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New York Solar Energy Society

Monthly Digest for March 2023

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Upcoming Events

2023 SARATOGA SUSTAINABILITY FAIR, SUNDAY, APRIL 16, 10:00 AM - 4:00 PM - SKIDMORE COLLEGE
The fair brings exhibitors, presenters, and the community together to advocate for and improve awareness about sustainability activities and opportunities. The 2023 fair will include a keynote speaker; workshop presentations; an electric vehicle car and bike show; and exhibitor booths presented by businesses and non-profits in energy, climate, equity, and environmental education.
More Information: Here

SUPER SATURDAY STEM EXPO – MAY 13th 2023 – 11 AM – 3 PM - THE HARLEM ARMORY – 40 West 143rd ST (Btw Lenox and Fifth Avenue)
Super Saturday is the premier event in Harlem for those interested in experiencing hands-on activities and demonstrations related to Science, Technology, Engineering and Math (STEM). The event will feature projects presented by Harlem's own District 5 PRE K-12 students, as well as interactive exhibits from some of NYC's most prominent museums and science & technology centers. Representatives from local colleges, afterschool programs, non-profits, and government agencies will be available to answer questions
More volunteers the merrier!
More Information: Here

LINK TO*:

- NATIONAL AND INTERNATIONAL
- CLIMATE-EMERGENCY/ENVIRONMENT
- CARBON-FREE ENERGY
- SOLAR
- ENERGY STORAGE
- GREEN HYDROGEN
- NUCLEAR
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- OPINION
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- ABOUT NYSES

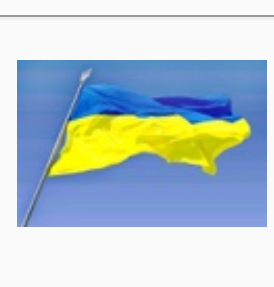
* On cell phones, local links connect through web browsers

National & International

Selected Headlines

- **Climate Change Is Speeding Toward Catastrophe.** The Next Decade Is Crucial! It is still possible to hold global warming to relatively safe levels, but doing so will require global cooperation, billions of dollars and big changes, the U.N. Intergovernmental Panel on Climate Change (IPCC) stated. nytimes.com/
- **The European Union reached a provisional deal on higher renewable energy targets,** an important pillar of the bloc's plans to fight climate change and end dependence on Russian fossil fuels. euters.com/
- **U.S. imports of solar panels are finally picking up** after months of gridlock stemming from the implementation of a new law banning goods made with forced labor, according to two Chinese solar companies. **(related below).** reuters.com/

- **Appointees to the Environmental Protection Agency (EPA) under the previous administration** meddled in agency science to weaken the toxicity assessment of a dangerous chemical, PFBS, a type of PFAS (forever chemical) compound that is toxic at low levels. theguardian.com/
- **President Biden issued his first veto,** blocking the repeal of a Labor Department rule that permitted (but did not require) retirement investing tied to environmental and social goals. politico.com/



Statistics from early this year put the physical damage suffered by Ukraine from Putin's initiated unprovoked Russian invasion reached over $130 billion.

Construction waste from destroyed houses, apartment buildings, hospitals, schools, and other facilities threatens to overwhelm Ukraine's landfills. Building from scratch would release vast amounts of greenhouse gas emissions.

Concrete is the most widely-used man-made substance on Earth. The cement used as a binding ingredient within it is responsible for around 8 percent of the world's CO2 emissions.

The EU is moving to a 'closed loop of demolition', where a much smaller proportion of building waste is sent to landfills.

In anticipation of rebuilding the country after the war, Ukraine is a participant in developing technologies to achieve more complete ways of recycling concrete now ongoing in several West European countries.

Cement powder is heated in a specially made high-powered microwave to reinstate its bonding properties. *Hubert Rahier*

Dutch company Slim Breker has created a high-powered microwave oven to process sand and gravel loosened from mechanically ground concrete. to be used as a cement binder., heating up the crushed concrete to 600°C to break it out of the chemical bond and return it to a reusable state. This process uses electricity generated by solar panels.

The technology is expected to be rolled out by the end of this year.

- euronews.com/green/

War has its own unique carbon dynamics. The actual mechanics of warfare—all the bombs and shells, plus fuel for tanks and planes—represent less than 10% of the war's overall emissions, according to the Climate Focus report. Untamed fires accounted for nearly 25 million tons of CO2 emissions up to November, and methane leaking from the Nord Stream gas pipelines another 15 million tons of CO2 equivalent. But as with most natural disasters, repairing civilian infrastructure and housing will be the biggest carbon source in the Ukraine invasion. On one hand, about half of all emissions will come from the reconstruction. On the other, building back using low or negative carbon construction technologies could slash those figures, and help Ukraine leapfrog the rest of Europe in energy efficiency.

- .anthropocenemagazine.org/

The Biden administration has approved the controversial $8 billion ConocoWillow drilling project on Alaska's North Slope. One of the largest projects of its kind, it will involve drilling for oil and gas on the federal 23 million-acre National Petroleum Reserve. It will produce an estimated 576 million barrels of oil over 30 years. The extraction would potentially produce more than twice the amount of emissions all renewable energy projects on public lands by 2030 would cut combined.

The project is meeting fierce opposition from environmentalists and some Alaska Native communities, who say it will speed up the climate breakdown and undermine food security.

Approval has come after a long contentious process. Trump Administration approved it, but a federal judge reversed that decision. AK's two GOP senators and sole representative (D) have advocated for the project. Some Alaska Native tribal organizations have supported the project as a boost to the. state's economy. Yet to come, court challenges.

- theguardian.com/

H.R. 1, called the Lower Energy Costs Act, passed by the House Republicans on March 30, includes, among others, provisions for

LOWER ENERGY COSTS ACT

- boosting the production and sales of oil and gas
- requiring the Interior Department to hold at least four annual sales per state in at least nine states for oil and gas drilling rights
- reducing the royalty rate that companies that drill offshore need to pay to the government from at least 16.67 percent down to 12.5 percent,
- limiting the president's authority to block cross-border energy projects like the Keystone XL pipeline.
- barirng any kind of pause on fracking, an oil and gas extraction method that has become controversial for its potential health and environmental effects, including being linked to increased childhood cancer rates.
- eliminating several programs that were passed last year as part of Democrats' climate, tax and health care legislation. One of these is a grant and loan program to assist companies to cut methane emissions as well as fining them for excess emissions.

While the Act has little chance to get pass the senate and the president it is also obvious that its sponsors and their followers are either utterly ignorant of or chose to deliberately ignore the dangers our planet is facing. (Ed.)

- thehill.com/

In Norway, Indigenous Sámi activists intensified their protests against an illegal wind farm. In 2018, a U.N. human rights committee asked Norway to stop construction on a power plant that would become part of the final wind farm. However, the Norwegian government disregarded the request once construction passed domestic legal hurdles. Norway's Supreme Court ruled in 2021 that the wind farm violated the Sámi's human rights and was constructed illegally. The Norwegian government has yet to take action on the ruling.
Note: *Sámi-speaking people inhabit the region of Sápmi, which today encompasses large northern parts of Norway, Sweden, Finland, and of the Kola Peninsula in Russia. (The area was formerly known as Lapland.)*

- *https://en.wikipedia.org/wiki/20Peninsula%20in%20Russia.*
- grist.org/

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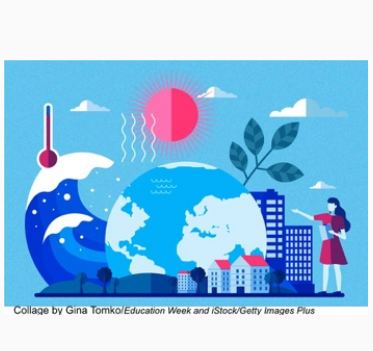

Collage by Gina Tomko/Education Week and iStock/Getty Images Plus

CLIMATE EMERGENCY/ENVIRONMENT

The world is likely to breach a critical global warming benchmark — temperatures rising 1.5 degrees Celsius above preindustrial levels — sometime after 2030, according to a report released by the U.N. Intergovernmental Panel on Climate Change (IPCC).

- It is possible to limit the average global temperature to rise by 2 degrees Celsius and still to avoid the worst impacts of climate change with a rapid rollout of clean energy technologies and a shift from fossil fuels, experts say.
- For the electric sector, demand-side management technologies could play a major role in managing greenhouse gas emissions, according to the IPCC. Widespread electrification could add 60% to electricity demand by 2050, but the increase could be "avoided through demand-side mitigation options."
- utilitydive.com/
- nytimes.com/

Temperatures soared to record levels in Greenland in early March, up to 50 degrees above normal in some places. Researchers say this early warm spell could make its ice sheet more vulnerable to melt events this summer. "If the temperature of the existing snow is higher than it would otherwise be, there is less heat required to bring it to the melting point," said a Danish climate scientist. Because of human-caused climate change, the Arctic is warming as much as four times as fast as the rest of the globe, and additional rapid warming and melting ice are projected into the future.

- washingtonpost.com/

With California's mountains buried under a historically deep snowpack and more storms on the way, NOAA shows continuing improvement in the state's drought situation. As of March 16, the snowpack stood at 223% of the average accumulation.

- axios.com/

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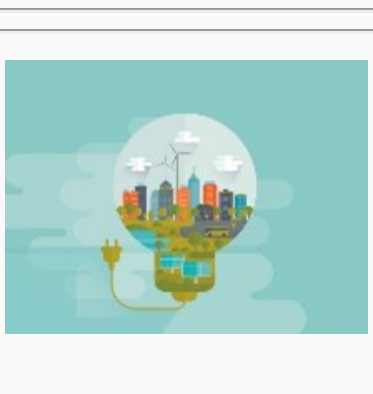

NO-CARBON / LOW-CARBON ENERGY

Before the Russian invasion, renewables accounted for more than 12 percent of Ukraine's energy mix and were rapidly expanding. The government was aiming for 25 percent of the country's energy to come from renewables by 2035. Coal, natural gas and nuclear power account for more than 80 percent of the country's energy mix, with more than half of all power coming from nuclear generation before the war, according to the International Energy Agency (IEA).

The war has emphasized the role renewables can play over the longer term in providing Ukraine with greater energy security and helping it integrate more with the European Union as it works to decarbonize its energy system.

Ukraine's Solar Association, along with other organizations, is working to provide solar and storage systems to hospitals, particularly in cities that were once under Russian occupation.

- scientificamerican/

The number of wind turbines in Texas has grown significantly over the past decade, and the number of solar farms is rising, too. Texas produces more wind energy than any other state. It rivals California for solar.

Small, rural counties especially benefited from a recently expired economic incentives program (Chapter 313) that brought renewable energy companies to their areas, according to a spokesperson for Texas Advanced Power Alliance. Those companies generated funding for local schools, the government and landowners.

The governor of the state, Greg Abbott, takes a position against state incentives to encourage renewable energy. "I support **not** providing economic incentives for renewables," Abbott said. "There's [sic] already federal incentives for renewable projects, and those will continue to be allowed. As it concerns especially energy and power and the power grid, our focus is on dispatchable power," such as natural gas or coal.

- texastribune.org/

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Solar

Uyghur Forced Labor Protection Act (UFLPA) prevents the import of goods produced using forced labor in China's Xinjiang Province, including much of the polysilicon used in solar panels. Importers must prove the entire value chain is free from production in Xinjiang and a lack of precise guidance from the U.S. Customs and Border Protection (CBP). Panels are taking months to clear customs, industry experts say. Importers must pay the cost of warehousing panels which amounts to around $250,000 for 10 MW of panels for three months,

Developers are adapting their procurement strategies to reduce dependence on Chinese materials and many are hiring third-party auditors to validate the origin of their imports. But finding new suppliers and implementing tracing protocols is expensive and time-consuming.

Soaring global demand for solar is adding to the challenges faced by U.S. developers. Equipment such as inverters, trackers and transformers can be sourced from U.S. or European suppliers, but lead times have increased as Europe also hikes renewable energy targets.

The time it takes to develop a 100 MW solar project in the U.S. from greenfield to starting construction has increased from 18-24 months to 36-48 months.

While U.S. tariffs are helping to shift polysilicon production and ingot and wafer manufacturing away from China, the Inflation Reduction Act (IRA is accelerating domestic capacity. But the transition will take time to implement.

- reuters.com/

The number of retired solar panels will continue to increase dramatically over time as they reach the limits of their useful lives. Today, some 90 percent of old or damaged panels end up in municipal landfills.

A panel recycling industry is developing. SolarCycle in Texas, for example, strips the panel assemblies into individual components, grinds the panels and extracts valuable components - silver, copper and crystalline silicon - and sells them along with the retrieved aluminum frames and glass. The company is also building a power plant using refurbished older panels.

According to the National Renewable Energy Laboratory (NREL), recycling a solar panel in the US can cost $15.00-45,00 while sending a panel to the landfill costs $1.00-5.00. (In the EU recycling costs $0.75 per panel because of mandates requiring manufacturers to pay into a fund that subsidizes recycling.)

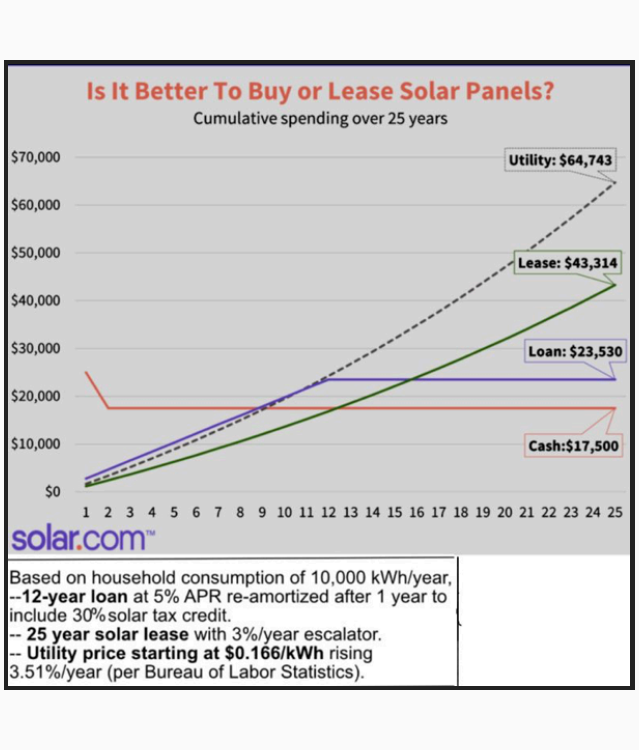
Solar recyclers face significant economic, technological, and regulatory challenges. For one, part of the problem is a lack of data on panel recycling rates, which hinders potential policy responses that might provide more incentives for solar-farm operators. Another problem is that the Toxicity Characteristic Leaching Procedure—an EPA-approved method used to determine whether a product or material contains hazardous elements that could leach into the environment—is known to be faulty. Consequently, some solar farm owners end up "over-managing" their panels as hazardous without making a formal hazardous-waste determination. They end up paying more to dispose of them in landfills permitted to handle hazardous waste or to recycle them.

- wired.com/s

Under a carbon offset agreement, the District of Columbia-based American Institute of Architects (AIA) is offsetting greenhouse gas emissions from the renovation of its 50-year-old landmark headquarters structure in the District with a donation that will cover the cost of solar panels on an estimated 72 low-income Habitat for Humanity Virginia homes.

The overhaul will fully electrify the building, reduce energy use by 58% and tap into a 100% renewable energy mix. At the same time, the AIA will be able to claim renewable energy credits funded through its donation to Habitat for Humanity.

- energynews.us/



Is It Better To Buy or Lease Solar Panels?
Cumulative spending over 25 years

Based on household consumption of 10,000 kWh/year,
--**12-year loan** at 5% APR re-amortized after 1 year to include 30%solar tax credit.
-- **25 year solar lease** with 3%/year escalator.
-- **Utility price starting at $0.166/kWh** rising 3.51%/year (per Bureau of Labor Statistics).

Leases and or power purchase agreements (PPA) were the most common ways to acquire solar panels when they were too expensive for most people to own. But between the plummeting costs and incentives, buying solar panels now is much more feasible and beneficial for most. homeowners.
`cleantechnica.com/

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Energy Storage

For many electric vehicles, there is no way to repair or assess even slightly damaged battery packs after accidents, forcing insurance companies to write off cars with few miles - leading to higher premiums and undercutting gains from going electric. EV battery production emits far more CO2 than fossil-fuel models, meaning EVs must be driven for thousands of miles before they offset those extra emissions.

- reuters.com/

Battery storage failure due to a faulty sprinkler system could mark the beginnings of exclusions from insurance policies if certain providers develop a negative track record. Faulty sprinkler system activations have been responsible for battery failures at two major battery storage projects in California recently: Terra-Gen's Valley Center and Vistra's Moss Landing Energy Storage Facility, the latter the largest project in the world which was taken out of service for months as a result.

- energy-storage.news/

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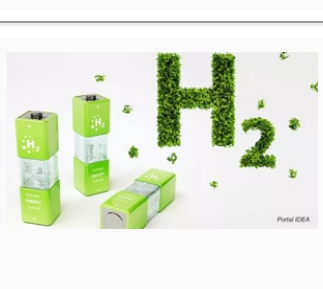

Green Hydrogen (H2)

As billions of "Inflation Reduction Act" dollars are poised to start flowing toward "green hydrogen" technology, environmentalists, scientists and some clean-tech firms fear the subsidies could boost fossil fuels. They are fighting intense lobbying to make tax credits for the "IRA" available also to companies that are using fossil fuels to produce hydrogen. The worries of an increased release of greenhouse gases are shared by environmental and clean energy groups and are grounded in a study from a team of scientists at Princeton University.

The study concludes the looser accounting guidelines influential fossil industry players are seeking would enable them to make the energy-intensive fuel without adding enough new clean power to local electricity grids to produce it. Current production methods generally combine large amounts of natural gas with high-temperature steam, emitting large amounts of greenhouse gases.

The rules several companies are advocating would allow for far less vigilant tracking of the electricity used to run the electrolyzers, giving no assurance each new hydrogen plant connected to the grid is accompanied by enough renewable energy to power it. Instead, developers would purchase credits to offset any emissions they create while using fossil fuels.

The lobbying companies also argue that the proposed hourly tracking of the source of electricity powering hydrogen plants would be prohibitively expensive. The Princeton scientists found otherwise.

- .washingtonpost.com/

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Nuclear

Clean Hydrogen Generation System at Nine Mile Point *(Constellation Energy)*

The Nine Mile Point Nuclear Station in Oswego, New York is the first-of-its-kind facility in the United States to generate clean hydrogen using nuclear power. Hydrogen generated on-site will help cool the power plant. U.S. Department of Energy supported the construction and installation of a low-temperature electrolysis system that leverages the facility's existing hydrogen storage system.

Roughly 95% of the H_2 produced in the U.S. is sourced from fossil fuels.

- power-eng.com/

Rosatom, Russia's state-owned nuclear energy firm, is the world's biggest exporter of nuclear reactors. A paper published in *Nature Energy* in February by climate/energy and policy experts at the Norwegian Institute of International Affairs notes that at least nine countries, including Bangladesh and Egypt, could be vulnerable to political pressure because they depend on Russian-built or -operated nuclear plants. Several other countries have high levels of nuclear cooperation with Russia. Yet this, too, may be weakening. Russia's interruption of gas exports to Europe may undermine its general reputation as a reliable supplier of energy.

- nature.com/ (via .economist.com/)

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FOSSIL & OTHER FUELS

Flares burn off methane and other hydrocarbons at an oil and gas facility in Lenorah, Texas. | *David Goldman/AP Photo*

Methane is a potent greenhouse gas that makes up 11 percent of all U.S. emissions, according to the EPA. About one-third of all methane comes from oil and gas production.

Last year's Inflation Reduction Act (IRA) imposed a federal fee on greenhouse gas. Now a group of Republican House representatives wants to eliminate the charge. They also want to cut out a counterbalancing grant package intended to help develop methane-tracking technology and to ensure producers have some financial assistance to comply with the law and reduce their methane emissions.

- eenews.net/

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NORTH-EAST

New York

A New York City pilot program replaces food carts' gasoline-powered generators with batteries**,** though operators find it hard to keep them running for 12-plus-hour shifts. *(The City* via *Northeast Energy News))*

Work begins to lay a 56-mile undersea power cable between the South Fork wind farm and Long Island, New York. *(Newsday* via *Northeast Energy News)*

Beacon becomes the third municipality in the state **to ban natural gas use in new buildings and major renovations**, barring some exceptions. *(Times Union* via *Northeast Energy News)*

Electric car ownership has more than doubled **in the past two years in New York City and its suburbs**. *(New York Times* via *Northeast Energy News)*

New York City council considers legislation to decrease rooftop spacing requirements to let more homeowners install solar panels. *(City Limits* via *Northeast Energy News)*

The Staten Island borough president is questioning how a multitude of the controversial lithium-ion battery energy storage systems (BESS) is continuing to be built in the heart of residential Staten Island communities -- with one new site recently cropping up next to an active gas station.

- silive.com/

Long Island ranks fourth among major American population centers for exposure to the physical and economic risks of climate change, behind only San Francisco, Cape Coral, Florida and New York City, according to a report released last Moody's Analytics. *The report indicates* that Long Island is uniquely at risk of warming temperatures, along with severe weather events such as hurricanes and major flooding — all risks that experts attribute to climate change. On a scale of zero to 100, the island received scores between 52 and 63 in three key risk categories — heat, sea level rise and water stress, the latter indicating an elevated risk for drought because of the region's sole source aquifer.

- newsday.com/

Massachusetts

The mayor of Boston, Michelle Wu, is slated to file a proposal with the City Council to adopt an optional state building code that would require new buildings using fossil fuels to add solar panels, wiring, and other accommodations to support a future shift to electrification. If approved by the City Council, Boston would be one of the few cities and towns in Massachusetts to sign onto the "Municipal Opt-in Specialized Stretch Energy Code" since its development late last year.

In addition, the Mayor's Office of Housing will launch a new, federally-funded $10 million grant program to usher in energy efficiency through retrofitting income-restricted buildings with 15 or more units.

- boston.com/

A new assessment finds roughly one-third of the land in Amherst, Massachusetts, could feasibly be used for solar generation, but only a small fraction of those locations are actually developed. *(Daily Hampshire Gazette* via *Northeast Energy News)*

New Hampshire

At least 10 New Hampshire towns will be deciding at their April town meetings whether to join community power, continuing a shift in the way local governments let their residents buy electricity instead of only from their local utility. By aggregating demand, communities will be able to buy electricity from producers more cheaply than the default rate charged by utilities under state regulation.

- *.concordmonitor.com/ via Northeast Energy News*

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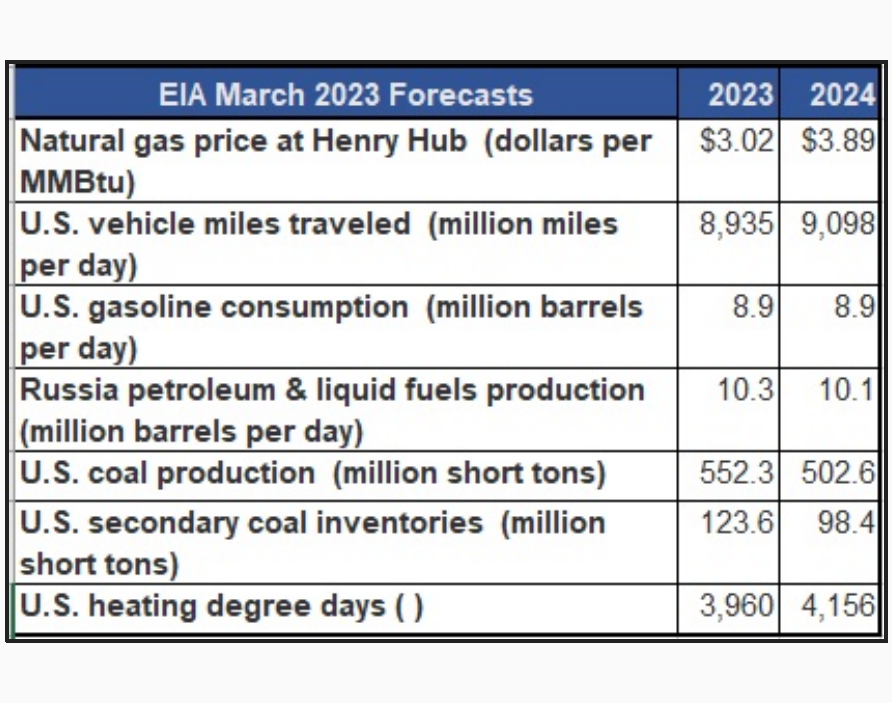
DATA

From Energy Information Agency (EIA):

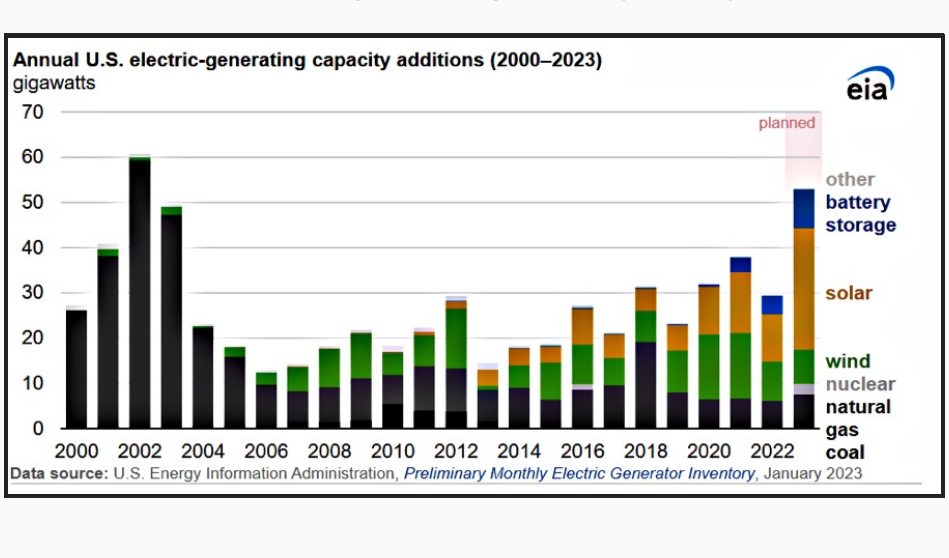
EIA Data:

- In 2022, U.S. natural gas consumption averaged a record 88.5 billion cubic feet per day (Bcf/d)—the highest annual natural gas consumption, according to records beginning in 1949. It also was a 5% increase over 2021.
- The United States will close the withdrawal season at the end of March with more than 1.9 trillion cubic feet of natural gas in storage, 23% more than the five-year average and 27% more than forecasted in the January STEO.
- U.S. natural gas consumption is forecast to average 99.1 billion cubic feet per day (Bcf/d) in the first quarter of 2023 (1Q23), down 5% from 1Q22.
- Wholesale electricity prices will fall in 2023. The decline in price reflects the forecast drop in natural gas prices from 2022 to 2023. Natural gas is the most-used fuel for power generation in the United States. In addition, increasing electricity generation from renewable sources contributes to lower power prices.



EIA March 2023 Forecasts	2023	2024
Natural gas price at Henry Hub (dollars per MMBtu)	$3.02	$3.89
U.S. vehicle miles traveled (million miles per day)	8,935	9,098
U.S. gasoline consumption (million barrels per day)	8.9	8.9
Russia petroleum & liquid fuels production (million barrels per day)	10.3	10.1
U.S. coal production (million short tons)	552.3	502.6
U.S. secondary coal inventories (million short tons)	123.6	98.4
U.S. heating degree days ( )	3,960	4,156

- Wind, solar, and battery storage are growing as a share of new electric-generating capacity each year. In 2023, these three technologies account for 82% of the new, utility-scale generating capacity that developers plan to bring online in the United States, according to the *Preliminary Monthly Electric Generator Inventory*.



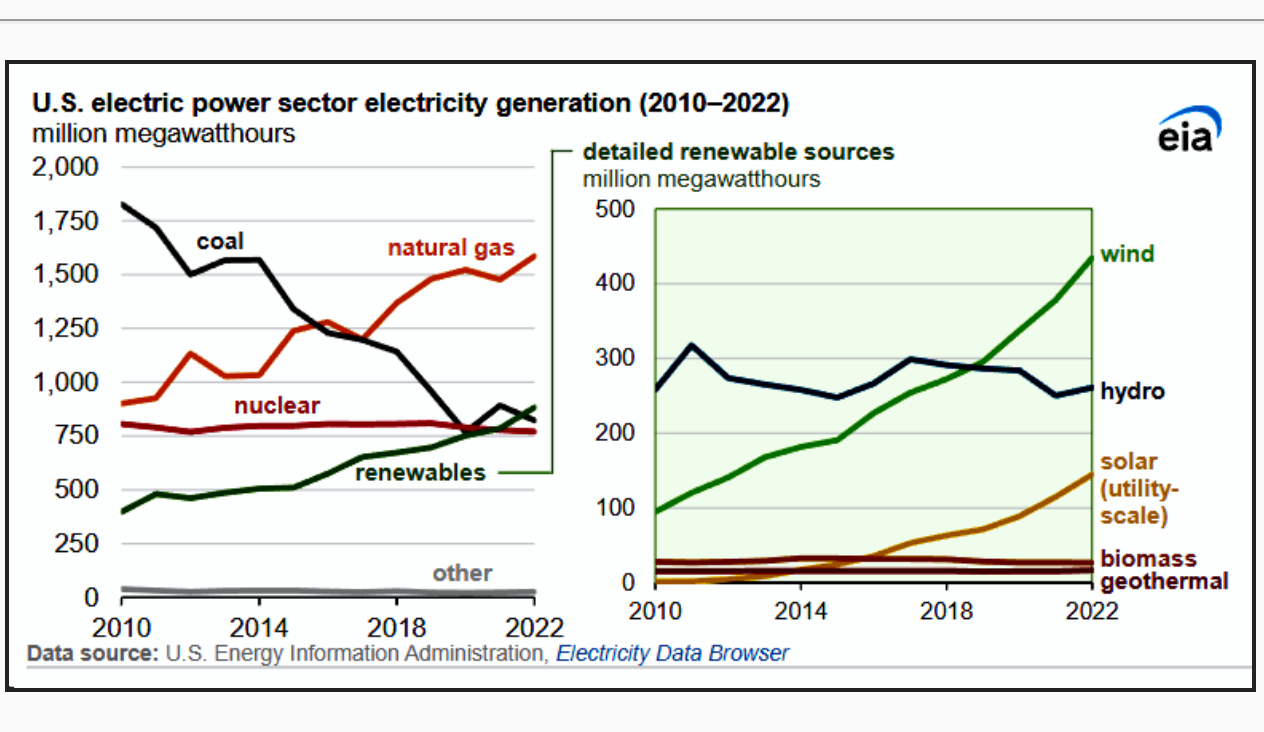
Annual U.S. electric-generating capacity additions (2000–2023)
gigawatts

Data source: U.S. Energy Information Administration, *Preliminary Monthly Electric Generator Inventory*, January 2023

As of January 2023, operating capacities in the U.S. were,

- 73.5 gigawatts (GW) of utility-scale solar, about 6% of the U.S. total.
- 141.3 GW of wind, about 12% of the U.S. total.

- Although significant renewable capacity has been added in the past decade, differences in the amount of electricity that different types of power plants can produce mean that wind and solar made up about 17% of the country's utility-scale capacity in 2021 but produced only 12% of our electricity.
- Waste-to-energy (WTE) plants (facilities that burn municipal solid waste (MSW) in boilers to produce steam) are a small but steady source of electric power in the United States. Providing less than 1% of electricity generation in the U.S., over the last decade, the WTE plants delivered around 14,000 gigawatt hours (GWh) of electricity each year, according to data from EIA's *Power Plant Operations Report*.



U.S. electric power sector electricity generation (2010–2022)

Data source: U.S. Energy Information Administration, *Electricity Data Browser*

https://www.eia.gov/

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January and February 2023 were close to the warmest for those months on records going back to 1895, according to preliminary data from the National Oceanic and Atmospheric Administration The mild weather was concentrated in the eastern part of the U.S.

- NOAA

Combined renewable **generation - including solar, wind, hydro, and nuclear power supplied over 40 percent of the** US**'s total energy output in 2022** according to the *Sustainable Energy in America 2023 Factbook by the* Business Council for Sustainable Energy.

- euronews.com/

The U.S. installed 20.2 gigawatts (GW_{dc}) of solar PV capacity in 2022 to reach 142.3 GW_{dc} of total installed capacity, enough to power 25 million American homes, reports Solar Energy Industries Association in its March 9 report. Solar accounted for 50% of all new electricity-generating capacity added in the U.S. in 2022, the largest annual share in the industry's history and the fourth consecutive year that solar was the top technology with new electric capacity installations.

Residential solar had a record year with nearly 6 GW_{dc} of installations, representing 40% growth over 2021. The other market segments saw downturns in 2022 due to significant supply chain challenges; utility-scale solar in particular fell 31% over the previous year.

- seia.org/

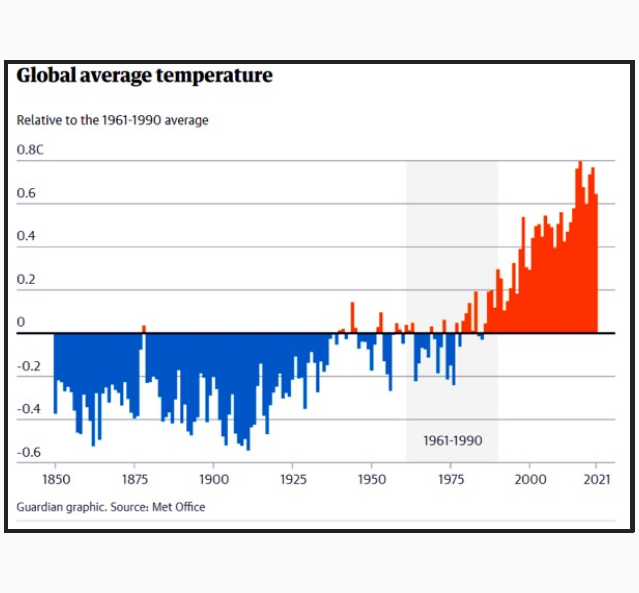
A recent analysis (pdf download)**, by the National Renewable Energy Laboratory of the impact of the clean energy legislation,** the Inflation Reduction Act of 2022 (IRA) and the Infrastructure Investment and Jobs Act of 2021, finds, provided barriers are successfully bridged, that by 2030:

- Clean electricity shares could rise from 41% in 2022 to a range of 71%–90% of total generation.
- Annual power sector CO2 emissions could decline to 72%–91% below the 2005 level.
- The net total and average annual bulk power system costs (inclusive of tax credit value) are estimated decrease.
- The rates of deployment of wind and solar technologies could grow rapidly with the average annual combined rate of deployment (2023–2030) ranging from 44 GW per year to 93 GW per year.
- Fossil generation with carbon capture and storage (CCS) could be economically deployed at levels reaching the tens of gigawatts if such technologies achieve projected cost and performance levels and the required supporting infrastructure is successfully developed.

Development barriers that could materially reduce the rate of clean electricity deployment and the associated benefits include, siting and permitting challenges, supply-chain constraints, and social acceptance of electricity infrastructure development.

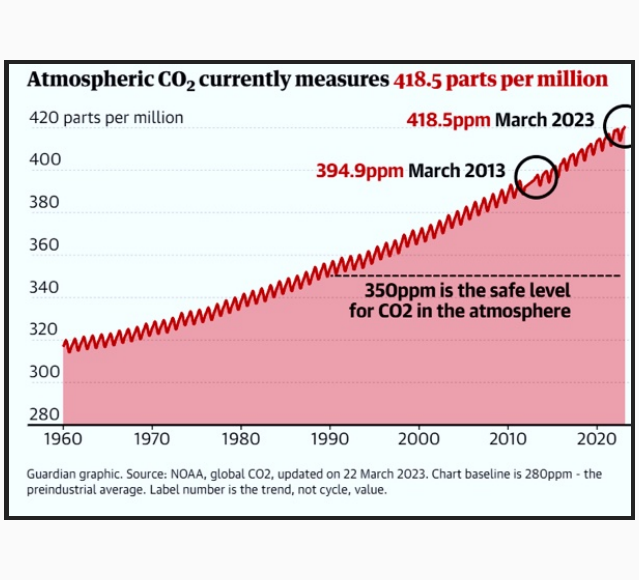
The report follows a similar analysis released last year by Princeton University's Zero Lab, which projected a more conservative level of 75 to 77 percent carbon-free electricity,

- thehill.com/



Global average temperature

Guardian graphic. Source: Met Office



Atmospheric CO_2 currently measures 418.5 parts per million

Guardian graphic. Source: NOAA, global CO2, updated on 22 March 2023. Chart baseline is 280ppm - the preindustrial average. Label number is the trend, not cycle, value.

- theguardian.com/

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Energy: Research/Development

Agrivoltaics

Researchers around the world are exploring growing everything from grapes and raspberries to potatoes and wheat under and between photovoltaic panels. They have shown that sheep will preferentially graze in field areas where shade was offered by solar panels; lambs that foraged under solar panels put on as much weight as those in open fields and in late spring needed less water.
Co-developing land for both solar photovoltaic power and agriculture could provide 20% of total electricity generation in the United States with an investment of less than 1% of the annual U.S. budget, a recent paper by Oregon State University researchers found.

- reuters.com/

Similarly, researchers at Cornell University argue that co-locating agriculture and solar PV (agrivoltaics) is one attractive solution, but its widespread adoption is hindered by the perception that co-located sites will see major tradeoffs between food and energy production. The researchers in their paper show that an agrivoltaic solar farm mounted at 4 meters with soybeans underneath exhibits solar module temperature reductions of up to 10 °C compared to a solar farm mounted at 0.5 meters over bare soil. These results indicate that ground conditions and panel height play important roles in solar farm cooling and that agrivoltaic systems can potentially help to resolve the global food-energy crisis by improving solar PV conversion efficiency while enabling agricultural production on the same land.

- sciencedirect.com/

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Environment/Climate

Last month in the opinion section of the Digest, we referred to opposite stands related to the research by two groups of scientists related to impacting the climate by injecting reflective agents into the stratosphere.

Scientists say the technology necessary to hack the atmosphere is not complicated. Airplanes would spray sulfur into the sky at high altitudes. Done right, the material would condense, reflecting a portion of the sun's rays and shielding the Earth. But, the sulfur technique is not localized, it does not stay above the country that does the spraying. Instead, it spreads across the globe. Beijing's decisions could affect the climatic conditions in the United States — and vice versa.

Beyond that, one country intervening to modify its climate could carry serious geo-political consequences.

- washingtonpost.com/

More on the topic:

Dead before arrival: The governance of stratospheric aerosol injection. hebulletin.org/

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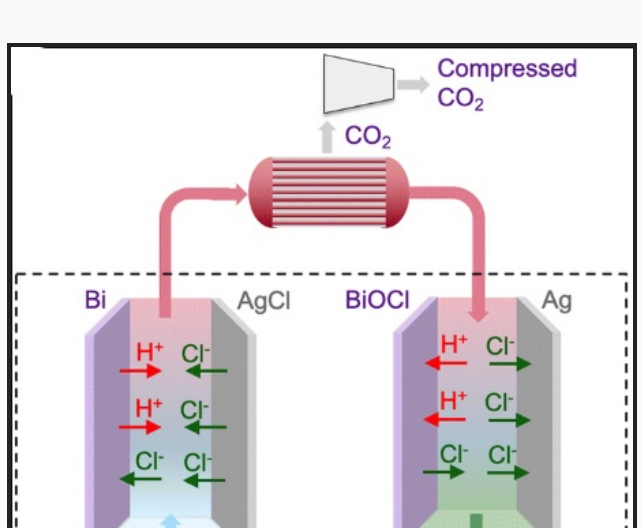
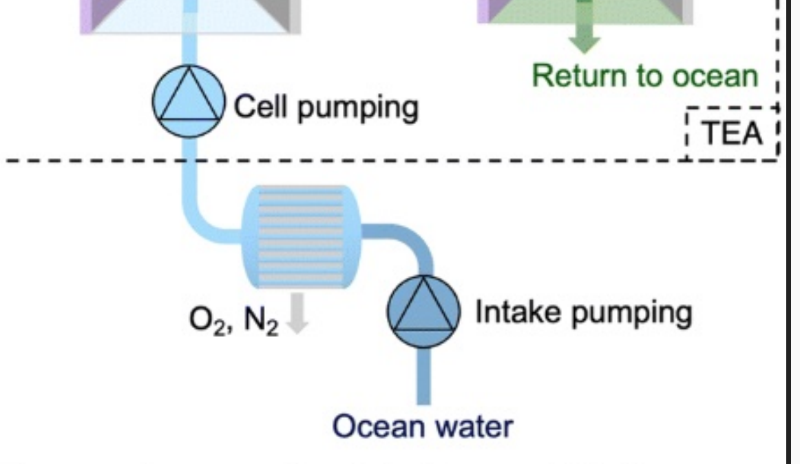


Much attention has been focused on strategies for reducing global CO_2 through capture at point sources and storage underground. More recently there has been a surge of interest in negative emissions technologies in which the CO_2 (currently at an atmospheric concentration of ~415 ppm) is removed from the ambient environment itself through various approaches, such as direct air capture, bioenergy with carbon capture and sequestration, and reforestation.

The focus on the atmospheric accumulation of carbon dioxide took some attention away from oceans and other surface waters - the large carbon sinks - that are absorbing 30-40% of human activity-related, anthropogenic, CO_2 emissions. The result is increased ocean water acidification that seriously damages the marine environment. The total acidification that seriously damages the marine environment. The total amount of CO2 entering ocean water rivals that entering the atmosphere. The actual concentration of the gas, on a volumetric basis, is substantially higher in ocean water than in the ambient air, 100 mg/litter vs 0.77 mg/litter. Effective means for its removal from ocean water could augment the other negative emissions technologies.



Source: Asymmetric chloride-mediated electrochemical process for CO2 removal from oceanwater from *Energy & Environmental Science*, Feb. 23, 2023,

Existing methods for removing carbon dioxide from seawater require membranes or chemicals, which make the process complex and expensive. Researchers at MIT developed a system made of two electrochemical cells. One converts the carbonate and bicarbonate in the water to carbon dioxide. A vacuum chamber removes carbon dioxide from the water as it passes through into the second cell in which a reverse voltage soaks up the protons, turning the acidic water back to alkaline, so it can be released back into the ocean. These carbon dioxide removal modules could be installed on cargo ships, on platforms located near offshore wind farms, floating solar islands, and facilities handling seawater -- like ocean water desalination plants.

The estimated cost of the system is between $50-100/ton of CO2 (plus additional costs for intake filters, pumps, and gas separation) vs. $250–600 per ton for direct air capture. The practical demonstration project could be ready in two years.

- anthropocenemagazine.org/
- pubs.rsc.org/

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Battery Energy Storage System (BESS)

Until recently, the major contenders for battery chemistry were lithium polymer and then lithium-ion. Now researchers at the Technische Universität Wien in Vienna, Austria, are developing oxygen-ion batteries that promise to be an improvement over currently used chemistry while offering greater safety, and a greener, more sustainable footprint. Their plates are made of non-combustible, ceramic materials, and the batteries do not require rare-earth elements. The ability of oxygen-ion batteries to receive a charge does not diminish over time and can be constantly recharged without breaking down, unlike lithium-based batteries. The major disadvantages of these BESTs getting very hot during operations (200 - 400°C) and having low energy density, thus not being appropriate for consumer uses.

- .gasworld.com/

Iron-air batteries were first developed in the 1960s by NASA. This technology has the potential to overcome several key issues with lithium-based batteries. Iron is the fourth most abundant element on Earth, which overcomes a significant problem with using lithium: the element's rarity.

Form Energy, a Massachusetts energy storage and battery technology company is developing iron-air battery technologies which can help address the demands of the global electric system.

The company's flagship commercial product is a washing machine-sized iron-air battery. Each unit holds approximately 50 iron-air cells, surrounded by an electrolyte.

Key to their operation is the principle of "reverse rusting" wherein the cells "breathe" in air. In this process, iron is transformed into iron oxide, producing energy. The reaction can be reversed by applying a current and converting the iron oxide back into iron.

Lithium-ion batteries provide about four hours of energy storage capacity. Iron-air batteries could provide up to one hundred hours of storage. They do, however, have major disadvantages compared to lithium-ion batteries, they are big and recharge slowly.

Iron-air batteries can act as a bridging technology during energy gaps, such as on cloudy days, which would otherwise limit solar power plants.

- azocleantech.com/

EnerVenue will open in Kentucky a major manufacturing facility to produce battery energy storage systems applying nickel-hydrogen battery technology. The technology was originally developed for aerospace applications in 2017. Stanford researchers redesigned the vessel, moving it toward commercialization by improving performance and reducing cost.

According to the company, the batteries operate best in ambient temperatures from -40 F to 140 F. The battery purportedly comes with no risk of fire or thermal runaway and includes no toxic materials, so it is also recyclable.

The company claims that its batteries have a more than 30-year lifespan, can go through more than 30,000 cycles without experiencing degradation and offer exceptional overcharge, over-discharge, and deep-cycle capabilities.

- pvmagazine-usa.com

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The Reads

SOUTH DAKOTA
MINNESOTA
WISCONSIN
NEBRASKA
IOWA
ILLINOIS
MISSOURI
Navigator CO₂

Plans that would bury carbon underground rather than release it in the air **have stoked debate over climate and property rights.**

There is no question that technology exists to remove carbon from industrial sites and to transport and store it underground. Less clear: Is carbon capture really an effective counterweight to the overheating planet? And, if so, at what cost?

- nytimes.com/

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Miscellany

Strategic placement of EV charging is recommended by MIT researchers:

1. In workplaces, better availability could help to absorb peak power being produced at midday from solar power installations. It would also utilize higher mid-day PV electricity production, some of which may go to waste, and reduce evening and overnight electricity demand.
2. At homes, broadly individual and apartment building garages, and parking areas. Pre-programmed EV chargers installed on residential streets could be accompanied by a simple app to delay the start of the charging cycle to meet other following day's transportation schedule.

Combining the two measures — workplace charging and delayed home charging — would reduce peak electricity demand, store solar energy, and conveniently meet drivers' charging needs on all days, according to study results. In addition, this setup would eliminate the need for networked centrally controlled devices.

- cleantechnica.com/

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OPINION ,

David Goldman/Associated Press

Restoring American energy independence. By reps. Kevin Hern (R-OK) and August Pfluger (R-TX), opinion contributors.

(***Warning:*** *Not a word about the impact of fossil fuels on the climate and the future of the planet* (Ed.))

(According to the opinion writers,) the House Energy Action Team (HEAT) is committed to restoring and exceeding the energy independence that resulted from the shale revolution. In 2019, the United States became a net exporter of oil and gas for the first time since 1952. The economy thrived as the U.S. reduced its reliance on foreign energy. The Biden administration wasted no time destroying that progress. Following through on his campaign promise to "end fossil fuel", Biden canceled the Keystone XL pipeline (that should be delivering 830,000 barrels of oil per day to the U.S.) and unilaterally blocked oil and gas lease sales in his first week in office. This war on traditional energy was just the tip of the iceberg, as Biden has worked to impose similar draconian policies into Americans' kitchens and retirement savings.

- hehill.com/

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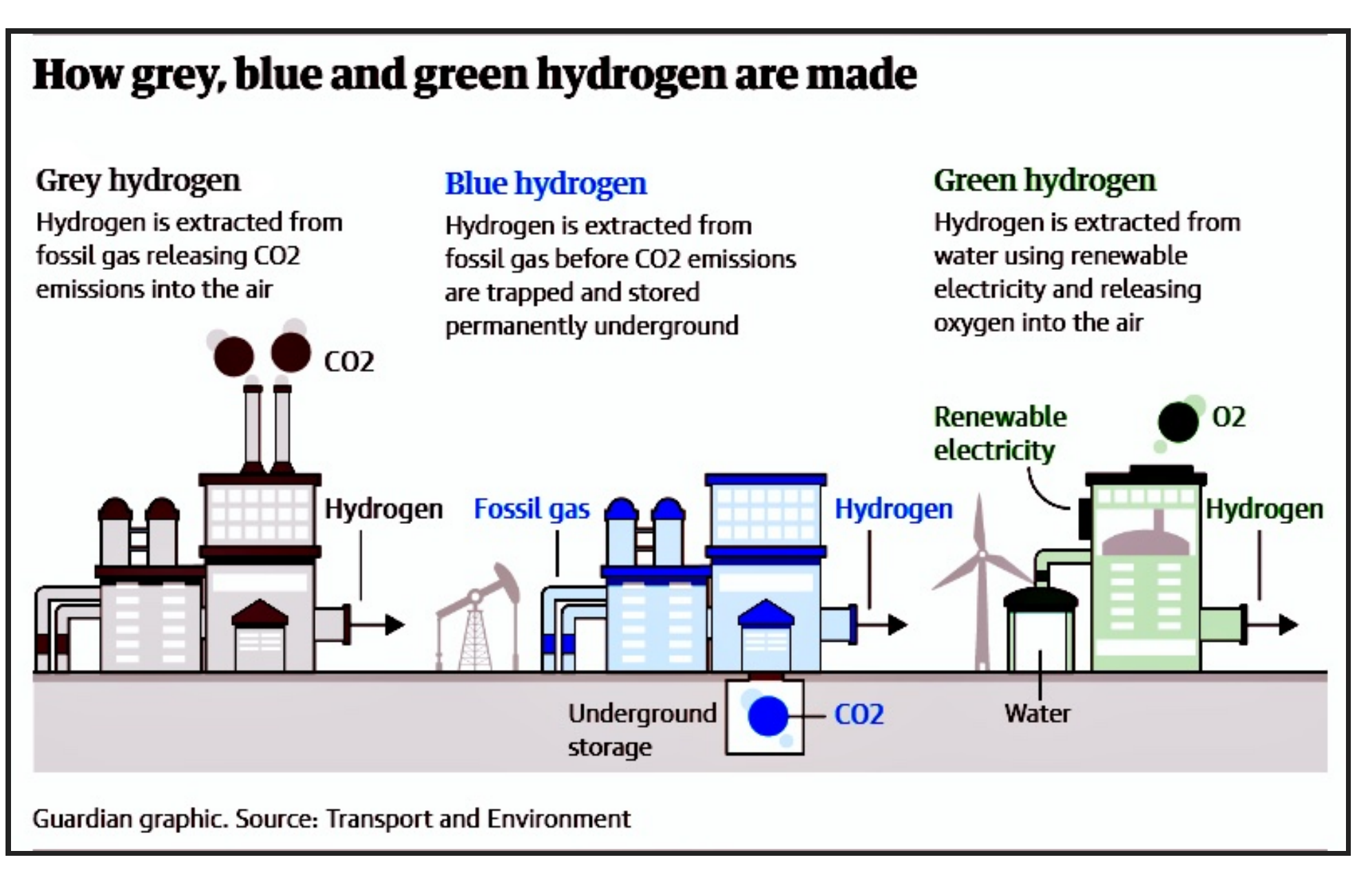
ICYMI / FYI


How grey, blue and green hydrogen are made
Grey hydrogen
Hydrogen is extracted from fossil gas releasing CO2 emissions into the air
Blue hydrogen
Hydrogen is extracted from fossil gas before CO2 emissions are trapped and stored permanently underground
Green hydrogen
Hydrogen is extracted from water using renewable electricity and releasing oxygen into the air
CO2
Hydrogen
Fossil gas
Hydrogen
Renewable electricity
O2
Hydrogen
Underground storage
CO2
Water
Guardian graphic. Source: Transport and Environment

- theguardian.com/

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The New York Solar Energy Society (NYSES)

a Chapter of the American Solar Energy Society (ASES)

prepares consumer knowledge handouts about energy conservation and renewable energy, and distributes Green Energy Times, a resource publication, to the public throughout eastern New York State. NYSES analyses legislation and state programs and visits with the staff of legislators in New York City, New York State, and Washington, DC. NYSES is a volunteer, grassroots, membership organization serving the children, families, engineers, architects, and teachers of New York State since 2007.

Our Mission:

To encourage the understanding and use of solar energy technologies through public outreach, to be a source of sound technical knowledge, and to provide a forum to address critical regional and state issues relating to solar energy solutions. We address the energy usage of all segments of society by increasing awareness of the benefits of renewables: solar, wind, biomass, geothermal ground source, tidal/wave energy, and energy efficiency.

For more information, please contact:

New York Solar Energy Society
5270 Sycamore Avenue, Bronx, NY 10471
www.nyses.org
917 974 4606

Join and Support NYSES -- http://nyses.org/Main/Join

By renewing your membership and/or making one-time or periodic donations, you can help to sustain and expand the efforts and activities of the New York Solar Energy Society.

Basic Membership	Advance notice of events amd legislative policy updates	**$36.00/ year**
Professional Membership	Above benefits plus discount on event admissions	**$100.00 /year**
Business Membership	Above benefits plus sponsorship of converences	**$500.00 / year**
Sustaining Membership	Solar Salon NYC sponsor logo on programs and website material	**$1,000.00 /year**

www.nyses.org **website NYSES Contribute online via the**

or mail check to the address above

Thank you!

Please send your comments/suggestions via Contact-Us

The Board of Directors of the New York Solar Energy Society meets on the fourth Tuesday of odd-numbered months via teleconference. Please contact us **if you wish to attend.**

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Monthly Digest is compiled & edited by Yuri Kalina

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