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New York Solar Energy Society

Monthly Digest for May 2023

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Upcoming Events

SOLARFEST'23: Sat July 15th & Sun. July 16

Live music, workshops, local food, exhibits, camping, family fun, and more.

Location:	Directions
Main Stage @ Solar Fest	
144 Steinberg Rd	Tickets On Sale Now!
Brandon, VT 05733	More Information: Here

ASES SOLAR 2023
Transforming the Energy Landscape for All
August 8-11, 2023
University of Colorado, Boulder
AMERICAN SOLAR ENERGY SOCIETY

Join us at the America Solar Energy Society's 52nd ANNUAL NATIONAL SOLAR CONFERENCE on August 8-11, 2023, in Boulder, Colorado!
SOLAR 2023 is designed to serve and advance the solar energy industry by bringing together national labs, installers, government officials, and enthusiasts in the solar and renewable energy industries to explore solutions, new technologies, policy initiatives, and other key factors.
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National & International

Selected Headlines

* **Russia's invasion of Ukraine has helped ignite a boom in clean energy investment** which will significantly outpace spending on fossil fuels, reports the International Energy Agency. clean energy investment has accelerated well beyond spending on gas, coal and oil. However, the IEA report warned that Russia's war in Ukraine has also prompted increased investment in upstream oil and gas, which is expected to rise by 7% in 2023 in a return to 2019 levels. heguardian.com/

* **The Tennessee Valley Authority, t**he nation's largest public utility released plans to build a new natural gas plant in Tennessee, largely dismissing renewable energy alternatives one day after the Biden administration proposed strict new limits on greenhouse gas emissions from power plants. TVA has a goal of an 80% reduction in carbon emissions by 2035 over 2005 levels and net-zero emissions by 2050. apnews.com/

* **At the annual Petersberg Climate Dialogue** attended by officials from about 40 countries, Germany called governments around the world to work on setting an ambitious target for renewable energy that would "ring in the end of the fossil fuel age" and help prevent dangerous global warming. The call received a mixed reception among the attendees. phys.org/news/

* **Norway will end the sale of cars** with internal combustion engines in 2025. nytimes.com/

* **More than 100 technology providers are competing** in the long-duration energy storage market as the U.S. Department of Energy seeks to boost commercializationm utilitydive.com/

* **Rural electric cooperatives, renewable energy companies and electric utilities will be able to apply for funding** through two programs totaling nearly $11 billion to help bring affordable clean energy to rural communities throughout the country. apnews.com/

Russian attacks on Ukraine's energy grid have left it severely damaged. Now a growing number of Ukrainian hospitals, schools, police stations and other critical buildings are racing to install solar power ahead of what many expect will be another hard winter later this year.

Solar cannot easily rival the power generation of nuclear or fossil plants. But proponents say they are cheaper, faster to install and certainly more eco-friendly. They are more useful as a quick solution to Ukraine's immediate energy and security needs than many alternatives that can take years to build and install. Renewable advocates want solar power to be a sizable chunk of the new capacity. They also hope to make an impact that will last long beyond the war.

Children work on computers powered by solar panels at School No. 17 in town of Irpin - next to Kiiv. (Ed Ram for The Washington Post)

- washingtonpost.com/

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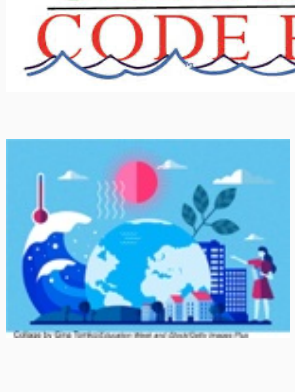
CLIMATE EMERGENCY / ENVIRONMENT

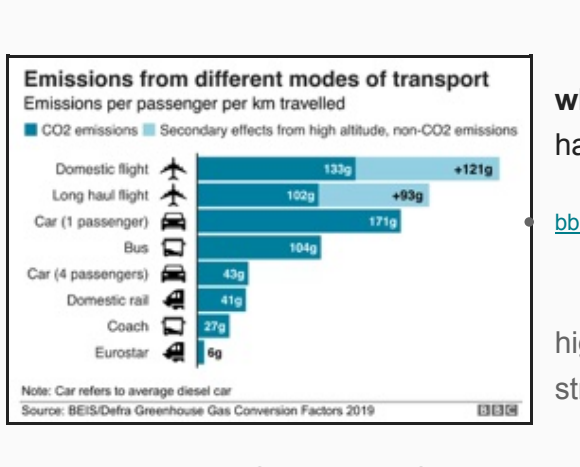


Plastic pollution could be slashed by 80 % by 2040, according to a new report by the UN Environment Program (UNEP). Refillable bottles, bulk dispensers, deposit-return schemes and packaging take-back schemes could help to cut **plastic pollution** by 30%.

Replacing plastic packaging should be done with alternative materials such as paper. could deliver an additional 17% drop in **plastic pollution**,
Shifting to a **circular economy** in plastic would result in almost €1.8 ($2.0) trillion in savings, considering costs and recycling revenues. The knock-on benefits for health, climate, **air pollution**, marine ecosystems and costs related to lawsuits would be even greater at more than €3.0 ($3.3) trillion.

Global treaties aimed at tackling plastic waste are being negotiated in Paris talks, May 28 - June 2.

- https://www.euronews.com



France has banned domestic short-haul (2.5 hours or less) flights where train alternatives exist, in a bid to cut carbon emissions. Critics have described the latest measures as "symbolic bans."

bbc.com/

Tropical Cyclone Mocha, which struck Myanmar and Bangladesh as a high-end Category 4 storm on May 14 is a catastrophic example of a rapidly strengthening storm — one that leaps multiple intensity categories.

Conditions were ideal for rapid intensification, with light winds aloft and warm ocean waters from the surface to deeper depths. In fact, Cyclone Mocha went through at least two major bursts of rapid intensification, with sustained winds climbing by at least 90 mph in 48 hours.

- axios.com/

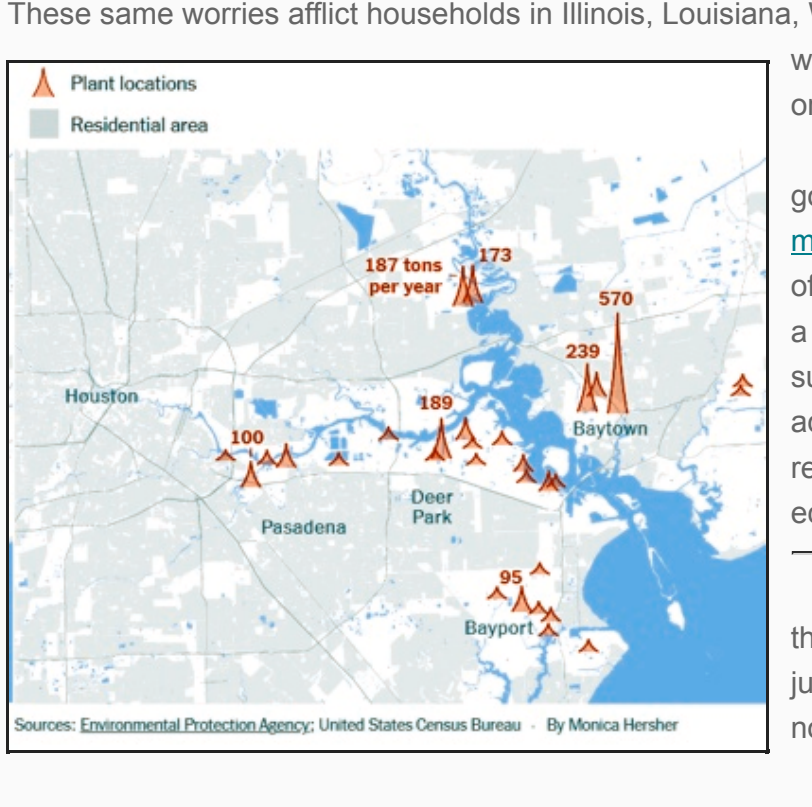
The Environmental Protection Agency proposed **greenhouse gas emissions limits for coal, gas and oil fired power plants,** with initial requirements beginning in 2030 for coal-fired generators and 2032 for gas-fired units. The limits could be met by highly efficient operations, carbon capture and sequestration, co-firing natural gas for coal units, and with "green" hydrogen for gas generators. The proposal would spur 22 GW of coal-fired capacity to retire and 24 GW of natural gas-fired capacity to be built, including 11 GW of capacity co-fired with clean hydrogen, from 2023 to 2035, according to the EPA.

- utilitydive.com/

Two recent assessments, by the Environmental Protection Agency and city officials in Houston, found that residents in neighborhoods in the vicinity of chemical plants are at higher risk of developing leukemia and other cancers than people who live farther from them.

These same worries afflict households in Illinois, Louisiana, West Virginia and other spots around the United States where families live near manufacturing facilities that make or use cancer-causing chemicals.

After years of only intermittent action by the federal government, the Biden administration is proposing measures that would significantly cut releases of a number of cancer-causing chemicals from plants. Companies from a variety of industries, including those that produce the substances and those that use them, are pressuring the administration to water down some of the rules, saying the repercussions of a ban or new restrictions could be economically crippling.

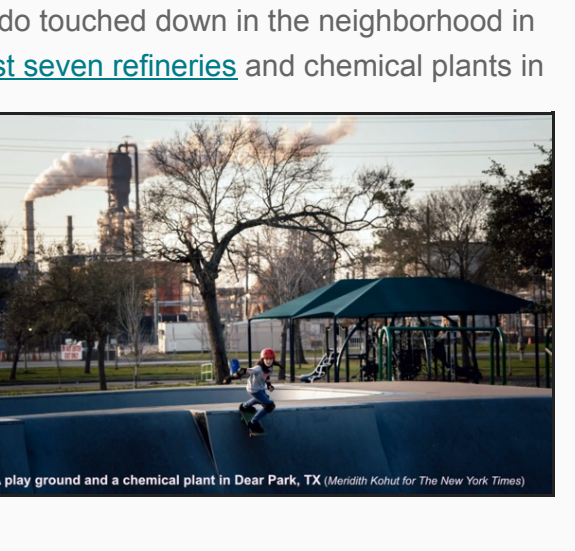


Sources: Environmental Protection Agency; United States Census Bureau · By Monica Hersher

Texas records examined by The New York Times show that toxic releases are happening regularly in Deer Park, just outside Houston, sometimes even without notifications to residents.

When a tornado touched down in the neighborhood in January, the power went out, disrupting pollution control equipment in at least seven refineries and chemical plants in the area and resulting in the discharge of known toxins that were visible in the form of black clouds of smoke. In March, an "emission event" over five hours on a weekday evening released nearly 15,000 pounds of hydrogen chloride, a gas that can irritate the eyes and throat, among more serious ailments. An analysis prepared by the advocacy group Earthjustice shows more than one million pounds of these so-called high-priority chemicals, including the carcinogens butadiene and formaldehyde, have been released over the past decade in the Deer Park neighborhood.

Research shows that the residents at greatest risk are typically Black and Latino residents of Houston in lower-income neighborhoods.


A play ground and a chemical plant in Dear Park, TX (Meridith Kohut for The New York Times)

- nytimes.com/

Related:

A fire burned for a third day at Shell Plc's chemical plant in the Houston suburb of Deer Park, Texas, a company spokesperson said. reuters.com/

The blazes in Deer Park, Galveston Bay and Corpus Christi follow a years-long string of explosions, fires and toxic releases in a region where oil refining and chemical production is highly concentrated, often close to residential neighborhoods. First Shell, then Marathon, then Valero. In the first three weeks of May, major fires broke n out at these companies' oil refineries and chemical plants in East Texas, leaving one dead and over a dozen injured. washingtonpost.com/

Florida Governor Ron DeSantis signed into law a bill barring state officials from investing public money to promote environmental, social and governance goals, and prohibiting ESG bond sales. The bill is one of the furthest-reaching efforts yet by U.S. Republicans against sustainable investing efforts. Republicans say many executives and investors have lost their focus on returns as they take growing account of issues like climate change and workforce diversity. "If we as a rating agency cannot assess environmental, social, or governance risk that creates a problem for us. There are climate and weather risks that are highly relevant, especially in a state like Florida, and would be captured in our assessment of credit risk," one credit rating agency executive said.

- reuters.com/

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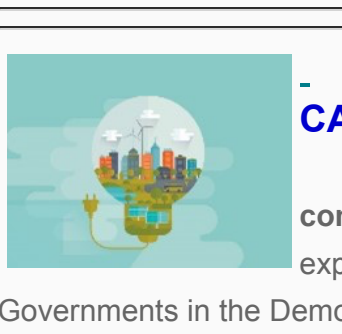
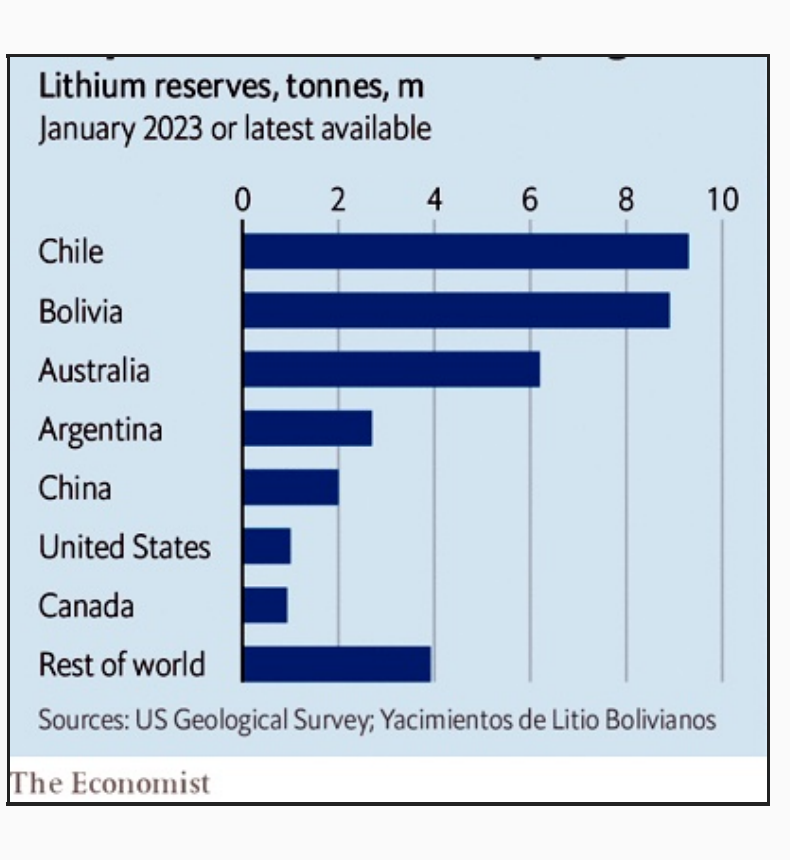
CARBON-FREE ENERGY



Partly in response to higher commodity prices, several countries have taken greater control of their resources. Indonesia, the world's biggest nickel producer, recently banned exports of nickel ore and is promising to do the same with bauxite, the ore for aluminum. Governments in the Democratic Republic of Congo, Kyrgyzstan and Madagascar are also dabbling with increased state intervention.
Latin America stands out for the speed with which countries are wielding state control. The recently elected left-leaning governments have three main goals:

1. to increase the state's revenues and economic clout.
2. to create more jobs and opportunities for business.
3. to reduce conflicts and promote social justice in resource extraction.



Sources: US Geological Survey; Yacimientos de Litio Bolivianos
The Economist

Resource nationalism carries huge risks. Pemex, Mexico's state oil firm, is the world's most indebted oil company. Venezuela's state oil giant, PDVSA, is synonymous with the country's collapse. Petrobras, Brazil's public oil company, was at the heart of the region's largest corruption scandal. And state firms may lack access to the cutting-edge technology that multinational companies typically excel at.

For as long as appetite remains insatiable for green resources Latin America will have enough leverage to impose conditions on private firms without strangling investment flows.

The big question is whether its slice of the cake ends up being smaller than it might have been as the case in Chile shows. The government there plays a big role in lithium production, exacting up to 40% royalties (vs. 3% in neighboring Argentina), requiring selling 25% of output locally at below market prices. Consequently, Chile is losing market share in supplying the metal to industries.

- economist.com/

A total of 115 out of 254 Texas counties have school districts that received tax breaks for renewable energy projects under a program created to attract investment in less populated, more rural counties.

School districts in counties that supported the Republican candidate in the 2020 presidential election by a larger margin received six times the amount of money from the program as counties with more Democratic voters. They also tend to be more rural.

Ensuing benefits have not been enough to sway lawmakers, who in the final days of the legislative session ironed out details of several major bills that are designed to change the future of how electricity is produced here. The policies intend to use state funds and the money from an expected increase in most Texans' electricity costs to spur the construction of new gas-fueled power plants and keep them operating into the future.

- .texastribune/.

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Solar

The amount of capital investment in the solar sector is poised to overtake that of oil production for the first time ever in 2023, reports the International Energy Association. Solar investments are expected to attract over $1 billion a day in 2023 with over $1.7 trillion slated to flow clean energy technologies such as EVs, renewables and storage. Overall, global investment in energy is projected to hit approximately $2.8 trillion in the current year.

- oilprice.com//

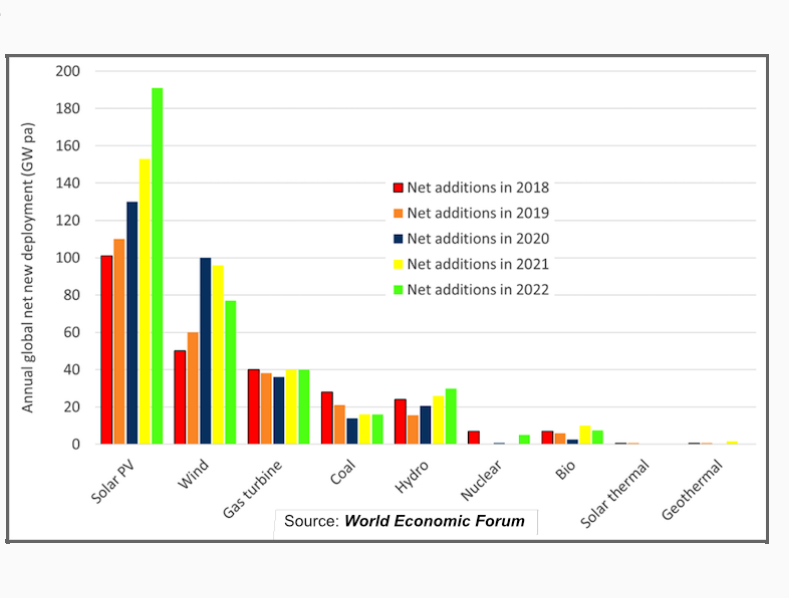
Nonprofit Solar United Neighbors launched the Ohio Valley Solar and EV Charger Co-op. The co-op is free to join, and joining isn't a commitment to purchase a system. Members of the co-op will have the option to individually purchase panels and electric vehicle chargers based on the bid of the competitively selected installer.

- theintelligencer.net/

Trust but verify: A now-shuttered suburban solar panel installation company swindled dozens of Chicagoans by promising quick installations that it knew would likely never be completed, Customers were paying an average of $13,000 in down payments through all of 2022, but the company had stopped fulfilling new orders earlier that year after running low on cash. The company "robbed Peter to pay Paul" to keep the business afloat without doing work on the contracts, according to a lawsuit filed by the City of Chicago.

- chicago.suntimes.com/

Total solar capacity tipped over 1 terawatt (1,000 gigawatts) for the first time last year, reports the World Economic Forum. The sector is growing at about 20% a year. If this continues, we'll hit 6 terawatts around 2031. In capacity terms, it would be larger than the combined total of coal, gas, nuclear and hydro.



Source: World Economic Forum

- www.weforum.org

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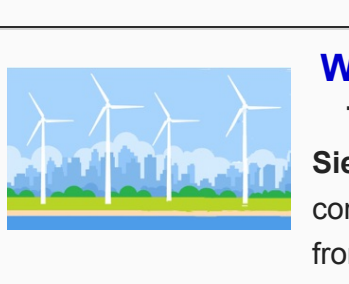
Green Hydrogen (H2)

Colorado lawmakers recently amended a bill to include the nation's first-ever clean hydrogen standards. The state's governor is expected to sign the legislation, offering a potential preview of similar restrictions under consideration at the national level.

- cpr.org/

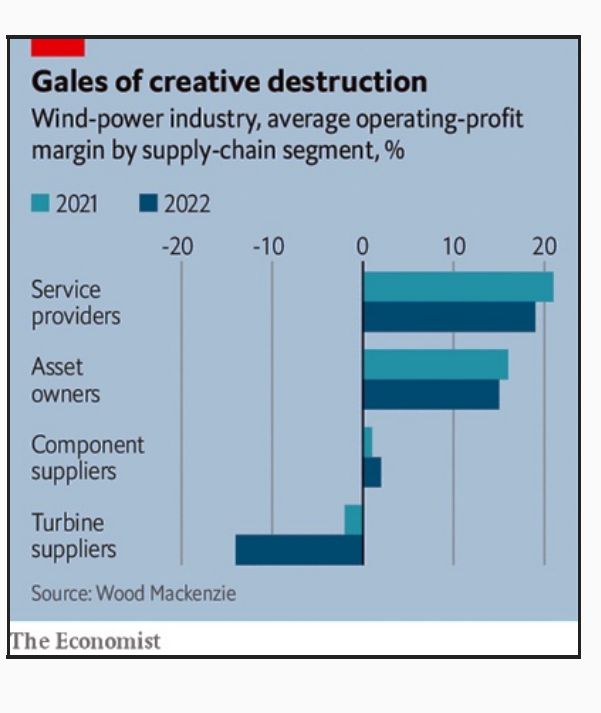
Wind



The four biggest Western makers of wind turbines—GE Renewable Energy, Nordex, Siemens Gamesa and Vestas—supply about 90% of the market outside China. In stark contrast to wind-farm operators who benefited from increased electricity rates following the Russian invasion of Ukraine, the turbine manufacturers together in 2022 raked in $5.5 billion in net losses. The trend continues this year.

On the one hand, the prices that turbines have been coming down. On the other hand, those buyers' appetite for new ever larger turbines kit has been cooled by the difficulty of securing the permits necessary to install them.

The time between signing a contract with wind-farm developers and erecting the turbines and getting paid is as much as three years on average for onshore projects and five for those offshore. Because terms are mostly locked in during that time, turbine makers are exposed to market vagaries - recently resulting from supply-chain disruptions, lack of raw materials and components, inflation, higher interest rates and geopolitical tensions.



Source: Wood Mackenzie
The Economist

- economist.com/

The tall bodies of wind turbines are topped with long fiberglass blades, some more than half a football field in length, made to withstand the harshest, windiest conditions. While about 90% of turbines are easily recyclable, their blades are not. They are made from fiberglass bound together with epoxy resin, a material so strong it is incredibly difficult and expensive to break down. Most blades end their lives in landfill or are incinerated.

Vesta, the Danish wind turbine manufacturer, in partnership with Aarhus University, the Danish Technological Institute and US-based epoxy company Olinis is working on a solution. The process uses a liquid chemical solution to break down the blade into epoxy fragments and fibers. The epoxy resin is then sent to Olin which can process it into "virgin-grade" epoxy.

- cnn.com

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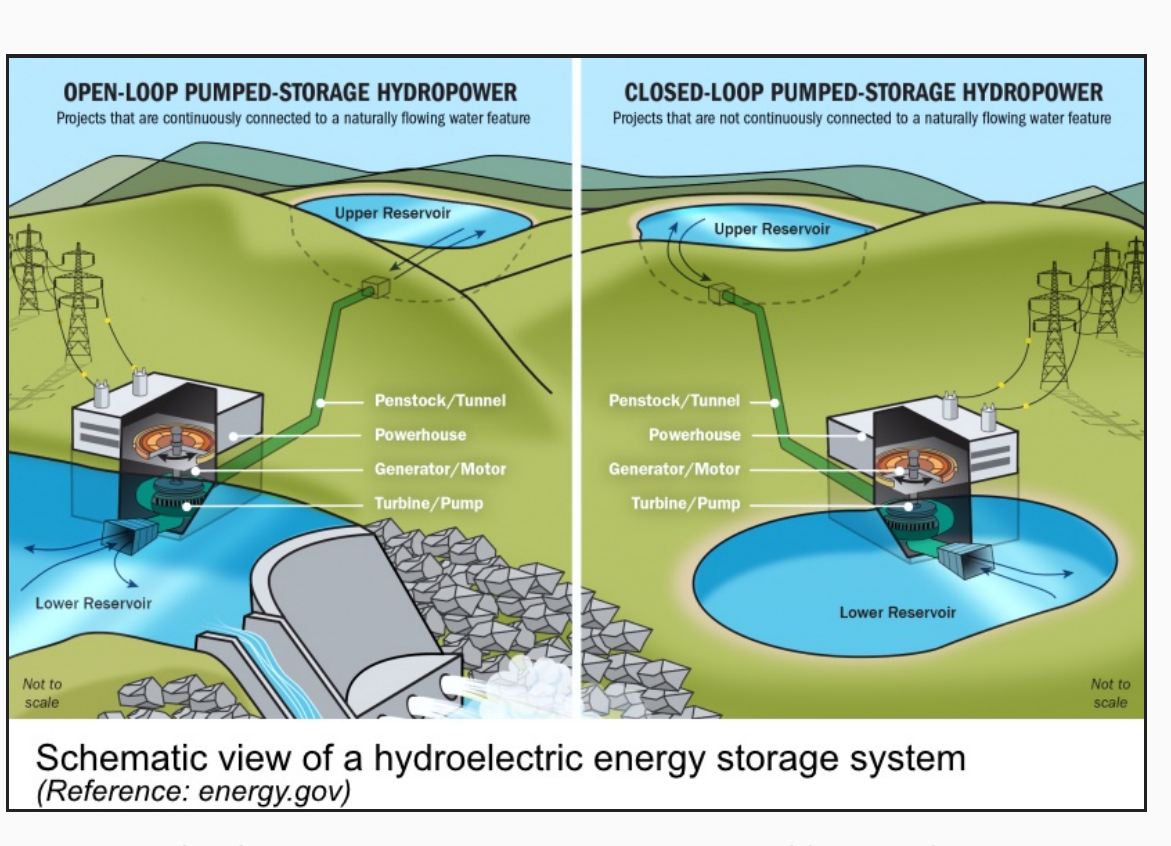
Energy Storage

Pumped storage hydropower (PSH) is a crucial component of the global energy transition, as the worldwide growth in variable renewable energy sources like wind and solar increases the need for energy storage solutions. Modeling by the International Renewable Energy Agency (IRENA) suggests that 420 GW of total installed pumped storage hydropower will be needed in order to allow the world to meet the Paris Agreement's climate goals by 2050.

Of all operating hydropower projects with at least 75 MW of nameplate capacity, only 14% (161 GW) is accounted for by pumped storage, and the other 86% (967 GW) is conventional storage or run-of-river. But pumped storage makes up 49% (439 GW) of prospective capacity, indicating the rising importance of this technology type in the coming years relative to other types of hydropower.

According to the Global Hydropower Tracker, the top five countries with the most operating pumped storage hydropower are:

1. China (51 GW, 30% of the global total)
2. Japan (24 GW, 14% of the global total)
3. United States (22 GW, 13% of the global total)
4. Italy (8 GW, 5% of the global total)
5. Germany (6 GW, 4% of the global total)


OPEN-LOOP PUMPED-STORAGE HYDROPOWER
Projects that are continuously connected to a naturally flowing water feature
CLOSED-LOOP PUMPED-STORAGE HYDROPOWER
Projects that are not continuously connected to a naturally flowing water feature
Upper Reservoir
Penstock/Tunnel
Powerhouse
Generator/Motor
Turbine/Pump
Lower Reservoir
Not to scale
Schematic view of a hydroelectric energy storage system
(Reference: energy.gov)

The pumped storage technology uses two reservoirs - upper and lower. The water is pumped to the higher reservoir at times of low demand and low electricity prices. At times of high demand - and higher prices - the water is then released to drive a turbine in a powerhouse and supply electricity to the grid.

There are two main types of pumped hydro:

· **Open-loop:** with either an upper or lower reservoir that is continuously connected to a naturally flowing water source such as a river.
· **Closed-loop:** an 'off-river' site that produces power from water pumped to an upper reservoir without a significant natural inflow.

- digitaljournal.com/ -- nytimes.com/ -- globalenergymonitor.org/

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FOSSIL & OTHER FUELS

China's apparent oil demand topped 16 million barrels per day in April, setting a new all-time-high just a month after it broke through the 15 million b/d mark for the first time.

China's fuel oil imports hit a 10-year high of 2.67 million tons (592,000 b/d), as small independent "teapot" refiners imported large volumes of discounted heavy fuel oil feedstock from Russia.

- energyintel.com/

Companies looking to harness the process that powers the sun and stars to generate electricity expect to spend about $7 billion by the time their first nuclear fusion plants come online, a recently published Fusion Industry Association (FIA) survey said.

- reuters.com/

No power plants with carbon capture are currently operating in the U.S. The most recent effort — the Petra Nova project in Texas — halted operations in 2020 due to chronic mechanical problems.

- axios.com/ - reuters.com/

Researchers in the United States found there are some 14,000 unplugged oil and gas wells that are either officially idle or have been inactive for at least five years in the waters off the southeastern coast of the United States.

Some 13,000 idle wells are in shallow waters close to shore, with 90% in federal waters and the rest in the state waters of Texas, Louisiana, and Alabama. Oil leaks from these shallow wells would be more likely to pose a threat to coastal habitats than those from deeper wells.

Under US laws, the costs for plugging wells in state waters are more likely to fall on the taxpayer, while in federal waters it is often the current or even previous owner that is liable.

Plugging the approximately 13,000 Gulf of Mexico inactive wells would cost an estimated total of $30 billion 6% of which would fall to state coffers.

- techxplore.com/

Four ways Biden is boosting fossil fuels — and drawing heat for it,

- In March, the administration approved a massive, 30-year oil drilling project on Alaska's Beaufort Sea (the Willow project). The project will release 576 million barrels of oil, resulting in 239 million metric tons of carbon dioxide, an approximate equivalent of two new coal plants burning, or 1.7 million new gas-powered cars, pumping out emissions for the next 30 years, based on EPA data.
- Also in March, the Department of the Interior auctioned off more than 73 million acres of federal Gulf Coast waters as part of Lease Sale 259.
- In April, the administration also approved a $39 billion Alaska-based gas export project, which ultimately aims to ship liquified natural gas (LNG) from the Arctic to Asia.
- In April, the Energy Department expressed support for and the U.S. Forest Service approved a controversial pipeline that would connect the fracking fields of West Virginia to central Virginia.

Multiple environmental groups expressed their strong disapproval of these actions, as further contributing to the environmental damage.

- thehill.com/

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NORTH-EAST

Floods along the New England coastline are around five times more common today than they were in the 1950s. These coastal flood events are expected to become even more common as sea levels are expected to rise another 1 to 2 feet in the next 50 years. (wmur.com/ *via Northeast Energy News)*

Department of Energy announced Solar District Cup Class of 2022–2023 winners **in solar-plus-storage design competition. Teams from Northeastern University finished first and third places across five district divisions.** nrel.gov/

New York

New York City Department of Transportation (NYC DOT) and New York Power Authority (NYPA) together plan to build as many as 13 electric vehicle (EV) fast-charging containing around 50 fast-charging plugs. The 150kW chargers will be compatible with all major electric vehicle models and offer up to 90 miles of range for every 10 minutes of charging.

- cleantechnica.com/

The FY 2024 state budget includes provisions that bar the use of natural gas in new residential buildings, the first such law in the nation. The provisions will take effect in 2026 for buildings seven stories and shorter and in 2029 for all other buildings.

- thehill.com/

Federal highway officials give New York permission to implement **a controversial peak congestion pricing plan** aimed at cutting emissions — a move New Jersey's governor has derided as "unfair" and a "money grab." *(Politico, NorthJersey.com via Northeast Energy News)*

Connecticut

At least three Fairfield County municipalities are working on gas-powered leaf blower restrictions. *(New Haven Register via Northeast Energy News)*

Eversource, the parent company of electric, water and gas companies in Connecticut, New Hampshire and Massachusetts, intends to exit the offshore wind business and sell its stakes in Massachusetts offshore wind leases to Ørsted for $625 million by the end of June. The sale will leave Ørsted as the sole owner of about 187,000 acres nearly 25 miles off the south coast of Massachusetts that can potentially hold up to 4 gigawatts of offshore wind projects. (ctexaminer.com/ *via Northeast Energy News)*

Maine

A nonprofit kicks off a new pilot program to offer free "energy coaches" to homeowners who need independent advice about efficiency and weatherization upgrades. *(Maine Monitor via Northeast Energy News)*

Massachusetts

The Acton Water District is planning to install a 1.5-megawatt solar energy and 2-megawatt-hour battery storage project to directly supply its microfiltration treatment plant. The project will add to its previously constructed 4.7 MW solar energy and 4 MWh storage systems. The energy project is expected to generate nearly 1.9 gigawatt hours of energy annually.

- .environmentalleader.com/

Vermont

Plans are underway for an $18 million facility in St. Albans, Vermont, that will convert organic waste from Ben & Jerry's Ice Cream and other area food manufacturers into biogas. *(News release via Northeast Energy News)*

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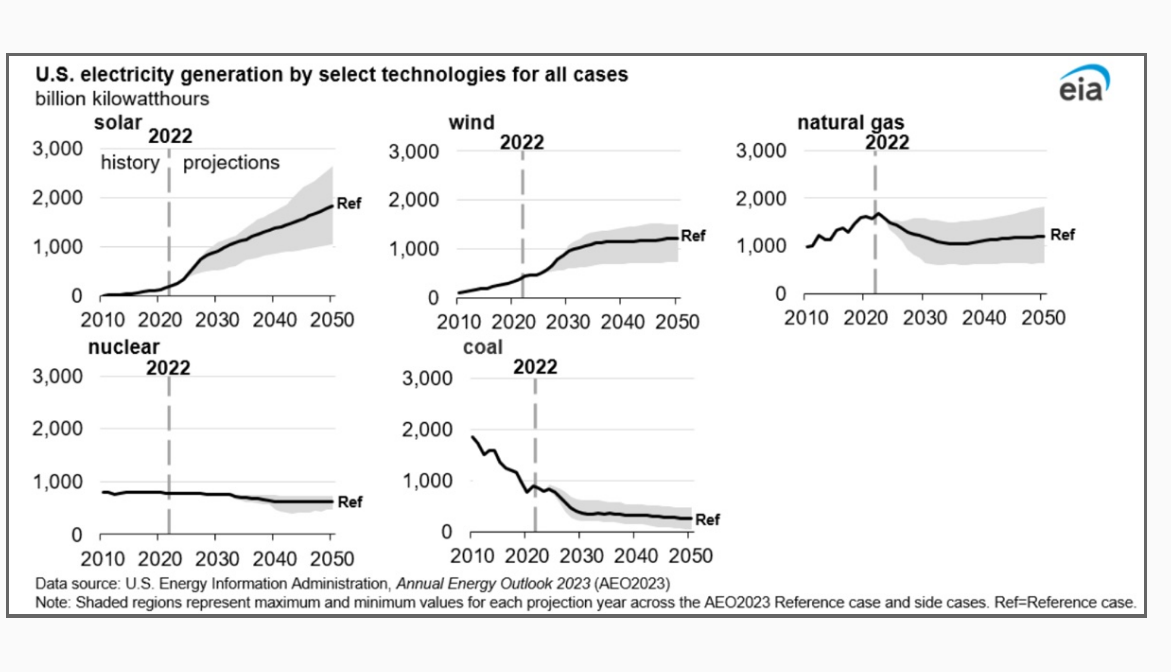
DATA

From Energy Information Agency (EIA):

EIA Projections:

- EIA in its *Annual Energy Outlook 2023* (AEO2023) projects electric vehicles, both battery-electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs), will account for between 13% and 29% of new light-duty vehicle sales in the United States in 2050 and between 11% and 26% of on-road light-duty vehicle stocks.
- AEO2023 explores long-term energy trends in the United States. It includes a Reference case and 12 side cases that explore key areas of uncertainty about how energy markets will develop. EIA retooled its graphs to emphasize the range of results, denoted by shaded areas, across the full suite of modeled cases.



Data source: U.S. Energy Information Administration, *Annual Energy Outlook 2023* (AEO2023)
Note: Shaded regions represent maximum and minimum values for each projection year across the AEO2023 Reference case and side cases. Ref=Reference case.

U.S. energy insecure households were billed more for energy than other households. Households identifying as energy insecure were billed $0.20 more per square foot than the national average and $0.26 more on average than households that did not experience energy insecurity.

As of April 1, European natural gas storage inventories were 56% full—the highest percentage on record for the end of a heating season (November 1 through March 31)—according to data from Gas Infrastructure Europe's Aggregated Gas Storage Inventory (AGSI+).

- www.eia.gov/

The International Energy Agency (IEA) expects investment in clean energy technologies, including "renewable power, nuclear, grids, storage, low-emission fuels, efficiency improvements and end-use renewables and electrification," to exceed $1.7 trillion in 2023, the most ever. Yet, even as clean energy investments grow, more than $1 trillion is expected to be invested in unabated fossil fuel supply and power, mainly oil and gas, but also coal, which is, notably, more than a 6% increase in unabated fossil fuel supply investments.

- powermag.com

Global wind turbine order intake hit a new Q1 record, with 2350MW of activity, a 27% increase year-over-year (YOY), according to a new analysis from research and consultancy group Wood Mackenzie.

- enews.biz

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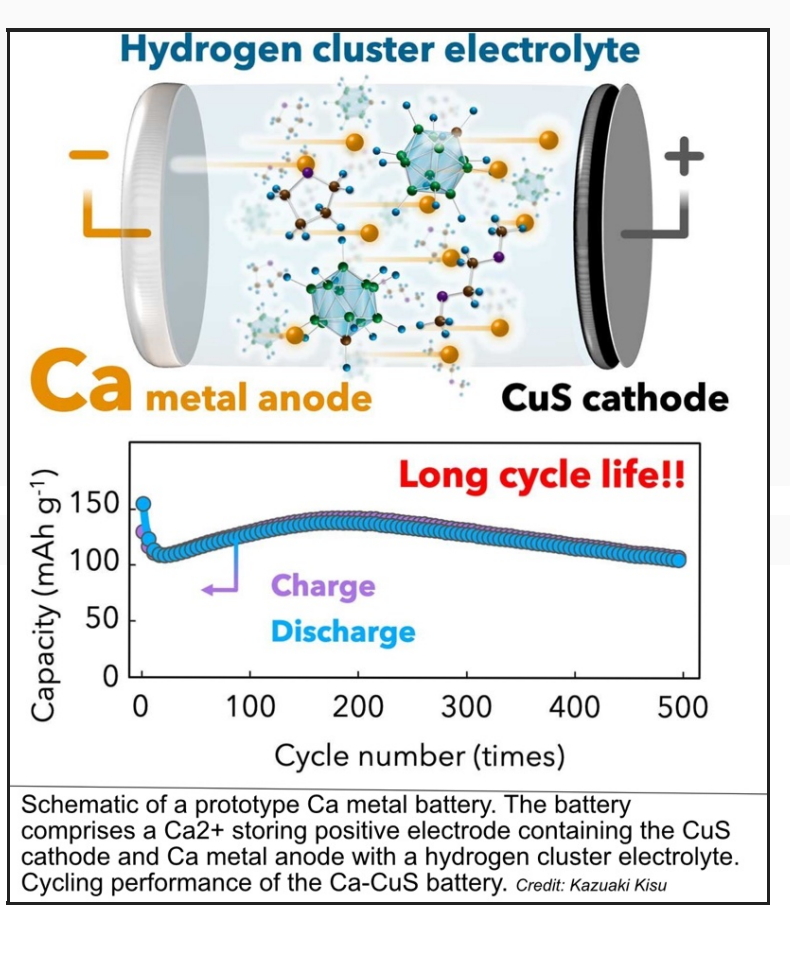
OF INTEREST

Energy: Research/Development

Batteries

Calcium (Ca) metal batteries could potentially replace lithium-ion batteries **(LIBs).** A research group at Tohoku University in Japan has developed a prototype calcium (Ca) metal rechargeable battery capable of 500 cycles of repeated charge-discharge—the benchmark for practical use. The lack of efficient electrolytes and the absence of cathode materials with sufficient Ca^{2+} storage capabilities have proved to be the main stumbling block toward battery commercialization. For now, the researchers tested the long-term operation of a Ca metal battery with a copper sulfide (CuS) nanoparticle/carbon composite cathode and a hydride-based electrolyte.



Schematic of a prototype Ca metal battery. The battery comprises a Ca2+ storing positive electrode containing the CuS cathode and Ca metal anode with a hydrogen cluster electrolyte. Cycling performance of the Ca-CuS battery. Credit: Kazuaki Kisu

- //techxplore.com/

Green Hydrogen

Proton exchange membrane (PEM) electrolyzers represent a new generation technology for electrolysis. They can split water into hydrogen and oxygen with higher efficiency at near room temperature. The reduced energy demand makes them an ideal choice for producing clean hydrogen by using renewable but intermittent sources, such as solar and wind.

Electrolyzers run with separate catalysts for each of its electrodes (cathode and anode). The cathode catalyst yields hydrogen, while the anode catalyst forms oxygen.

A multi-institutional team led by Argonne National Laboratory reports that it managed to replace very expensive and rare iridium with abundant cobalt in the anodes of the PEM electrolyzers.

- anl.gov/ -- science.org/

Related:

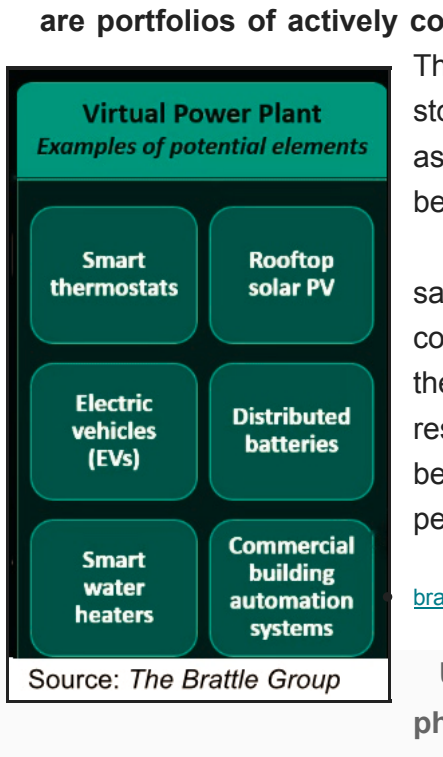
For Your Phone and EV, a Cobalt Supply Chain to a Hell on Earth: The race for high-tech metals has sparked a cobalt boom in the Democratic Republic of the Congo that has come at a steep human cost.

- e360.yale.edu/

Virtual Power Plants (VPPs)

are portfolios of actively controlled grid-integrated aggregations of distributed energy resources (DERs). The term "VPP" is associated with aggregations of behind-the-meter (BTM) solar and storage. However, dispatchable demand response (DR), enabled by technologies such as smart thermostats and electric vehicles (EVs), can provide many of the same benefits as distributed generation resources by reducing or shifting load.

According to an analysis released in early May by the Brattle Group, VPPs could save U.S. utilities $15 to $35 billion in capacity investment over 10 years.), the VPP could provide resource adequacy at a net utility system cost that is only roughly 40% of the net cost of a gas peaker, and 60% of the net cost of a battery. Decarbonization and resilience benefits would generate an additional $20 billion in societal benefits,e.g., grid reliability, decarbonization, and reduced emission, over that ten-year period.



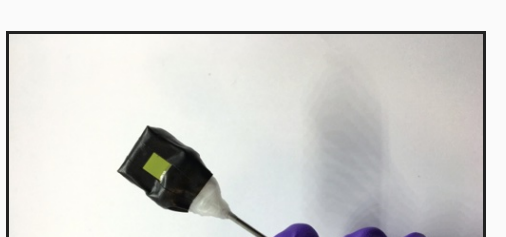
Source: *The Brattle Group*

brattle.com/ - rmi.org/

Using "artificial leaves", researchers at the University of Cambridge applied photosynthesis to convert carbon dioxide. water and sunlight into multicarbon fuels—ethanol and propanol—in a single step. These fuels have a high energy density and can be easily stored or transported.

To date, these artificial leaves have only been able to make simple chemicals, such as syngas, a mixture of hydrogen and carbon monoxide that is used to produce fuels, pharmaceuticals, plastics and fertilizers.

A new copper and palladium-based catalyst, was optimized to produce more



complex chemicals, specifically the multicarbon alcohols ethanol and n-propanol, using only solar energy.

At present, the device is a proof of concept and shows only modest efficiency. Further work will be required to improve sunlight absorption, optimize the catalyst to increase fuel production, and make the device scalable to produce large volumes of fuel.

A standalone artificial leaf attached to a metal rod support.
Credit: Motiar Rahaman

- techxplore.com/

Batteries

The notion of battery swapping is dismissed by some as unworkable. The main difficulty: EV batteries are cumbersome and there's no industry standard design.

A California startup, Ample, dedicated to battery swapping, is introducing a new streamlined station that cuts the process to about five minutes, far less than the 30 minutes or more needed at public fast chargers. The startup has come up with a modular design that accommodates the different EV designs.

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Environment/Climate

Human activities are undeniably altering the thermal structure of Earth's atmosphere. An analysis conducted by Lawrence Livermore National Laboratory (LLNL) scientists and colleagues for the first time demonstrates that extending "fingerprinting" techniques — used to identify the human effects on climate — to the mid-to-upper stratosphere (25-50 kilometers above Earth's surface) improves the detection of human effects on climate by a factor of five. The distinct patterns of CO2-driven temperature changes in these areas underscore the impossibility of natural causes explaining these shifts.

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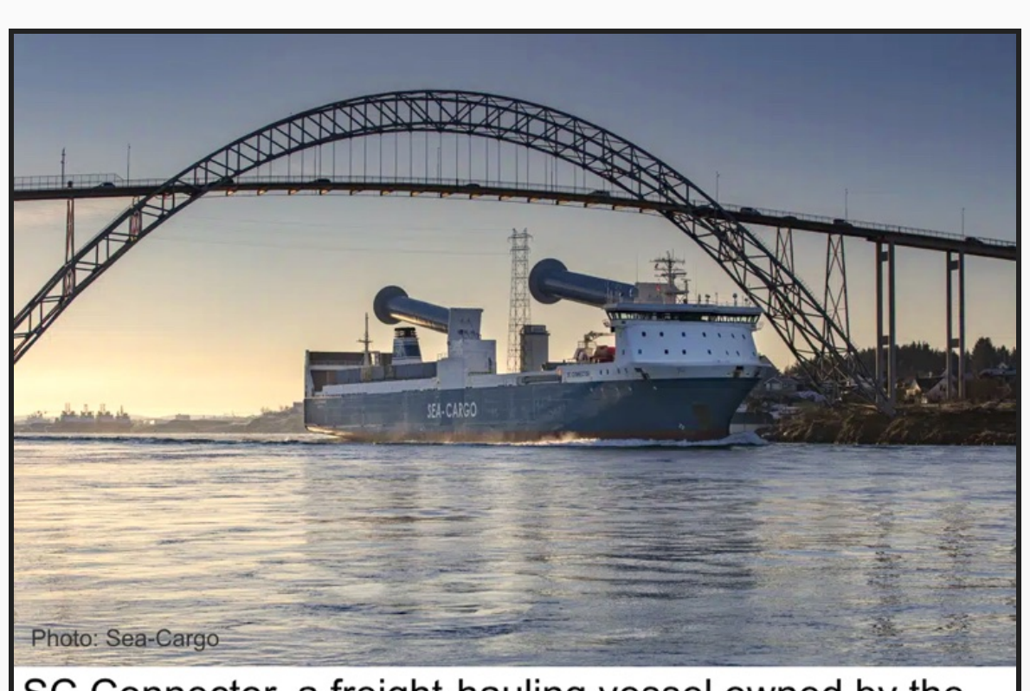

Photo: Sea-Cargo

SC Connector, a freight-hauling vessel owned by the Norwegian company Sea-Cargo, passing beneath the Karmsund Bridge in Norway. The ship is equipped with two rotor sails manufactured by Finland-based Norsepower. The 38-yard-high rotors spin in the wind and help propel the vessel. They also can tilt to avoid obstacles overhead. (*Tor Nilssen/Sea-Cargo via AP*)

Maritime shipping produces nearly 3% of the world's carbon emissions. The International Maritime Organization (IMO), which regulates commercial shipping, wants to halve its greenhouse gas releases by midcentury.

To this end, the IMO is pursuing the creation of "green shipping" corridors on which through the application of modern technologies it will seek to unite marine fuel producers, vessel owners and operators, cargo owners and ports in a common effort.

Ports of Los Angeles and Shanghai formed a partnership last year. Other agreements are being negotiated and executed.

"The vision is that a container will leave a factory on a zero-emissions truck (in China)," said the executive director of the Port of LA. "It will arrive at the port of Shanghai, be loaded onto a ship by a zero-emissions cargo handling equipment unit and move across the Pacific Ocean on a vessel that emits zero carbon. Once it gets to Los Angeles, the reverse happens."

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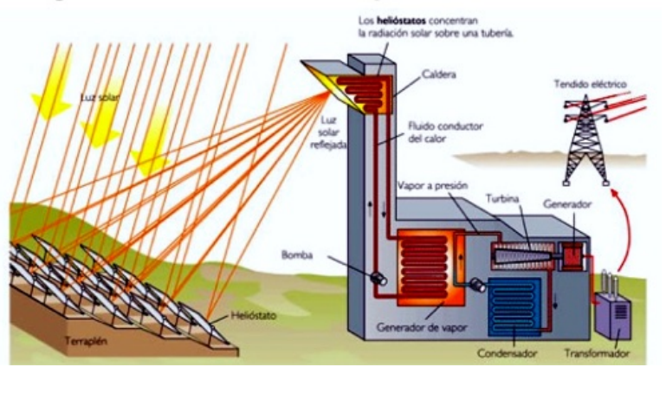
The Reads

Diagram of a CSP tower plant



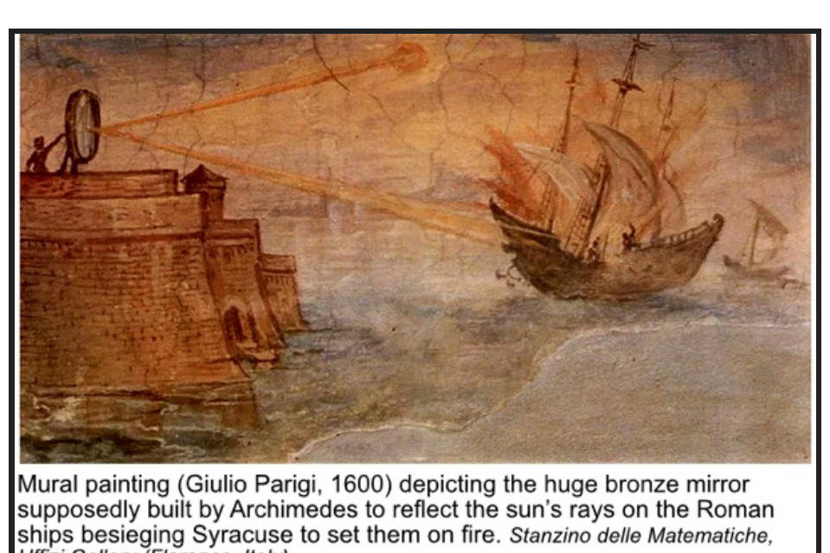
Concentrating Solar Power **(CSP), technology to store thermal energy and to provide flexible, renewable energy, 24 hours a day,** 7 days a week, in regions with excellent direct solar resources. (By **Ignacio Mártil,** *Professor of Electronics at the Complutense University of Madrid and member of the Spanish Royal Society of Physics)*

1. Concentrating Solar Power, the Other Major Renewable Energy Source

CSP plants are based on the use of mirrors that concentrate direct radiation from the sun onto a receiver filled with a fluid, usually thermal oil or molten salts. This fluid, called **heat transfer fluid, conducts heat to an exchanger where it is used to generate steam**. The steam is then directed under pressure to a turbine to move its blades and produce electrical energy, following a procedure similar to that used in conventional thermal power plants.

Broadly speaking, a CSP plant consists of three main units:

1. Solar collectors, are mirrors that reflect sunlight and concentrate it on a certain focus, converting solar energy into thermal energy.
2. A means of heat storage by means of water vapor or molten salts.
3. An electric power generator, which produces electricity via a turbine driven by steam that has been obtained from the conversion of solar radiation into heat.



Mural painting (Giulio Parigi, 1600) depicting the huge bronze mirror supposedly built by Archimedes to reflect the sun's rays on the Roman ships besieging Syracuse to set them on fire. *Stanzino delle Matematiche, Uffizi Gallery (Florence, Italy)*

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2. Pros and Cons of Concentrated Solar Power

Attributes of CPS:

+ High energy efficiency (without the baggage of other high-efficiency sources(: 20% -40% vs. photovoltaics at 18% - 26% vs. nuclear at about 35% vs. natural gas combined cycle power plants at 45% to 50%.

+ Capacity to store energy produced: CSP plants can store thermal energy for 10 to 15 hours.

+ Flexible technology: CSP plants can stop feeding electricity to the grid and store the energy as heat, which can be used when needed, even at night. In this regard, CSP and photovoltaic solar energy are perfectly complementary.

- Need for high levels of irradiance: Only in places with high levels of solar irradiance – over 2,000 kWh/m^2/year, typical in southern Europe and northern Africa – can CSP plants be rolled out at competitive costs.

- High cost of electricity produced at CSP plants: While rapidly declining, the cost per kWh is substantially higher than for photovoltaics or wind power.

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OPINION

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Nuclear power can play a significant role in the search for energy resilience. By *Chad Cramer, Bill Lacivita, Daniel Pacthod, and Humayun Tai, McKinsey & Company*

The power sector has to decarbonize—at present, it accounts for about 30 percent of global emissions, and electricity demand could triple by 2050, driven by increasing electrification and economic growth.

Unlike renewables that offer an intermittent energy supply, nuclear has already demonstrated that it can provide 24/7 reliable and flexible power while using far less land than many renewables building more nuclear plants to provide reliable, always-on, zero-emissions power generation can seem like a simple decision. Yet in many important markets, including Europe, Japan, and the United States, public skepticism and hostility to doing so remains.

- mckinsey.

ICYMI / FYI

Potential paths to a fusion energy breakthrough

The light and heat that warms the Earth, powers its wind and water cycles, and grows its plant life comes from the sun — an enormous fusion reaction 94 million miles away.

Fusion energy is released when two atoms are forced together until they collapse into each other. It's the opposite process to the atom-splitting, or fission, that powers current forms of nuclear energy.

Tokamak - a magnetic donut: The dominant form of fusion uses a donut-shaped reactor wound around with magnetic coils — invented by Soviet scientists in the 1950s.

In 2021, the international team at EAST (the Experimental Advanced Superconducting Tokamak) ran at 120 million degrees Celsius, or 216 million degrees Fahrenheit, for an unprecedented 101 seconds — a runtime it increased by a factor of four in April.

Stellarator - twisting the donut: Another vestige from the cold war era, built in Princeton also in the 1950s. In theory, its twisted shape cancels out the instabilities in the circulating plasma, giving the magnetic "cage" that contains it far more stability than it would have in a tokamak. In 2018, the publicly funded Wendelstein 7-X fusion in Germany achieved a record three seconds of fusion.

Pulses and lasers - a pocket of plasma that is 10 million times denser than that in a tokamak is fused over a period 10 million times shorter. That was the approach seen in the landmark results from the Lawrence Livermore National Laboratory in December. In a historic first, the fusion reaction released more energy than had been applied in the process.

Tokamaks and stellarators can't generate electricity directly. Instead, their fusion reactions release a flood of radioactive neutrons, which batter the metal walls of their container, releasing heat that can be tapped to boil water for a steam turbine.

Fusion engine: The approach involves generating electricity directly from the fusion reaction itself. It takes advantage of the fact that magnetic fields and electric currents are two aspects of the same phenomenon — or more specifically, that disruptions in a magnetic field, caused in this case by a series of tiny fusion explosions, creates outpourings of electricity. Helion, a company in which Microsoft recently invested, committed to provide 50 MW of power by 2028, or face financial penalties.

- thehill.com/ --.heverge.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
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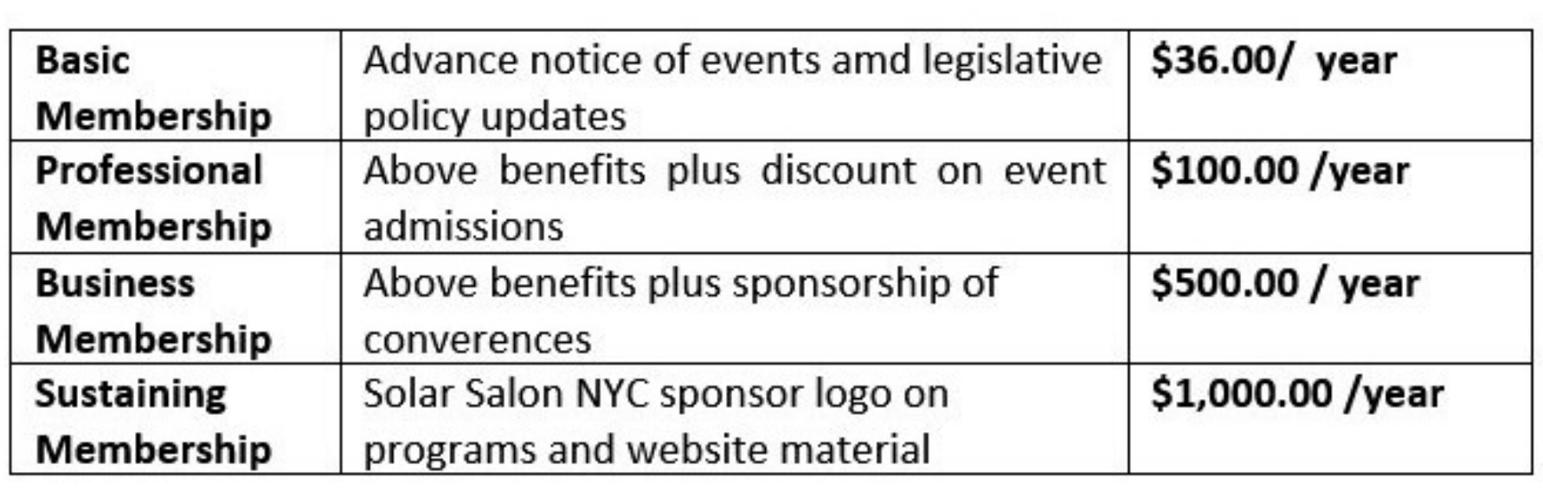
917 974 4606

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.



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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 Update is compiled & edited by Yuri Kalina

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