

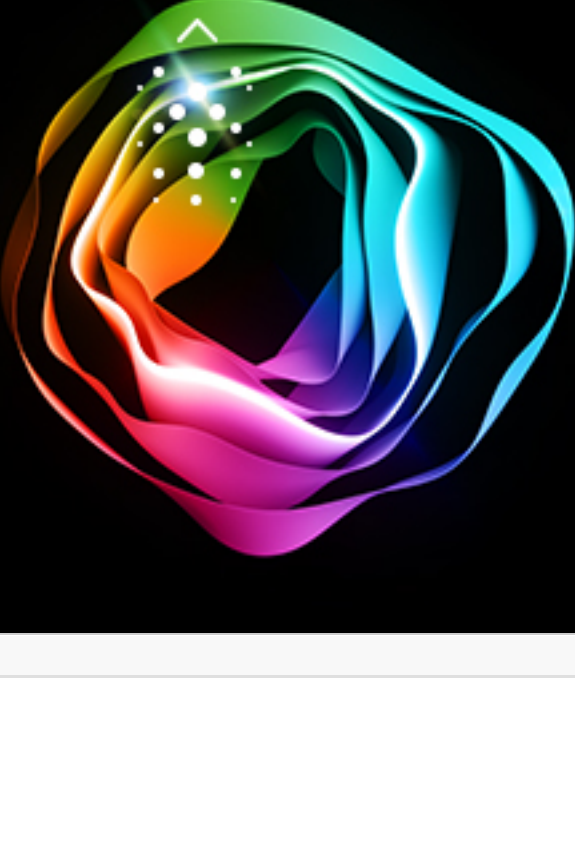
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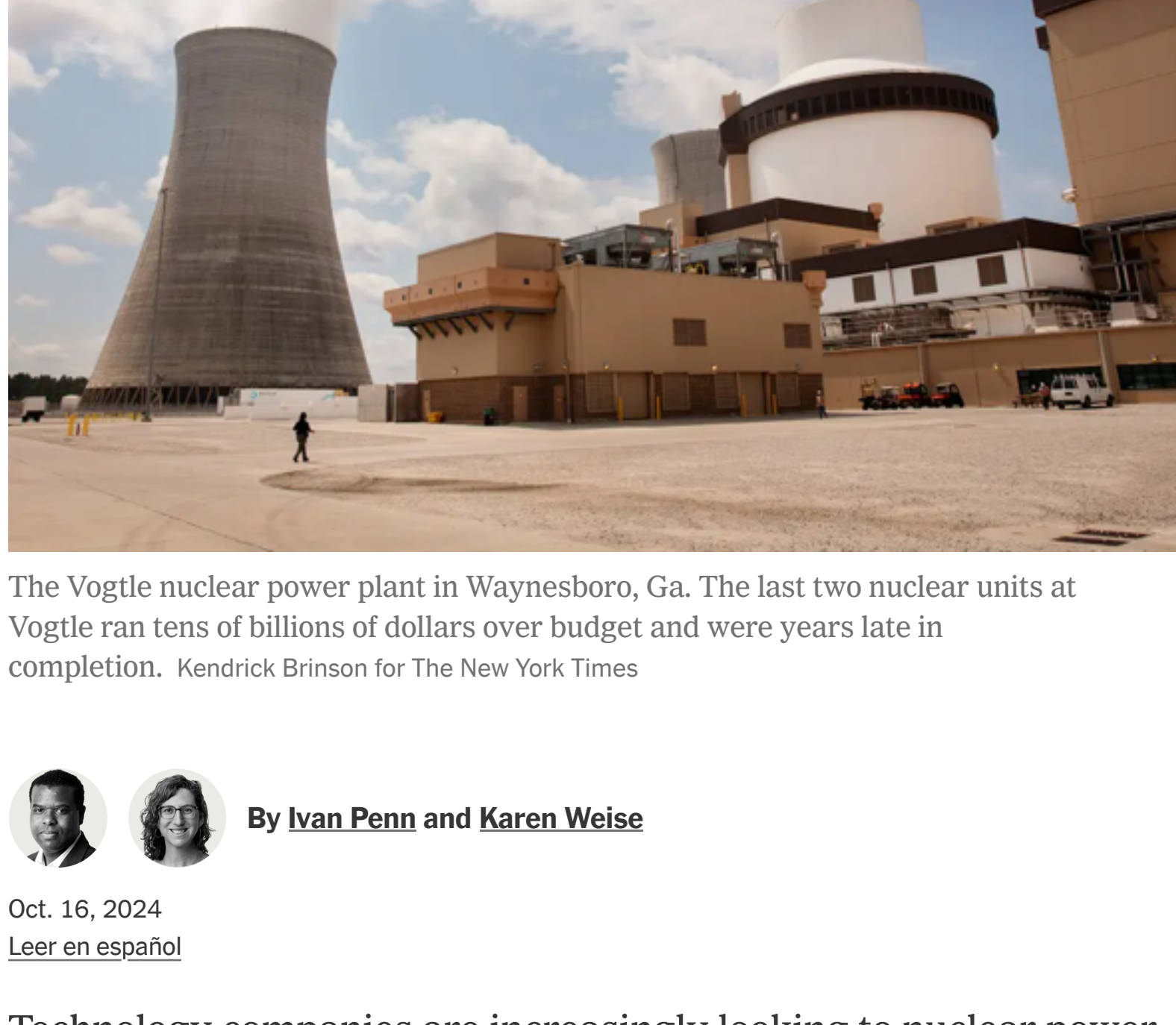
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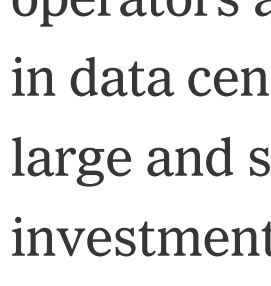
Hungry for Energy, Amazon, Google and Microsoft Turn to Nuclear Power

Large technology companies are investing billions of dollars in nuclear energy as an emissions-free source of electricity for artificial intelligence and other businesses.

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The Vogtle nuclear power plant in Waynesboro, Ga. The last two nuclear units at Vogtle ran tens of billions of dollars over budget and were years late in completion. Kendrick Brinson for The New York Times

 By [Ivan Penn](#) and [Karen Weise](#)

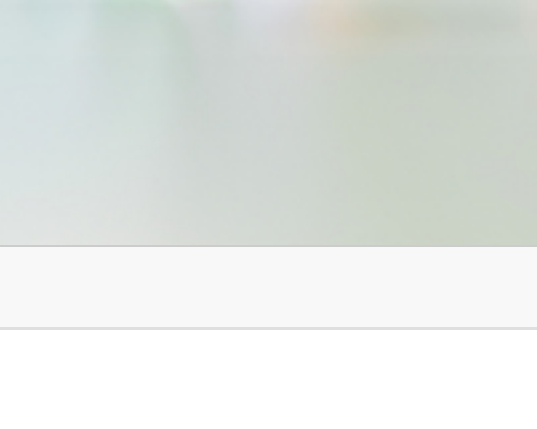
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Technology companies are increasingly looking to nuclear power plants to provide the emissions-free electricity needed to run artificial intelligence and other businesses.

Microsoft, Google and Amazon have recently struck deals with operators and developers of nuclear power plants to fuel the boom in data centers, which provide computing services to businesses large and small. The demand has accelerated because of the big investments these and other tech companies have made in A.I., which requires far more power than more conventional technology businesses like social media, video streaming and web searches.

Microsoft has agreed to pay an energy company to revive the shuttered [Three Mile Island nuclear power plant](#) in Pennsylvania. And this week, Amazon and Google said they were focusing on a new generation of small modular reactors. That technology has not yet been successfully commercialized but energy experts say it might be cheaper and easier to build than the large nuclear reactors that the United States has built since the 1950s.

Big technology companies, which previously invested a lot in wind and solar energy, are now gravitating toward nuclear energy because they want power that is available around the clock while producing no greenhouse gas emissions. Wind and solar don't contribute to climate change but are not available at all times without the help of batteries or other forms of energy storage. The biggest tech companies have all made pledges to power their operations with emissions-free power by 2030, but those commitments came before the boom in artificial intelligence, which has demanded more energy.



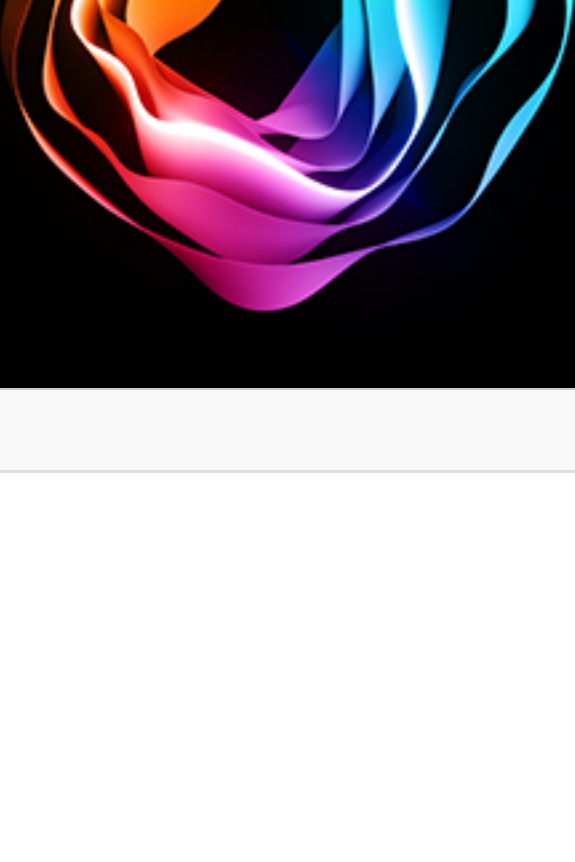
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“They have a desire to grow all this in a sustainable way, and at the moment the best answer is nuclear,” said Aneesh Prabhu, a managing director at S&P Global Ratings.



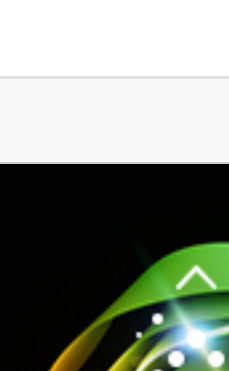
On Monday, Google said that it had agreed to purchase nuclear energy from small modular reactors being developed by a start-up called Kairos Power, and that it expected the first of them to be running by 2030. Then Amazon, on Wednesday, said it would invest in the development of small modular reactors by another start-up, X-Energy. Microsoft's deal with Constellation Energy to revive a reactor at Three Mile Island was announced last month.

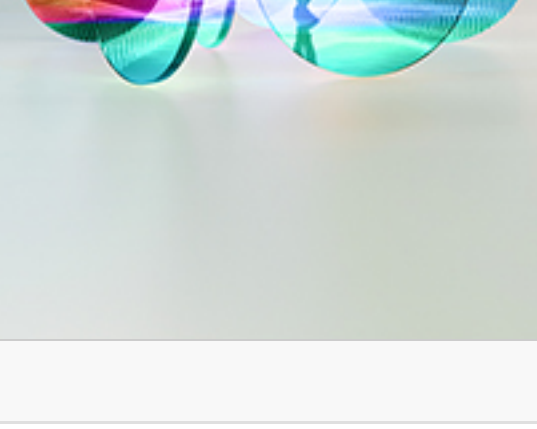
Mr. Prabhu said that small modular reactors could cost about \$1 billion each to build and that it might one day be feasible to place them next to data centers.

Technology companies are not alone in championing nuclear energy. President Biden recently [signed a law](#) passed by bipartisan majorities in Congress that its authors say will hasten the development of new nuclear energy projects.

The Biden administration sees nuclear power, which provides about 20 percent of the nation's electricity now, as critical to its goals of reducing greenhouse gas emissions. That's a change from the past when many Democrats opposed new nuclear plants because of safety, environmental and economic concerns.

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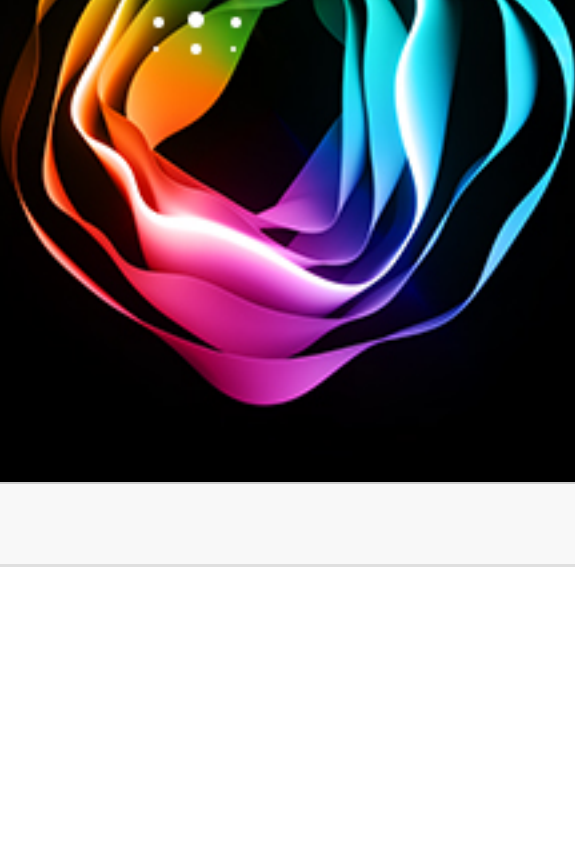
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“Revitalizing America's nuclear sector is key to adding more carbon-free energy to the grid and meeting the needs of our growing economy — from A.I. and data centers to manufacturing and health care,” the energy secretary, Jennifer M. Granholm, said in a statement.

The tech industry's backing of nuclear projects could help reinvigorate a power source that has struggled. With [94 active nuclear power plant reactors](#), the United States operates more units than any other country, but just two have been built here in recent decades. Both of the units were constructed at the Vogtle nuclear power plant in Waynesboro, Ga., but ran tens of billions of dollars over budget and were years late.

Behind the Journalism

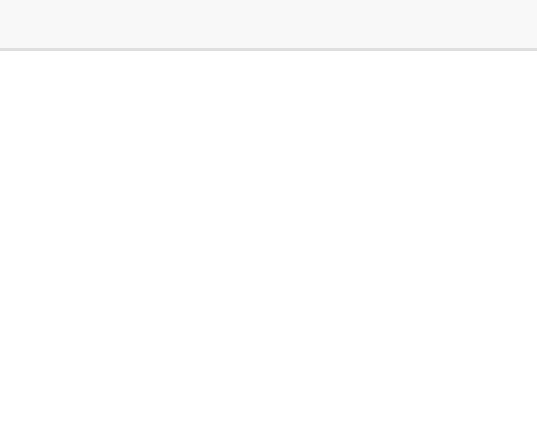
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The two units were part of a widely anticipated “nuclear renaissance” that was projected to result in about two dozen new reactors. But those ambitions fizzled in large part because of Vogtle's problems and [a failed nuclear power project in South Carolina](#).

Technology industry executives say this time will be different, and some have staked their personal fortunes on that belief. Microsoft's co-founder Bill Gates has invested more than \$1 billion in a start-up called [TerraPower](#), which is working to develop smaller reactors in partnership with Warren Buffett's utility company PacifiCorp.

The idea is that the components of each unit could be small enough to be mass-produced on an assembly line, making them cheaper. Each power plant could start with one or a few reactors, with more added over time.



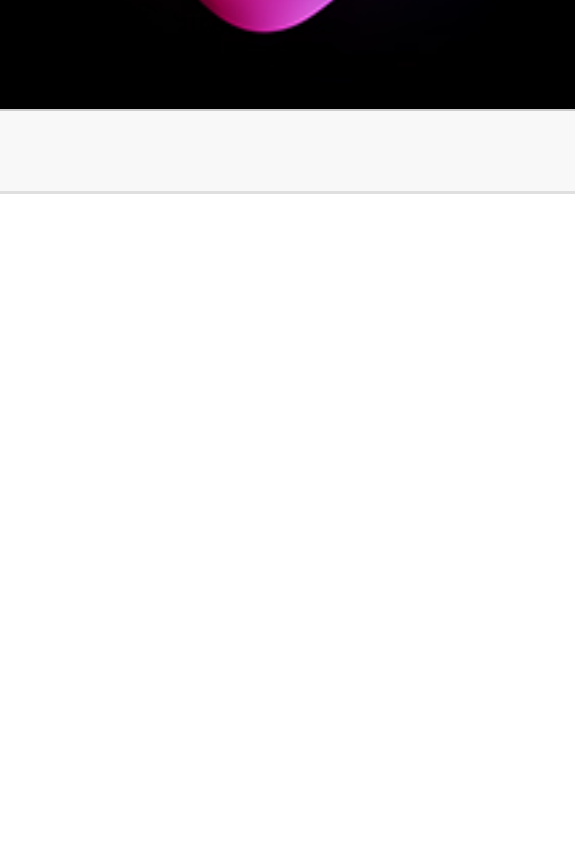
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“The key with nuclear is you have to pick something and build a lot of it to make it cheap,” said Rich Powell, the head of the Clean Energy Buyers Association, a trade group whose members include big tech companies.

But critics of nuclear energy are skeptical. They argue that while the pitch from utilities and the tech companies may sound appealing, it does not address longstanding problems with nuclear energy. Those problems include the high cost of new reactors, construction delays and the lack of a permanent storage site for spent nuclear fuel.

“Since 1960, the U.S. has attempted to build 250 power reactors,” said Arnie Gundersen, a chief engineer at Fairwinds Energy Education, a nonprofit that opposes nuclear power. “More than half were canceled before generating any electricity. Of the remaining reactors, not one was ever completed on time and on budget.”

Still, many tech and energy executives say nuclear is essential because renewable sources of power like wind, solar and hydroelectric are not reliable enough to meet the growing needs for energy.

Electricity use has already been growing in recent years as individuals and businesses turn to battery-powered vehicles, heat pumps and air-conditioners. Now the tech industry's data centers are turbocharging that growth.




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While data centers make up a small percentage of global energy consumption, their share is growing and they tend to be concentrated in certain regions, like Northern Virginia, where they can stress local grids.

Data centers use electricity to run — and, most critically, cool — computer servers. Power is so crucial for data centers that the industry talks about the size of a building based not on its square footage but on the amount of megawatts it has secured from utilities.

It takes about five to 10 kilowatts to power a single rack of servers in a typical data center, but a rack filled with advanced A.I. computing chips can demand well over 100 kilowatts, Raul Martynek, the chief executive of DataBank, a data center company, said in a recent interview. “From an infrastructure perspective, it is an order of magnitude more intensive,” he said.

The tech giants [have stepped up their spending](#) to stunning levels, in large part to meet the demand and potential they see for A.I. The five largest tech companies, including Alphabet, Microsoft and Amazon, spent a combined \$59 billion on capital expenses in the last quarter alone, 63 percent more than a year earlier. And they have signaled to investors they plan to keep spending.

Amazon this year spent \$650 million to buy a data center campus under development that will be directly powered by an existing nuclear power plant in Pennsylvania. In addition to the Three Mile Island deal, Microsoft has agreed to buy power from Helion Energy, a Seattle-area start-up seeking to build the world's first nuclear fusion power plant by 2028.

Ivan Penn is a reporter based in Los Angeles and covers the energy industry. His work has included reporting on clean energy, failures in the electric grid and the economics of utility services.

Karen Weise writes about technology and is based in Seattle. Her coverage focuses on Amazon and Microsoft, two of the most powerful companies in America.

A version of this article appears in print on Oct. 17, 2024, Section B, Page 1 of the New York edition with the headline: Tech Firms Are Turning To Reactors. [Order Reprints](#) | [Today's Paper](#) | [Subscribe](#)

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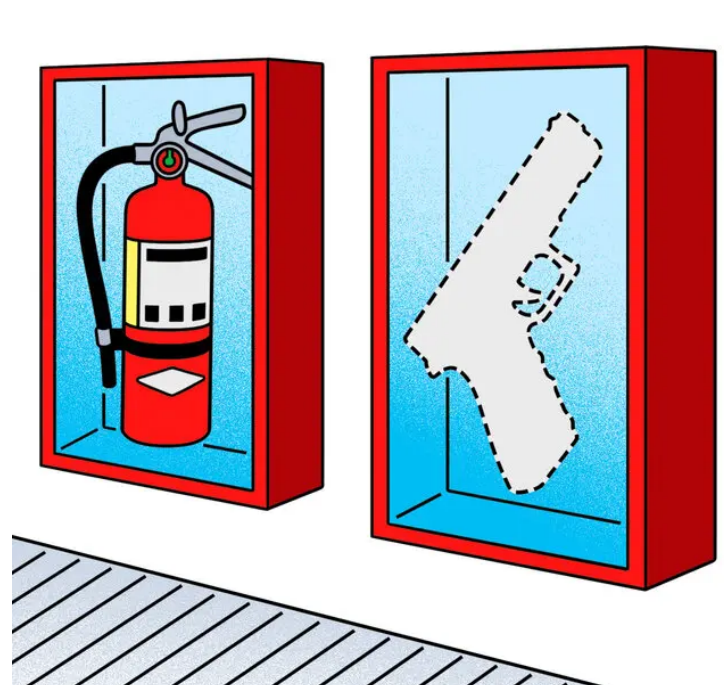
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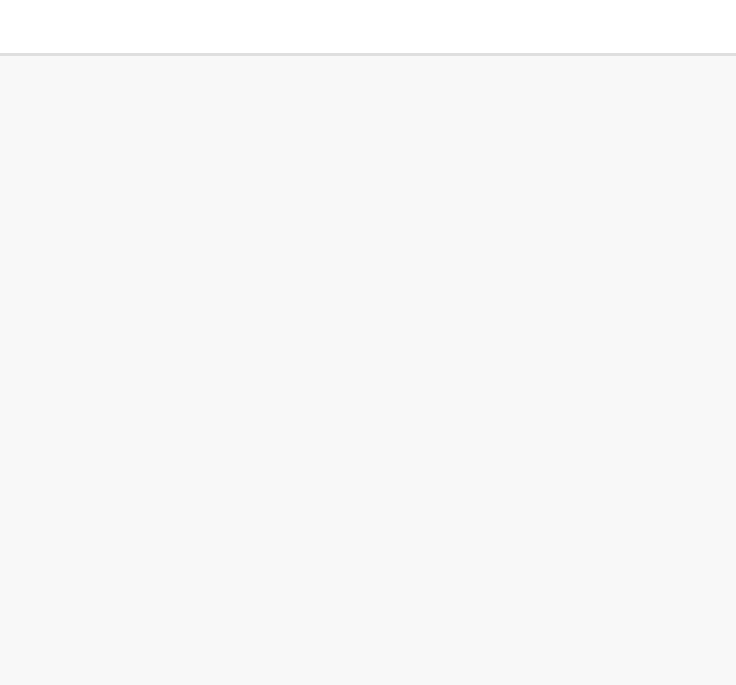
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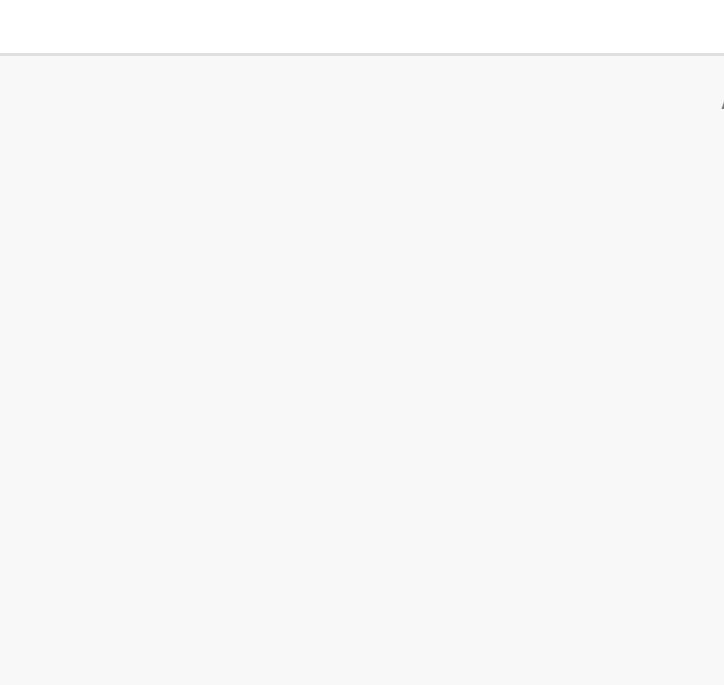
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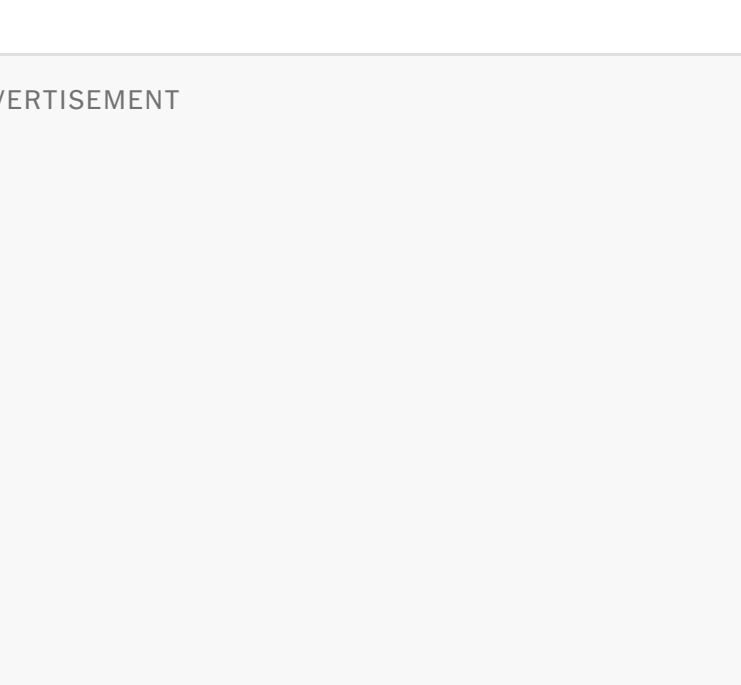
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