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Electricity: Overview and Issues for Congress

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Electricity: Overview of Congressional Issues

SUMMARY

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Electricity is of perennial interest to Congress, especially the policy issues of reliability, security, affordability, and greenhouse gas emissions.

The electricity sector is made of up three distinct, but interrelated systems. The generation system consists of power plants that generate electricity. The transmission system generally consists of high voltage transmission lines that move power across long distances. The distribution system makes final delivery of electricity to most homes and businesses. These systems are owned and operated by utilities with different ownership structures under different regulatory regimes across the country. Most aspects of electricity are regulated at the state or local level. The Federal Energy Regulatory Commission (FERC) primarily regulates electricity sales for resale in interstate commerce, rates for transmission service across state lines, and the reliability of many parts of the generation and transmission systems.

Market forces, such as capital costs and fuel costs, are key determinants of the *generation mix*, the share of different energy sources used to generate electricity. The U.S. generation mix has been changing since the mid-2000s, driven by declines in prices for natural gas, wind turbines, and solar panels. Federal and state policies and environmental regulations also affect the generation mix.

Multiple factors can potentially disrupt electricity supply, including weather events, cyberattacks, and physical attacks on electricity facilities. Aging infrastructure and the changing generation mix also pose potential reliability risks because of the operational challenges they present. FERC regulates reliability for much of the contiguous United States, though reliability for distribution systems (where most power outages occur) are largely outside of FERC's jurisdiction. The various threats to electric reliability and security can be prepared for, and responded to, in multiple ways. Congress might consider oversight activities related to current electric reliability and security conditions or the current regulatory framework in place to address risks. Improving reliability and security often comes at a cost to consumers. If Congress were to determine that additional reliability and security investments are needed within the electricity sector, Congress might consider how to allocate these costs among electricity consumers, utility shareholders (in the case of private utility companies), and the federal budget.

After adjusting for inflation, residential electricity prices have been stable or falling since about 2010, in large part due to the changing generation mix. This trend may change moving forward as costs for various electricity infrastructure and fuels increase. For example, upgrades to the existing transmission and distribution systems—much of which is at or beyond the end of its useful life—and recovery from natural disasters and other disruptions may lead to cost increases. Additionally, prices for natural gas are higher than they were before the Coronavirus Disease 2019 (COVID-19) pandemic. Higher natural gas prices tend to result in higher electricity prices because of the widespread use of natural gas for electricity generation. While affordability affects all electricity consumers, some are more vulnerable than others. In particular, low-income households spend around three times as much of their income on energy costs than the median household. Anecdotal evidence suggests that electricity disconnections for nonpayment (i.e., shutoffs) have increased since pandemic-related support policies were lifted in 2021. Black and Hispanic households appear disproportionally more likely to experience disconnection than White households. Several federal programs (e.g., the Low Income Home Energy Assistance Program) aim to address affordability by providing financial assistance to consumers. Also, federal incentives exist for technologies that can lower electricity usage through efficiency upgrades, onsite solar generation, or other options. Congress might consider oversight of existing federal programs related to electricity affordability, energy efficiency, and other options to reduce electricity bills. Congress might also consider modifications to existing programs to address topics of concern.

Greenhouse gas emissions associated with electricity generation have generally declined since the mid-2000s because of the changing generation mix. Reducing emissions further would have likely costs and benefits. Costs include those associated with building new power plants, retiring existing power plants before the end of their useful life, and building any necessary infrastructure (e.g., transmission lines). Benefits include reduced impacts of climate change and improved public health through reduced co-pollutants. Indirect costs and benefits include changes in employment in the electricity sector and its supply chain (e.g., fossil fuel production, solar panel manufacturing). Costs and benefits of reducing greenhouse gas emissions in the electricity sector remain a topic of active debate and research. Congress might consider evaluating these costs and benefits or conducting oversight of existing federal incentives for deploying zero-emissions energy sources (many incentives were established or extended in the 117th Congress). Congress might also consider an appropriate economy-wide greenhouse gas reduction goal (if any) for the United States and the role of the electricity sector in achieving any such goal.

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Electricity is central to modern life and is of perennial interest to Congress. This report provides an introduction to the electricity sector and discusses three key policy areas: electric reliability and security, electricity affordability, and greenhouse gas reduction.[1]

Introduction to the Electricity Sector

Generation Mix

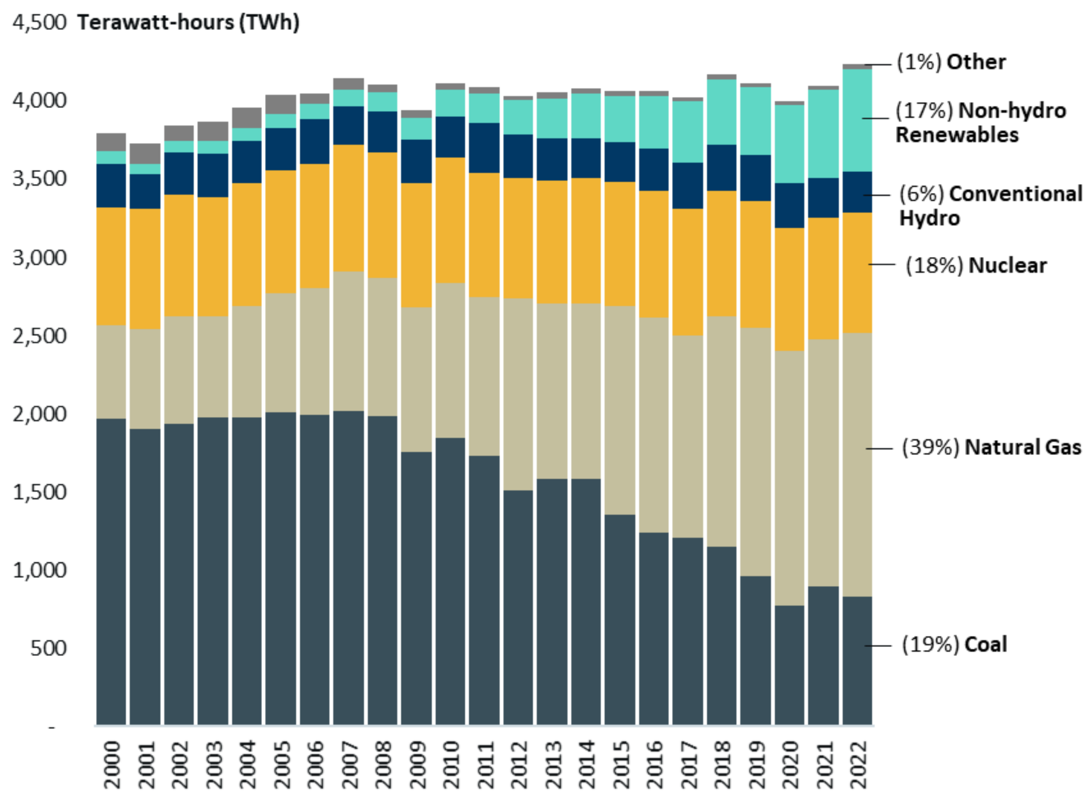
Electricity sector participants generally aim to produce and deliver electricity at the lowest possible cost (though policy support and environmental regulations are also important factors). As a result, the mix of fuels used to produce electricity is strongly influenced by capital and fuel costs.

The *generation mix*, the share of different energy sources used to generate electricity, is changing. Much of this change dates to the mid-2000s when development of U.S. shale gas lowered U.S. natural gas prices by half (or more).[2] Costs for wind turbines began falling at about the same time, due to technology innovation and increased global production. Largely as a result of these market changes, natural gas and wind grew in the U.S. electricity mix starting around 2010 (**Figure 1**). Prices for solar panels began declining a few years later for similar reasons as for wind turbines (i.e., technology innovation and increased global production capacity). The corresponding growth in generation from solar energy lagged growth in wind energy by a few years.

[1] A brief discussion of these policy areas is available in CRS In Focus IF12288, *Energy Transition: Affordability, Emissions, and Security*, by Brent D. Yacobucci, Corrie E. Clark, and Ashley J. Lawson.

[2] For a history of the U.S. natural gas industry, see CRS Report R45988, *U.S. Natural Gas: Becoming Dominant*, by Michael Ratner.

Figure 1. U.S. Electricity Generation by Energy Source, 2000-2022



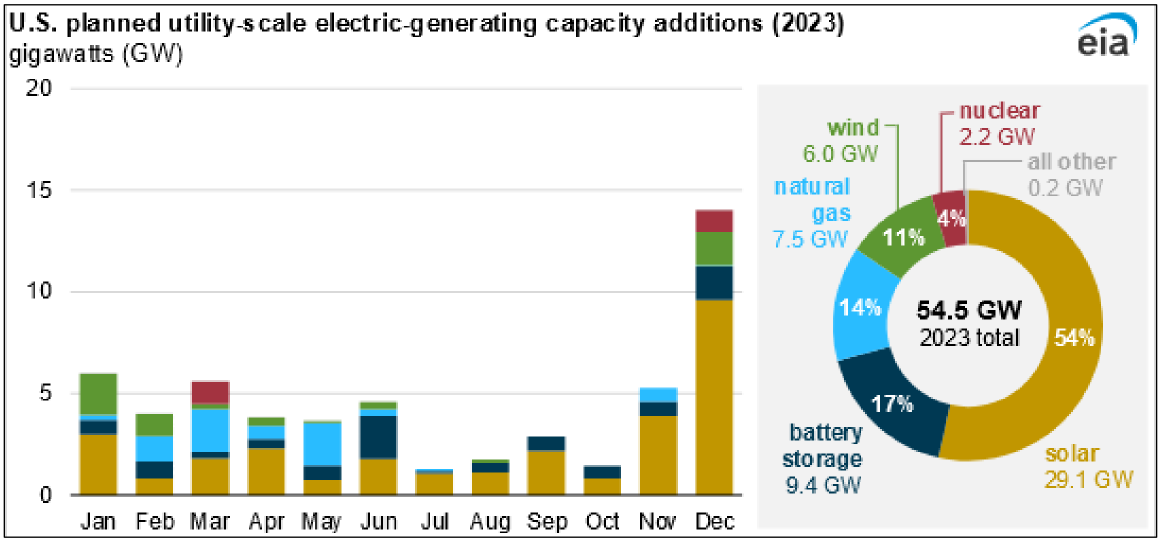
Source: U.S. Energy Information Administration, *Monthly Energy Review*, "Table 7.2a Electricity Net Generation: Total (All Sectors)," and "Table 10.6 Solar Electricity Net Generation," March 2023.

Notes: Other includes petroleum liquids, petroleum coke, pumped storage (which tends to be a negative value), blast furnace gas and other manufactured and waste gases derived from fossil fuels, non-biogenic municipal solid waste, batteries, hydrogen, purchased steam, sulfur, tire-derived fuel, and other miscellaneous energy sources. Non-hydro Renewables includes wood, black liquor, other wood waste, biogenic municipal solid waste, landfill gas, sludge waste, agricultural byproducts, other biomass, geothermal, solar thermal, solar photovoltaic, and wind. Beginning in 2014, EIA reported net generation from small-scale solar photovoltaic facilities that are also included in Non-hydro Renewables.

Wind and solar have now overtaken other energy sources (including natural gas) as the most common option for new power plant construction (**Figure 2**). Batteries are another important energy source, and are motivated, in part, by their ability to *balance* wind and solar. Balancing helps reduce operational challenges that can be caused by the variable nature of wind and solar energy.[3]

[3] For additional information on balancing, see CRS In Focus IF11257, *Variable Renewable Energy: An Introduction*, by Ashley J. Lawson, and CRS Report R45764, *Maintaining Electric Reliability with Wind and Solar Sources: Background and Issues for Congress*, by Ashley J. Lawson.

Figure 2. Planned U.S. Utility-Scale Electricity Generating Capacity Additions, 2023



Source: U.S. Energy Information Administration, "More Than Half of New U.S. Electric-Generating Capacity in 2023 Will Be Solar," February 6, 2023, https://www.eia.gov/todayinenergy/detail.php?id=55419.

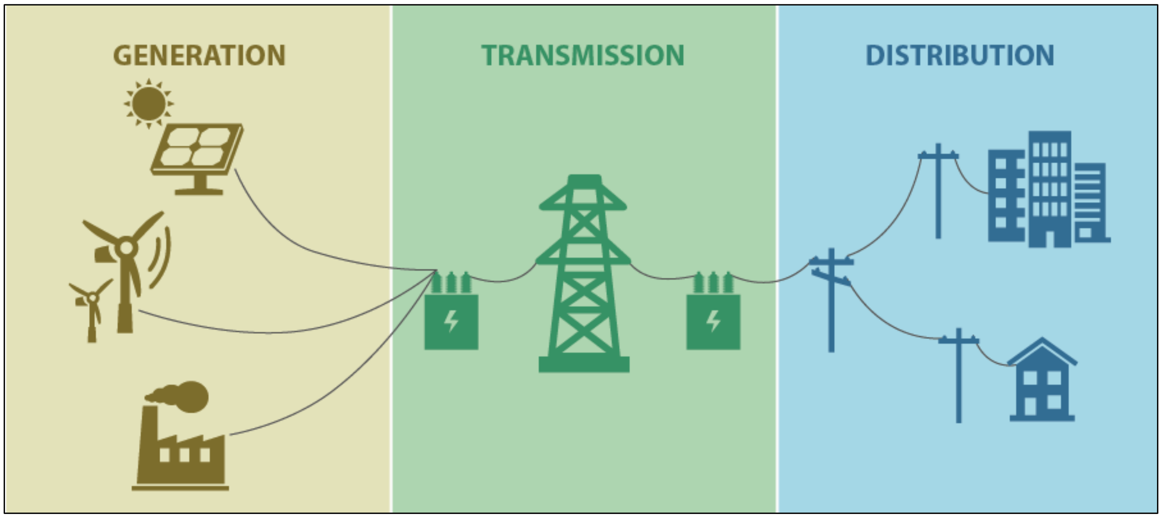
Notes: Does not include planned additions with less than 1 megawatt capacity (e.g., rooftop solar panels).

Ownership Structure and Regulation

The electricity system is made up of three distinct but interrelated systems (**Figure 3**). The generation system consists of power plants that generate electricity. The transmission system consists of high voltage transmission lines and associated equipment that move power across long distances.[4] The distribution system makes final delivery of electricity to most homes and businesses (some businesses with high electricity demand, such as heavy industry facilities, buy power directly from the transmission system).

[4] For additional information about the transmission system, see CRS In Focus IF12253, *Introduction to Electricity Transmission*, by Ashley J. Lawson.

Figure 3. Simplified Schematic of Electric Power Sector Systems



Source: CRS, adapted from U.S.-Canada Power System Outage Task Force, *Final Report on the August 14, 2003, Blackout in the United States and Canada: Causes and Recommendations*, April 2004, p. 5, https://www.energy.gov/sites/prod/files/oeprod/DocumentsandMedia/BlackoutFinal-Web.pdf.

Notes: Not all types of components in each system are shown.

Originally, the electricity system was made up of many vertically integrated utilities in charge of essentially all aspects of these three systems in their service territory, subject to state regulation. In 1935, Congress passed the Federal Power Act, limiting federal jurisdiction to "only those matters which are not subject to regulation by the States."[5] The Federal Power Act established areas of federal jurisdiction as "the transmission of electric energy in interstate commerce" and "the sale of electric energy at wholesale in interstate commerce." The Federal Energy Regulatory Commission (FERC) regulates these areas. Many aspects of electricity that are of interest to Members of Congress and their constituents—retail rates, the generation mix, siting of facilities, and others—are mostly outside of federal jurisdiction under current law.

Three main ownership models exist within the electricity industry.[6] A utility's ownership model affects how it is regulated.

- Investor-owned utilities (IOUs) are private companies that operate on a for-profit basis. State governments allow them to act as monopolies in their service territory, with no competition for electricity distribution. In return, IOUs are subject to regulation and oversight by state public utility commissions (PUCs). Such regulation includes the profits IOUs may earn.
- Publicly owned utilities (POUs, sometimes called municipal utilities or munis) are owned by local governments and operated on a not-for-profit basis. They are not generally regulated by PUCs. Instead, local governments regulate POUs and provide oversight.
- Electric co-operatives (co-ops, sometimes called rural co-ops) are member-owned organizations and operated on a not-for-profit basis. They are typically

[5] 16 U.S.C. §824(a). For a discussion of the jurisdictional boundaries established by the Federal Power Act, see CRS In Focus IF11411, *The Legal Framework of the Federal Power Act*, by Adam Vann.

[6] Other organizations, such as federal power marketing administrations, irrigation districts, and the Tennessee Valley Authority, own and operate electricity infrastructure, but these are special circumstances.

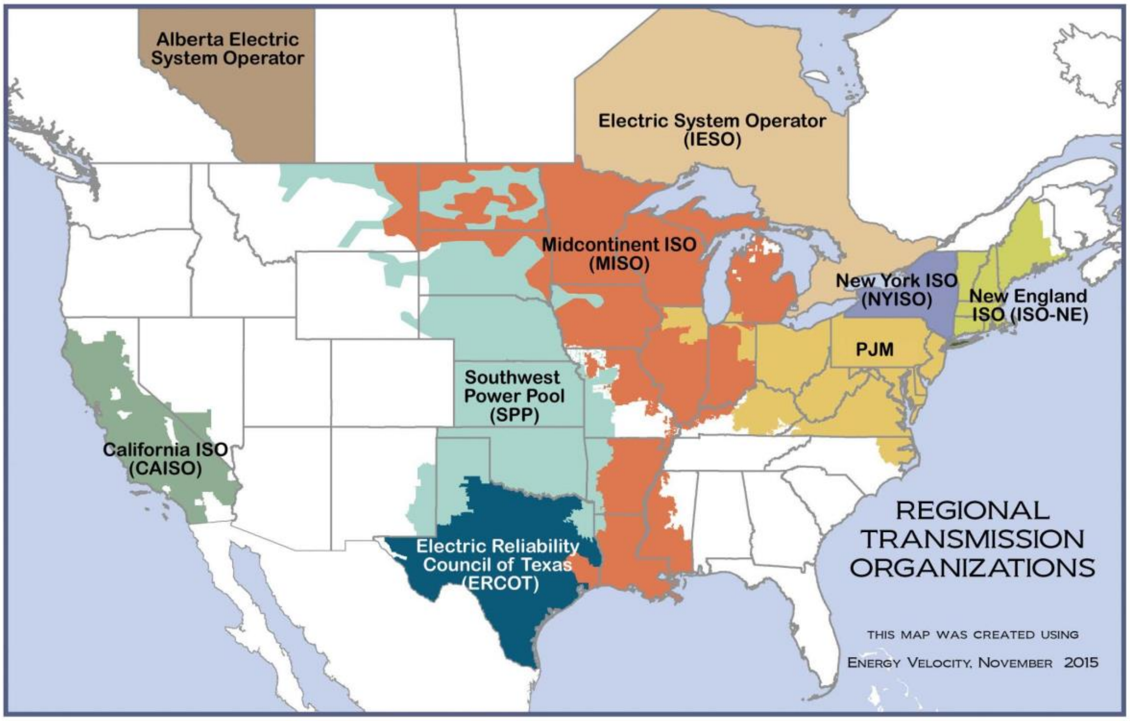
located in rural areas and are not generally regulated by PUCs. Instead, co-op members or their elected boards regulate co-ops and provide oversight.

In 1978, Congress passed the Public Utility Regulatory Policies Act of 1978 (P.L. 95-617), creating a class of non-utility power producers—qualifying small power and cogeneration facilities—which introduced competition for electricity generation. Congress further promoted competition for electricity generation with the Energy Policy Act of 1992 (P.L. 102-486). As a result, in many parts of the United States, the electricity industry began to transition from vertically integrated local monopoly companies to a business model in which power generation is competitive. This transition is called *restructuring* or *deregulation*. However, even when companies compete for generation, the transmission and distribution functions remain primarily operated by utilities regulated by state or local regulators as described above.

In regions with restructured electricity industries, competitive markets largely set the wholesale price of power. These regions are shown in **Figure 4**. What consumers ultimately pay for electricity are based on auctions in regional transmission organization (RTO) or independent system operator (ISO) systems, wherein generators competitively bid to provide energy. Rates for wholesale transactions of RTOs and ISOs are under FERC's jurisdiction (except for ERCOT which manages wholesale transactions solely within the state of Texas). Wholesale electricity generation rates depend upon the market rules and structure of the RTO or ISO, and can have cost components for energy, capacity, ancillary services,[7] operating reserves, and general system costs and regulatory fees. The retail rate consumers pay is the sum of these generation costs plus transmission and distribution costs. While FERC is largely responsible for regulation of the interstate transmission system and wholesale power markets, regulation of the distribution function of the electric power business is still largely carried out by state or local authorities.

[7] Ancillary services are "services that ensure reliability and support the transmission of electricity from generation sites to customer loads. Such services may include load regulation, spinning reserve, non-spinning reserve, replacement reserve, and voltage support." U.S. Energy Information Administration (EIA), "Glossary." For further discussion of ancillary services, see the appendix in CRS Report R45764, *Maintaining Electric Reliability with Wind and Solar Sources: Background and Issues for Congress*, by Ashley J. Lawson.

Figure 4. Regional Transmission Organizations and Independent System Operators



Source: Federal Energy Regulatory Commission.

Notes: FERC does not regulate the electricity industry in Alaska, Hawaii, or U.S. territories.

Electricity Reliability and Security

A stable supply of electricity is widely viewed as being critical to the economy, public health, and other aspects of modern life. Many kinds of events can potentially disrupt electricity supply, including weather events, cyberattacks, and physical attacks on electricity facilities. Aging infrastructure and the changing generation mix also pose potential reliability risks because of the operational challenges they present.

Congress directed FERC to regulate electric reliability, including cybersecurity considerations, in the Energy Policy Act of 2005 (P.L. 109-58). FERC's authority over reliability covers most of the generation and transmission systems in the contiguous United States. Alaska and Hawaii are exempt from federal reliability requirements. FERC oversees electric reliability in coordination with the North American Electric Reliability Corporation (NERC).

Weather events can damage electricity facilities, especially transmission and distribution systems. Prominent events in recent years—hurricanes, wildfires, winter storms, and heat waves—have exposed various vulnerabilities in the electricity system. Numerous options exist to prevent outages from similar events in the future, but they often are more expensive than the status quo. The federal government has provided financial assistance to prepare for and recover from damaging weather events. For example, disaster assistance funds sometimes support electricity system rebuilding, and Congress provided over $10 billion for FY2022-FY2026 for financial assistance for grid reliability and resilience in the Infrastructure Investment and Jobs Act (IIJA; P.L. 117-58), also known as the Bipartisan Infrastructure Law.[8]

Physical or cyberattacks against electricity facilities can also disrupt electricity supply. For example, in December 2022, two separate physical attacks on the electricity system led to power outages for tens of thousands of customers in North Carolina and Washington.[9] A successful cyberattack was reported for an unnamed Western utility in 2019, though the attack did not result in power outages.[10] The electricity system has numerous potential cyber vulnerabilities. The industry, its regulators, and federal agencies have taken a variety of actions to boost cybersecurity, but vulnerabilities remain.[11]

Congress and regulators have responded to reliability and security threats in recent years. For example, in February 2023, FERC approved strengthened reliability standards for extreme cold weather in response to Winter Storm Uri that caused widespread power outages in February 2021.[12] IIJA programs aim to fund upgrades to electricity infrastructure that can improve reliability and resilience. NERC reviewed existing reliability standards related to physical security in response to attacks in late 2022 and identified areas for potential improvement, such as clarification of appropriate risk management activities related to physical security.[13]

Congress could consider options related to electric reliability and security. Options include

- Continued monitoring of electric reliability and security, and oversight as necessary.
- Evaluating the effectiveness of the current regulatory framework.
- Providing additional financial assistance to grid infrastructure owners to prepare for, withstand, or recover from power outages.
- Assessing emerging or increasing threats to electricity reliability (e.g., the changing generation mix, malicious actors within the country and overseas, changing weather and climate conditions).
- Identifying electricity customers most vulnerable to power outages and potential policy options to support them.

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[8] For additional information on grid reliability and resilience funding in the Infrastructure Investment and Jobs Act (P.L. 117-58), see CRS Report R47034, *Energy and Minerals Provisions in the Infrastructure Investment and Jobs Act (P.L. 117-58)*, coordinated by Brent D. Yacobucci, and U.S. Department of Energy (DOE), "Grid Resilience and Innovation Partnerships (GRIP) Program," https://www.energy.gov/gdo/grid-resilience-and-innovation-partnerships-grip-program.

[9] CRS Insight IN12074, *Electric Grid Physical Security: Recent Developments*, by Paul W. Parfomak.

[10] North American Electric Reliability Corporation, *Lesson Learned: Risks Posed by Firewall Firmware Vulnerabilities*, September 5, 2019, https://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/20190901_Risks_Posed_by_Firewall_Firmware_Vulnerabilities.pdf.

[11] U.S. Government Accountability Office, "Securing the U.S. Electricity Grid from Cyberattacks," October 12, 2022, https://www.gao.gov/blog/securing-u.s.-electricity-grid-cyberattacks.

[12] FERC, *Order Approving Extreme Cold Weather Reliability Standards EOP-011-3 and EOP-012-1 and Directing Modifications of Reliability Standard EOP-012-1*, February 16, 2023, https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20230216-3062.

[13] NERC, *Evaluation of the Physical Security Reliability Standard and Physical Security Attacks to the Bulk-Power System*, April 14, 2023, https://www.nerc.com/FilingsOrders/us/NERC%20Filings%20to%20FERC%20DL/NERC%20Report%20on%20CIP-014-3.pdf.

Additional Resources

CRS Insight IN12074, *Electric Grid Physical Security: Recent Developments*, by Paul W. Parfomak.

CRS Report R45764, *Maintaining Electric Reliability with Wind and Solar Sources: Background and Issues for Congress*, by Ashley J. Lawson.

CRS Insight IN11242, *Power Generation and Electric Reliability in the U.S. Virgin Islands*, by Corrie E. Clark.

CRS Insight IN12048, *Electric Power Transformers: Supply Issues*, by Paul W. Parfomak.

CRS In Focus IF12061, *Critical Infrastructure Security and Resilience: Countering Russian and Other Nation-State Cyber Threats*, by Brian E. Humphreys.

CRS Report R47339, *Ensuring Electricity Infrastructure Resilience Against Deliberate Electromagnetic Threats*, by Brian E. Humphreys.

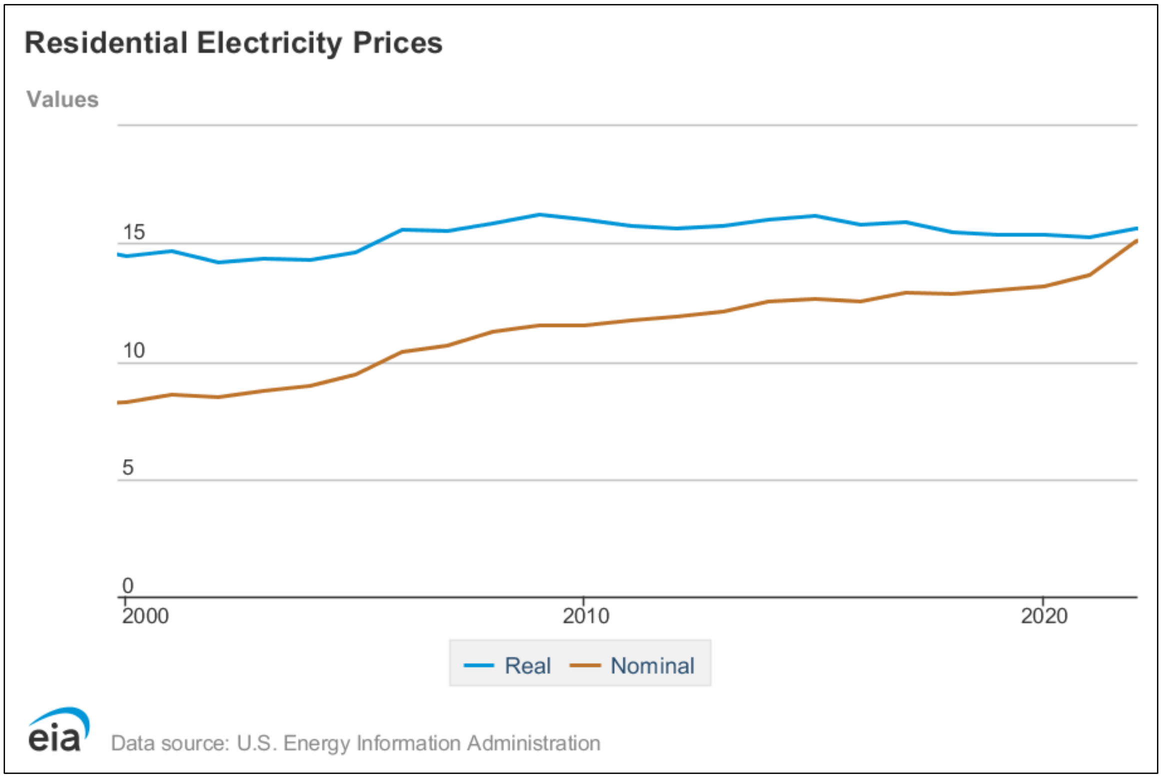
Electricity Affordability

High electricity prices can limit some households' ability to use the amount of electricity they would like and can reduce businesses' profitability. Electricity prices are influenced by the cost of producing electricity and the cost of delivering electricity to customers (i.e., the power lines). Nationally, inflation-adjusted (real) residential electricity prices have been mostly stable or falling since around 2010, driven largely by increasing use of low-cost natural gas. In some areas, prices may increase moving forward as utilities recover costs from repairing damage caused by weather events.[14]

[14] Jennifer Hiller, "Utility Bills Rise as Americans Pay Off Storm-Recovery Costs for Decades to Come," *Wall Street Journal*, December 11, 2022.

Figure 5. Average Annual U.S. Residential Retail Electricity Prices, 2000-2022

Cents per kilowatt-hour



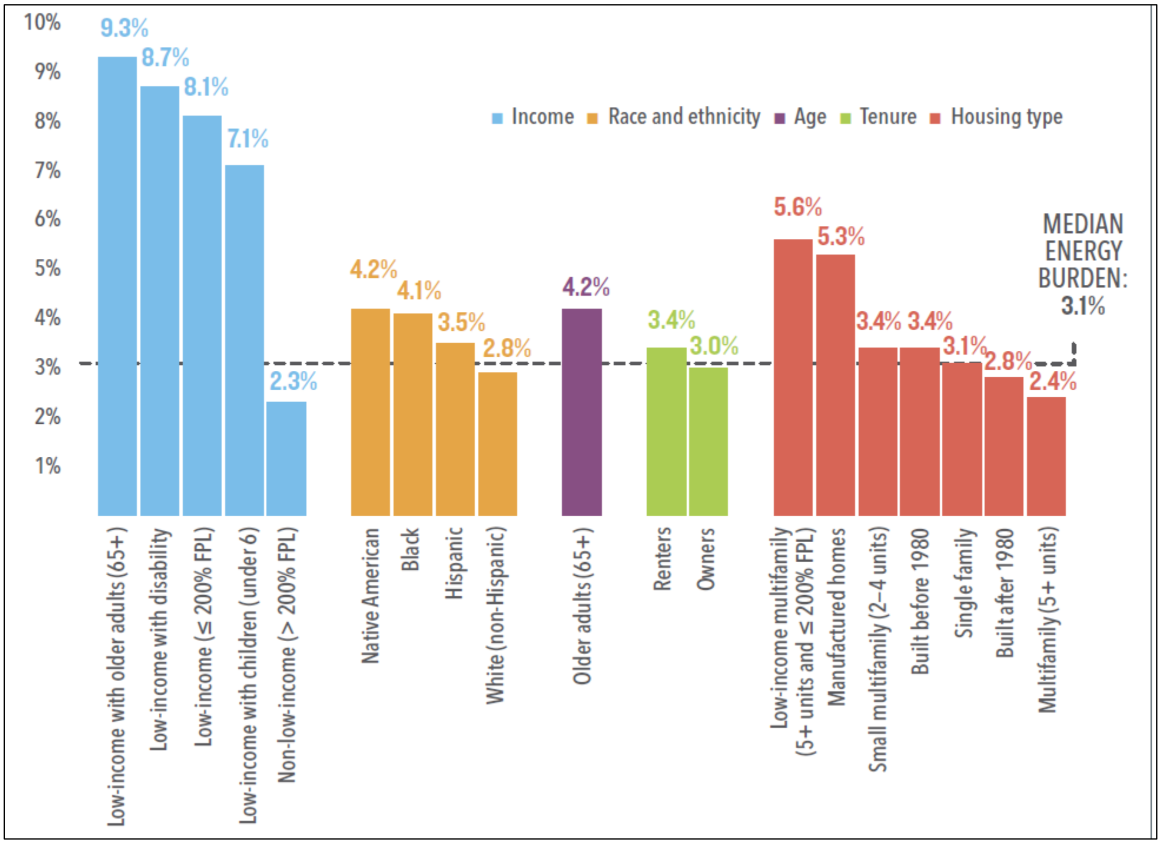
Source: U.S. Energy Information Administration (EIA), *Short Term Energy Outlook*, April 2023.

Notes: Real prices are adjusted for inflation by EIA using the Consumer Price Index for April 2023. Nominal prices are not adjusted for inflation.

The average U.S. household spends around 3% of their income on energy bills (electricity and heating fuels), but this *energy burden* varies among types of households (**Figure 6**).[15]

[15] American Council for an Energy-Efficient Economy, *How High Are Household Energy Burdens? An Assessment of National and Metropolitan Energy Burden Across the United States*, September 2020, p. iii.

Figure 6. Energy Burden by Household Type



Source: American Council for an Energy-Efficient Economy, *How High Are Household Energy Burdens? An Assessment of National and Metropolitan Energy Burden Across the United States,* September 2020.

Notes: FPL = federal poverty level.

Households that have trouble paying their bills can be disconnected for nonpayment. Experts estimate that approximately 1% of U.S. households are disconnected each year.[16] The estimate is somewhat uncertain because comprehensive data have not been reported. In December 2022, Congress directed the U.S. Energy Information Administration to begin collecting information on disconnection, so improved data may be available in the future.[17]

In the early part of the Coronavirus Disease 2019 (COVID-19) pandemic, many utilities and utility regulators banned most disconnections, providing some relief for households facing affordability challenges. By the end of 2021, nearly all these pandemic-related disconnection moratoria had expired, and anecdotal evidence suggests that the pace of disconnections in 2022 met or exceeded pre-pandemic levels.

[16] For more information on disconnections, see CRS Report R47417, *Electric Utility Disconnections*, by Ashley J. Lawson and Claire Mills.

[17] The explanatory statement accompanying the Consolidated Appropriations Act, 2023 (P.L. 117-328) recommends EIA "conduct a monthly survey of electric and heating service providers of final termination notices sent due to bill non-payment, service disconnections due to bill non-payment, and Service reconnections of customers disconnected for bill non-payment, in a form and manner determined by the agency." *Congressional Record*, December 20, 2022, p. S8363, https://www.congress.gov/117/crec/2022/12/20/168/198/CREC-2022-12-20-pt1-PgS7819-2.pdf.

Congress has responded to affordability concerns in recent years. For example, annual and supplemental appropriations to the Low Income Home Energy Assistance Program (LIHEAP) can provide direct financial assistance to eligible electricity customers. Several committees have held hearings on electricity prices and affordability.[18] Additionally, prices and affordability have been prominent topics of debate in the context of major energy bills in the 117th and 118th Congresses.[19]

Congress could consider additional options related to electricity affordability. Options include

- Monitoring the development of federal data collection related to disconnections.
- Providing additional support of energy efficiency or distributed electricity generation (e.g., rooftop solar panels, community solar) as ways of reducing customers' electricity bills.
- Evaluating the effectiveness of federal assistance options for consumers (e.g., LIHEAP).
- Identifying and promoting best practices among the states.
- Providing financial assistance to utilities to reduce potential rate increases utilities might pursue.
- Debating the appropriate role of the federal government in addressing electricity affordability.

Additional Resources

CRS Report RL31865, *LIHEAP: Program and Funding*, by Libby Perl.

CRS Report R47417, *Electric Utility Disconnections*, by Ashley J. Lawson and Claire Mills.

Greenhouse Gas Reduction

The change in generation mix illustrated in **Figure 1** has led to a decline in greenhouse gas emissions from the electricity sector. Emissions declined 36% between 2005 and 2021, falling from 2,456.9 million metric tons of carbon dioxide equivalent (Mt CO_2e) in 2005 to 1,584.1 Mt CO_2e in 2021.[20] Some proponents of climate change action—including President Biden—have called on reducing electricity sector emissions to zero by as early as 2035.[21]

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[18] See, for example, U.S. Congress, Senate Committee on Energy and Natural Resources, *The Reliability, Resiliency, and Affordability of Electric Service in the United States Amid the Changing Energy Mix and Extreme Weather Events*, 117th Cong., March 11, 2021.

[19] See, for example, debate in U.S. Congress, House Select Committee on Climate Crisis, *A Big Climate Deal: Lowering Costs, Creating Jobs, and Reducing Pollution with the Inflation Reduction Act*, 117th Cong., September 29, 2022, and U.S. Congress, House Committee on Energy and Commerce, *Unleashing American Energy, Lowering Energy Costs, and Strengthening Supply Chains*, 118th Cong., February 7, 2023.

[20] Estimates of electricity sector greenhouse gas emissions include emissions from generation, transmission, and distribution. The sector emits several greenhouse gases monitored by the U.S. Environmental Protection Agency (EPA), but carbon dioxide from fossil fuel combustion makes up approximately 97% of total sector greenhouse gas emissions. EPA, *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2021*, April 13, 2023, Table 2-11: Electric Power-Related Greenhouse Gas Emissions (MMT CO2 Eq.).

[21] Executive Order 14008, "Tackling the Climate Crisis at Home and Abroad," 86 *Federal Register* 7619, January 27, 2021, and *White House Fact Sheet: President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies*, April 22, 2021.

Reducing greenhouse gas emissions in the electricity sector would have likely costs and benefits. Costs include those associated with building new power plants, retiring existing power plants before the end of their useful life, and building any necessary infrastructure (e.g., transmission lines). Benefits include reduced impacts of climate change and improved public health through reduced co-pollutants. Indirect costs and benefits include changes in employment in the electricity sector and its supply chain (e.g., fossil fuel production, solar panel manufacturing). Costs and benefits of reducing greenhouse gas emissions in the electricity sector remain a topic of active debate and research.

Researchers have evaluated potential pathways to achieving a zero-emissions U.S. electricity sector (some evaluated achieving this by 2035 and others by 2050).[22] While specific technology pathways and cost estimates vary depending upon researchers' assumptions, studies generally find that a zero-emissions electricity sector would require deployment of wind and solar technologies at a faster pace than has been done to date. Additionally, other sources are likely needed to *balance* wind and solar (i.e., to provide electricity when the wind is not blowing or the sun is not shining). Balancing sources could be battery storage, nuclear, hydrogen, other renewables such as hydropower or geothermal, or, potentially, fossil fuel-fired power plants using carbon capture and storage technology (CCS).[23] Other options to promote balancing include flexible load (i.e., large electricity users that can reduce their consumption in response to changing electricity supply) and expanded transmission capacity.

As discussed in the section "Ownership Structure and Regulation," states have most authority over deciding what energy sources should be used to generate electricity. A number of states have adopted policies requiring zero-emissions electricity by 2050 or earlier. Additionally, some utilities have adopted voluntary goals.[24]

The 117th Congress passed two laws aimed, in part, at reducing greenhouse gas emissions: IIJA and P.L. 117-169, commonly known as the Inflation Reduction Act (IRA). Combined, the new laws promote the use of many low- and zero-emissions technologies across the economy. Within the electricity sector, the laws support renewable energy, energy efficiency, energy storage, nuclear energy, CCS, hydrogen, and others.

Congress could consider options related to greenhouse gas reduction in the electricity sector. Options include

- Evaluating federal incentives for deploying zero-emissions electricity sources, such as those included in IIJA and IRA.
- Considering federal requirements to reduce greenhouse gas emissions from the electricity sector.
- Monitoring developments related to state greenhouse gas reduction policies (e.g., renewable portfolio standards) and voluntary utility goals.

[22] For a summary of major zero-emissions electricity studies conducted between 2019 and 2021, see Table 2 of CRS Report R46691, *Clean Energy Standards: Selected Issues for the 117th Congress*, by Ashley J. Lawson.

[23] Carbon capture and storage (CCS) typically captures up to 95% of carbon dioxide emissions from a point source, so additional reductions may be required if CCS were to be used to achieve zero emissions from the electricity sector. For additional background on CCS, see CRS Report R44902, *Carbon Capture and Sequestration (CCS) in the United States*, by Angela C. Jones and Ashley J. Lawson.

[24] For updates on states and utilities with 100% zero-emissions electricity policies, see the Smart Electric Power Alliance's Utility Carbon Reduction Tracker at https://sepapower.org/utility-transformation-challenge/utility-carbon-reduction-tracker/.

- Identifying an appropriate greenhouse gas reduction goal (if any) for the United States, and the role of the electricity sector in achieving any economy-wide goal.

Additional Resources

CRS Report R47034, *Energy and Minerals Provisions in the Infrastructure Investment and Jobs Act (P.L. 117-58)*, coordinated by Brent D. Yacobucci.

CRS Report R47262, *Inflation Reduction Act of 2022 (IRA): Provisions Related to Climate Change*, coordinated by Jane A. Leggett and Jonathan L. Ramseur.

CRS Report R45913, *Electricity Portfolio Standards: Background, Design Elements, and Policy Considerations*, by Ashley J. Lawson.

CRS Report R46947, *U.S. Climate Change Policy*, coordinated by Richard K. Lattanzio.

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