

MEMORANDUM FOR: Angelina LaRose
Assistant Administrator for Energy Analysis

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

SUBJECT: Summary of *Annual Energy Outlook 2025 (AEO2025)* Working Group for Electricity, Renewables, Coal, and Nuclear held on May 15, 2024

The working group presentation summarized the proposed model enhancements for the *Annual Energy Outlook 2025 (AEO2025)* for electricity, renewables, coal, and nuclear. The presentation materials included these updates and are available as a separate document on EIA.gov.

Overview

Developments for AEO2025 include

- Introducing hydrogen representation
- Improving carbon capture, transportation, and sequestration modeling
- Improving electric power sector modeling
- Improving technology representation
- More comprehensively addressing existing and upcoming laws and regulations

This working group focused only on improving electric-power sector modeling.

Model updates

EIA staff summarized the proposed model updates and enhancements for AEO2025, which include:

- Develop a model capable of representing a credible zero-carbon emissions electric power sector through one or more likely policy mechanisms
- More fully represent provisions of the Inflation Reduction Act of 2022 (IRA)
- Represent the U.S. Environmental Protection Agency (EPA) finalized 111 rule that regulates CO₂ emissions from the electric power sector
- Improve model performance
- Modernize the optimization of the NEMS Electricity Market Module (EMM)
- Improve model convergence

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- Include bioenergy with carbon-capture and sequestration (BECCS) as a technology type in the model

We informed participants of other working groups that are covering other AEO2025 topics this summer and of a subsequent set of working groups where we will share preliminary results in early fall 2025.

The meeting then opened for questions and comments about updates we are considering for AEO2025 and beyond.

Several attendees submitted questions with their registration for the event. One of these questions whether we will capture possible shifts in electricity trends due to more radical events and changes, events that have high impact but low probability. We responded that the *Annual Energy Outlook* (AEO) is not a projection that can easily capture such possible shifts. Although the AEO does include a variety of sides cases—such as our high and low zero-carbon technology cost cases, our high and low oil and natural gas supply cases, and our high and low macroeconomic growth cases—these cases are meant to show impacts across a reasonable variation of our key inputs and drivers.

Several attendees either submitted questions during registration or asked during the working group about whether we are considering commercial load impacts for data centers. Presenters, with the assistance of other EIA staff from the Energy Consumption and Efficiency Modeling Team, replied that although we are not directly measuring load impact from data centers, we are including the expected electricity demand from data center servers in our computing end-use load shapes. We added that we are also accounting for additional cooling demand as part of the electricity demand from on-premise data center operations.

One attendee inquired as to whether EIA had plans to update the system load shapes for AEO2025 or just the end-use load shapes. We responded that we are planning on updating the system load shapes as well for AEO2025.

One attendee asked if EIA is planning any changes related to advanced nuclear technologies for AEO2025. We explained that we are not changing how we will handle advanced nuclear technologies for AEO2025 compared with how we handled them in AEO2023. We still model an AP1000 conventional nuclear facility as well as a small-modular reactor technology. The capital costs for these technologies have been adjusted for AEO2025, but nothing else for the technologies will change.

The presenters were asked whether the National Renewable Energy Laboratory Restock and Comstock end-use load shapes in the presentation and included in AEO2025 were borrowed from NREL as-is or if we applied any post processed modifications to them before integrating with the NEMS building energy consumption demand. We responded that we take the ResStock and ComStock data directly from NREL's database, and their end-use equipment is aggregated into categories based on NEMS end-use demand categories. Then the data are further aggregated temporally and spatially to match the NEMS model resolution.

An attendee asked if AEO2025 will include the latest version of the Polysys model for biomass, and if using this latest version would increase the amount of biomass available for use in the newly modeled BECCS technology. We responded that we are currently not using the latest version of the Polysys model for AEO2025 but are looking to update it, time permitting.

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An attendee asked how our technology costs for AEO2025 compared with previous years and asked EIA staff what impact inflation has on near-term costs. We explained that technology costs between AEO2025 and AEO2023 vary from technology to technology in terms of their directional impact. Several technologies changed their designs and specifications, which changed the baseline technology that might be compared with previous reports. We have not determined final modeled inflation numbers, so the impact on inflation on near-term costs is still to be determined.

An attendee asked we have any planned updates to the cost of transmission builds, either spur lines or long-distance transmission for AEO2025, or if EIA will otherwise reflect increased challenges to transmission builds. We responded that although NEMS does not model individual transmission buildouts, the distance and cost to install electric transmission for electricity generation capacity buildouts are accounted for in the planning decisions of the model. We also explained that we are aware of the Federal Energy Regulation Commission's recent rule on transmission buildout for electric power generators and are monitoring it to determine if model input and assumptions need to be altered to account for the rule.

EIA was asked if the Electricity Capacity Planning Submodule (ECP) and Electricity Fuel Dispatch Submodule (EFD) have foresight into the phase-out of the production tax credit (PTC) and the investment tax credit (ITC) in the Inflation Reduction Act (IRA). We stated that the phase-out of the PTC and ITC as part of the IRA is being determined exogenous of the model and will likely remain so for AEO2025, but we could consider ways to endogenously phase out the tax credits in future AEOs.

An attendee pointed out that the EPA's Rule 111d has left room for flexibility in the form of averaging or trading under a rate-based standard and asked whether EIA has any plans to represent this potential. We stated that we do not currently have plans to represent that flexibility for AEO 2025.

Attendees

We hosted the working group meeting entirely online, and 98 people attended, including EIA staff and external participants. Attendees represented several organizations, including:

American Electric Power Co.
Bureau of Ocean Energy Management
Congressional Budget Office
DTE Energy
Edison Electric Institute
Electric Power Research Institute
Equitrans Midstream
GTI Energy
ICF
Leidos
Midcontinent Independent System Operator
National Aeronautics and Space Administration
National Energy Technology Laboratory
National Mining Association

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National Renewable Energy Laboratory
 Ohio Consumer Counsel
 OnLocation
 Pacific Northwest National Laboratory
 PJM
 Rhodium Group
 Sargent & Lundy
 SciReg Inc.
 Solar Energy Industries Association
 Southwest Power Pool
 Synapse Energy
 U.S. Department of Defense
 U.S. Department of Energy
 U.S. Environmental Protection Agency
 U.S. Geological Service
 Underground Energy
 Union of Concerned Scientists
 Wartsila

A full list of attendees is provided below.

External participants

| First Name | Last Name | Organization |
|-------------------|------------------|---|
| Jason | Baker | American Electric Power Co. |
| Jennifer | Kenyon | Bureau of Ocean Energy Management |
| Nicholas | Chase | Congressional Budget Office |
| Willow | Latham-Proenca | Congressional Budget Office |
| Elias | Baraque-Lopez | DTE Energy |
| Jason | Busse | DTE Energy |
| Steve | Frauenheim | Edison Electric Institute |
| Anand | Kumar | Electric Power Research Institute |
| Dylan | Sawyer-Villers | Equitrans Midstream |
| Ram | Dharmarajan | GTI Energy |
| Boddu | Venkatesh | ICF |
| John | Meyer | Leidos |
| Logan | Pollander | Midcontinent Independent System Operator |
| Mohit | Mehta | National Aeronautics and Space Administration |
| John | Wimer | National Energy Technology Laboratory |
| Leslie | Coleman | National Mining Association |
| Wesley | Cole | National Renewable Energy Laboratory |
| Joe | Perez | Ohio Consumer Counsel |
| Frances | Wood | OnLocation |

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|-----------|--------------|---------------------------------------|
| Francisco | deLaChesnaye | OnLocation |
| Sharon | Showalter | OnLocation |
| Matthew | Binsted | Pacific Northwest National Laboratory |
| Mojgan | Hedayati | PJM |
| Anna | van Brummen | Rhodium Group |
| Ben | King | Rhodium Group |
| Hannah | Kolus | Rhodium Group |
| Joshua | Junge | Sargent & Lundy |
| Tracy | Damico | SciReg Inc. |
| Forrest | Levy | Solar Energy Industries Association |
| Josh | Norton | Southwest Power Pool |
| Bruce | Biewald | Synapse Energy |
| Shailesh | Shah | U.S. Department of Defense |
| Brandon | McMurtry | U.S. Department of Energy |
| Colin | Cunliff | U.S. Department of Energy |
| Glenda | Oskar | U.S. Department of Energy |
| Greg | Cooney | U.S. Department of Energy |
| James | Easton | U.S. Department of Energy |
| Jason | Frost | U.S. Department of Energy |
| Jun | Shepard | U.S. Department of Energy |
| Derek | Gaston | U.S. Department of Energy |
| Misha | Adamantiades | U.S. Environmental Protection Agency |
| Elisa | Alonso | U.S. Geological Service |
| Laura | Singer | Underground Energy |
| Sandra | Sattler | Union of Concerned Scientists |
| Alex | Espejo | Wartsila |
| Matthew | Fioretti | Wartsila |

U.S. Energy Information Administration Staff

| First Name | Last Name |
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| Monica | Abboud |
| Greg | Adams |
| Katherine | Antonio |
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| Singfoong | Cheah |
| Jonathan | Church |
| Michael | Cole |

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| Peter | Colletti |
| Anna | Cororaton |
| Jim | Diefenderfer |
| Kenneth | Dubin |
| Michael | Dwyer |
| Kathryn | Dyl |
| Mindi | Farber-DeAnda |
| Alexander | Felhofer |
| David | Fritsch |
| Peter | Gross |
| Patricia | Hutchins |
| Kevin | Jarzomski |
| Scott | Jell |
| Christina | Jenq |
| Mala | Kline |
| Vikram | Linga |
| Nilay | Manzagol |
| Cara | Marcy |
| Laura | Martin |
| Mark | Morey |
| Kevin | Nakolan |
| Chris | Namovicz |
| BoonTeck | Ong |
| Kendyl | Partridge |
| Christopher | Peterson |
| Brittany | Phalon |
| Catherine | Prendergast |
| Estella | Shi |
| Sauleh | Siddiqui |
| Matthew | Skelton |
| Andrew | Smiddy |
| William | Sommer |
| Courtney | Sourmehi |
| Manussawee | Sukunta |
| John | Taber |
| Edward | Thomas |
| Gregory | Vance |
| Nina | Vincent |
| Neil | Wagner |
| Mary | Webber |
| Joshua | Whitlinger |
| Jared | Woollacott |

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