Highlights of GAO-25-107172, a report to congressional requesters

April 2025

TECHNOLOGY ASSESSMENT

Artificial Intelligence

Generative AI's Environmental and Human Effects

Why GAO did this study

Generative AI uses large amounts of energy and water. Additionally, generative AI may displace workers, help spread false information, and create or elevate risks to national security. The benefits and risks of generative AI are unclear, and estimates of its effects are highly variable because of a lack of available data. The continued growth of generative AI products and services raises questions about the scale of benefits and risks.

GAO was asked to conduct a technology assessment of generative AI effects, particularly its risks. GAO examined: (1) potential environmental effects of generative AI technologies, (2) potential human effects of generative AI technologies, and (3) what policy options exist to enhance the benefits or mitigate the environmental and human effects of generative AI technologies.

What GAO found

Generative artificial intelligence (AI) could revolutionize entire industries. In the nearer term, it may dramatically increase productivity and transform daily tasks in many sectors. However, both its benefits and risks, including its environmental and human effects, are unknown or unclear.

Generative AI uses significant energy and water resources, but companies are generally not reporting details of these uses. Most estimates of environmental effects of generative AI technologies have focused on quantifying the energy consumed, and carbon emissions associated with generating that energy, required to train the generative AI model. Estimates of water consumption by generative AI are limited. Generative AI is expected to be a driving force for data center demand, but what portion of data center electricity consumption is related to generative AI is unclear. According to the International Energy Agency, U.S. data center electricity consumption was approximately 4 percent of U.S. electricity demand in 2022 and could be 6 percent of demand in 2026.

While generative AI may bring beneficial effects for people, GAO highlights five risks and challenges that could result in negative human effects on society, culture, and people from generative AI (see figure). For example, unsafe systems may produce outputs that compromise safety, such as inaccurate information, undesirable content, or the enabling of malicious behavior. However, definitive statements about these risks and challenges are difficult to make because generative AI is rapidly evolving, and private developers do not disclose some key technical information.

Selected generative artificial antelligence risks and challenges that could result in human effects

Source: GAO analysis and illustration. | GAO-25-107172

View GAO-25-107172. For more information, contact Brian Bothwell at BothwellB@gao.gov or Kevin Walsh at WalshK@gao.gov.

GAO identified policy options to consider that could enhance the benefits or address the challenges of environmental and human effects of generative AI. These policy options identify possible actions by policymakers, which include Congress, federal agencies, state and local governments, academic and research institutions, and industry. In addition, policymakers could choose to maintain the status quo, whereby they would not take additional action beyond current efforts. See below for details on the policy options.

Policy options that could enhance the benefits or address the challenges of environmental and human effects of generative artificial intelligence (AI).

Policy options	Example implementation approaches	Opportunities and considerations
4.1 Environmental Effects		
Maintain status quo (report page 29)	• Continue technical innovations in hardware. • Continue technical innovations in algorithms and models. • Continue current federal agency efforts.	• Technical innovations may address some challenges described in this report without additional resources. • Current efforts may not fully address the challenges described in this report, given the existing knowledge gaps and uncertain future demand of generative AI.
Improve data collection and reporting (report page 29)	• Encourage industry to share the environmental effects of building and disposing of their equipment. • Developers could provide information such as model details, infrastructure used for training and using generative AI, energy consumption, carbon emissions, and water consumption.	• Efforts to address gaps in understanding of environmental effects can assist policymakers in identifying specific environmental effects to address. • Industry and developers may not wish to release information they view as proprietary. • As generative AI becomes integrated into industry products and services, differentiating between energy and water use by generative AI, other AI, and non-AI capabilities could be difficult.
Encourage innovation (report page 30)	• Government could encourage developers and researchers to create more resource-efficient models and training techniques. • Industry and researchers could increase efforts to develop more efficient hardware and infrastructure to reduce energy and water use.	• Development of technical methods to reduce environmental effects may need improved data collection and reporting by industry. • Industry may resist developing new innovations until development, engineering, and economic costs are better understood.
4.2 Human Effects		
Maintain status quo (report page 30)	• Government policymakers are taking various policy actions to begin efforts aimed at understanding and addressing human effects of artificial intelligence.	• Existing policy actions relevant to AI in general, some of which are not fully implemented, may not fully address the specific human effects of generative AI challenges identified in this report.
Encourage use of AI frameworks (report page 31)	• Developers could create acceptable use policies that inform a product's user community of policies they must adhere to while using the developer's product. • Government could encourage the use of available frameworks, such as GAO's AI Accountability Framework and National Institute of Standards and Technology's AI Risk Management Framework.	• Developers can use these frameworks to manage risks and challenges of generative AI development and use and to increase public transparency and other trustworthiness characteristics. • Internal testing and external, independent review methods applying frameworks may be insufficient, costly, and time-consuming. • Available frameworks may not sufficiently address human effects brought by new technology developments in generative AI.
Share best practices and establish standards (report page 32)	• Industry or other standards-developing organizations could identify the areas in which best practices and standards would be most beneficial across different sectors or applications that use generative AI technologies.	• This could require adoption of knowledge sharing mechanisms to share best practices for the management of human effects challenges. • Consensus from many public- and private-sector stakeholders can be time- and resource-intensive.

Source: GAO. | GAO-25-107172