

# ENERGY MATTERS

*Soundbite summaries of the energy news you need to know*

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AMERICAN ENERGY SOCIETY

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**March 7, 2022**

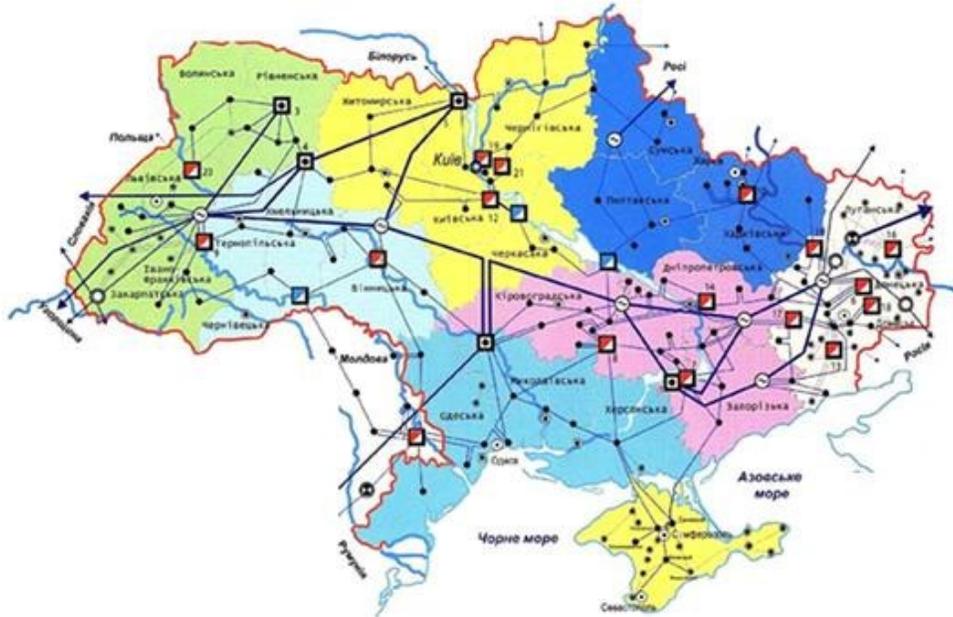
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## **- The Power Read -** Spotlight on the Ukraine power grid

As of the second week of conflict; source: [NPC Ukrenergo](#) (site currently down);  
AES also recommends the [YouTube video](#),  
"Ukraine's Energy Gamble: Can It Unplug From Russia."

- There are 9 individual power grids in Ukraine (see map below).
- Currently, only one power unit is fully operational and under Ukrainian control (evening temperatures are usually below freezing).
- The grid with the Zaporizhia Nuclear Power Plant is offline and has been seized by Russian troops (there is no evidence of leaked radiation); a Russian missile also damaged the NPP's thermal energy pipeline.
- The seven other power systems have been put into safe operation mode and can be immediately disconnected if threatened (right now, all seven are operating at a controlled standard frequency of 50Hz).
- The highest priority of power system engineers is compliance with IAEA nuclear safety standards.
- The next highest priority is synchronizing Ukraine grids with the larger ENTSO-E grid (European Network of Transmission System Operators).
- Much of the Armed Forces of Ukraine can be supplied with electricity.
- There is no electricity in regions under attack; repairs will begin as soon as engineers can get to the damaged high-voltage power lines and substations.

- *AES editors' note:* In spite of the attack on Europe's largest nuclear power plant, some of the Ukrainian power system is still functioning, an incredible feat of engineering that is keeping the grid operating under extreme circumstances.



## - News from the Society -

- July 7–8, **American Energy Society co-hosts the 12th annual SISE Conference: [Celebrating the Prosumer](#)**, in partnership with the University of Illinois, Chicago, and Argonne National Laboratory. [Contact us](#) if you are a student or early-career energy professional and would like to apply for a SISE Fellowship. Also, AES recommends the "[New Energy](#)" resource at Dartmouth for early-career energy professionals.

- AES is a *Supporting Organization* of [Electrification 2022](#), hosted by the Electric Power Research Institute (EPRI), an in-person conference June 28-30, Charlotte, NC.

- AES applauds the [MIT Energy Conference](#), March 31 and April 1, in Boston.

## - Fossil Fuels -

### - Oil -

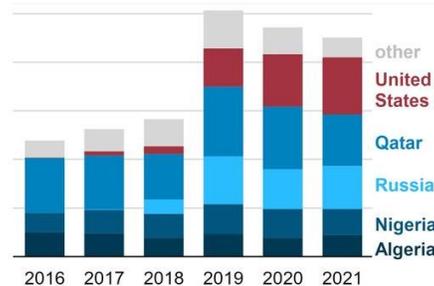
- The Russian invasion of Ukraine — the event that triggered oil's jump to \$100+/barrel — will probably **not change production strategies for OPEC+**; six months ago, the 20 countries in the expanded cartel agreed to increase the overall production quota by 400,000 barrels/day. Many members of the cartel have already announced that they will hold to the quota at the next scheduled meeting on March 9 and 10. **What to know about OPEC+:**

- Format: OPEC+ is an amalgamation of OPEC and invited oil-exporting nations
- Co-chairs of OPEC+: Saudi Arabia and Russia
- National membership [fee](#): \$2 million (USD)

- Location of meeting: Vienna, Austria (Austria is not a participating member)
- OPEC members: Algeria, Angola, Republic of Congo, Equatorial Guinea, Gabon, Iran, Iraq, Kuwait, Libya, Nigeria, Saudi Arabia, UAE, Venezuela
- OPEC+ has a less formal membership profile, and at times consists of: Azerbaijan, Bahrain, Brunei, Egypt, Kazakhstan, Malaysia, Mexico, Norway, Oman, Russia, and Sudan (and South Sudan).
- Lapsed members: Ecuador, Indonesia, Qatar.

### - Gas -

- Usually, about **70%** of Europe's supply of liquefied natural gas (LNG) comes from the US (26%), Qatar (24%), and Russia (20%). However, the US is currently supplying more than half of the total imported. *Insert:* LNG imports to Europe (EU-27) by source country, 2016 to 2021.



### - Mining, Minerals and Coal -

- Prices for almost all rare earth metals and elements are **increasing** right now, and also for nickel, iron ore, and aluminum. This is primarily due to the failure of supply-chains/trade logistics. Russia's invasion of Ukraine has added another layer of disruption to the highly-interconnected supply chain system, and recent inflation is also adding uncertainty.

### - Carbon Capture –

- Each year, there is a **13.3 billion ton gap** between country-level emissions as reported to the United Nations and actual emissions.

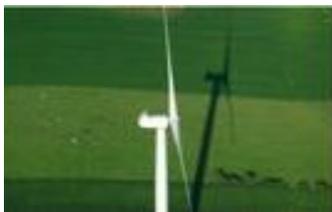
### - Low-Carbon Energy –



- AES recommends the "utility-scale solar technology trends" **interactive map and report.**

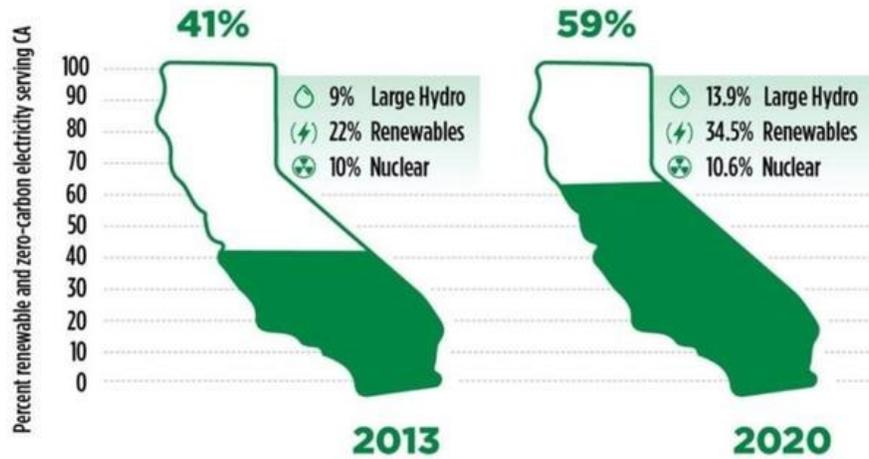
*Map insert* - installed megawatts, by module and mount type:

c-Si: 26,668  
Thin film: 11,219  
CPV: 59



- **Shadow Flicker** (abbrev. "SF"), *intransitive verb*, definition: The moving shadows caused by wind turbines.

- In 2013, California established a **goal** of 100% clean energy by 2050, the most ambitious in the US. *Insert:* the state's progress toward that goal, as of 2021.



- About 40% of all corn grown in the US is used for [biofuels](#) (mostly ethanol). Note: 36% of the US corn crop is used as animal feed, including distiller grains left over from ethanol production; much of the rest is exported. The smallest percentage is used for food, much of that for high-fructose corn syrup.

## - Energy Policy & Energy Geopolitics -

### - A few things to know about Russia's invasion of Ukraine in terms of energy geopolitics:

- Russia has been essentially unplugged from the global financial community.
- Oil majors [pulling](#) their investments in Russia are: Equinor, Exxon and Shell. TotalEnergies will not invest in new projects. The remaining oil majors are "[limiting their exposure](#)."
- Global sanctions against Russia [do not](#) yet include the oil and gas industry, which generates half of Russia's total revenues, because it would have severe consequences for global markets (such as inflation, which is already at a 40-year high).
- The US and the IEA will [release](#) 60 million barrels of oil from global stockpiles. To put that total in context, Russia exports about 5 million barrels of crude oil each day.
- [Hawaii](#) imports most of its oil from Russia.

### - To understand "why now" look at global energy markets -

REPLAY from *Energy Matters*, 8.5 ([AES Members](#) have access to the archive)

To a great extent, the timing of Russia's attack of Ukraine is directly related to the current tightness of the world energy market. From mid-2014 until the onset of the global pandemic in 2020, Russian gas sold for less than \$10 per million metric British thermal units, and sometimes less than \$5 (all USD). But the low prices of the 2010s discouraged investment in new supply, setting the conditions for higher prices in the 2020s. As the world economy began to recover from the early pandemic, so did the price of gas. The price of Russian gas on spot markets surpassed \$10 per million metric BTUs in June 2021, then \$15, then \$20; it's now about \$30.

Russia is the world's No. 3 exporter of oil, and its No. 2 exporter of natural gas. Europe coming out of another energy crisis, mostly electrical power. Higher prices in all markets, including electricity, made Europe vulnerable to market manipulations.

Higher crude and natural gas prices enabled Russia to build massive holdings of dollars, euros, and gold. Those holdings now exceed \$630 billion, an impressive stash for a country with a GDP of only \$1.5 trillion. Now, Russia's power over its oil and gas customers is at a zenith—and its financial resources are

enormous. Putin has been building to this moment for a long time. Even if Russia's military objectives fail, Russia can still manipulate energy markets in Europe, as they have in the past.

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## - Climate and Sustainability -

- "**Maladaptation**" (*non-productive noun*) definition: the failure to adjust adequately or appropriately to the environment or situation.

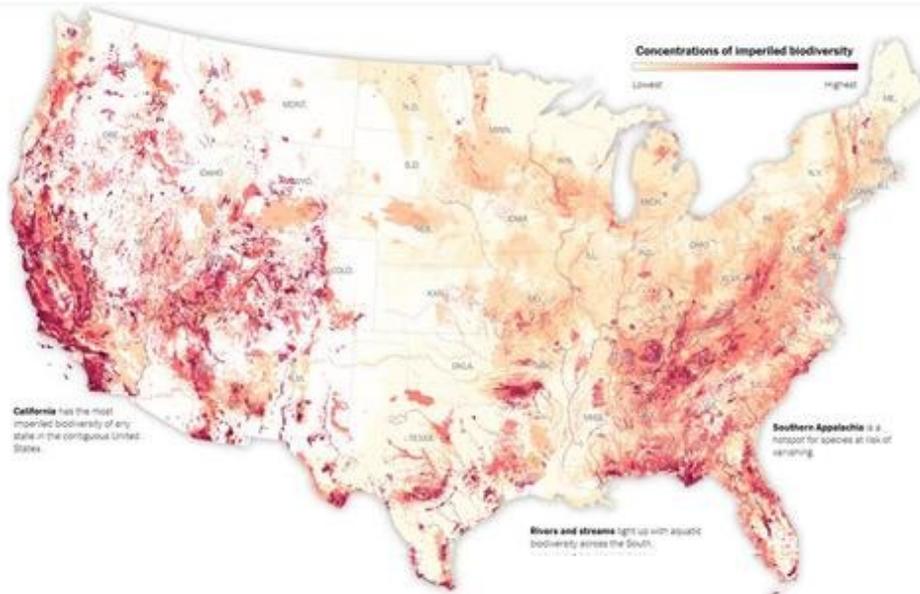
Below: the top-3 climate change maladaptation solutions that are also creating new problems (*source: [chapter 5](#) of an IPCC 3,576 page report*):



1. Tree planting in ecosystems that were never meant to be forested.
2. Irrigation projects that counteract drought in order to support agriculture also limits the amount of groundwater that naturally seeps into and refills underground water tables.
3. Sea walls that protect against rising ocean levels expose regions outside the seawall borders to flooding.

- There are about 10,000 chemical and petrochemical storage facilities in the US; of these, **3,219 are located in areas identified as "at risk" in a changing climate**, and of these, more than 2,400 are in "[high risk](#)" flood zones.

- **Regions in the US with the most "at-risk" biodiversity** (plant and animal species):



- **The total number of tree species in the world is much higher than previously thought**; however, the total number of "at risk" tree species is also higher than previously thought. [AES Members](#) have access to the peer-reviewed research.



- The east coast of Australia — Southeast Queensland and the north coast of New South Wales — has had extensive [rain and flooding](#), and the level of damages and loss of life is still undetermined.

Related, **the Intergovernmental Panel on Climate Change (IPCC) received updates to its 6th assessment report from [Working Group II](#)**. *Summary*: "the atmosphere and seas are warming at

unprecedented rates," "extreme weather is taking hold in every part of the planet," and "we are running out of time."

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## - Research and Markets -

- [Argentina](#) signed an agreement to join the China Belt and Road Initiative. Related, the top-4 lithium producers, in order: Australia, Chile, China, Argentina. Meanwhile, **lithium prices are at an all-time high** at \$78,000/ton (USD), more than 4X its price four years ago.

### Spotlight: EVs



- The DoE will provide \$2.91 billion to [support](#) the EV supply chain, with special emphasis on domestic sourcing of raw materials.
- The Biden administration detailed [plans](#) for a \$5 billion network of EV chargers along interstate highways.
- GM recently announced plans to [invest](#) \$7 billion in vertically integrated battery production at four Michigan plants.
- Venture [funding](#) for EV batteries grew from \$175 million in 2020 to \$3.6 billion in 2021, primarily due to investments by OEMs.

- For the last 15 years, Professor Yushan Yan's research team at CalTech has been working to overcome a serious problem with hydrogen fuel cells: they're too sensitive to CO2 in the air. By [leveraging](#) this issue, however, the team was able to create a **hydrogen-powered system that's extremely good at filtering CO2 in the air** — up to 99% in one pass.

- *Trend-spotting AES data*: there is growing interest — or perhaps hype? — about "**natural capital accounting**" (calculating the total stocks and flows of natural resources and services in a given ecosystem or region; accounting for such goods may occur in physical or monetary terms). Two of the more reputable groups in this new field are [TNFD](#) and [TCFD](#).

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## - Electricity, Power, Efficiency, and the Grid -

- In 2021, the **retail electricity price paid by US residential electric customers increased at the fastest rate since 2008** (+4.3%, which is similar to the change in the US Consumer Price Index, which was +4.7%).

- Duke Energy operates 11 coal-fueled power plants, including six in North and South Carolina, one in Florida and four that serve multiple states in the Midwest. **Duke announced that it will convert all 11 power plants to natural gas or to renewable sources.**

- A lot of **energy investment capital is on the sidelines due to concerns about [inadequate](#) transmission/interconnection grid infrastructure**. Indeed, recent [public comments](#) submitted to FERC emphasize a desperate need for "faster, accelerated" review of new transmission and interconnection infrastructure proposals.

### - Cybersecurity Spotlight -

- **When will Russia use [cyber attacks](#) as a military weapon?**

- In 2015, Russian government hackers breached the Ukrainian power grid, leading to widespread outages.
- In 2017, Russia deployed the NotPetya malware via Ukrainian accounting software and the virus quickly spread around the world.
- Russia frequently uses Ukraine as a "testing ground" for its cyberwar capabilities.

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### - Texas & Boston universities in the spotlight -



In case you missed it ... [Universities in the Spotlight](#): 20 under-appreciated university programs making outsized contributions to energy.

- AES appreciates [HURRI](#) (the Hurricane Resilience Research Institute) and [GLEAMM](#) (a microgrid testing center) at **Texas Tech**.

- AES recommends the archive of webinars hosted by the [Center for Midstream Management & Science](#) at **Lamar University**.

- There are 28 individual faculty members in the Cockrell School of Engineering at **UT- Austin** and thru its [Energy Institute](#) who are working on [battery research](#), from storage materials to resource recovery.

- AES applauds the [Energy Research Society](#) at **Texas A&M**.

- AES recognizes the [student-centered approach](#) of the Maguire Energy Institute at **SMU**, including the Miller Energy Management Student Program, and the Spindletop Student Managed Energy Investment Fund.

- AES admires the [unconventional](#) energy-related projects and programs at **Rice University**, including the SSPEED Center (severe storm predictions), the Energy & Natural Resources Initiative, and the NEWT Center (water treatment systems).

- AES awards **St. Edward's University** as the most [sustainable](#) in Texas.

- **Boston University** has a convergent data science program, like [iMAP](#), that intersects with a wide variety of energy related programs, like the [Institute for Sustainable Energy](#) and the [Hariri Institute](#).

- AES gives "[Ocean Filibuster](#)" a new musical theater production at the American Repertory Theater, commissioned and developed through a collaboration with the **Harvard University** Center for the Environment (HUCE).

- The [Law Land & Environmental Law Program](#) at **Boston College** is an exceptional training ground for activists looking to promote and defend policies in support of sustainability.

- AES applauds the solutions-oriented approach of [Climate Policy Lab](#) at **Tufts University**.

- And of course, from MIT ...



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## - Quotes -

### *Russia and the global energy market*

"We do not use natural gas as a weapon. Even during the hardest parts of the Cold War Russia regularly fulfilled its contractual obligations and supplied gas to Europe."

- Russian President Vladimir Putin

"You are looking at losing 5 million barrels of Russian exports.... The market can't afford to lose Russian barrels."

- Bob Yawger, director of the futures division at Mizuho Securities USA, on Russia cutting off its O&G trade with Europe

"He [Putin] has used energy as a weapon and we are afraid to have it on the table? I'm sorry, he put it on the table. This is not going to be easy on Europe or the United States. Hopefully it will be most difficult on Russia."

- US Senator Lisa Murkowski (R-Alaska)

## - Bulletin Board -

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- **Featured:** The DOE **National Energy Technology Laboratory is conducting a search for a [Chief Research Officer](#).**
  - [CERAWeek](#), March 7-10 in Houston.
  - AES recommends the [Bifrost Summit](#), March 15 at NASDAQ in San Francisco.
  - American Energy Society supports the upcoming webinar [Innovation Hubs: A New Horizon for Cleantech Investing](#), by SEP on March 22.
  - Many companies are implementing drone programs; here's what a successful drone program looks like, from AES expert member [DroneDeploy](#).
  - Clearpath has published a new report on [clean hydrogen](#).
  - Don't miss the 8th Annual West Texas Oil & Gas Convention [March 23-24](#) at the Midland County Horseshoe Pavilion. All [AES Members](#) can register for free.
  - mHUB has launched its [Climate and EnergyTech](#) accelerator program (in support of prototype hardware solutions. Applications are open through March 28.
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- Gratitude -

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