Independent Statistics & Analysis
U.S. Energy Information Administration

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

FROM: Jim Turnure
Director, Office of Energy Consumption and Efficiency Analysis

SUBJECT: Summary of AEO2020 Buildings Working Group 2 held on October 3, 2019

This memorandum provides an overview of the presentation given at the second *Annual Energy Outlook 2020* (AEO2020) Buildings Working Group meeting and summarizes the discussion. The meeting covered preliminary AEO2020 Reference case results compared with AEO2019 Reference case results. It also highlighted the major modeling and data updates that were incorporated for AEO2020. The presentation for this meeting is available in a separate document.

AEO2020 results overview and comparison with AEO2019

The meeting began with a discussion about the preliminary delivered energy consumption projections by fuel and sector. The U.S. Energy Information Administration (EIA) staff then compared preliminary AEO2020 results with AEO2019 results. Residential and commercial electricity and natural gas prices were shown, followed by projected heating and cooling degree day data. A participant asked how EIA develops its weather trends. EIA staff clarified that we use a 30-year linear trend using historical National Oceanic and Atmospheric Administration (NOAA) weather data from 1989 to 2018. The starting point for this trend (in 2021) begins from the end of NOAA's 15-month short-term forecast.

EIA then shared residential housing stocks, which are lower in AEO2020 because of reduced housing starts from the Macroeconomic Activity Module of the National Energy Modeling System (NEMS). Commercial floorspace projections are very similar to those from AEO2019, growing at 1% per year from 2019 through 2050.

Residential purchased electricity consumption, which does not include any distributed generation used onsite, and delivered natural gas consumption are both higher than AEO2019 because of lower fuel prices, higher heating and cooling degree days, and lower projected distributed generation—namely from solar photovoltaics (PV). Fuel prices and weather also affect commercial consumption although commercial natural gas consumption grows more slowly than in AEO2019 as a result of lower growth in combined heat and power (CHP).

The U.S. Department of Energy (DOE) has issued a final rule to reverse a January 2017 expansion of the definition of general service lighting (GSL), which means that the 45 lumen per watt *backstop standard* for 2020 will apply to fewer bulbs than before. We have incorporated this final rule into AEO2020.[1] About two-thirds of 2015 residential lighting stock is A-type,[2] according to the *2015 Residential Energy Consumption Survey* (RECS) and the DOE *2015 U.S. Lighting Market Characterization* report.[3] EIA assumes these lamps still qualify as GSLs, even under the narrowed definition. However, a significant portion of the residential market still has no applicable backstop standard, and AEO2020 projections of lighting consumption from 2020 to 2030 are higher than in AEO2019. By contrast, about 80% of commercial lighting is linear, to which the backstop standard never applied. AEO2020 commercial lighting consumption projections are therefore more similar to AEO2019.

EIA has a contractor task in place to update current and projected distributed generation cost and performance data. EIA compared draft report data by sector and technology with existing assumptions to provide context for changes in projected distributed generation capacity compared with AEO2019. Staff also described the change in methodology for commercial distributed generation. For commercial solar PV, wind, and CHP projections, EIA re-estimated parameters for the shape, speed, and maximum levels of distributed generation diffusion to calibrate distributed generation model builds to recent historical data. EIA also introduced more electricity rate variation into niches for internal rate of return calculations and revised assumptions such as diffusion start year, treatment of existing and new buildings, and PV-eligible roof space by building size.

EIA then compared AEO2020 solar PV capacity with AEO2019, highlighting the incorporation of Stanford University's *Deep Solar* data into the residential model. Staff reiterated how reductions in distributed generation cause increases in purchased electricity. Preliminary commercial AEO2020 PV projections are higher than AEO2019 projections before 2035, as a result of the recalibration of growth parameters along with installed cost declines. However, commercial AEO2020 PV projections level out in later years, falling below AEO2019 projections by 2050. Lower projections in later years are driven by lower electricity prices and an updated NREL Annual Technology Baseline (ATB), which predicts higher installed costs for PV through 2050.

AEO2020 also projects lower CHP growth than AEO2019. Most current CHP capacity is in mature technologies such as natural gas turbines and reciprocating engines. These technologies have not experienced large capacity growth in recent years and are not anticipated to experience rapid cost and performance improvements in the future. In addition, commercial mid-scale (100 kilowatt to 1 megawatt) wind turbines have largely disappeared from the U.S. market. Although some large commercial customers have adopted turbines greater than 1 megawatt, growth in commercial wind capacity has slowed considerably. As a result, AEO2020 projects much slower growth in commercial wind than AEO2019.

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[1] DOE has also issued a notice of proposed rulemaking that would effectively eliminate the backstop standard altogether. Because this rule is still a proposal as of October 3, 2019, we have not incorporated it into AEO2020 projections.

[2] A-type bulbs are the *pear-shaped* bulbs most commonly found on the residential market.

[3] U.S. Energy Information Administration, 2018, *2015 Residential Energy Consumption Survey*, available at https://www.eia.gov/consumption/residential/data/2015/. U.S. Department of Energy, 2017, *2015 U.S. Lighting Market Characterization,* available at https://www.energy.gov/sites/prod/files/2017/12/f46/lmc2015_nov17.pdf.

EIA then discussed other model updates, including revisions to parameters for commercial minor fuel estimation based on recent historical data. EIA staff described how our collaborative discussions about specific unpublished data led the U.S. Census Bureau to publically release air-source versus ground-source heat pump installation data for the first time. These data were incorporated into AEO2020. A participant asked whether reintroducing EIA's retired geothermal heat pump manufacturer survey (Form EIA-902) could be useful to stakeholders. The buildings team noted how we have received various questions about ground-source heat pumps and agreed that the survey data could fill an existing data void.

Staff mentioned the incorporation of 2015 RECS wood consumption data that were released following AEO2019 modeling updates. We also discussed the update of sub-census division niches using average 2015 RECS electricity expenditure data, as well as distributed generation interconnection limitations based on the Database of State Incentives for Renewables & Efficiency® (DSIRE) and records from state legislatures.

Finally, EIA staff discussed updates affecting energy efficiency rebates and incentives. AEO2020 energy efficiency assumptions incorporate more data from a greater variety of sources. For a second year, EIA has worked with the Northeast Energy Efficiency Partnerships (NEEP) to gather detailed data on utility and state energy efficiency program incentives from the Northeast. Nevertheless, the updated assumptions cause only minor changes in end-use consumption relative to AEO2019.

Discussion

A participant asked if EIA incorporates state-level incentives for fuel switching. EIA responded that NEMS does not currently incorporate any explicit incentives for fuel switching. However, modeled incentives for electric space and water heating appliances such as air-source heat pumps can encourage the adoption of these appliances in place of natural gas appliances, effectively increasing electricity consumption and decreasing natural gas consumption.

The RECS survey manager shared that 2020 RECS is hoping to publish data for all 50 states (plus Washington, DC, and possibly Puerto Rico). An EIA employee asked if state-level RECS data would help to better characterize sub-census division trends in fuel switching, and buildings team staff said that any increase in granularity of RECS could potentially feed into and improve the ability to model such trends in NEMS.

Onsite attendees

Name	Affiliation
Jared Langevin	Lawrence Berkeley National Laboratory (LBNL)
Aven Satre-Meloy	Lawrence Berkeley National Laboratory (LBNL)
Aaron Ng	U.S. Department of Energy

Remote attendees (Webex/phone)

Name	Affiliation
Alan Cooke	Pacific Northwest National Laboratory (PNNL)
Alex Maki	U.S. Department of Energy
Amir Roth	U.S. Department of Energy
Ben King	Rhodium Group
Cara Marcy	U.S. Environmental Protection Agency
Chioke Harris	National Renewable Energy Laboratory (NREL)
Elizabeth Titus	Northeast Energy Efficiency Partnership (NEEP)
Eric Mackres	World Resources Institute (WRI)
Hannah Kolus	Rhodium Group
Ian Hoffman	Lawrence Berkeley National Laboratory (LBNL)
Mike Russo	Itron
Nora Wang	Pacific Northwest National Laboratory (PNNL)
Paul Donohoo-Vallett	U.S. Department of Energy
Peter Kobylarek	Leidos

EIA onsite attendees
Stacy Angel
Chip Berry
Greg Lawson
Katie Lewis
Bill McNary
Eileen O'Brien
Jay Olsen
Jennifer Palguta
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Team Members
Erin Boedecker
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