



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 AEO2023 Buildings Working Group held on
September 7, 2022

This memorandum provides an overview of the presentation given at the first *Annual Energy Outlook 2023* (AEO2023) Buildings Working Group meeting and summarizes the discussion, where we debriefed AEO2022 results and highlighted the major modeling and data updates planned for AEO2023. The presentation for this meeting is available in a separate document.

Debrief of AEO2022 results

First, we provided an overview of the meeting agenda, then we discussed AEO2022. We briefly highlighted the case design for two published *Issues in Focus* reports that the buildings team co-authored: [AEO2022 Alternative Weather Assumptions](#) and [AEO2022 Extended and Sunset Tax Credit cases](#). We described how the *Alternative Weather Assumptions* report focuses on changes in energy demand, as well as supply and prices, based on varied heating degree day (HDD) and cooling degree day (CDD) projections. We discussed the changes in projected energy consumption, energy generation, and CO₂ emissions as a result of assuming differing HDDs and CDDs relative to the AEO2022 Reference case. In the *Extended and Sunset Tax Credit cases* we found that, in the case of extending tax credits, solar generation surpasses hydroelectric and wind generation. We also found that sunseting tax credits early slightly reduced solar generation relative to the AEO2022 Reference case. We noted that modeling alternative policy cases gives us a foundation for understanding and modeling the Inflation Reduction Act of 2022 (IRA) provisions.

For AEO2022, we updated assumptions of Miscellaneous Electrical Loads (MELs), including technology penetration and energy use. We noted that, based on a new [contractor report](#), the number of MELs that we explicitly characterize has grown to include technologies such as smart speakers and warehouse robots that were less prevalent when the previous report was released in 2013. We noted a sizable amount of *other* residential and *other* commercial energy consumption that we don't have sufficient data to disaggregate. We project that portion of other residential MELs to grow at the same rate as

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personal disposable income as reported by the NEMS Macroeconomic Activity Module (MAM). Other commercial MELs are growing at the same rate of MAM's non-manufacturing service sector output.

Finally, we discussed solar photovoltaic (PV) capacity projections in the AEO2022. Solar PV capacity varies with equipment costs and fuel prices in each of the AEO2022 side cases. We noted that participants should keep in mind that our projections will change as we model the IRA because the law will affect rebates and tax credits going forward.

AEO2023 model updates, policy updates, and historical updates

First, we discussed the IRA and the Infrastructure Investment and Jobs Act (IIJA). We noted that incorporating the IRA provisions will be a multiyear modeling process, where the scope of the work will expand as programs are developed and more information is made available to the public. For AEO2023, we will model the extension and expansion of existing tax credits for distributed generation and combined-heat-and-power equipment and high-efficiency end-use equipment.

Our presentation then turned to the IIJA, where we indicated that this law included fewer buildings-specific programs. The two major subprograms of the bill we are actively researching are the *Cost-Effective Codes Implementation for Efficiency and Resilience* and the *Broadband Equity, Access, and Deployment Program*. We will continue to investigate and model new federal energy efficiency standards and ENERGY STAR® product specifications as possible.

We then discussed how we've incorporated the impacts of COVID-19 into AEO2023. We use historical data from our State Energy Data System (SEDS) through 2020 and our *Monthly Energy Review* (MER) through 2021. We also noted that near-term consumption is aligned with our *Short-Term Energy Outlook* (STEO) forecasts. Lastly, we receive updated macroeconomic projections from IHS Market, including housing starts and commercial floor space builds.

We announced an upcoming contractor report that will update some of our characterized major end-use technologies for the current and future reports. Specifically, contractors are providing updates to lighting, commercial refrigeration, and commercial ventilation technologies, which will be incorporated into AEO2023.

Lastly, we talked about the historical updates made for AEO2023. Beyond updates to sectoral energy consumption by fuel from SEDS, MERS, and STEO, we also incorporate the National Oceanic and Atmospheric Administration's (NOAA) latest historical HDD and CDD weather data and near-term forecasts. We discussed how the team also calibrates new residential space heating equipment shares and average household square footage based on U.S. Census Bureau data. We also revise historical distributed generation and combined-heat-and-power capacity, costs, and select technology characteristics based on the latest available data from various sources. We noted that we are refining recent historical and projected impacts of utility energy efficiency incentives in the buildings sectors.

Other items

We shared the latest information about the availability of buildings characteristics tables from the 2018 *Commercial Buildings Energy Consumption Survey* (CBECS) and the 2020 *Residential Energy Consumption Survey* (RECS). We demonstrated how attendees could access AEO data online, including interactive graphs and Microsoft Excel files containing Reference and side cases.

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Finally, we then articulated three main areas of active research for future AEO reports. First, we'll update cost and characteristics for space heating and cooling, water heating, cooking, and residential appliances. Second, we'll undertake the task of investigating how to model storage technologies for buildings, such as battery storage. Lastly, we'll actively work towards identifying ways in which we can use the residential and commercial models to analyze various types of buildings-related electrification. We ended this future work section noting that these projects will not make their way into AEO2023, but we will continue to investigate these as we look to future AEOs.

Discussion

Regarding the IRA's 26 U.S. Code § 25C *Nonbusiness energy property* extensions, a participant asked whether the same equipment credits will be expanded, or if we will be updating the efficiency level qualification for the credit. We explained that we are unsure exactly how the new credits will be implemented because, while we do know that there are different levels at which all equipment and technologies meet the new IRA credit assumptions, we have not yet determined how all of these credits will play out. In addition, the participant asked whether we plan to adjust shell retrofit efficiency improvements to reflect applicable IRA provisions. We responded by explaining that there are tax credits for new building shells and equipment, and we are currently developing assumptions to reflect how these programs are expected to be implemented. It will take us some more time to incorporate the IRA impacts on existing building shells and retrofits, such as insulation and air sealing improvements, into our models.

A participant asked if the additional equipment characteristics data mentioned earlier in the presentation will cover all modeled technologies, or if there will be technologies that still require data updates in 2023 and 2024. We explained that AEO2023 will include lighting, as well as commercial ventilation and refrigeration technologies. The contract to update space cooling and heating and other major end uses is only just now starting, so data is very unlikely to make it into AEO2023; it is more likely to be incorporated in AEO2024. The data will be published to our website once available so that anyone who is interested can view it, and our assumptions for AEO2023 will be posted so that it is clear what has and has not been incorporated.

A participant asked about the impact of high inflation and the price increases in the oil and natural gas industries, which are expected to cause changes in consumption behavior. The participant asked about plans to update price elasticity of demand with respect to natural gas, oil, and electricity prices. We responded by explaining that this topic may be explored in core side cases where we will look at different supply and cost assumptions. In addition, we have high and low economic growth cases that can show how inflation may affect drivers for commercial and residential consumption. We do revise elasticities every few years based on historical data; the most recent [elasticity report](#) was released last year. As we gather more historical data, we can revise our assumptions, but we currently have no specific plans to revise elasticities during this AEO cycle.

A participant asked how residential and commercial EV chargers are represented in NEMS. We directed them to the upcoming Transportation Working Group meeting to learn more about how energy use from EV charging is accounted for in NEMS. We clarified that vehicle charging is not modeled at all on the buildings side of NEMS, and they are not explicitly characterized in transportation modeling. Instead, the transportation sector uses an electricity price in combination with data regarding the size and specific characteristics of EVs to model EV adoption and energy use.

Attendees

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