

Buildings Working Group Meeting

AEO2022 debrief and AEO2023 updates



Energy Consumption and Efficiency Modeling Team

September 7, 2022 | Virtual

By

Buildings Energy Modeling Group

Overview

- AEO2022 debrief
- AEO2023
 - Recent legislation and policy assumptions
 - Inflation Reduction Act
 - Infrastructure Investment and Jobs Act
 - COVID-19
 - Modeling updates
 - Historical updates
- Upcoming projects
- Discussion

AEO2022 debrief

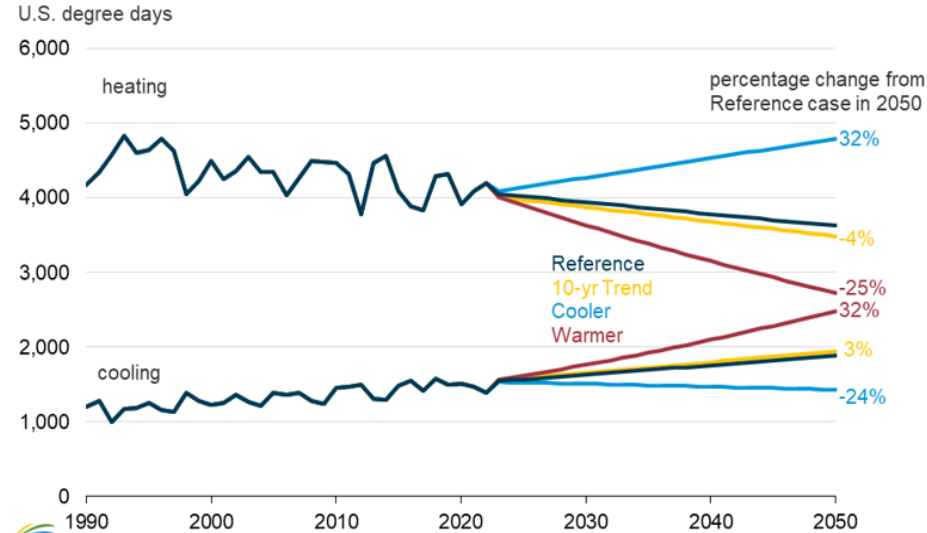
AEO2022 highlights

- Published *Issues in Focus*
 - [Alternative Weather Assumptions](#)
 - [Extended and Sunset Tax Credit cases](#)
- Updated miscellaneous electric loads (MELs)
 - Based on [Analysis and Representation of Miscellaneous Electric Loads in NEMS](#) report
 - New and disaggregated residential and commercial end uses
- Adjusted incentives for renewable distributed generation and end-use equipment to reflect extensions provided by the Consolidated Appropriations Act, 2021

AEO2022: Alternative Weather Assumptions

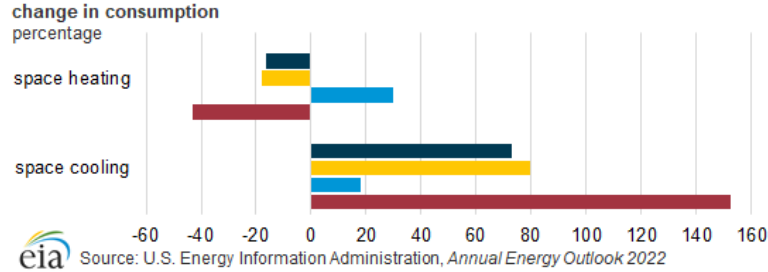
U.S. degree day projections, Reference case and alternative weather assumption cases (1990–2050)

Figure 1. U.S. degree day projections, Reference case and alternative weather assumption cases (1990–2050)



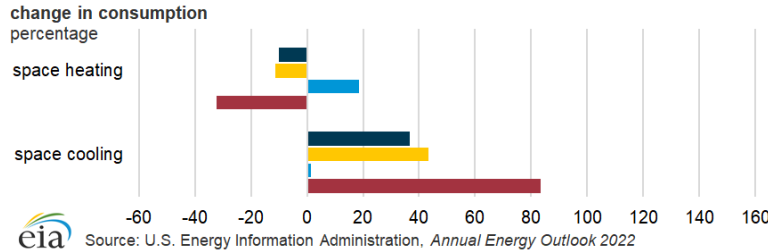
Source: U.S. Energy Information Administration, *Annual Energy Outlook 2022*

Changes in residential space conditioning by end use and case



Reference 10-yr Trend Cooler Warmer

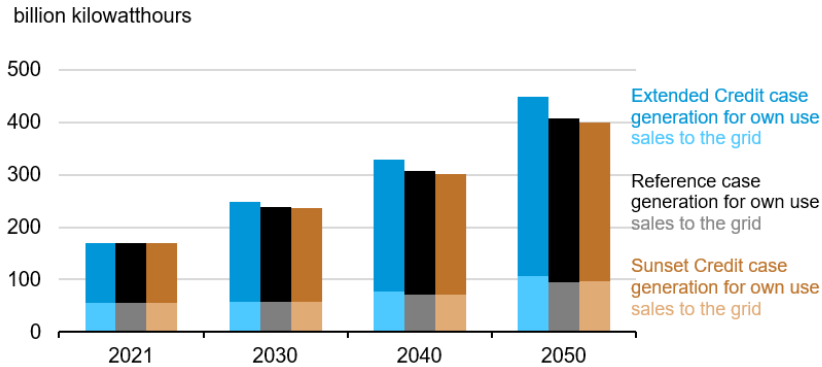
Changes in commercial space conditioning by end use and case



[Annual Energy Outlook 2022: Alternative Weather Assumptions](#)

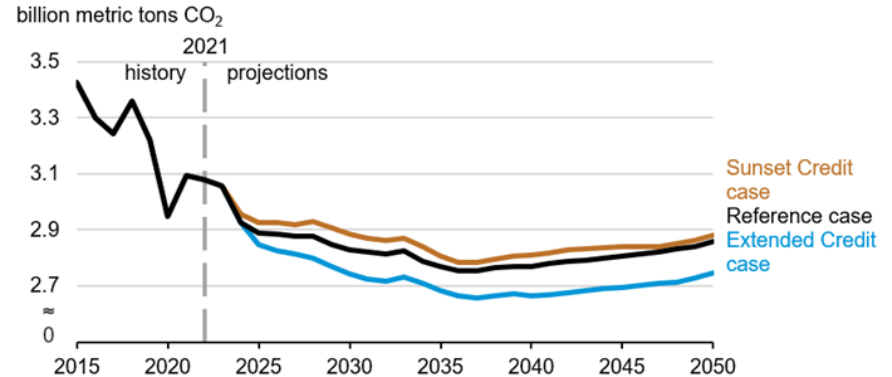
AEO2022: Extended and Sunset Tax Credits

On-site electricity generation among select end-use sectors, Reference and Extended and Sunset Tax Credit cases (2021–2050)



Data source: U.S. Energy Information Administration, *Annual Energy Outlook 2022*

Buildings and industrial energy-related emissions, Reference and Extended and Sunset Tax Credit cases (2015–2050)



Data source: U.S. Energy Information Administration, *Annual Energy Outlook 2022*

[Annual Energy Outlook 2022: Extended and Sunset Tax Credit Cases](#)



AEO2023 Buildings Working Group | Virtual
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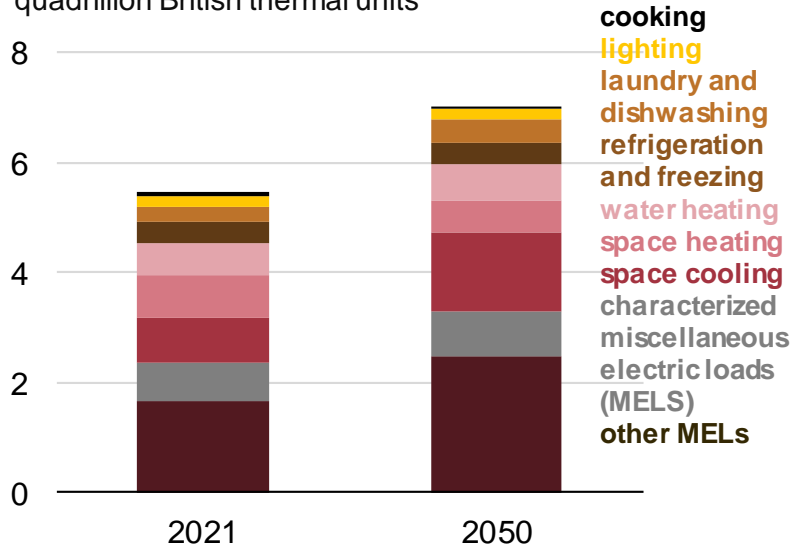
**WORKING GROUP PRESENTATION FOR
DISCUSSION PURPOSES. DO NOT QUOTE OR CITE
BECAUSE RESULTS ARE SUBJECT TO CHANGE**

Residential electricity use and miscellaneous electrical loads

Electricity consumed to meet residential end-use demand

AEO2022 Reference case

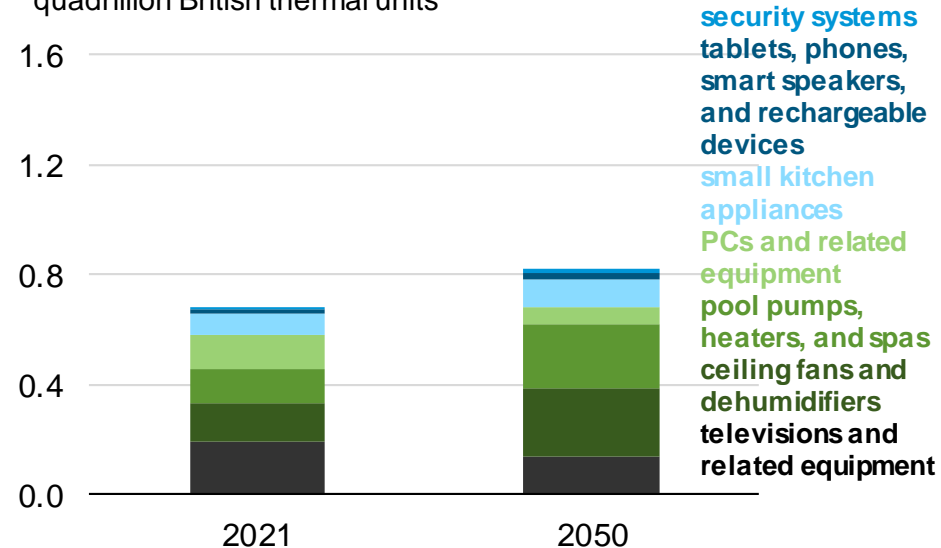
quadrillion British thermal units



Characterized miscellaneous electric loads in the residential sector

AEO2022 Reference case

quadrillion British thermal units



Data source: U.S. Energy Information Administration, *Annual Energy Outlook 2022*

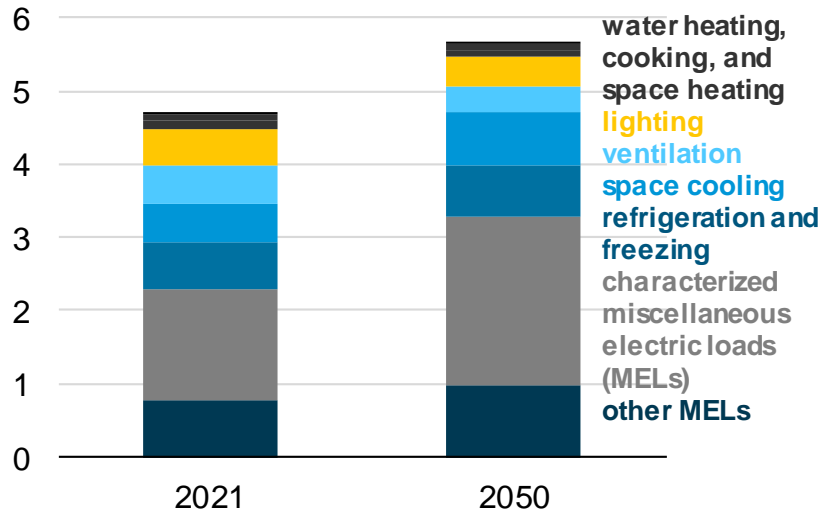
Note: The other MELs category includes aggregated energy use for end uses not explicitly characterized in the righthand chart, as well as unspecified electricity consumption.

Commercial electricity use and miscellaneous electrical loads

Electricity consumed to meet commercial end-use demand

AEO2022 Reference case

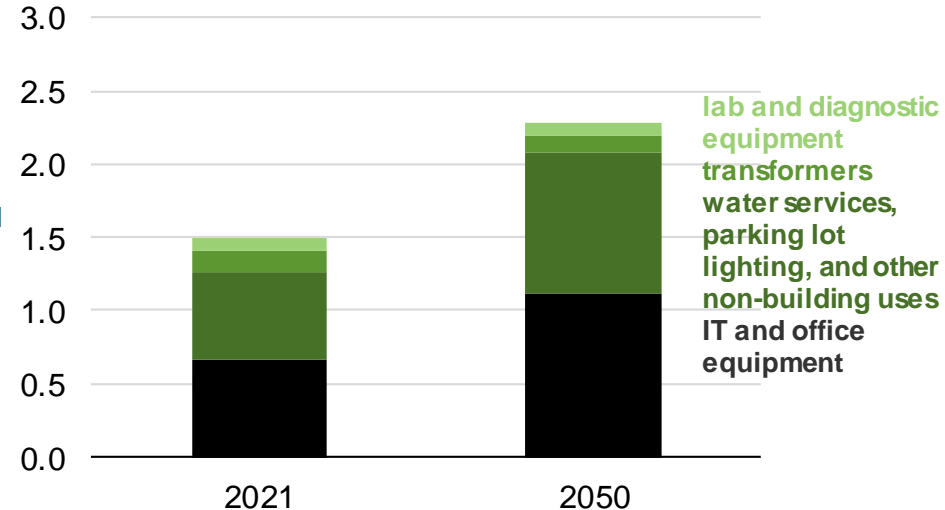
quadrillion British thermal units



Characterized miscellaneous electric loads in the commercial sector

AEO2022 Reference case

quadrillion British thermal units

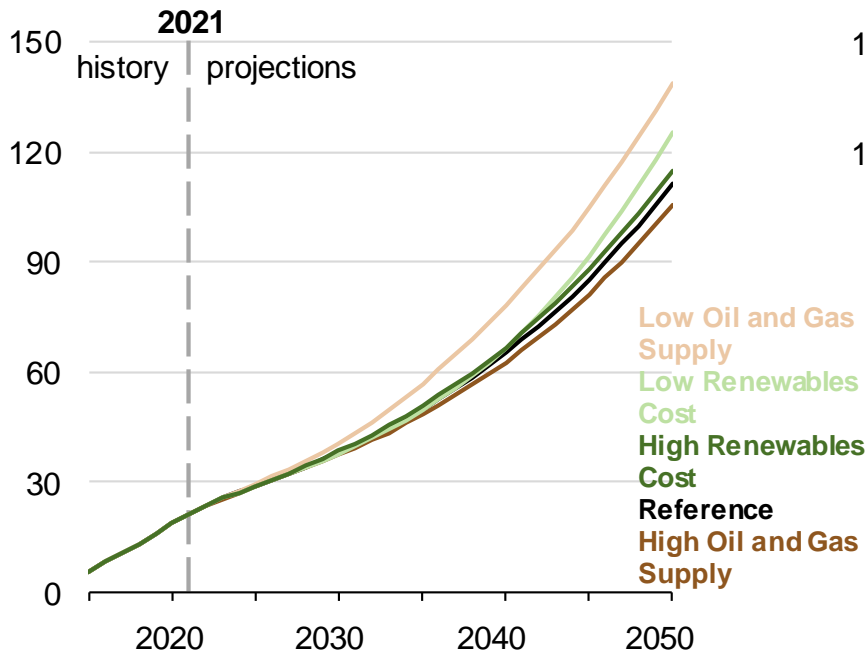


Data source: U.S. Energy Information Administration, *Annual Energy Outlook 2022*

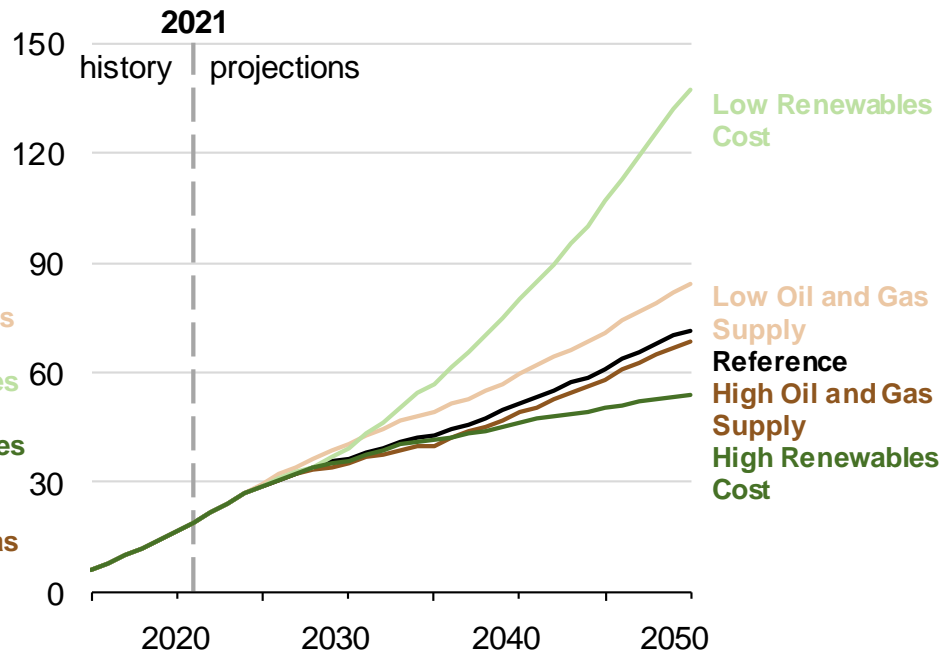
Note: The other MELs category includes aggregated energy use for end uses not explicitly characterized in the righthand chart, as well as unspecified electricity consumption.

Solar photovoltaic capacity varies with equipment costs and fuel prices

Residential solar distributed generation capacity gigawatts direct current



Commercial solar distributed generation capacity gigawatts direct current



Data source: U.S. Energy Information Administration, *Annual Energy Outlook 2022*

AEO2023 (and beyond)

Recent legislation and policy assumptions

- Inflation Reduction Act
 - Extension and modification of energy credit (IRS 48): extend renewables and combined heat and power investment tax credits
 - Residential clean energy credit: extend renewables and combined-heat-and-power investment tax credits
 - Extension, increase, and modification of new energy efficient home credit (IRS 45L): extend tax credits for high efficiency residential housing packages (new construction)
 - Extension, increase, and modification of nonbusiness energy property credit (IRS 25C): extend residential energy efficiency tax credits
 - Cost recovery for qualified facilities, qualified property, and grid improvement property: extend Modified Accelerated Cost Recovery System (MACRS) for modeled end-use equipment

Recent legislation and policy assumptions

- Inflation Reduction Act (continued)
 - Home Owner Managing Energy Savings (HOMES) Rebates: investigate whole-home retrofit savings potential
 - High-Efficiency Electric Home Rebate Program: investigate what share of homes and equipment qualifies
 - Assistance for Latest and Zero Building Energy Code Adoption: investigate potential affects on regional building energy code adoption
 - Energy efficient commercial buildings deduction (IRS 179D): investigate potential impact on building code compliance in new construction and heating and cooling energy use

Recent legislation and policy assumptions (continued)

- Infrastructure Investment and Jobs Act
 - Cost-Effective Codes Implementation for Efficiency and Resilience: investigate potential affects on regional building energy code adoption
 - Broadband Equity, Access, and Deployment Program: consider modifying future MELs penetration
- Incorporate new federal energy efficiency standard rulemakings if and when finalized.
- Identify any new ENERGY STAR specifications for major end-use equipment and MELs.

COVID-19

- Historical data from EIA's *State Energy Data System* (SEDS) through 2020 and EIA's *Monthly Energy Review* (MER) through 2021
- Near-term consumption from EIA's *Short-Term Energy Outlook* (STEO) forecasts
- Updated macroeconomic projections from IHS Markit (including housing starts and commercial floorspace builds)

AEO2023 lighting, commercial refrigeration and ventilation update

Draft- do not cite

Performance/Cost Characteristics » Residential General Service LED Lamps (60 Watt Equivalent)

DATA	2015	2020	2022				2023 ²	2030		2040		2050	
	Installed Stock Average	Installed Stock Average	Low	Typical	High	ENERGY STAR ¹	Standard	Typical	High	Typical	High	Typical	High
Lamp Wattage	9	9	10	9	8	10	18	7	7	6	5	5	4
Lamp Lumens	656	803	800	800	800	800	800	800	800	800	800	800	800
Lamp Efficacy (lm/W)	75	87	80	90	100	80.0	45.0	109	121	139	154	161	179
CRI	81	85	80	81	90	80	N/A	81	90	81	90	81	90
Correlated Color Temperature (CCT)	2700	2700	2700	2700	2700	2700	N/A	2700	2700	2700	2700	2700	2700
Average Lamp Life (1000 hrs)	25	21	15	14	18	15.0	N/A	14	18	14	18	14	18
Annual Operating Hours (hrs/yr)	7	657	657	657	657	N/A	657	657	657	657	657	657	657
Lamp Price (2022\$)	53	3.9	3.9	3.9	3.9	N/A	3.23	4.3	4.3	4.3	4.3	4.3	3.33
Lamp Cost (2022\$/klm)	63	5.68	5.68	5.68	5.68	N/A	4.04	5.49	5.49	5.49	5.49	5.49	4.17
Labor Cost (2022\$/hr)	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	N/A	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Labor Installation (hr)	0.0	0.0	0.0	0.0	0.0	0.0	N/A	0.0	0.0	0.0	0.0	0.0	0.0
Total Installed Cost (2022\$/klm)	\$13.53	\$4.56	\$6.20	\$3.92	\$5.32	\$6.20	N/A	\$3.23	\$4.39	\$2.84	\$3.86	\$2.46	\$3.33
Annual Maintenance Cost (2022\$)	\$0.35	\$0.15	\$0.27	\$0.18	\$0.19	\$0.27	N/A	\$0.15	\$0.16	\$0.13	\$0.14	\$0.11	\$0.12
Total Installed Cost (2022\$/klm)	\$20.63	\$5.68	\$7.75	\$4.90	\$6.65	\$7.75	N/A	\$4.04	\$5.49	\$3.56	\$4.83	\$3.07	\$4.17
Annual Maintenance Cost (2022\$/klm)	\$0.54	\$0.18	\$0.34	\$0.22	\$0.24	\$0.34	N/A	\$0.18	\$0.20	\$0.16	\$0.17	\$0.14	\$0.15

DRAFT DATA

- Criteria outlined in ENERGY STAR® Program Requirements Product Specification for Lamps (Light Bulbs): Eligibility Criteria Version 2.1 (Published June, 2017, Revised June 2020)
- In April 2022, DOE codified into Code of Federal Regulations the 45 lm/W backstop requirement for general service lamps that Congress prescribed in the Energy Policy and Conservation Act. The new minimum efficacy requirements go into effect for manufacturing and import in January 2023, and for retail and distribution in July 2023. All LED lighting products exceed the new minimum efficacy standards.

Will be published to <https://www.eia.gov/analysis/studies/buildings/equipcosts/>

Historical updates

- Update sectoral energy consumption by fuel.
 - *State Energy Data System (SEDS) and Monthly Energy Review (MER)*
 - *Short-Term Energy Outlook (STEO)*
- Incorporate the National Oceanic and Atmospheric Administration's (NOAA) latest historical heating and cooling degree day weather data (and forecast).
- Calibrate new residential heating equipment shares and average household square footage based on U.S. Census Bureau data.
- Revise historical distributed generation capacity, solar photovoltaic costs and characteristics, and combined-heat-and-power generation.
- Continue to refine historical (and projected) impacts of utility energy efficiency incentives.

EIA Energy Consumption Survey updates

- *2018 Commercial Buildings Energy Consumption Survey (CBECS)*
 - Building characteristics data tables and microdata has been released; preliminary consumption and expenditure data will be released later this month. We will likely release final data in December 2022.
 - Data will be in AEO2024 at the earliest.
 - The 2018 CBECS does not capture long-term changes in commercial consumption caused by the pandemic (e.g., remote work, ventilation consumption); the AEO will capture such effects at the sector level from historical data and STEO forecasts.
- *2020 Residential Energy Consumption Survey (RECS)*
 - National and state-level tables and the preliminary housing characteristics public-use microdata file are now available.
 - National and state-level consumption and expenditures data will be released early Spring 2023.
 - Data will be in AEO2024 at the earliest.
 - [2020 Residential Energy Consumption Survey \(RECS\) Webinar](#) on September 14 at 1pm ET

Upcoming projects

- Update technology cost and characteristics for space heating and cooling, water heating, cooking, and residential appliances.
- Investigate modeling of storage technologies for buildings.
- Identify ways in which we can use the residential and commercial models to analyze various types of buildings-related electrification.

2022 ACEEE Summer Study on Energy Efficiency in Buildings: Modeling Electrification in Buildings using NEMS

Category	Model assumptions	NEMS modeling elements
Technology	Improved efficiency	Technology characteristics Miscellaneous electric loads (MELs) characteristics Distributed generation (DG) and combined-heat-and-power (CHP) characteristics Building envelope characteristics
	Reduced equipment or installation costs	Technology, DG/CHP characteristics
	New technology options	Technology, MELs, DG/CHP characteristics
	Fuel switching	Technology characteristics
	Policy	Future energy efficiency standards
Policy	Building energy codes	Building envelope characteristics
	Utility energy efficiency rebates	Technology, DG/CHP characteristics
	Federal tax credits	Technology, DG/CHP, building envelope characteristics
	Behavior	Consumer purchase behavior
Consumer preferences for upfront versus operating costs		Decision parameters
Responses to increasing fuel prices		Price elasticities

Data source: [Modeling the Effects of Electrification in Buildings Using the National Energy Modeling System](#)

View our data online

- Interactive graphs available as part of our online data table browser

www.eia.gov/outlooks/aeo/data/browser

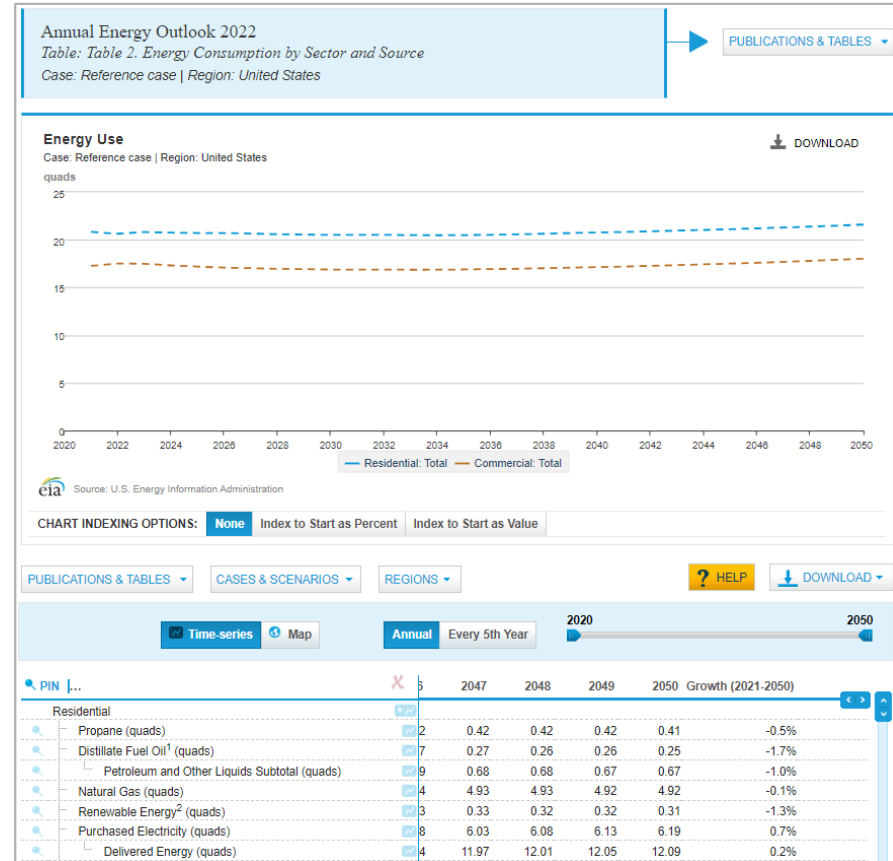
- Excel spreadsheets for Reference and side cases

www.eia.gov/outlooks/aeo/tables_ref.php

www.eia.gov/outlooks/aeo/tables_side_xls.php

- Buildings-specific chart highlights

www.eia.gov/outlooks/aeo/pdf/AEO2022_ChartLibrary_Buildings.pdf



Questions or comments?

For more buildings information

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For more information

U.S. Energy Information Administration homepage | www.eia.gov

Buildings Working Group materials | www.eia.gov/outlooks/aeo/workinggroup/buildings

Today in Energy | www.eia.gov/todayinenergy

Annual Energy Outlook | www.eia.gov/aeo

Short-Term Energy Outlook | www.eia.gov/steo

State Energy Data System | www.eia.gov/state/seds

Monthly Energy Review | www.eia.gov/mer

Residential Energy Consumption Survey | www.eia.gov/recs

Commercial Building Energy Consumption Survey | www.eia.gov/cbecs

International Energy Portal | www.eia.gov/international

Bonus slides

Buildings energy data and modeling resources

Use our data, reports, and studies

[2020 Residential Energy Consumption Survey \(RECS\)](#)

[2018 Commercial Buildings Energy Consumption Survey \(CBECS\)](#)

[Repository of buildings reports and studies](#)

Read our analyses

[Annual Energy Outlook 2022 \(AEO2022\)](#)

[Annual Energy Outlook 2022: Alternative Weather Assumptions](#)

[Annual Energy Outlook 2022: Extended and Sunset Tax Credit Cases](#)

Learn about our assumptions

[National Energy Modeling System \(NEMS\) documentation](#)

[Assumptions to the Annual Energy Outlook 2022](#)

[Updated Buildings Sector Appliance and Equipment Costs and Efficiency \(updates in progress\)](#)

[Analysis and Representation of Miscellaneous Electric Loads \(MELs\) in NEMS](#)

[Modeling Distributed Generation in the Buildings Sectors](#)

Contact our staff

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Source: <https://www.eia.gov/consumption/workshop/resources.php>