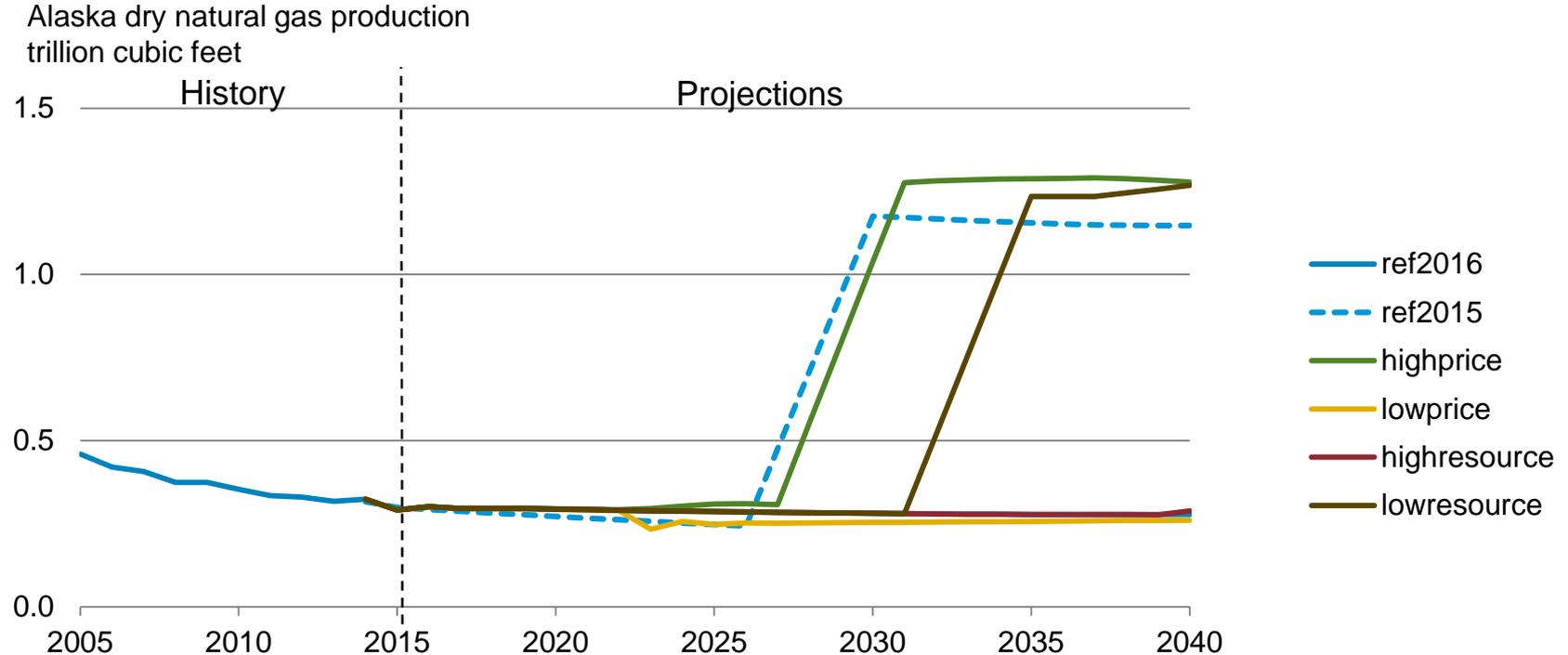
Lower 48 offshore dry natural gas production by case

Lower 48 offshore dry natural gas production
trillion cubic feet



Source: Preliminary AEO2016 runs, dated as of 02/25/16

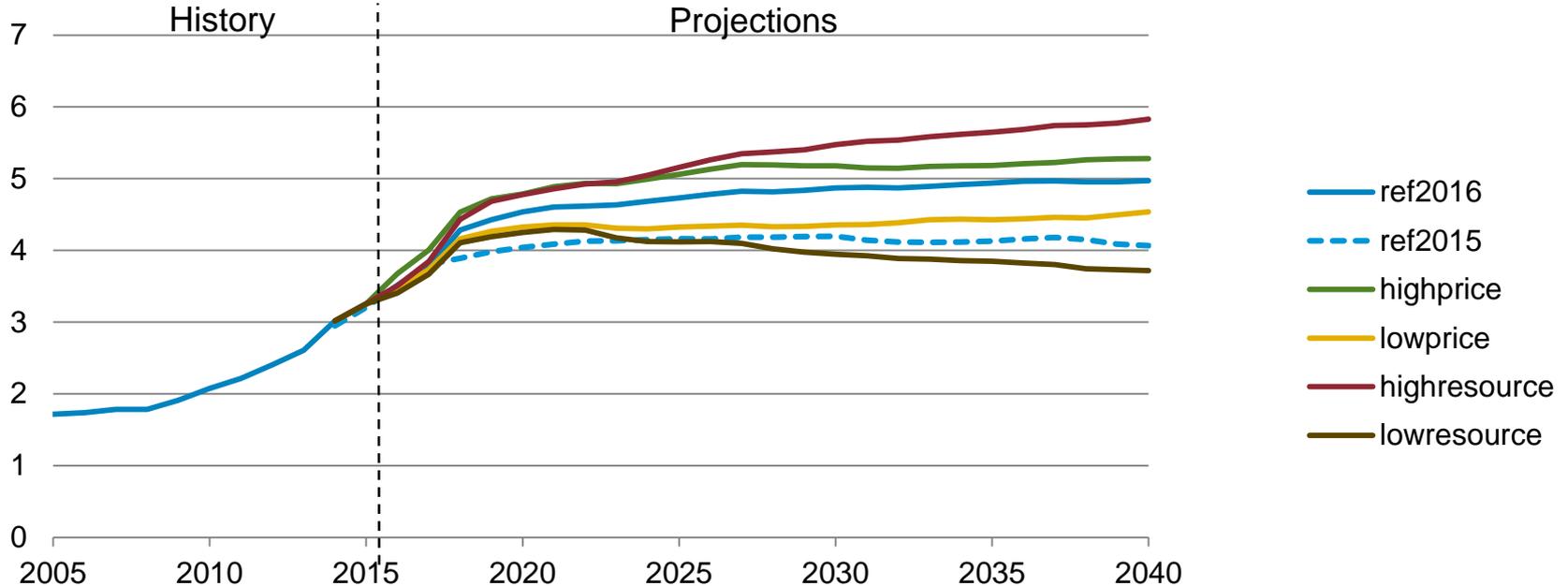
Alaska dry natural gas production by case



Source: Preliminary AEO2016 runs, dated as of 02/25/16

U.S. natural gas plant liquids production by case

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



Source: Preliminary AEO2016 runs, dated as of 02/25/16

We welcome feedback on our assumptions and documentation

- The AEO Assumptions report <http://www.eia.gov/forecasts/aeo/assumptions/>
- Appendix 2.C and Appendix 2.D in the AEO Documentation [http://www.eia.gov/forecasts/aeo/nems/documentation/ogsm/pdf/m063\(2014\).pdf](http://www.eia.gov/forecasts/aeo/nems/documentation/ogsm/pdf/m063(2014).pdf)
- We have restarted our working papers series <http://www.eia.gov/workingpapers/>
- And these working group meetings <http://www.eia.gov/forecasts/aeo/workinggroup/>