



Top Ten Energy Stories of 2022

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1

Russia Invades Ukraine

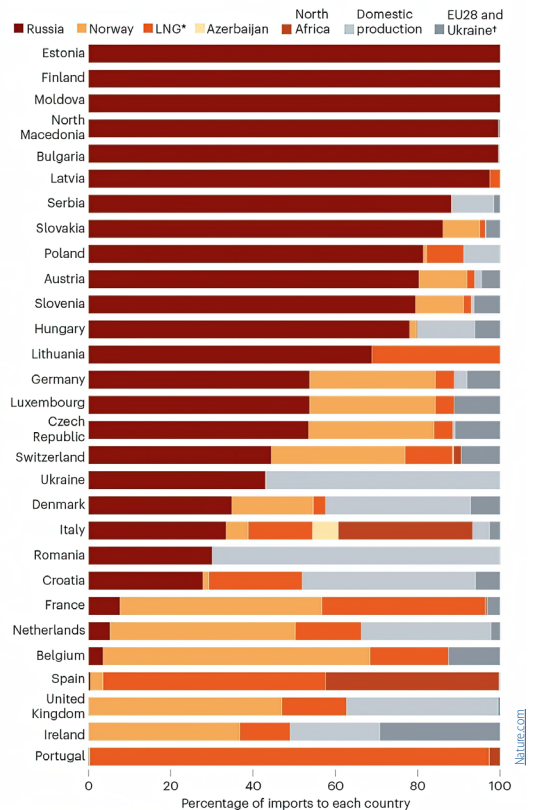
Russia's invasion of Ukraine precipitated high energy prices globally and exacerbated a European energy crisis that was already underway.

On 24 February 2022, Russia invaded Ukraine. As Russia's aggression escalated, many countries imposed sanctions and many international companies made efforts to sever ties with the aggressor. For example, [Shell, BP, and Equinor pledged to exit their Russian operations](#). The invasion has contributed to volatile prices for [natural gas](#), [coal](#), [oil](#), and [gasoline](#), and has [reshaped the world's energy markets](#).

Prior to the start of the war, Europe imported approximately [40% of its gas from Russia](#), with [former Soviet territories generally importing more](#) than others. However, prior to the invasion [Germany imported the most gas of any European Union country](#). Following Russia's actions in Ukraine, [Germany nixed its plans for Nord Stream 2](#), a nearly complete pipeline that would have doubled the amount of Russian gas sent to Germany. Pipeline construction began in 2018—after Russia annexed Crimea—and finished in September 2021, but the [certification process was put on hold in November](#) as Russia began stationing troops at Ukraine's border. In February 2022, the process was [halted completely](#). The EU ultimately banned new investments in the Russian energy sector, which was part of an EU-wide effort to end dependence on Russian gas by 2030. Stepping up to fill the gap, [exports of LNG](#) (liquefied natural gas) from the United

WHERE EUROPE GETS ITS GAS

Russia supplies about 40% of the natural gas to the European Union overall, but many individual countries receive a much higher proportion.



*LNG, liquefied natural gas imports.
 †Does not include nation's own production. The UK left the EU28 in January 2020.
 Sources: Bruegel/European Network of Transmission System Operators for Gas/Eurostat/UK Government/Government of Ukraine ©nature

States could potentially play a role in helping to further or completely reduce imports of Russian gas in Europe. For its part, the [United States banned imports of Russian oil, liquefied natural gas, and coal](#) and the G7 imposed a [price cap](#) of \$60 per barrel of Russian crude starting in late December 2022.

While European nations have mostly pledged to reduce imports of Russian oil, gas and coal after the invasion, other global customers—namely China and India—continue to buy Russian energy resources, blunting the blow to the Russian economy. While global oil prices are elevated, some Russian oil cargoes have been [selling for a discount](#) given many countries' refusal to buy it. The continued disruption of energy supply to Europe and expanding threat of a broader conflict has the continent on the precipice of plunging into one of the most challenging geopolitical situations in decades.

The cascading geopolitical effects are numerous. China's state-run Sinopec Group, in response to heavy sanctions, suspended discussions to [invest up to \\$500 million in the new gas chemical plant in Russia](#). Sinopec would have partnered with Russia's largest

petrochemical producer Sibur for the project. However, a [minority shareholder and board member of Sibur, Gennady Timchenko, had been sanctioned](#) following the Russian invasion. Sanctions limit financing options for the project, making its future untenable. Sinopec also [halted discussion over a Russian gas marketing venture](#) as one of the shareholders of potential partner Novatek has been sanctioned by the US, as well.

The ongoing conflict thrust the energy-security nexus on full display when a vulnerable network of undersea pipelines were sabotaged in September 2022. Three major sections of underwater natural gas pipelines in the Baltic Sea, part of the Nord Stream 1 and 2 conduits, were [damaged in late September in what appears to be sabotage by an unknown actor](#). Seismologists in Denmark and Sweden registered [two blasts](#) under water near the leaks. The three sections of pipe contained about [778 million cubic meters of natural gas](#), whose release amounted to about [1/1000th of estimated annual global methane emissions](#) and the [largest single release of methane](#) into the atmosphere from the energy sector. ●

Mystery leaks reported from Nord Stream gas pipelines



Sources: European Network of Transmission System Operators for Gas (ENTSOG); Danish and Swedish maritime authorities
Prasanta Kumar Dutta | Reuters, Sept. 27, 2022

2

Washington DC Makes Energy and Climate History

After years of debate, federal policymakers pass the largest energy infrastructure and climate legislation in history.

In August 2022, the US Congress passed the Inflation Reduction Act (IRA), a major piece of legislation that will have lasting impacts on the energy sector. The bill, alongside the Infrastructure Investment and Jobs Act (IIJA) passed in late 2021, includes significant changes for clean energy, electrification, and environmental justice that is projected to help [reduce energy bills](#) and drive reductions in greenhouse gas emissions in the energy sector [by as much as 43% compared to 2005](#).

While the [IIJA's GRIP Program](#) will help upgrade the electric grid across the US to improve capacity and increase grid reliability, the IRA aims to bolster electric transmission, through [loans and loan guarantees for construction and updates](#). Transmission is a key component of achieving a [net zero economy in the US](#) and is a key part of expanding electrification and the continued adoption of distributed energy resources, two major priorities of the IRA. The bill makes big



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strides in clean energy, including clean energy tax credits and home electrification rebates. The bill [expands the scope of federal production and investment tax credits](#) to allow any new zero-emissions technology to qualify for either. Additionally, [to increase clean energy equity](#), the tax credits have bonuses for locating zero emissions projects in “[energy communities](#)”. The IRA includes [\\$9 billion in home energy rebate programs](#) as well as tax credits for electric appliances like energy efficient heat pumps and water heaters. The IRA also includes billions of dollars in investment tax credits and loans to support clean tech manufacturing, including solar, wind, and electric vehicles.

Both the IIJA and the IRA provide pathways for bolstering the development of clean hydrogen and carbon capture utilization and storage. The IIJA authorizes [\\$9.5 billion in grants for research and scaling of hydrogen](#) in the US while the IRA provides production and

investment tax credits that can help reduce clean hydrogen costs. The IIJA includes [\\$6.5 billion for carbon management](#) while the IRA provides [funding for CCUS and increases the availability of tax credits](#) for CCUS projects.

The IIJA and the IRA together pave the way for major transmission and clean energy investments. [Rapid deployment of these resources over the next decade is needed](#), but permitting issues could slow down development. There is [bipartisan support for reform](#) as it could speed up the federal review process for all projects, including clean energy, transmission, carbon capture, and fossil fuel extraction. However, advocates worry [shortening the permitting process could reduce public input](#). Two permitting reform bills have been filed by Sens. Joe Manchin (D-W. Va.) and Shelley Moore Capito (R-W.Va.). Whether Congress will be able to come to an agreement on permit reform in 2023 remains to be seen. ●

3

Grids in Crisis

Between domestic attacks on energy infrastructure by extremists and extreme weather such as freezes, droughts, hurricanes and floods, electricity grids are in crisis.

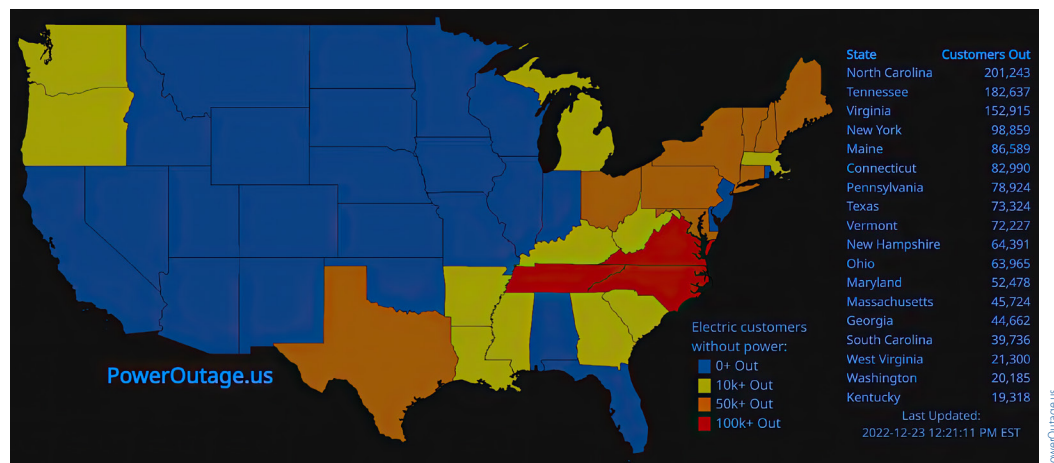
ERCOT skirted through multiple heat waves and freezes without shedding load. Florida's grid was hammered hard by Hurricane Ian in September. Eastern grids struggled with December 2022 winter storms, forcing offline 3+ GW of coal plants in the TVA service area alone. Heat and drought again strained the California grid because of low hydroelectric output and wildfire risk.

Californians experienced an epic heatwave in September 2022, with [record-setting triple digit temperatures](#). The heat forced multiple [fossil fuel generators out of service](#) while the [drought limited water supplies to hydroelectric generators](#). The extended high temperatures meant residents were under a [statewide Flex Alert calling for voluntary energy conservation in the evenings for over a week](#). California Independent System Operator (CAISO) [declared Stage 1 and Stage 2 emergency alerts](#) signaling expected shortages and

activating emergency generators and other urgency measures, respectively.

On [Tuesday September 6, 2022, CAISO issued a Stage 3 emergency alert](#), indicating imminent potential for rolling blackouts. CAISO reported [peak demand reached 52,061 megawatts](#), exceeding the previous peak demand of [50,270 MW set in 2006](#) but did not order blackouts. However, [three Northern California cities did experience power outages](#) and thousands of customers in California were left without power. Voluntary collaboration by consumers to shed several gigawatts of power demand helped CAISO avoid a larger power crisis.

Not all grid troubles were weather related. In early December 2022, two Duke Energy substations in Moore County North Carolina were attacked, leaving [40,000 homes and businesses without power](#) for multiple days in cold winter temperatures. The attackers [disabled](#)



[the substations with gunfire](#), breaching a gate at one. The incidents were [investigated by local, state, and federal law enforcement](#). Copycat attacks in [Oregon and Washington](#) occurred in the subsequent days and weeks.

The attacks highlight the physical vulnerability of US power grid infrastructure as well as the rising rate of these attacks. Between January and August 2022, there were 70 electric incidents or disturbances attributed to physical attacks, sabotage, or vandalism

[reported to the Department of Energy](#), a [75% increase compared to all of 2015](#). These kinds of domestic energy infrastructure terrorism [are not new](#). A [congressional report from 2014](#) reported a large number of ways to damage infrastructure, specifically transformer substations. Relatively inexpensive [protections such as sandbags and better view-blocking fencing could help](#) prevent some of these types of attacks. ●

4

Renewables Experience Growing Pains

Renewables continue their meteoric rise globally, but also hit their own obstacles of higher prices, community pushback, questions about sourcing of critical materials, and scrutiny from policymakers who consider them a threat to fossil fuels.

Texas alone added [6,060 megawatts of solar power in 2021](#), which was similar to national and global trends for growth in renewables. The trend is expected to continue through 2023 as consumers seek cleaner options that are quick to build. Incentives in the Inflation Reduction Act should reduce costs for solar for customers and utility-scale developers, further propelling future solar installation.

While this growth has many desirable features, global supply chain constraints are increasing prices for renewable energy, perpetuating the largest cost increase ever experienced for these technologies. In April, LevelTen estimated costs for wind and solar panels increased by nearly [30% in a year](#). In June, BloombergNEF estimated that since 2021 the cost to build fixed axis solar and on-shore wind [increased by 14% and 7%](#), respectively.

Input materials saw higher prices and more scrutiny on labor and environmental conditions for their sourcing. The cost of shipping and the price of materials used in renewable energy manufacturing like steel and polysilicon has increased amid supply chain issues perpetuated by the coronavirus pandemic. Steel, used in racking for solar panels, [increased 215%](#) in price between March 2020 and the summer of 2021, but has since declined. Polysilicon, used in solar cells, [increased in price by 175%](#). Shipping costs increased [over 500% due to both the pandemic and extreme weather](#). [Increased fuel and labor costs](#) also contributed to the increased cost of renewable energy. Moreover, governments and customers are raising the alarm about the national security concerns of depending on non-friendly nations for critical minerals and the labor and environmental justice aspects of their mining and enrichment. ●

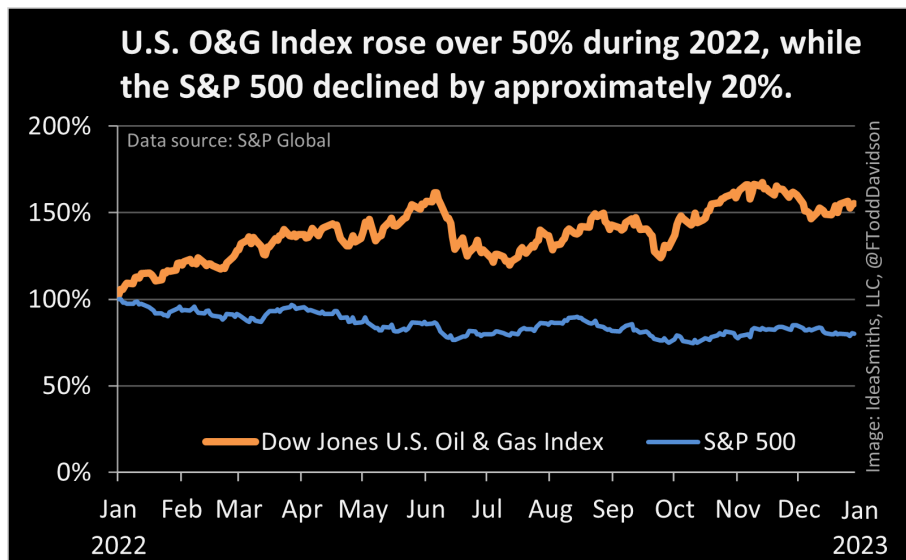
5

O&G Revenues, Shares & Profits Up

An ongoing post-COVID economic recovery and European energy crisis followed by the Russian invasion of Ukraine caused energy prices to skyrocket, bringing oil and gas industry revenues and profits with them.

Energy demand rebounded from the depths of COVID, which caused tightness and high prices in the markets, all of which were exacerbated by the Russian invasion of Ukraine. As a consequence, energy prices rose, creating more revenues and profits for active producers. The Dow Jones U.S. oil and gas index saw [a 56% rise in value](#) from January to December 2022. During the same period of time, the S&P 500 declined by [nearly 20%](#).

A supportive policy environment and higher prices and profits put the O&G industry on strong financial footing for investments in carbon management and hydrogen, all of which accelerated in 2022 with passage of the IRA. Multinational O&G companies made major announcements for [new hydrogen facilities](#) and launched partnerships for direct air capture. ●



6

US Army Climate Strategy

In light of the U.S. military's conclusion that climate change is a threat multiplier, the Assistant Secretary of the Army for Installations, Energy and the Environment developed a climate strategy that will produce profound change in how the Army operates and the impact that it has on the natural landscape.

The United States Army developed [a new climate strategy](#), paving the way for a major change in how the Army operates and its impact on the environment. The Army sees climate change as a threat to security—[due to extreme weather events, high temperatures, and other hazards increasing risk to military operations](#)—and has developed the [U.S. Army Climate Strategy](#) to reduce its impact and proactively consider security implications. The release of the climate strategy comes on the heels of other critical guidance from both civilian and military leadership, including [Army Directive 2020-03](#), Executive Orders [14008](#) and [14057](#), the [Defense Climate Adaptation Plan](#), previous [Quadrennial Defense Reviews](#), and other strategic reports that have identified climate change as a threat multiplier.

With this strategy, the Army aims to achieve 50% reduction in its net greenhouse gas emissions by 2030, compared to 2005 levels, and net-zero by 2050. The Army plans to achieve these goals by focusing on

operationalizing climate adaptation and mitigation practices in three main areas: installations, acquisitions and logistics, and training.

The majority of emissions attributable to the Army are associated with electricity and heating demand at installations, as well as fuel consumption for powering non-tactical and tactical vehicles. Operational energy demand for the Army (e.g., consumption of jet fuel for Abrams tanks) accounted for [approximately 10%](#) of energy consumption across the four major branches of the U.S. military, as of 2020; the majority of the remaining energy consumption is for powering aircraft. The Army also sustains over a hundred domestic installations that require reliable supplies of [electricity and natural gas](#). This energy consumption has direct impacts on the environmental footprint of the Army and creates vulnerabilities to the threat of disrupted energy supplies. These vulnerabilities also have critical implications for maintaining access to clean water to sustain personnel in austere environments. To address these challenges the climate



U.S. Army photo by Pfc. Lisa Marie Miller

A U.S. Army Green Beret with 1st Special Forces Group (Airborne) sets up solar panels for operational communications at the National Training Center, Fort Irwin, California. The solar panels enable special operations forces to operate their equipment in the most remote locations and continue training forward of conventional forces while moving as a team through rough desert terrain, simulated ambushes and limited communications.

strategy includes targets such as improvements to building control systems, providing 100% carbon-pollution-free electricity for Army installation needs by 2030, significant reductions in operational water use by 2035, and fielding an all-electric non-tactical vehicle fleet by 2035 and fully electric tactical vehicles by 2050. There remain significant challenges to achieving these goals, including developing the capability for [MW-level](#) charging of tactical vehicles in combat environments. One

option under consideration is the deployment of mobile nuclear reactors, funded under [Project Pele](#) that might have significant implications for development of commercial small modular reactors.

Despite the significant hurdles of the U.S. Army Climate Strategy, it also catalyzes specific goals that could move the Army towards a future that reduces environmental impacts of military operations while simultaneously increasing resilience and military capability. ●

7

Nuclear Power Captures Public Interest Again

With new nuclear power plants under construction, existing plants granted lifetime extensions, and a new buzz around fusion, nuclear is front page news again.

Headlines about a nuclear renaissance have been wrong for over a decade, yet it seems like the current convergence of events have given nuclear power a more positive brand and relevance in 2022. Climate concerns and the Russian invasion of Ukraine, which induced high energy prices, triggered some lifetime extensions or delayed closures. Nuclear plants in [California](#) and [Germany](#) whose closures were delayed helped reduce stress on the power grid during [record setting peak demand in California](#) and amid [gas supply constraints in Europe](#). Other notable events include fueling at Southern Company's Vogtle power plant, which is poised to operate near capacity starting in the first quarter of 2023.

Energy companies Brookfield Renewable and [Cameco](#) formed a partnership to purchase nuclear services company [Westinghouse Electric Co.](#) in a [\\$7.9 billion deal](#). The companies touted the [resurgence in nuclear energy and the need for this type of electricity](#) in a net zero future as motivation for this deal. Globally, nuclear power capacity is increasing. [Sixty reactors are under construction in 15 countries](#).

However, nuclear power still faces obstacles. Generators in France suffered operational challenges with higher temperatures and drought during a summer heatwave, limiting cooling supplies and [constraining their output](#) while others were out for [repairs and scheduled maintenance](#) that had been delayed by the coronavirus pandemic. International Atomic Energy Agency inspectors investigated [reactors in Ukraine following emergency shutdown](#) due to shelling during Russia's invasion of the country.

Fusion is also one of the year's most interesting science and business stories. Scientists at the National Ignition Facility reached a critical milestone by generating more energy with fusion than was applied with multiple lasers at the point of ignition. While not anywhere near commercial deployment, nuclear fusion offers the potential for massive amounts of clean electricity without the radioactive waste issues that plague the nuclear fission fuel cycles we utilize today. Fusion startups also [attracted billions of dollars of venture capital money](#), which is a hint that the markets think fusion is getting closer to market-ready. ●

8

Electric Vehicles Take Center Stage

Electric vehicle market share was already growing rapidly, but U.S. federal policies will accelerate that growth further.

After years of lagging behind China and Europe, the market for electric vehicles in the USA is starting to grow more quickly. Incentives in the Inflation Reduction Act will likely inspire even more rapid uptake by consumers.

Importantly, though Tesla has dominated the market for EVs for many years, other name brand manufacturers such as Ford, GM, and Volkswagen are producing or about to produce multiple popular vehicle types, such

as SUVs and [pickup trucks](#) and are poised to claw back some of Tesla's position. And, despite Tesla's share price [falling almost 70%](#) this year on inflation and higher interest rate fears, many analysts remain bullish in the space. Many manufacturers are also making [significant investments](#) for batteries and manufacturing supply chains as part of the encouragement from recent federal legislation, including an [extension of the EV tax credit](#). ●



IdeaSmiths' own Dr. Michael E. Webber contributed to the growth of EVs in 2022 with the purchase of a new Ford Mustang Mach-E.

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The Year of the Heat Pump

With Europe scrambling to reduce reliance on Russian gas, consumers, buildings, and homeowners are looking to electrify home heating. Heat pumps are a modern day opportunity to do so.

With Europe scrambling to reduce reliance on Russian gas, which accounted for about [40% of European Union gas consumption](#) at the start of 2022, homeowners are looking for electric solutions for space and water heating. Compared to conventional units, heat pumps [consume about 40% less energy](#). They are also a major linchpin of electrifying the commercial and residential sectors and reducing related carbon emissions as touted [in recent net zero studies](#). Buildings account for about 38% of EU gas use, so phasing out this demand could play a significant role in reducing dependence on Russian gas while also furthering decarbonization goals.

Heat pumps experienced [record high growth in Europe, the United States, and China](#) in 2021, with further growth in 2022. Climate-friendly regulations and a drive to decrease gas demand amid supply constraints have propelled demand for heat pumps in Europe over the last few years. The European

Heat Pump Association estimated about [25% growth in 2021](#) and the German heat pump market [grew by 28%](#), partially due to a [carbon tax on heating fuels](#). The Polish Heat Pump Association reported about [60% growth](#) the same year, mainly due to regulations phasing out coal heating in homes. The United States is not experiencing the same drivers yet heat pump demand was still strong. In 2021, the air source heat pump market grew by 15%. The market adoption of heat pumps might increase as manufacturers begin to roll out solutions for highly efficient operation down to temperatures as low as -5°F (-21°C), as well as increasingly favorable tax policy. The [tax breaks for heat pumps included in the Inflation Reduction Act](#) should propel demand even further in years to come. The global heat pump market reached about [\\$50.8 billion in 2021](#) and is expected to reach about [\\$85.4 billion by 2027](#). Demand in 2022 is expected to remain positive, but [supply chain issues could constrain growth](#). ●

10

Water as the Chokepoint

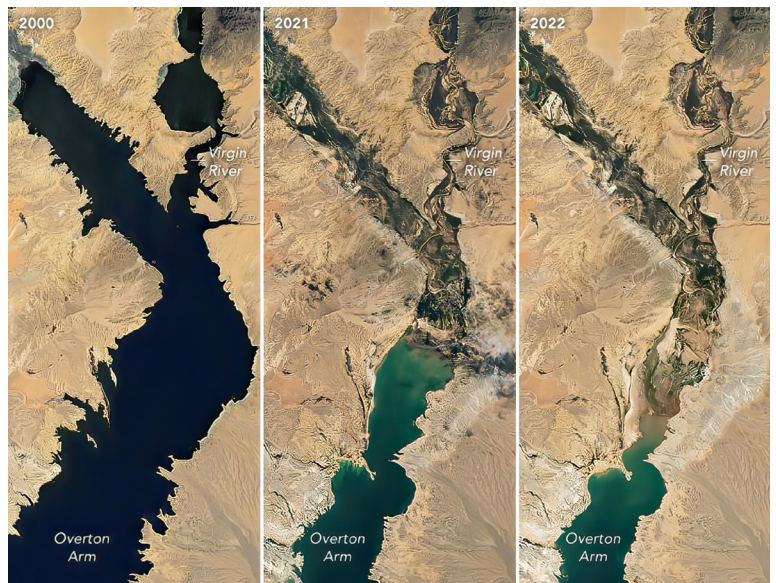
Drought conditions strain nuclear power plants, block barges moving coal, and reduce output at hydroelectric facilities.

The risks of the energy-water nexus have been identified [many times before](#) by the IdeaSmiths team, but 2022 gave some fresh global reminders. For example, [record low water levels in the Colorado River basin](#) in the southwestern United States reduced output at hydroelectric power plants with significant consequences for Arizona, California, and Nevada.

Europe's drought problems in 2022 were even more significant. Low water levels were a contributing factor to significant nuclear power outages in France as water intake levels were too low and water temperatures too high to safely cool the power plants at full capacity. The power plant capacity reductions meant that more expensive, scarce or security-compromised fuels (such as gas from Russia) would be used instead, raising prices, increasing emissions, and worsening the security posture of the region. Lower water levels in Europe also meant coal-fired power plants had a

harder time getting fuel because of the difficulty in transporting fully-loaded barges along inland waterways. Those same water levels also reduced output from hydroelectric dams, ultimately triggering a [natural gas price cap](#) to protect consumers.

Thankfully, many energy solutions for a decarbonized future – such as wind, solar, and air-cooled small modular nuclear reactors – require less water cooling. As such, reducing greenhouse gas emissions might also free up more water for ecosystems or other uses. ●



This composition shows the difference in water levels at Lake Mead from July 6, 2000 to July 3, 2022.



**Honorable
Mention**

IdeaSmiths' Work Gains Notice

We were proud to see that in that in Q4 2022 IdeaSmiths earned two spots on the American Council on Renewable Energy's Macro Grid Initiative Top-10 List and got a shout-out from Secretary of Energy Jennifer Granholm.

"The old environmental movement was about stopping things from getting built. The new environmental movement's about building stuff." - Josh D. Rhodes

twitter.com/TheMacroGrid/status/1605588008899485697

www.esquire.com/news-politics/a41536123/clean-energy-transition-transmission-power-lines-wind-solar/

"One of the most obvious fixes would be for Texas to put aside its parochialism and fear of federal oversight and connect its grid with the rest of the country." - Michael E. Webber

twitter.com/TheMacroGrid/status/1605587989760876546

www.nytimes.com/2022/02/15/opinion/texas-electricity-grid.html

IdeaSmiths report showing that TX solar and wind resources saved consumers \$billions.

www.ideasmiths.net/wp-content/uploads/2022/10/IdeaSmiths_CFT_ERCOT_RE_FINAL.pdf

twitter.com/SecGranholm/status/1585321125646684161

www.utilitydive.com/news/texas-solar-and-wind-resources-saved-consumers-nearly-28-billion-over-12-y/634893/

Our previous Top 10 Energy Stories:

www.ideasmiths.net/wp-content/uploads/2022/02/IdeaSmiths-Top-10-2021-1.pdf



About Us

IdeaSmiths' Top Ten Energy Stories of 2022 was prepared by:

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IdeaSmiths LLC was founded in 2013 to provide clients with access to professional analysis and development of energy systems and technologies. Our team focuses on energy system modeling and assessment of emerging innovations, and has provided support to investors, legal firms, and Fortune 500 companies trying to better understand opportunities in the energy marketplace.

www.ideasmiths.net

