



Independent Statistics & Analysis

U.S. Energy Information
Administration

October 8, 2019

MEMORANDUM FOR: Stephen K. Nalley
Acting Assistant Administrator for Energy Analysis

FROM: Jim Diefenderfer
Director, Office of Electricity, Coal, Nuclear, and Renewables Analysis

SUBJECT: Summary of AEO2020 Preliminary Results for the combined Electricity, Coal, and Renewables Working Group Meeting held on September 11, 2019

The working group presentation fostered discussion about the preliminary results for the *Annual Energy Outlook* (AEO2020) Reference case in relation to electricity, coal, and renewables. The presentation materials are available in a separate document on the U.S. Energy Information Administration's (EIA) website.

Overview

The meeting began with a presentation of the updates for AEO2020, followed by an overview of preliminary results. In addition to the Reference case, which is based on current laws and policies, the following side cases will be included in AEO2020:

- High/Low Oil and Natural Gas Resource and Technology
- High/Low Macroeconomic
- High/Low Oil Price
- High/Low Renewable Technology Cost

Assumptions and model updates

The presentation highlighted updates for AEO2020:

- Updated capital costs and performance characteristics for new generating units for all technologies
- Redefinition of NEMS (National Energy Modeling System) Electricity Market Module regions
- Enhanced representation of Renewable Portfolio Standards (RPS) and of states/districts that recently updated their RPS including the District of Columbia, Ohio, Maine, Maryland, Nevada, New Mexico, New York, and Washington
- Inclusion of state level energy storage and offshore wind mandates
- Change of the coal base year from 2017 to 2018

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- Modeling of current laws and regulations, including New Jersey's addition to the Regional Greenhouse Gas Initiative (RGGI), New Source Performance Standards (NSPS), the Affordable Clean Energy Rule (ACE), and 45-Q tax treatment

Preliminary results

Preliminary results from AEO2020 are summarized as

- Results suggest a shift across generating sources, as more renewable capacity additions are expected, and more coal and nuclear retirements are expected than for AEO2019
- Lower photovoltaic solar and wind plant costs significantly increase growth rates for new capacity builds as compared with previous AEOs
- Coal retirements are slower than previous AEOs, but then coal-fired generation stabilizes in response to rising natural gas prices in the later years of the projection period
- Nuclear retirements quicken as energy and capacity revenues decline
- Share of natural gas-fired generation growth is moderated in the middle by the growth of renewables and the stabilization of coal-fired generation

Discussion

Renewables

During the discussion, EIA staff learned that the offshore wind mandate values presented in the slide deck were slightly off from current laws and regulations. The working group participant provided an update of the current offshore wind mandates and has been included in the final set of input assumptions.

One participant asked whether EIA staff was considering bifacial module-based photovoltaic solar systems or hybrid wind-solar storage projects. EIA staff noted that within a given technology, EIA's learning curve methodology is indifferent about the specific source of cost reductions. To the extent that bifacial modules gain market share, it will be because they increase panel efficiency and thus reduce installation costs. EIA does not expect bifacial modules to result in substantially altered capacity factors or time-of-day output for PV systems, so the main impact of this development (cost reduction) is already implicitly accounted for in the current learning methodology. EIA is not currently modeling PV-battery hybrid systems, but we have prepared cost estimates and will be researching different system configurations for possible inclusion in AEO2020. As for other hybrid systems, EIA staff is currently waiting to see if any given configuration becomes the dominate configuration before deciding what to model for future AEOs.

A participant noted that the capital cost change for concentrated solar thermal plants appears to include components not included in the cost assumptions used in previous AEOs. EIA staff noted that the capital cost for concentrated solar thermal for AEO2020 includes the cost of molten salt storage, which was not included in the assumptions of previous AEOs.

One participant asked how EIA staff was handling carbon capture and storage in the modeling of current RPS. EIA staff explained that for state-level RPS policies the practice has been to include only those technologies listed in the legislation or explicitly allowed for by the respective state public service commission. For any situation where a state has passed a 100% carbon-free or carbon-neutral policy and

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does not explicitly indicate what technologies are considered carbon-free or carbon-neutral, EIA has applied the technologies outlined by the California 100% carbon-free legislation, which include nuclear and natural gas technologies, along with carbon capture and storage (CCS). In such cases, EIA allows the 90%-capture CCS configuration to qualify for the requirement.

Several participants asked how battery storage growth is reflected in the preliminary results given the high levels of deployment of renewable capacity additions. EIA staff noted that although the amount of projected battery storage capacity additions have increased from AEO2019, it is not a direct one-for-one match to renewable capacity generation. However, new diurnal storage installations are often projected for regions that have already achieved significant penetration of solar generation.

Electricity

Multiple participants asked a series of related questions based on the observation that the preliminary AEO2020 results project an increase in nuclear retirements and fewer coal plant closures than expected given recent trade press reporting and relative to AEO2019. Participants also noted that the preliminary AEO2020 results project coal capacity to stabilize after 2025, while coal generation stabilizes within the next couple of years.

A participant asked how EIA staff incorporate the strategies for capacity additions and retirements reflected in utilities' Integrated Resource Plans, and we answered that these results were under ongoing review by EIA analysts to ensure that they reasonably represent market responses to the best available data under current laws and regulations. EIA staff noted that although we do look at forward-looking market analysis such as long-term planning documents from utilities and other market participants, we do not use such information as the basis for our projections. Integrated resource plans and similar statements of market intent are developed using assumptions about future market, policy, and technology conditions that do not necessarily correlate with the assumptions or results of the AEO. EIA staff also noted that the decline in coal prices in the preliminary AEO2020 results reflected the update of the Coal Market Module (CMM) to 2018 base-year data for commodity costs, transportation rates and contracts, lower input fuel costs, and declining demand for coal.

Key differences could include such things as substantially different projections of future demand, different fuel price paths, and significantly different policy environments. While recognizing that integrated resource plans can provide some insight into utility thinking about such issues, EIA assumes through its modeling effort that, in the long run, we must present a consistent view of market economics and policies across the projection and not rely on varied reports of each market actor. For planned generator retirements, EIA relies on both retirements as reported to EIA statistical staff as well as supplemental analysis of announced capacity retirements.

A participant asked for clarification after EIA staff mentioned that although capital costs for natural gas combined cycle used in AEO2019 were based on the PJM cost for new entrants study, the capital costs used in AEO2020 correctly accounted for regional multipliers. EIA staff confirmed that regional multipliers were looked at in detail to ensure regional factors were not double counted in capital cost assumptions.

Coal

A participant asked if EIA staff looks at any plants retrofitting with carbon capture and storage to take advantage of the tax credit under 45-Q. EIA staff confirmed that the inclusion of 45-Q in NEMS allows plants retrofitting with CCS to take advantage of the tax credit. Following up, the same participant asked whether the low impact of 45-Q occurred before or after the implementation of enhancements to the CO2 Enhanced Oil Recovery (EOR) resource assessment in the NEMS Oil & Gas Supply Module (OGSM). EIA staff has been working with our external contractors to update this representation in NEMS to address these concerns.

Additional issues

One participant inquired whether EIA staff has regional generation and peak demand projections for the 25 individual regions. Even though regional generation projections are available upon request once the AEO is finalized, EIA does not include regional generation in preliminary results and does not project regional or aggregate peak demand.

A participant asked how increased electric vehicle adoption will affect electricity. EIA staff noted that demand for electricity was modeled separately, and EIA would be holding a demand-focused working group meeting at a later date. Although preliminary AEO2020 results show some growth in electric vehicle demand, it is projected to remain a relatively small fraction of total transportation energy demand and total electricity use under current laws and policies.

EIA staff was asked about gross domestic product (GDP) growth assumption relative to AEO2019. EIA staff indicated that GDP growth is lower in AEO2020 than in AEO2019.

A participant asked about reserve margin contribution from the generating technologies. EIA staff noted that for AEO2019, we had significantly revised and improved our methodology to assign a capacity credit to wind and solar resources. Our revised methodology accounts for the contribution of these resources to reserve margin on a 12-month by 24-hour basis, which allows the model to recognize the shift in net peak demand and the diurnal output of solar as it starts to saturate conventional peak hours in the afternoon. As wind or solar resources begin to saturate peak demand hours, their contribution to planning reserve margins will decrease.

EIA staff was asked whether combustion turbine installations followed photovoltaic solar installations in AEO2020 projections. EIA staff noted that as we get increasing levels of PV generation in any given region, we tend to see both a shift from combined-cycle capacity to simple combustion turbines, as well as an increase in diurnal storage.

A participant asked if in preliminary AEO2020 results battery storage supplanted combustion turbines to meet peak demand. EIA staff responded that batteries supplement peak demand but do not eliminate the contribution of combustion turbines to meet peak demand.

A participant asked whether EIA staff had finalized the side cases for AEO2020, and if a side case regarding the stabilization of coal was planned. EIA staff indicated that we were planning on doing a high-cost renewables case and a low-cost renewables case. Other cases were in discussion, but the final selection would likely depend on which areas of the model results provided the most interesting opportunities for additional analysis. In response to this answer, another participant asked if EIA staff had any baseline for the intended costs for the high/low renewables cost case. EIA staff noted that we had not finalized the parameters for these cases. The working assumption was that the high-cost case

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was likely to be a frozen technologies case, where costs would be held at current values for select technologies, but that this case might vary. EIA had not determined if the case would only fix technology-specific capital costs, or if it might also fix technology performance learning and/or costs that are indexed to broader measures of cost. EIA staff was not sure whether a coal side case was likely.

Attendees

The working group meeting had 64 participants, 23 in person and 41 via WebEx, and included both EIA staff and external participants.

Participants via WebEx (external to EIA)

Name	Affiliation
Mikhail Adamantiades	U.S. Environmental Protection Agency
Frank Benavides	Alliance Resource Partners
Ann Benson	Greenergy
Wesley Cole	National Renewable Energy Laboratory
Leslie Coleman	National Mining Association
Erich Eschmann	U.S. Environmental Protection Agency
Irene Fagotto	Bipartisan Policy Center
Brian Fisher	U.S. Environmental Protection Agency
Sarah Forbes	U.S. Department of Energy
Jai Gopal	Deloitte
Garrett Gulish	General Electric
Warren Hess	Midcontinent ISO
Galen Hiltbrand	Rhodium Group
Stephanie Hutson	U.S. Department of Energy
Anthony Jones	U.S. Environmental Protection Agency
Neil Kern	Electric Power Research Institute
Hannah Kolus	Rhodium Group
Tyanghe Liu	Entergy
Britny Lockridge	Southern Company
Jennifer Macendonia	Bipartisan Policy Center
Gavin Pickenpaugh	National Energy Technology Laboratory
Ron Schoff	Electric Power Research Institute
Sharon Showalter	OnLocation
Cynthia Simpson	U.S. Department of Labor
Paul Spitsen	U.S. Department of Energy
Nicholas Swanson	U.S. Environmental Protection Agency
Bill Turkowski	Westinghouse
Boddu Venkatesh	ICF
Celeste Wanner	American Wind Energy Association
John Wilson	Southern Alliance for Clean Energy
Jeff Winick	U.S. Department of Energy
Ryan Wiser	Lawrence Berkley National Laboratory

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Thomas Vos

Trisategt

EIA participants via WebEx

Name

Lori Aniti

Mindi Farber-DeAnda

Kathryn Dyl

Tyler Hodge

Scott Jell

Perry Lindstrom

Bonnie West

In-person participants (external to EIA)

Name

Affiliation

Jose Benitez Torres

Deloitte

Paul Donohoo-Vallett

U.S. Department of Energy

Benjamin King

Rhodium Group

Jordan Kislear

U.S. Department of Energy

Cara Marcy

U.S. Environmental Protection Agency

Rich Tusing

U.S. Department of Energy

EIA in-person participants

Name

Greg Adams

Katherine Antonio-Sanjinez

Erin Boedecker

Richard Bowers

Kien Chau

Jim Diefenderfer

Kenny Dubin

David Fritsch

Thaddeus Huetteman

Kevin Jarzomski

Jeff Jones

Augustine Kwon

Vikram Linga

Laura Martin

Chris Namovicz

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Jennifer Palguta

Mike Scott

Manussawee Sukunta

Terry Yen

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