Assumptions to the Annual Energy Outlook 2026: Residential Demand Module

April 2026

Independent Statistics and Analysis
U.S. Energy Information Administration

www.eia.gov
U.S. Department of Energy
Washington, DC 20585

The U.S. Energy Information Administration (EIA), the statistical and analytical agency within the U.S. Department of Energy (DOE), prepared this report. By law, our data, analyses, and forecasts are independent of approval by any other officer or employee of the U.S. Government. The views in this report do not represent those of DOE or any other federal agencies.

Table of Contents

Table of Figures

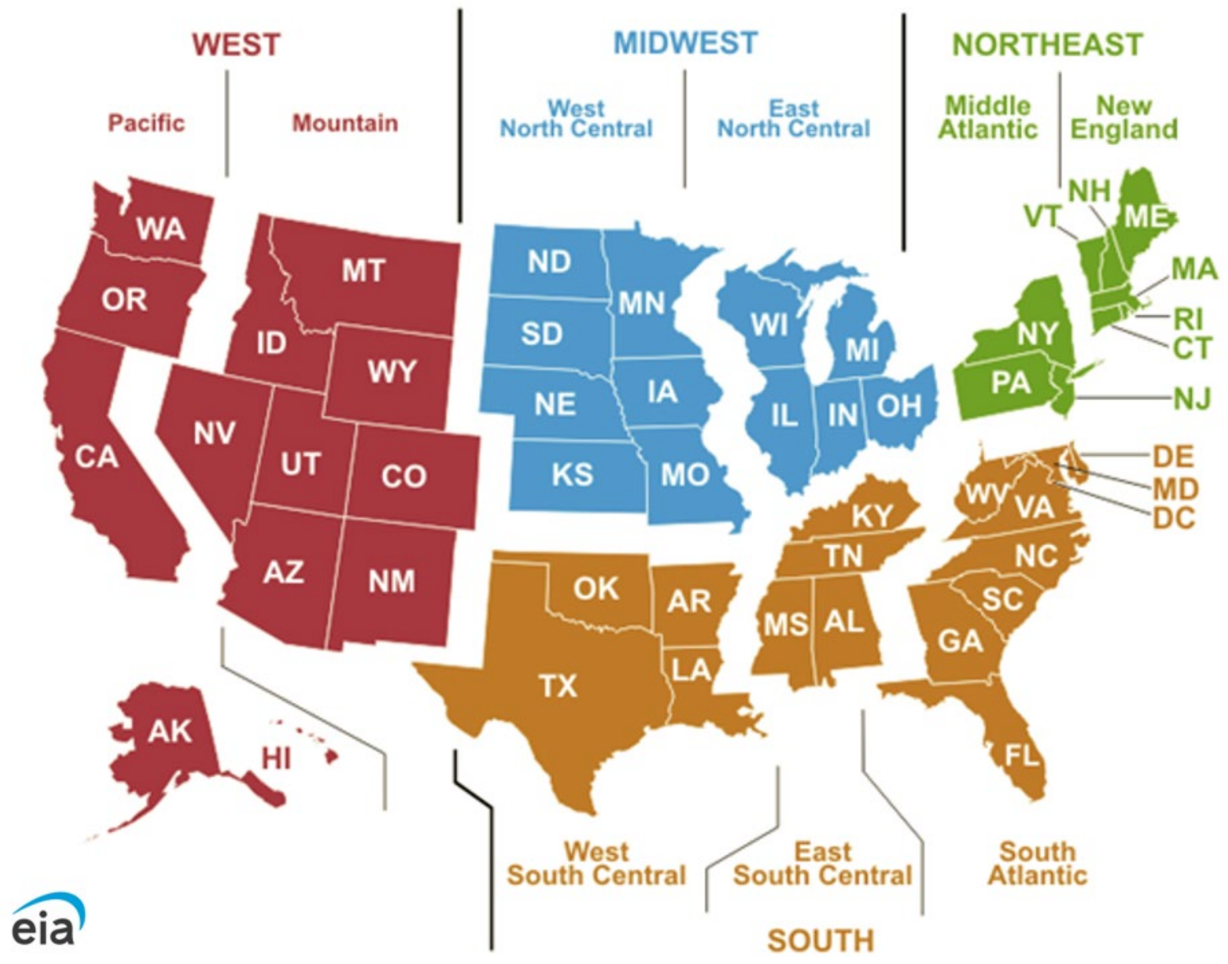
Table of Tables

Residential Demand Module

The National Energy Modeling System's (NEMS) Residential Demand Module (RDM) projects future residential sector energy requirements based on the number of households and the stock, efficiency, and intensity of energy-consuming equipment. RDM projections begin with a base-year estimate of the housing stock, the types and number of energy-consuming appliances servicing the stock, and the unit energy consumption (UEC) by appliance (in million British thermal units per household per year). The RDM adds new housing units to the stock, determines the equipment installed in new units, retires existing housing units, and retires and replaces appliances. The primary exogenous drivers for the module are housing starts by type (single-family, multifamily, and mobile homes) and by census division as well as prices for each energy source for each of the nine U.S. census divisions (Figure 1).

The RDM also requires projections of available equipment and their installed costs. Over time, equipment efficiency tends to increase because of general technological advances and federal and state efficiency standards. As energy prices and available equipment change during the projection period, the module includes changes to the type and efficiency of equipment purchased and to the use intensity of the equipment stock.

Figure 1. U.S. census regions and divisions



Data source: U.S. Energy Information Administration

We model major end-use equipment stocks—which use several different fuel types—to include:

- Space heating and air-conditioning equipment
- Furnace fans and boiler pumps
- Water heaters
- Refrigerators
- Freezers
- Dishwashers
- Cooking ranges
- Clothes washers
- Clothes dryers
- Lighting

The RDM's output includes number of households; energy consumed by end-use service, fuel, and census division; equipment stock; and average equipment efficiencies for major end uses. The RDM models several miscellaneous electric loads (MELs) in lesser detail based on changes in device penetration or saturation and estimated annual energy consumption. These MELs include:

- Televisions and related equipment (set-top boxes, home theater systems, over-the-top streaming devices, and video game consoles)
- Computers and related equipment (desktops, laptops, monitors, and networking equipment)
- Non-PC rechargeable electronics
- Ceiling fans
- Coffee makers
- Dehumidifiers
- Microwaves
- Pool pumps
- Pool heaters
- Home security systems
- Portable electric spas
- Wine coolers and miscellaneous refrigeration products
- Smart speakers
- Smartphones
- Tablets
- Small kitchen appliances

In addition to the modeled end uses previously listed, we project the average energy consumption per household for other electric and non-electric uses. The fuels represented are distillate fuel oil (including kerosene), propane, natural gas, electricity, wood, and solar energy.

In the Counterfactual Baseline case projections, we assume that no radical changes in residential-sector technology or consumer behavior will occur through 2050. We assume no new regulations of efficiency beyond current law and no new government programs affecting efficiency improvements. We assume that major end-use technologies that have not gained widespread acceptance today will generally not be widely accepted by the end of the projection period. Currently available technologies will increase in efficiency and decrease in cost. In general, future technologies at the same efficiency level will be less expensive, in real dollar terms, than those available today. When choosing new or replacement technologies, consumers will behave similarly to the way they now behave, and the intensity of end uses will change moderately in response to price changes.[1] We do, however, allow for substantial penetration of MELs that are exhibiting prominent adoption in the sector (for example, smart speakers), although we do not have explicit stock turnover modeling of these minor end uses.

Key Assumptions

Housing Stock Submodule

An important determining factor for future energy consumption is the projected number of occupied households. We derive the base-year estimates for 2020 from our *Residential Energy Consumption Survey* (RECS) (Table 1). We project the number of occupied households separately for each census division. This number represents the previous year's surviving stock as well as housing starts provided by the NEMS Macroeconomic Activity Module. The RDM Housing Stock Submodule assumes a constant survival rate—the percentage of households in the current projection year that were also included in the preceding year—for each housing type: 100.0% for single-family units, 100.0% for multifamily units, and 98.2% for mobile homes. Values are based on housing stocks and starts over the 30-year period prior to the RECS base year. If an endogenously calculated value exceeds 100%, then it defaults to 100%, implying conversion from commercial or other buildings.

Table 1. Number of households by type and census division, 2020

Census division	Single-family units	Multifamily units	Mobile homes	Total units
New England	3,637,502	2,098,565	140,099	5,876,166
Middle Atlantic	9,541,561	6,144,683	357,259	16,043,503
East North Central	13,498,851	4,422,986	625,075	18,546,912
West North Central	6,417,005	1,730,073	348,737	8,495,815
South Atlantic	17,169,669	5,673,955	1,999,637	24,843,261
East South Central	5,361,237	1,248,996	770,484	7,380,717
West South Central	10,231,867	3,267,791	1,119,436	14,619,094
Mountain	6,559,193	1,989,740	668,981	9,217,914
Pacific	12,101,984	5,600,868	802,791	18,505,643
United States	84,518,869	32,177,657	6,832,499	123,529,025

Data source: U.S. Energy Information Administration, *2020 Residential Energy Consumption Survey*
Note: A prefabricated or modular home assembled onsite is a single-family housing unit and not a mobile home.

Projected fuel consumption depends not only on the projected number of housing units but also on the type and geographic distribution of the households. The intensity of space heating energy use varies greatly across U.S. climate zones. In addition, fuel prevalence varies across the country. Distillate fuel oil is more frequently used for heating in the New England Census Division and Middle Atlantic Census Division than in the rest of the country. Natural gas is the most common heating fuel in the Midwest

Census Region. Fuel prevalence also varies by housing type. For example, mobile homes are more likely to use propane than single-family or multifamily homes.

Technology Choice Submodule

The key inputs for the Technology Choice Submodule are fuel prices by census division and characteristics of available equipment (installed cost, annual maintenance cost, efficiency, and equipment life). The Integrating Module of NEMS estimates fuel prices through an equilibrium simulation that balances supply and demand and passes the prices to the RDM.

Prices combined with equipment UEC (a function of efficiency) determine the operating costs of equipment. Equipment characteristics are exogenous to the model and are modified to reflect federal standards, equipment subsidies or tax credits, and anticipated changes in the marketplace. Table 2 lists capital costs and efficiency for selected residential appliances for select years.

Table 2. Installed cost and efficiency ratings of selected equipment, 2022 and 2040

Equipment type	Relative performance[a]	2022 average installed cost (2022$)	2022 efficiency[b]	2040 efficiency[b]
Electric air-source heat pump (heating component)	Minimum	$6,730	8.2	9.3
	High	$8,620	12.4	12.4
Natural gas furnace[c]	Minimum	$3,690	0.80	0.95
	High	$4,320	0.99	0.99
Room air conditioner	Minimum	$560	10.9	12.0
	High	$675	15.7	15.7
Central air conditioner[d]	Minimum	$5,250	13.0	14.4
	High	$5,980	17.0	17.0
Refrigerator[e]	Minimum	$740	411	401
	High	$760	358	358
Electric water heater[f]	Minimum	$905	0.92	0.93
	High	$1,715	3.73	3.73
Solar water heater	N/A	$8,060	N/A	N/A

Data source: U.S. Energy Information Administration, *Updated Buildings Sector Appliance and Equipment Costs and Efficiency*
Note: N/A=not applicable
[a] *Minimum* performance refers to the minimum federal energy efficiency standard or typical performance where no standards exist. *High* refers to the highest-efficiency equipment available as characterized in the report.

[b] Efficiency metrics vary by equipment type. Electric heat pumps are characterized by the Heating Seasonal Performance Factor (HSPF). Natural gas furnaces are characterized by the Annual Fuel Utilization Efficiency (AFUE). Central air conditioners are characterized by the Seasonal Energy Efficiency Ratio (SEER). Room air conditioners are characterized by the Combined Energy Efficiency Ratio (CEER). Refrigerators are characterized by kilowatthours per year. Water heaters are characterized by the Uniform Energy Factor (UEF).
[c] Values are for southern regions of the United States where minimum heating efficiency requirements are lower.
[d] Values are for northern regions of the United States where minimum cooling efficiency requirements are lower.
[e] Reflects a refrigerator with a top-mounted freezer with a 19-cubic-feet nominal volume.
[f] *Minimum* efficiency represents a typical storage water heater, and *high* represents a heat pump water heater.

Table 3 provides the cost and performance parameters for representative distributed generation (DG) technologies. Cost parameters account for tax incentives for DG technologies, along with the effects of Section 201 tariffs placed on imported solar cells and modules in January 2018. We base residential solar photovoltaic system penetration on a ZIP code-level hurdle model, and we calculate fuel cell and distributed wind system penetration using a 30-year cash flow analysis.

The RDM also incorporates endogenous learning for the residential DG technologies, allowing for declining technology costs as shipments increase. For fuel cell and solar photovoltaic systems, learning parameter assumptions for the Counterfactual Baseline case result in a 13% reduction in capital costs each time the installed capacity in buildings doubles (in the case of photovoltaics, commercial- and utility-scale capacity is also included for learning). Capital costs for small distributed wind turbines, a relatively mature technology, decline only 3% each time shipments double.

Table 3. Capital cost and performance parameters of selected residential distributed generation technologies

Technology type	Year introduced	Average generating capacity (kW_{DC})[a]	Electrical efficiency[b]	Combined efficiency (electricity and thermal)	Installed capital cost (2022$ per kW_{DC})	Service life (years)
Solar photovoltaic	2020	6.7	0.198	N/A	$4,336	25
	2030	7.6	0.217	N/A	$3,199	25
	2040	8.1	0.226	N/A	$2,759	25
	2050	8.6	0.234	N/A	$2,535	25
Fuel cell	2020	5.0	0.45	0.854	$10,193	10
	2030	5.0	0.45	0.855	$9,758	10
	2040	5.0	0.45	0.855	$9,758	10
	2050	5.0	0.45	0.855	$9,758	10
Wind	2020	9.5	0.19	N/A	$6,159	20
	2030	9.3	0.19	N/A	$7,411	20
	2040	9.3	0.19	N/A	$7,411	20
	2050	9.3	0.19	N/A	$7,411	20

Data source: U.S. Energy Information Administration, *Distributed Generation, Battery Storage, and Combined Heat and Power System Characteristics and Costs in the Buildings and Industrial Sectors*; Lawrence Berkeley National Laboratory, *U.S. Distributed Solar and Storage, 2025 Data Update*; and National Laboratory of the Rockies, Annual Technology Baseline
Note: N/A=not applicable
[a] kW_{DC}=kilowatts of direct current
[b] For wind, this value represents the system capacity factor.

The RDM projects equipment purchases based on a nested choice methodology. The first stage of the choice methodology determines the fuel and technology to be used. The equipment choices for air conditioning and water heating are linked to the space heating choice for new construction. Technology and fuel choice for replacement equipment uses a nested methodology similar to that for new construction. It also includes explicit costs for fuel or technology switching in addition to the capital and installation costs of the equipment. Examples of these costs include costs for installing natural gas lines if a consumer switches from electricity or distillate fuel oil to natural gas or costs for adding ductwork if the consumer switches from electric resistance heat to central heating types. In addition, for replacements, fuel choice is not linked for water heating and cooking like it is for new construction. Technology switching across fuels is allowed for replacement space heating, air-conditioning, water heating, cooking, and clothes drying equipment.

Once the RDM determines the fuel and technology choices for an end use, the second stage of the choice methodology determines efficiency of new and replacement equipment. In any given year, equipment options of varying efficiency are available: minimum standard, some intermediate or ENERGY STAR® level, and highest efficiency. We base efficiency choice on a functional form and on coefficients that give greater or lesser importance to the installed capital cost (first cost) versus the operating cost. Generally, within a technology class, the higher the first cost, the lower the operating cost. For new construction, the model makes efficiency choices based on the costs of both the space heating and air-conditioning equipment and the building shell characteristics.

After the RDM determines equipment efficiencies for a technology and fuel combination, the module calculates annual installed efficiency for each combination's entire stock.

Equipment efficiency

We initially base the average energy consumption for most technology types on estimates that primarily come from the 2020 RECS. As the stock efficiency changes during the projection period, energy consumption decreases in inverse proportion to efficiency. In addition, as efficiency increases, the efficiency rebound effect (discussed in the Energy Efficiency Rebates section) will offset some of the reductions in energy consumption by increasing demand for the end-use service. For example, if the stock average for electric heat pumps is now 10% more efficient than in 2010, then, all else held constant (weather, real energy prices, shell efficiency, etc.), energy consumption per heat pump would average about 9% less.

Energy efficiency rebates

The RDM accounts for the effects of utility-level energy efficiency programs designed to stimulate investment in high-efficiency equipment for space heating, air conditioning, lighting, and other select appliances. As with federal tax credits, we average these utility incentives, subsidies, and rebates at the census division level and apply them as a percentage reduction to equipment costs in the Technology Choice Submodule (Table 4). Rebate levels may vary by technology within end uses. Lighting rebates phase out starting in 2022 because high adoption rates of LED bulbs reduce purchase costs, and certain appliance rebates may change slightly over time as the incremental cost of the technology changes.

Table 4. Selected rebates (as a percentage of installed cost) by residential end use

Technology	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific
Natural gas furnaces	10%	12%	5%	5%	8%	7%	0%	4%	15%
Natural gas boilers	13%	10%	4%	4%	1%	0%	0%	4%	1%
Distillate fuel oil furnaces	0%	0%	0%	0%	0%	0%	0%	0%	0%
Distillate fuel oil boilers	0%	0%	0%	0%	0%	0%	0%	0%	0%
Central air conditioners	4%	4%	3%	3%	2%	1%	11%	3%	6%
Air-source heat pumps	14%	5%	8%	5%	2%	0%	19%	5%	11%
Ground-source heat pumps	25%	10%	8%	6%	7%	9%	4%	5%	2%
Clothes washers (front-loading)	8%	3%	3%	2%	3%	3%	4%	4%	7%
Clothes washers (top-loading)	10%	4%	4%	2%	3%	4%	6%	4%	9%
Natural-gas water heaters	12%	9%	1%	3%	0%	1%	0%	2%	4%
Electric-heat-pump water heaters	26%	26%	15%	12%	13%	7%	21%	9%	23%
Refrigerators (top-mounted freezer)	1%	5%	4%	3%	6%	8%	1%	4%	11%
Refrigerators (side-mounted freezer)	1%	3%	2%	1%	3%	4%	0%	2%	6%
Refrigerators (bottom-mounted freezer)	1%	4%	4%	2%	5%	7%	1%	3%	9%
LEDs (2022)	12%	0%	12%	17%	25%	0%	32%	32%	32%
LEDs (2023)	4%	0%	4%	6%	8%	0%	11%	11%	11%
LEDs (2024)	3%	0%	3%	4%	6%	0%	8%	8%	8%
LEDs (2025)	1%	0%	1%	1%	2%	0%	2%	2%	2%

Data sources: U.S. Energy Information Administration (EIA), *Northeast Regional Energy Efficiency Database (REED) 2021 data update*, September 2024; EIA, *Northeast Regional Energy Efficiency Database (REED), Program and Measure Data: Report on Results of Investigations*, May 2020; EIA, *Assessing Existing Energy Efficiency Program Activity*, June 2018; ENERGY STAR Summaries of Programs; and Consortium for Energy Efficiency (CEE) Program Summaries
Note: We apply rebates to all projection years unless noted otherwise.

Appliance Stock Submodule

The Appliance Stock Submodule is an accounting framework that tracks the quantity and average efficiency of equipment by end use, technology, and fuel. It separately tracks equipment requirements for new construction and existing housing units. For existing units, this submodule calculates the number of units that survive from previous years, allows certain end uses to further penetrate into the existing housing stock, and calculates the total number of units required for replacement and further penetration. Air conditioning, dishwashing, and clothes drying are three major end uses not considered to have fully penetrated all residential housing units.

Once a piece of equipment enters into the stock, the submodule tracks its remaining life. The decay function is based on Weibull distribution shape parameters that approximate linear decay functions. Weibull shapes allow some retirement before the listed minimum lifetime, as well as some equipment to survive beyond its listed maximum lifetime. Values for equipment life scale, shape, and delay parameters are generally sourced from DOE Technical Support Documents.[2] We assume that, when a house is retired from the stock, all of the equipment contained in that house retires as well (in other words, no second-hand market exists for this equipment).

Fuel Consumption Submodule

The RDM calculates energy consumption by multiplying the vintage equipment stocks by their respective UECs. The UECs include adjustments for the:

- Average efficiency of the stock vintages
- Short-term price elasticity of demand and rebound effects on usage (Short-term price effect and efficiency rebound)
- Size of new construction relative to the existing stock
- People per household
- Shell efficiency
- Weather effects (space heating and air conditioning)

The model derives the various levels of aggregated consumption (consumption by fuel, by service, etc.) from these detailed equipment-specific calculations. Consumption at the end-use level includes both electricity purchased from the grid and onsite electricity generation for own use.

Miscellaneous electric loads

Unlike the Technology Choice Submodule's accounting framework, the energy consumption projection of several miscellaneous electric loads (MELs) is characterized by assumed changes in per-unit consumption multiplied by assumed changes in the number of units. In this way, the RDM projects the stock and UEC concepts without the decision-making parameters or investment calculations of the Technology Choice Submodule. The UECs of certain MELs may be further modified beyond their input assumption by factors such as income, square footage, and degree days, where relevant.

Adjusting for the size of housing units

Estimates for the size of each new home built in the projection period vary by type and region, and we base our projection of them on historical data from the U.S. Census Bureau.[3] For existing structures, the RDM assumes that about 1% of households that existed in the RECS base year add about 600 square feet of heated floorspace each year of the projection period.[4] We assume that the energy consumption for space heating, air conditioning, and lighting increases with the conditioned square footage of the structure. This assumption results in an increase in the average size of a housing unit from 1,618 square feet in 2020 to 1,759 square feet in 2050.

Adjusting for weather and climate

Weather in any year always includes short-term deviations from the expected longer-term average (or climate). Recognizing the effect of weather on space heating and air conditioning is necessary to avoid inadvertently projecting abnormal weather conditions into the future. The RDM adjusts space heating and air conditioning UECs by census division using data on heating degree days (HDDs) and cooling degree days (CDDs). A 10% increase in HDDs would increase space heating consumption by 21%, and a 10% increase in CDDs would increase air-conditioning consumption by about 15%.

State-level projections of degree days beyond the most recent historical month of data follow a linear trend using the most recent 30 years of complete annual historical degree-day data, which are then population-weighted to the census-division level. In this way, the projection accounts for projected population migrations across the nation and continues any realized historical changes in degree days at the state level.

Short-term price effect and efficiency rebound

We assume that energy consumption for a given end-use service is affected by the marginal cost of providing that service. In other words, all else equal, a change in the price of a fuel will have an opposite, but less than proportional, effect on fuel consumption. The current value for the short-term elasticity parameter for non-electric fuels is -0.15.[5] This value implies that if the price of fuel increases by 1%, energy consumption will correspondingly decrease by -0.15%.

Changes in equipment efficiency affect the marginal cost of providing a service. For example, a 10% increase in efficiency will reduce the cost of providing the end-use service by 10%. Based on the short-term elasticity, the demand for the service will rise by 1.5% (-10% multiplied by -0.15). We assume that both elasticities and the efficiency rebound effect will affect only space heating, air conditioning, and lighting. For electricity, the short-term elasticity parameter is set to -0.30 to account for deployment of smart grid projects and increased consumer energy price awareness.

Shell efficiency

The shell efficiency of the building envelope (including thermal losses from walls, roofs, doors, and windows) is an important determining factor of the heating and cooling load for each type of household. In the NEMS RDM, shell efficiency is an index that changes over time to reflect improvements in the building envelope. The shell efficiency index is formulated based on the age and type of housing unit, fuel used, end-use service (space heating and air conditioning), and census division.

We classify homes as new (built after the RECS base year) or existing. The most recent RECS represents existing homes, which have a shell index value based on the mix of homes that existed in the base year. The shell efficiency improvement over time of these homes is a function of two factors: an assumed annual efficiency improvement and improvements made when real fuel prices increase. We do not make price-related adjustments when fuel prices fall.

For new construction, the model determines building shell efficiency based on the relative costs and energy bill savings for several levels of space heating and air-conditioning equipment along with the building shell attributes. RDM inputs characterize various *package* choices for new construction, which represent shell performance, space heating and air-conditioning loads, shell costs, and energy efficiency subsidies based on census division, housing type, and equipment type. The packages represented in NEMS include homes that meet the International Energy Conservation Code (IECC);[6] homes that are built with the most efficient shell components; and non-compliant homes that do not meet the IECC. Shell efficiency in new homes increases over time when energy prices rise or the cost of more efficient equipment falls, all else being equal.

Legislation and Regulations

One Big Beautiful Bill Act (OBBBA) (P.L. 119-21)

The H.R. 1 legislation, passed in July 2025, ends various energy efficiency and clean energy investment tax credit (ITC) provisions after 2025 and 2026—including 26 U.S. Code § 25C, 25D, and 45L. See the AEO2026 narrative for a description of distinct OBBBA provisions.

Inflation Reduction Act of 2022 (P.L. 117-169)

The H.R. 5376 legislation, passed in August 2022, extended and expanded various energy efficiency and clean energy ITC provisions. The ITC extension for residential solar photovoltaic (PV), fuel cells, and distributed wind energy generation systems allows a 30% tax credit through 2032 and then a two-year phaseout before expiring in 2035. The tax credits are used to reduce the cost of these DG systems, as well as select renewable and high-efficiency end-use equipment (as covered by the Energy Policy Act of 2005 (EPACT2005)) and new housing units. See the *Issues in Focus*: *Inflation Reduction Act Cases in the AEO2023* and the AEO2023 narrative for a description of distinct IRA provisions.

Infrastructure Investment and Jobs Act (P.L. 117-58)

Passed in November 2021, the Infrastructure Investment and Jobs Act, sometimes referred to as the Bipartisan Infrastructure Law, or BIL, has several energy provisions that are discussed in detail in *The Bipartisan Infrastructure and Jobs Act in the Annual Energy Outlook 2022*. Regarding residential buildings, the law contains spending measures to support expanded rural broadband access and to support state and local energy code adoption, which are intended to promote energy efficiency in buildings. These measures are not explicitly modeled in the RDM but may affect building code adoption and compliance across the United States and MELs penetration in rural areas in future years.

Consolidated Appropriations Act, 2021 (P.L. 116-260)

Passed in December 2020, this act extended the phaseout of ITCs for distributed generation equipment by an additional two years, and residential ITCs end after 2023. We do not apply any safe harbor provisions to distributed generation equipment ITCs in the buildings sector. We assume all systems will be installed within the same calendar year as the relevant ITC rate.

Taxpayer Certainty and Disaster Tax Relief Act of 2019 (H.R. 3301)

Passed in December 2019 as part of the Further Consolidated Appropriations Act of 2020 (P.L. 116-94), this act retroactively extended existing federal 25C tax credits for home energy efficiency upgrades and equipment through 2020.

Bipartisan Budget Act of 2018 (P.L. 115-123)

Passed in February 2018, this act retroactively extended existing federal 25C tax credits for home energy efficiency upgrades and equipment through 2017. It also extended 25D non-solar technology tax credits with the same ramp-down through 2021 as the solar tax credits.

Solar PV tariffs under Section 201 of the Trade Act of 1974 (P.L. 93-618)

Effective February 2018, the United States imposed four-year tariffs on imported solar PV cells and modules. The tariff level is 30% in the first year, declining by 5% per year during the remaining three years. The tariff includes an exemption for 2.5 gigawatts (GW) of PV cells per year and also excludes some developing countries.

Consolidated Appropriations Act, 2016 (P.L. 114-113)

The H.R. 2029 legislation, passed in December 2015, extended the ITC provisions of the Energy Policy Act of 2005 for renewable energy technologies. The five-year ITC extension for solar energy systems allowed a 30% tax credit through 2019. The tax credit then decreased to 26% in 2020, 22% in 2021, and expired after 2021.

American Recovery and Reinvestment Act of 2009 (ARRA2009)

The ARRA2009 legislation, passed in February 2009, provided energy efficiency funding for federal agencies, state energy programs, and block grants, as well as a sizable increase in funding for weatherization. To account for the impact of this funding, we assume that all of the funding was aimed at increasing the efficiency of the existing housing stock. We base the assumptions about energy savings for space heating and air conditioning on evaluations of the impact weatherization programs have over time. Further, we assume that each weatherized house requires a $2,600 investment to achieve the space heating and air-conditioning energy savings estimated by Oak Ridge National Laboratory[7] and that the efficiency measures last about 20 years. We revised down (and further into the future) the assumptions for funding amounts and timing, based on the Inspector General of the U.S. Department of Energy's[8] analysis of the weatherization program.

The ARRA2009 provisions removed the cap on the 30% tax credit for ground-source heat pumps, solar PV, solar thermal water heaters, and small wind turbines through 2016. In addition, the ARRA2009 increased the cap for the tax credits for other energy efficiency improvements, such as windows and efficient furnaces, to $1,500 through the end of 2010. Congress extended several tax credits at reduced credit levels through the end of 2011 as part of the Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010. It further extended these tax credits through the end of 2013 as part of the American Taxpayer Relief Act of 2012, but those tax credits did not exist during 2012 and so were not part of consumers' decision-making process.

Successful deployment of smart grid projects based on ARRA2009 funding could stimulate more rapid investment in smart grid technologies, especially smart meters on buildings and homes, which would make consumers more responsive to electricity price changes. To represent this possibility, we increased the price elasticity of demand for residential electricity for services that could alter energy intensity (for example, lighting).

Energy Improvement and Extension Act of 2008 (EIEA2008)

EIEA2008 extended and amended many of the tax credits that the Energy Policy Act of 2005 (EPACT2005) made available to residential consumers. Residential consumers could continue to claim tax credits for energy-efficient equipment through 2016, but Congress removed the $2,000 cap for solar technologies. In addition, the tax credit for ground-source (geothermal) heat pumps was increased to $2,000. Congress extended the production tax credits for dishwashers, clothes washers, and refrigerators by one to two years, depending on the appliance and efficiency level. The EPACT2005 section includes more details about product coverage.

Energy Independence and Security Act of 2007 (EISA2007)

EISA2007 contained several provisions that affected projections of residential energy use. Standards for general service incandescent light bulbs were phased in from 2012 through 2014, and a more restrictive backstop standard was originally specified for 2020. These standards required an estimated 29% fewer watts per bulb in the first phase-in, increasing to 67% fewer watts in 2020. General service incandescent bulbs became substandard in the 2012–2014 period, so halogen bulbs serve as the incandescent option in the RDM.

Energy Policy Act of 2005 (EPACT2005)

The passage of EPACT2005 in August 2005 provided additional minimum efficiency standards for residential equipment as well as tax credits to producers and purchasers of energy-efficient equipment and builders of energy-efficient homes. EPACT2005 included improved standards for torchiere lamps, dehumidifiers, and ceiling fan light kits. Tax credits were available for manufactured homes that were 30% more energy efficient than the latest code and for homebuilders that built 50% more energy-efficient homes than code required. We assume the builder tax credits and production tax credits were passed through to the consumer as a lower purchase cost.

EPACT2005 included production tax credits for energy-efficient refrigerators, dishwashers, and clothes washers, and consumers could claim a 10% tax credit for several types of appliances, including:

- Energy-efficient natural gas, propane, or distillate fuel oil furnaces and boilers
- Energy-efficient central air conditioners
- Air- and ground-source heat pumps
- Water heaters
- Windows

Consumers could also claim a 30% tax credit for purchases of solar PV, solar water heaters, and fuel cells, subject to a cap.

Notes and Sources

---

[1] For additional details concerning model structure and operation, refer to U.S. Energy Information Administration, *Residential Demand Module—NEMS Documentation*, DOE/EIA-M067.

[2] U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Standards & Test Procedures.

[3] U.S. Census Bureau *Survey of Construction* data from various years of publications.

[4] U.S. Census Bureau, Annual Housing Survey 2001 and Professional Remodeler, *2002 Home Remodeling Study*.

[5] See Dahl, Carol, *A Survey of Energy Demand Elasticities in Support of the Development of the NEMS*, October 1993.

[6] The IECC established guidelines for builders to meet specific targets in energy efficiency for space heating and air-conditioning load.

[7] Oak Ridge National Laboratory*, Estimating the National Effects of the U.S. Department of Energy's Weatherization Assistance Program with State-Level Data: A Metaevaluation Using Studies from 1993 to 2005*, September 2005.

[8] U.S. Department of Energy, Office of Inspector General, Office of Audit Services, *Special Report: Progress in Implementing the Department of Energy's Weatherization Assistance Program Under the American Recovery and Reinvestment Act*, February 2010.