

September 27, 2017

MEMORANDUM FOR: Ian Mead
Assistant Administrator for Energy Analysis

FROM: John Staub
Director, Petroleum, Natural Gas, and Biofuels Analysis

Subject: Summary of Oil and Gas Working Group Meeting for the Annual Energy Outlook (AEO) held on September 21, 2017

This memorandum provides an overview of the presentations given during the second AEO2018 Oil and Gas Working Group meeting and a summary of the resulting discussions that took place. The presentation slides are available in a separate document.

Preliminary model results

This meeting focused on preliminary results from AEO2018 modeling, as compared to the first working group meeting's focus on model updates.

Preliminary results were discussed for each of the three modules covering oil and gas markets: the Oil and Gas Supply Module (OGSM), Liquid Fuel Market Module (LFMM), and Natural Gas Market Module (NGMM).

OGSM

The following preliminary results related to the OGSM were highlighted:

- Brent crude prices will be lower than in AEO2017, with a narrower uncertainty band.
- Higher tight oil resources, especially in the Permian, will lead to higher U.S. crude oil production than in AEO2017.
- U.S. dry natural gas and natural gas plant liquids (NGPL) production will be higher than in AEO2017.

LFMM

The following preliminary results related to the LFMM were highlighted:

- Crude oil exports will be higher than in AEO2018 mostly because of increased domestic production.
- Petroleum product exports will increase because of decreased domestic petroleum product consumption.
- There will be a smaller price spread between gasoline and diesel prices than in AEO2017 resulting from multiple model updates.
- Updates made to renewable feedstock prices will result in higher renewable liquids production in AEO2018 than in AEO2017.

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NGMM

The following preliminary results related to NGMM were highlighted:

- Henry Hub spot prices will be lower than in AEO2017.
- Regional flow patterns will continue to reverse from historical trends as natural gas flows out of the Northeast into the South Atlantic and to the West.
- U.S. liquefied natural gas (LNG) exports will be greater than in AEO2017, with capacity utilization dependent on regional supply prices.
- Imports from Canada will decline over the projection, similar to AEO 2017, while U.S. exports to Mexico and eastern Canada will continue to increase and be at higher levels.

Discussion

The discussion followed the order in which the oil and gas market modules were presented.

OGSM

EIA began by presenting preliminary price curves for Brent crude. Compared to AEO2018, the Reference case prices were lower throughout the projection period. Furthermore, the price uncertainty range was narrower in AEO2018 than in AEO2017, especially the upper bound. No question were raised on this topic.

EIA projected higher U.S. crude oil production than in AEO2017. This rise in production was driven by the increase in oil resource estimates. These resource estimates have increased in each AEO since AEO2008, mostly driven by tight oil formations.

A participant asked about the key assumptions made regarding the growth in Permian Basin crude production. EIA staff indicated most of the Permian production growth was driven by the Wolfcamp play, which increased from two layers in AEO2017 to five in AEO2018 and expanded to areas not developed yet. Spraberry had some growth, but it is a smaller play than Wolfcamp. Avalon and Bonespring also had some growth.

A participant asked about the assumptions governing logistical factors, such as rigs and fracturing efficiency. EIA staff answered that the trend of increasingly high performance rigs was assumed, as well as improvements in technology, and growth in estimated ultimate recovery (EUR). EIA staff briefly described the “learning by doing” methodology in the model for technology improvement (i.e., improvements in techniques and in targeting). As drilling ramps up, technology improvements are accelerated.

Participants asked whether all of these assumptions were documented somewhere. EIA staff said they were not yet documented because the model for AEO2018 has not been finalized. However, the assumptions document from AEO2017 was available, and EIA staff indicated they were willing to speak with the stakeholder offline about the various assumptions. EIA staff also indicated that preliminary AEO2018 distributions of the estimated ultimate recovery of wells in the major tight oil and shale plays were presented in the July working group meeting, and that the presentation has been posted.

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EIA indicated that the resource assumptions for the Three Forks formation in the Bakken play were being revisited. A participant encouraged revisiting because the estimate of 20 billion barrels produced from the Bakken by 2050 was far too high in their opinion.

U.S. dry natural gas production was higher than in AEO2017 after the year 2018, with the Marcellus and Utica plays projected to be the most prolific producers. U.S. NGPL production was higher than in AEO2017 after 2025, which was mainly a result of revised NGPL content estimates in the Permian Basin.

A participant asked if the revised NGPL numbers were based on historical data or plant buildout. EIA staff responded that the NGPL number estimates were in part historical, county-level data and in part based on plant-level data. A participant stated that EIA's liquids numbers for the Permian looked correct, as the play should have a high liquids content.

It was then asked whether production costs by play were based on historical costs, and if so, where the data were from. EIA staff answered that they did not get the data from any one database, but instead used multiple sources and then calculated general cost functions linked to lateral length and depth of the wells.

A participant wanted to know about the trend of production costs by play. EIA staff had not compared them, and they could not say with certainty. However, the model accounts for the fact that increased drilling activity leads to increased costs.

LFMM

The discussion on liquid fuels markets began with crude oil exports. Because of increased domestic production of crude oil, exports of crude oil will be higher in this year's AEO than in AEO2017. The presenter noted that some of this increased production will be refined domestically and a portion will be exported. There were no questions related to this.

EIA presented the Brent-WTI price spread. In AEO2018, the price spread will widen to about \$4.50. The presenter noted that this price spread is needed to maintain the elevated level of crude oil exports. There were no questions on the price spread between Brent and WTI.

Petroleum product exports increase as domestic demand for petroleum products decreases. This was shown as a decrease in net petroleum product imports. Toward the end of the projection period, an uptick in domestic demand for petroleum products results in an increase of net petroleum product imports. There were no questions related to this.

There will be a smaller price spread between gasoline and diesel in AEO2018 compared with AEO2017. This was mostly because of model updates to taxes, distribution costs and international supply and demand curves. There were no questions related to gasoline and diesel prices.

Finally, renewable liquids were discussed. It was mentioned that EIA updated renewable feedstock prices this year. These updates resulted in higher renewable liquids production than in AEO2017. There was a question about the effects on this projection if government mandates for ethanol were lost. The presenter explained that this is not something that EIA will examine in this year's AEO. The same participant asked if the projection assumes the same policies throughout the projection period, to which EIA staff responded that yes, we assume some representation of the renewable fuel standards (RFS)

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policy throughout the projection period. The participant asked if different gasoline consumption levels were considered when revising AEO2017 ethanol production numbers. EIA staff indicated this was considered, and gasoline consumption levels were slightly lower than last year.

NGMM

EIA reminded the participants that the major change this year was the replacement of the Natural Gas Transmission and Distribution Module (NGTDM) with the Natural Gas Markets Module (NGMM). To better capture changing market dynamics and bidirectional flows, the NGMM is an optimization model that solves at the state and monthly levels.

The natural gas markets portion began by showing the Henry Hub spot prices in AEO2018 were below those in AEO2017.

U.S. LNG exports were projected to continue to increase above AEO2017 projections; however, it was noted that the results presented were preliminary and data updates were forthcoming. Most capacity additions were expected in Texas and Louisiana, and the utilization of the facilities was solved in an optimization model. One additional LNG export facility, Elba Island, is now included as a planned build. Shipping costs were also lowered.

A participant asked how much LNG export levels were driven by projections of international prices, as well as what EIA's assumptions were on contracts versus spot trading in the LNG market. EIA staff replied that LNG behaves similarly to the representation in the prior NGTDM model. NGMM considers the prices of Brent, natural gas, and uncontracted LNG available on the market. Most assumptions came from the International Energy Outlook 2017 (IEO2017).

The discussion then moved on to pipeline imports and exports. Imports from Canada were projected to continue their decline while U.S. exports to eastern Canada were expected to rise. The decrease in Canadian imports was comparable to AEO2017 while U.S. exports to eastern Canada increased at a faster rate.

A participant asked about Canadian imports on the West Coast. Specifically, if natural gas production was slowing west of the Rockies, could it be offset by natural gas imported from western Canada? EIA staff said this possibility had not been explored closely, but that the bulk of the decline in Canadian imports is because of displacement of Canadian natural gas by U.S. natural gas into the Midwest.

The final part of the natural gas market discussion focused on exports to Mexico. A participant asked why exports began to decrease after 2025. They stated that Mexican fields were oily rather than gassy, and Mexico would therefore continue to need U.S. natural gas. EIA staff said the decrease was a result of associated natural gas from offshore deep-water fields and shale gas in Northeastern Mexico supplanting imports from the United States. Throughout the projection period, U.S. exports to Mexico were above those projected in AEO2017.

Additional issues

The meeting concluded with a few general announcements:

- If stakeholders were interested in receiving information about other working group presentations, they can email the new AEO email account, AnnualEnergyOutlook@eia.gov.
- EIA mentioned that the Transportation working group will occur Thursday, September 28.

Attendees

Registered Guests (WebEx/phone)

Vello Kuuskraa	Advanced Resources International
Celeste Marshall	API
Don Hanson	Argonne National Lab
Seth Snyder	Argonne National Lab
Radford Schantz	BOEM
Thierno Sow	BOEM
Ron Gecan	CBO
Ben Aaron	Continental Resources
Brian Lavoie	DOE
Elena Melchert	DOE
Gabby Intihar	DOE
Maria Sanchez	Drillinginfo
Michael Schaal	Energy Ventures Analysis
Brian Keaveny	EPA
Elizabeth Miller	EPA
Glenn Sondak	IEA
Kevin Birn	IHS
Marshall Carolus	INTEK Inc.
Ken Walsh	Leidos
Richard Nehring	Nehring Associates
Peri Ulrey	NGSA
Jack Weixel	PointLogic Energy
Chris Foster	S&P Global
Danny Chu	S&P Global
John Hilfiker	S&P Global
Jarrett Whistance	University of Missouri
Wyatt Thompson	University of Missouri

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EIA attendees (in person)

Faouzi Aloulou
Joseph Benneche
Hannah Breul
Samantha Calkins
Meg Coleman
John Conti
Katie Dyl (presenter)
Mindi Farber-DeAnda
Peter Gross
Angelina LaRose
Melissa Lynes
Arup Mallik
Elizabeth May
Shirley Neff
James Preciado (presenter)
Corrina Ricker
Nicholas Skarzynski
John Staub (presenter)

EIA attendees (WebEx/phone)

Erin Boedecker
Mark Schipper
Dana Van Wagener (presenter)

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