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Energy Transition: Affordability, Emissions, and Security

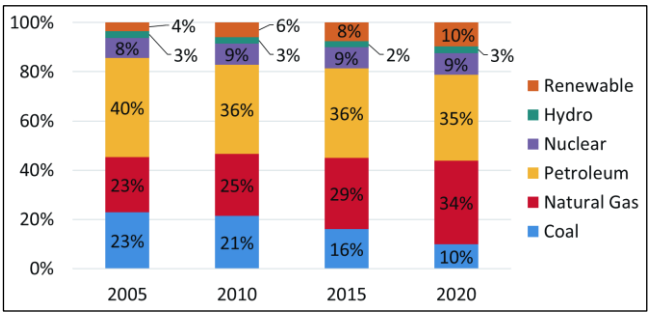
Overview

The United States is undergoing a transition in the energy sector, with a shift in energy supplies and production over relatively short periods of time. Over the last 20 years, natural gas has surpassed coal as the dominant fuel for electricity generation, and the proportion of renewable energy employed has roughly doubled. During this time, the United States became a net exporter of both petroleum and natural gas. This ongoing energy transition, both in fossil fuels and renewable energy, has led to continuing energy policy discussion at all levels.

U.S. energy policy has often focused on three major goals: keeping energy costs low, protecting the environment, and assuring a secure supply of energy. Sometimes, these goals have been competing, sometimes complementary. In pursuit of these goals, government programs have been developed to improve the efficiency with which energy is utilized; to mitigate the detrimental effects of energy supply and use; to promote the domestic production of an array of energy sources; and to develop new sources.

Implementing federal energy programs is often controversial because varying stakeholders have different energy policy priorities. For some, having inexpensive, abundant energy to supply the U.S. economy is the key policy objective. For others, the continued use of fossil fuels, whatever their origin, in the face of their environmental impacts, may be most important. Still others view U.S. (or allied) dependence on foreign energy, particularly from adversaries, as a primary concern.

Figure 1. Share of U.S. Primary Energy Consumption by Fuel Type, 2005-2020



Source: Energy Information Administration, *Annual Energy Review*, November 2022.

Since 2005, U.S. primary energy consumption has held relatively steady while the economy has generally grown (except for occasional dips related to major world events—e.g., in 2009 due to the great recession, and in 2020 due to the COVID-19 pandemic). During that time, the U.S. economy has become more efficient at using energy. Natural gas and renewable energy sources (mostly wind and solar) have replaced coal in the energy mix, primarily as fuel for electricity production, while petroleum demand—mostly for transportation—has declined somewhat. (See **Figure 1**.)

Over the same time period, greenhouse gas emissions from U.S. electric power plants have steadily decreased. Emissions from transportation have declined at a slower rate, and in 2017 transportation emissions exceeded those of electricity for the first time. (**Figure 2**.)

Affordability

In general, U.S. energy policy has sought to ensure supplies of inexpensive, abundant energy to support the U.S. economy and consumers. Policies such as establishing the Strategic Petroleum Reserve (SPR) are aimed at preventing price shocks. Policies promoting oil, natural gas, and renewable energy production on federal lands aim at increasing domestic energy supply. Historically, the United States has also promoted nuclear power through a range of policies to reduce its costs (e.g., nuclear liability insurance, incentive payments). The United States has also enacted a range of tax credits and research programs over time to promote various energy sources. Most recently, the 117th Congress enacted a suite of tax incentives, rebates, and research, development, demonstration, and deployment (RDD&D) programs aimed at reducing the cost of new energy supplies for producers and consumers.

Residential, commercial, and industrial customers' exposure to high and volatile prices has been in evidence in recent years. Events include high gasoline prices in 2022, as well as weather-related spikes in electricity and natural gas prices in Texas in 2021. The extent to which policy tools can address price volatility varies, as prices are driven by a range of factors, including domestic and international energy supplies, trade policies, emissions requirements, state and local taxes, and other regulations, many of which vary by fuel type and end use.

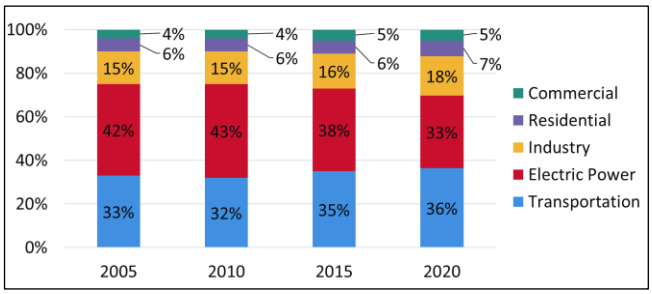
Greenhouse Gas Emissions

Carbon dioxide (CO_2) from combustion of fossil fuels (petroleum, natural gas, and coal) represents the single largest source of U.S. greenhouse gas (GHG) emissions (73% in 2020). Other GHGs include methane and fluorinated gases, which may also be emitted from energy systems. The transportation sector and electric power sector each represent roughly one-third of U.S. GHG emissions from fossil fuel use, and each represent roughly one-quarter of total U.S. GHG emissions.

U.S. GHG emissions have been declining. Total GHG emissions dropped 12% between 2005 and 2019. The electricity sector has led emissions reductions. CO_2 emissions from fossil fuel combustion, a subset of total U.S.

emissions, dropped by 16% over the same time. The Biden Administration has made international commitments regarding GHG reduction. These declines are insufficient by themselves to meet these commitments or the levels many scientists assert are necessary to prevent the most drastic effects of climate change.

Figure 2. Share of Fossil Fuel Combustion CO_2 Emissions by Sector, 2005-2020



Source: Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2020*, April 2022.

Note: Total CO_2 emissions from fossil fuel combustion reduced 16% from 2005 to 2019 and 24% through 2020 (onset of the COVID-19 pandemic).

Policies enacted that directly or indirectly reduce GHG emissions from energy supply and use include efficiency standards; incentives and other policies directed at increasing renewable energy; nuclear power initiatives; hydrogen research, development, and demonstration; funding to advance carbon capture and storage (CCS); and policies to promote vehicle electrification and charging infrastructure.

Security

Energy security can have many facets. For some stakeholders, the primary aim of energy policy is to limit imports of energy, particularly petroleum, in support of U.S. jobs and economic development. For others, guaranteeing a reliable supply of energy from diverse sources, be those domestic or foreign, is a priority. For still others, energy security is viewed as a geopolitical tool to protect the national interests of the United States and its allies against its adversaries. Some stakeholders see reductions in fossil fuel use as key to promoting U.S. security. Other potential concerns are the reliance on critical mineral imports for renewable energy, battery, and other technologies, as well as the domestic and international supply of critical infrastructure equipment, such as electric transformers.

Over time, U.S. policies on energy security have shifted. For example, the relative importance of U.S. fuel stockpiles has waxed and waned. U.S. crude oil production increased starting around 2010. Responding to that increase, along with a mismatch between the specifications of U.S.-produced crude oil and refineries along the Gulf of Mexico, in 2015 Congress lifted the ban on U.S. crude oil exports. U.S. crude oil or refined products (e.g., gasoline and diesel fuel) may be freely exported; exports of natural gas to non-Free Trade Agreement nations must be deemed in the national interest before they are approved.

Following the invasion of Ukraine in February 2022, there is increased commitment to supplying U.S. liquefied natural gas (LNG) to U.S. allies in the region. U.S. capacity to liquefy and transport natural gas, and Europe's capacity to receive that fuel, is insufficient to completely replace Russian supply. In 2022, a shift in U.S. LNG shipments to Europe largely came with reduced shipments to other allies, as opposed to an overall increase in LNG exports.

Actions in the 117th Congress

The 117th Congress enacted three major laws to promote the transition from conventional fossil fuels—the predominant energy source in the 20th century and into the 21st century—to newer energy sources, both fossil and non-fossil.

- The Infrastructure Investment and Jobs Act (IIJA, P.L. 117-58) appropriated roughly $80 billion for various energy-related programs, including efficiency, electric grid modernization, vehicle electrification, hydrogen, nuclear energy, and CCS.
- P.L. 117-167 (often referred to as the CHIPS and Science Act) authorized roughly $68 billion for basic science, advanced nuclear, low-emissions steel production, and critical minerals research, development, and demonstration, among other topics. Funding has not been appropriated for these authorizations.
- P.L. 117-169 (often referred to as the Inflation Reduction Act, or IRA) established or expanded an estimated nearly $400 billion in tax credits for renewable electricity production, alternative fuels, and low-emission vehicles; home energy rebate programs; and Department of Energy loans and loan guarantees, among other provisions.

Issues for the 118th Congress

Key issues that may be raised in the 118th Congress, particularly related to oversight, include:

- the effectiveness of programs established, expanded, and/or funded in the 117th Congress;
- the effect of newer energy sources on the economics (including consumer affordability and employment, among others) of U.S. energy supply;
- the effect of the energy transition on U.S. greenhouse gas and other emissions, and the sufficiency of new technology and policy to meet U.S. emission targets;
- options to use U.S. resources to foster energy security among its allies, particularly in Europe; and
- the extent to which a transition from traditional to new energy sources will promote the interconnected goals of affordability, environment, and security.

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