



Independent Statistics & Analysis

U.S. Energy Information  
Administration

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**MEMORANDUM FOR:** Angelina LaRose  
Assistant Administrator for Energy Analysis

**FROM:** Jim Diefenderfer  
Director, Office of Long-Term Energy Modeling

**Subject:** Summary of Oil and Gas Supply, Liquid Fuels Markets, and Natural Gas Markets Working Group Meeting held on May 25, 2021

This memorandum summarizes the presentation given during the *Annual Energy Outlook (AEO) 2022* Oil and Gas Supply, Liquid Fuels Markets, and Natural Gas Markets Working Group meeting and the discussions that followed. The meeting had three parts that focused on different modules:

1. The Oil and Natural Gas Supply Module (OGSM)
2. The Liquid Fuels Market Module (LFMM) and International Energy Model (IEM)
3. The Natural Gas Markets Module (NGMM)

The presentation slides are available in a separate document on our website.

All slides, charts, and discussions for AEO2022 were preliminary and, therefore, should not be quoted or cited. We will release final AEO2022 materials in early 2022.

## OGSM

Albert Painter presented results from AEO2021, planned data updates and model improvements for AEO2022, recent laws and regulations that affect oil and natural gas, and assumptions and questions to evaluate for AEO2022. He highlighted the following points:

### *Results (AEO2021)*

- We project U.S. exploration and production from offshore and the Gulf of Mexico to level off toward the end of the projection period.
- We project U.S. natural gas and crude oil production to return to pre-pandemic levels by 2023.
- We project dry natural gas production to grow in the Appalachian, Southwest, and Gulf Coast regions.

### *Planned model and data updates (AEO2022)*

- Update tight and shale estimated ultimate recovery (EUR) per well
- Update Lower 48 states offshore and Alaska announced discoveries
- Update historical production through 2020 and estimated production for 2021
- Update natural gas plant liquids (NGPL) factors for plays in the Denver-Julesburg Basin
- Calibrate to the *Short-Term Energy Outlook (STEO)*

- Split onshore Lower 48 states production into federal and nonfederal (if time permits)

### *Recent laws and regulations*

- Revised oil and natural gas permitting rules in Colorado
- Took into account the pause on leasing federal lands and waters

### *Assumptions and questions to evaluate (AEO2022)*

- Given current laws and regulations, what other considerations would affect the development of U.S. crude oil?
- What developments in NGPL production are not being captured?
- In the AEO2021, increased production in the Appalachian Basin primarily drives the growth in dry natural gas production. What are potential impediments to this projected production growth?
- What concerns exist about the projected growth in dry natural gas production from oil formations, particularly in the Permian Basin (Southwest region)?

### *Discussion*

One attendee asked about dry natural gas growth in the Permian Basin. We explained that the demand for liquefied natural gas (LNG) exports primarily contributes to natural gas production growth. The greatest growth is in the Permian Basin and Haynesville Basin, which are close to the Gulf Coast LNG export facilities.

Another attendee asked if our models incorporate the social costs of greenhouse gases (GHG) in government decision-making, such as leasing. We explained that the model assumes current laws and regulations and that we consider carbon dioxide and GHG in the macroeconomic and carbon modules of the National Energy Modeling System (NEMS). We do not model social costs of GHG on leasing.

## **LFMM and IEM**

Peter Colletti presented key data updates planned for AEO2022, assumptions and questions to evaluate for AEO2022, and renewable fuel modeling hurdles for the LFMM. He highlighted the following points:

### *Results (AEO2021)*

- We project about 30% of domestic light crude oil production to be exported.
- We project heavy crude oil imports to be almost twice the volume of light crude oil exports.
- We project refinery utilization to remain stable over the projection period, as long as product exports remain economical to balance changes in petroleum-based product demand.
- We project the High Oil Price case to have higher market penetration of biofuels.

### *Planned model and data updates (AEO2022)—LFMM*

- Update Renewable Fuels Standard (RFS) mandate levels
- Update refinery and biofuels capacities
- Update liquid fuels pipeline capacity
- Update historical and STEO data

### *Planned model and data updates (AEO2022)—IEM*

- Update international crude oil supply curves
- Update crude oil price differentials for all crude oil types traded in LFMM
- Update U.S. petroleum products export and import curves

### *Assumptions and questions to evaluate (AEO2022)*

- What percentage of domestic production of light crude oil is expected to be exported? Will it be balanced by heavy crude imports?
- Will refinery utilization continue to be high and balanced by product exports?
- What expectations exist between biodiesel and renewable diesel production levels? Both use the same feedstock (seed oil, yellow and white grease).
- Under what circumstances would we expect biofuels to have a larger penetration in the liquid fuels market?

### *Discussion*

An attendee asked about anticipated electric vehicle (EV) impacts on gasoline demand. We explained the Transportation Demand Model (TDM) determines which vehicles, and by extension which fuel sources, are more relevant. LFMM provides the liquid fuels to meet TDM demands. We also added that the LFMM is not anticipating changes in the market with regard to ethanol blending, so any changes would depend on demands from the TDM.

An attendee asked if the LFMM splits E10 and E15 endogenously. We explained the E10 requirement for any blend can be displaced if it is economical. We further added that it is not forced but E15 allowance is exogenously limited. Someone also asked if ethanol and renewable diesel compete for D6 renewable identification numbers (RINs) in our model, but we do not model RIN accounting. An attendee who is a biofuel modeler shared that his team is investigating renewable diesel and biodiesel competition for feedstocks. They found that higher soybean oil prices will favor renewable diesel over biodiesel, but how long this trend persists is a key uncertainty.

An attendee asked if we analyze the competitiveness of U.S. refinery operations relative to other global refineries. We explained the *International Energy Outlook* (IEO) provides a comparison of domestic refining to other world regions. Although some refineries are closing or converting service to renewables production, we can only represent this shift in our model's existing and planned capacity input data. The model is not set up to make these decisions endogenously.

An attendee asked about modeling sustainable aviation fuel. We stated that although it is not explicitly represented in the model at this time, sustainable aviation fuel is on the list for future updates.

## **NGMM**

Stephen York presented planned updates for AEO2022, natural gas pipeline infrastructure, liquefied natural gas (LNG) exports and facilities, and assumptions and questions to evaluate for AEO2022. He highlighted the following points:

### *Results (AEO2021)*

- We project the average annual Henry Hub price to remain below \$4 in the Reference case.
- We project LNG demand will be sensitive to domestic and world oil prices.

- We project natural gas pipeline flows will increase as a result of pipeline expansion in the mid-Atlantic region to demand areas such as the eastern Midwest.
- We project U.S. natural gas exports will level off as a result of eastern Canada's shift away from natural gas.

#### *Planned model and data updates (AEO2022)*

- Incorporate data from the *Natural Gas Annual*, released November 2020 (2019 annual data)
- Update pipeline capacity data, natural gas price data, and historical data for Mexico and Canada
- Update in-service dates of LNG export facility projects
- Update world oil price assumptions
- Update economic recovery and related consumption changes
- Update STEO calibration

#### *Assumptions and questions to evaluate (AEO2022)*

- Which consumption sectors are most likely to see growth or declines over the next 30 years?
- What changes to interstate natural gas flows and pipeline infrastructure can we expect?
- Which LNG facilities that have yet to reach a final investment decision (FID) are most likely to come online, fueling LNG export growth?
- How much can U.S. natural gas pipeline exports grow?

#### *Discussion*

One attendee asked if natural gas assumptions will take into account climate goals established by the Biden administration and how these goals might affect natural gas demand. We replied that leasing orders, policies, and regulations are handled within OGSM. We explained that laws and regulations that are approved and in effect are reflected in the AEO. The administration's goals are not integrated into the model. We explained that we need more details on how these goals will be implemented before considering model updates.

#### **Attendees**

##### *Registered guests (WebEx/phone)*

Amy Andruszak	Interstate Natural Gas Association of America
Emil Attanasi	U.S. Geological Survey
Joe Benneche	
Kevin Birn	IHS Markit
Ray Boswell	National Energy Technology Laboratory
Marshall Carolus	INTEKI
Luciane Cunha	National Energy Technology Laboratory
Kenneth Ditzel	FTI Consulting
Anthony Dixon	California Energy Commission
Katharine Ehly	Natural Gas Supply Association
Steven Gabriel	University of Maryland
Kathy Gramp	Congressional Budget Office

Walter Guidroz	U.S. Geological Survey
Robert Hershey	Consultant
David Hughes	
Bryan Just	American Petroleum Institute
Jordan Kislear	U.S. Department of Energy
Stephanie Kruse	Oregon State Government
Brian Lavoie	U.S. Department of Energy
Michael Lynch	Energy Seer
James Nowlin	U.S. Army Corps of Engineers
John Powell	U.S. Department of Energy
Darryl Rogers	IHS Markit
Isabella Ruble	U.S. Department of Energy
Janani Shankaran	Congressional Budget Office
Yvonne Sisler	Z Federal
Robert Sudar	U.S. Office of Natural Resources
Jarrett Whistance	University of Missouri

*EIA participants (WebEx/phone)*

Greg Adams	Elizabeth May
Daniel Agee	Kyle Morley
Erin Boedecker	Kevin Nakolan
Peter Colletti (presenter)	Albert Painter (presenter)
Troy Cook	April Patel
Jim Diefenderfer	James Preciado
Kathryn Dyl	Corrina Ricker
Joshua Eiermann	Andri Rizhakov
Mindi Farber-DeAnda	Mark Schipper
Adrian Geagla	Estella Shi
Peter Gross	Nicholas Skarzynski
Sean Hill	William Sommer
Ari Kahan	John Staub
Mala Kline	Manussawee Sukunta
Angelina LaRose	Dana Van Wagener
Mary Lewis	Neil Wagner
Perry Lindstrom	Warren Wilczewski
Laura Martin	Stephen York (presenter)