17 November 2025

German solar plant cleared to provide secondary control reserve

Enerparc subsidiary Sunnic Lighthouse, flexibility provider Entelios, and transmission system operator 50Hertz completed prequalification for the 37.4 MW Schkölen solar park in Thuringia, Germany, to participate in the secondary control reserve market. The plant has provided up to 25 MW of positive and negative automatic frequency restoration reserve over the past week.

Photovoltaic assets have not previously participated in Germany's secondary reserve segment. The companies said the Schkölen project establishes "new standards in the integration of renewable energy," with three additional parks in preparation. Managing Director Arved von Harpe said any large plant could take part and smaller ones could qualify "if we can bundle them together." He added that networking multiple assets provides redundancy, and that Schkölen still retains a significant buffer even though the maximum reserve capacity is 25 MW.

aFRR sits within one of four reserve segments and must be fully delivered for 15 minutes within a five-minute activation window. Tenders are now issued the day before in four-hour blocks, with the Federal Network Agency planning to shift to 15-minute blocks next spring. That change favors photovoltaic and wind generation. The primary reserve segment must respond within 30 seconds, while the tertiary reserve allows 12.5 minutes for delivery.

Photovoltaic systems can supply positive and negative aFRR, and the Schkölen plant is qualified for both. A rise in grid frequency enables rapid curtailment, while a fall allows a previously curtailed plant to boost output. Under strong irradiation, the response can exceed the ramping capability of fossil-fuel units or large industrial loads. Market rules already anticipate such participation.

Operators said the technical challenge lies in ensuring real-time visibility into available balancing energy, which varies by time, season, and weather. Limited data transparency has constrained wind participation and previously excluded solar entirely. The consortium described Schkölen as an "innovative flagship" that marks a "paradigm shift," said von Harpe, "not only for Sunnic and our industry, but also for the entire energy system."

Entelios adapted the park's control system for aFRR compatibility. The project is "a true milestone – and proof of what is possible when technological innovation meets collaborative partnership," said Entelios CEO Fabian Becker. Sunnic Lighthouse, Entelios, and 50Hertz jointly developed the metering setup, data architecture, and AI-supported forecasting model. Both companies praised 50Hertz, which initiated the effort. Von Harpe said "a phone call came two years ago" after earlier aFRR-solar attempts stalled, with 50Hertz committing to support solar-based balancing power.

From a policy standpoint, operators said the economics are compelling. Surplus photovoltaic periods allow a solar park to provide secondary reserve at market premium or PPA prices, often at lower cost than gas-fired capacity. While balancing demand remains limited, the service offers a new revenue stream for solar asset owners.

Pv-magazine
http://www.pv-magazine.com/

17 November 2025

Adani to Invest $7.17bn in Two Energy Projects in Assam, India

Adani Group has committed Rs630 billion, equivalent to $7.17 billion, toward two significant energy initiatives in Assam, a state in northeastern India. These developments include a major coal-based power facility developed by the private sector and pumped storage systems, as detailed in recent reports. The coal-fired power plant, managed by an

Adani operational entity, involves an allocation of approximately $5.46 billion for construction. Commissioning of the project is scheduled to begin in stages from December 2030.

In the preceding month, Adani Power was identified as the most competitive participant in a bidding process for supplying 3.2 gigawatts of coal-generated electricity, initiated by the Assam government. The company intends to expand its overall power generation capacity from the current 18 gigawatts to 42 gigawatts by the fiscal year 2032, supported by a total planned outlay of Rs2 trillion. Additionally, in August, Adani Power revealed commitments of around $5 billion for the development of two separate coal-fueled generation facilities. India ranks as the second-largest producer and user of coal globally, with coal accounting for about 75 percent of its annual electricity output.

Adani Green Energy, the renewable-focused division of the group, will direct Rs150 billion into a pair of pumped storage projects located in Assam. Together, these initiatives will offer a capacity of 2,700 megawatts, incorporating 500 megawatts of storage that was secured through a recent competitive award. The renewable energy unit presently manages a portfolio of 16.7 gigawatts and aims to reach 50 gigawatts by 2030.

At the start of the year, Gautam Adani, chairman of Adani Group, confirmed an investment of Rs500 billion dedicated to the northeastern area of India. Furthermore, the group has outlined a Rs1 trillion commitment over the coming ten years for diverse sectors in Andhra Pradesh, situated in southern India. In September, Adani Power received formal approval to establish a 2,400-megawatt new facility in Pirpainti, within Bihar's Bhagalpur district.

These projects contribute to enhancing energy infrastructure in various regions, addressing growing electricity requirements through a combination of thermal and renewable sources. The phased approach for the Assam coal plant allows for systematic integration into the grid, ensuring reliability during expansion. Pumped storage systems play a key role in balancing intermittent renewable outputs by storing excess energy for peak demand periods. The awarded storage component supports grid stability in the state.

Adani's capacity growth strategy involves both conventional and clean energy pathways, aligning with national objectives for sustained power availability. Investments in multiple states demonstrate a broad commitment to regional development. The northeastern focus builds on earlier pledges, fostering economic activity through job creation and technology deployment. Similarly, the Andhra Pradesh plan spans industries, promoting comprehensive progress. The Bihar greenfield project adds to the pipeline of upcoming generation assets, utilizing available land and resources efficiently.

Overall, these announcements reflect structured planning to meet future energy needs while incorporating diverse generation methods. The mix of coal and hydro storage underscores efforts to maintain supply security amid increasing consumption patterns. As implementation advances, monitoring of timelines and environmental compliance will be essential for successful outcomes. The group's portfolio expansion positions it to support India's evolving power landscape effectively.

Power-technology
http://www.power-technology.com/

18 November 2025

ENTSO-E Publishes the Report and the Position Paper on Flexibility from Renewable Energy Sources (RES)

Flexibility from renewable energy sources (RES) is essential to ensure a secure, efficient, and resilient European power system as the share of renewables continues to grow. ENTSO-E advocates for unlocking the full flexibility potential of RES, particularly

during periods of high generation and low demand. This requires improving the observability and controllability of RES assets and implementing market incentives that reward system-friendly behaviour.

To achieve this, ENTSO-E calls for:

- The rollout of smart and granular metering systems to make assets observable;
- Standardised control interfaces and data exchange between plant operators, Balance Responsible Parties, and system operators;
- Financial and regulatory frameworks that encourage RES to adjust generation dynamically and participate in balancing and system services.

By leveraging flexibility, RES can play an active role in maintaining grid stability, supporting system defence, maximising renewable integration and minimising overall costs for consumers.

ENTSO-E remains committed to working with the European Commission, ACER, Member States, regulators, DSOs and all relevant stakeholders to ensure that flexibility from RES becomes a cornerstone of Europe's decarbonised electricity system.

ENTSO-E
http://www.entsoe.eu/

18 November 2025

'There's Room for Everybody': California Ports Prepare for OSW Development

At a two-day workshop held by the California Energy Commission, offshore wind experts and fishermen identified challenges associated with building offshore wind turbines in Humboldt Bay and other parts of the coastline while not displacing the fishing industry.

Recent federal policy changes have left the future of the renewable energy resource in limbo, but California officials continue to push ahead with offshore wind design and development plans. (See CEC Approves 5 Offshore Wind Projects at California Ports.)

At the CEC's Nov. 13 workshop, engineers, fishermen, developers and port officials, among others, talked about the path towards a future in which offshore wind turbines send electrons to the Golden State's grid.

"It really takes a lot of our California ports working together to be able to realize this vision," said Matt Trowbridge, a vice president with infrastructure design company Moffatt & Nichol. No existing port terminals along the West Coast can support the equipment that's needed to build offshore wind facilities, he said.

"How much of these manufacturing sites that are building the components needed for offshore wind are going to be in the U.S. and in California, and how many are going to come from other places?" Trowbridge asked. "What's the right amount of in-state fabrication that will allow this industry to move?" The fishing industry wants certainty that it will continue to be a viable career for people when offshore wind farms operate in the state.

"Fishing is one of the oldest industries in the United States," said Ken Bates, vice president of the Humboldt Fishermen's Marketing Association. "For old fishermen like me and the younger guys that are looking at this, nobody understands how they're going to survive ocean industrialization." Humboldt Bay is the second-largest estuary in California and a huge nursery ground for tons of commercial species, he said.

Ports are the starting and stopping point for fishing operations: When fishing boats come back into the port, "there's a whole other set of things that they require to keep their businesses running and to get the fish processed for the customer," Bates said. "And in the last 25 to 30 years, the priority of the fishing industry and its position in the pecking order, has moved down and down and down. Do we place any value on having a fish processing plant in a little port? There's room for everybody."

Another challenge with building offshore wind in California is ensuring that wind farm developers have more certainty about the amount of transmission infrastructure that will be available for offshore projects, said Martin Christensen, senior onshore works manager with Vineyard Offshore. The Humboldt region does not have enough transmission capacity to bring the power from offshore wind projects to load centers, Christensen said.

"Right now, I think Humboldt can only accept, like, 150 MW, and our project's going to be between 1 and 2 GW," Christensen said. "The math just doesn't add up." Most existing offshore wind farms are built with fixed-bottom turbines, which anchor using piles or truss jackets, Trowbridge said. But in the Pacific Ocean, the outer continental shelf drops off near California's coastline, which makes fixed-bottom turbines inadequate. California will need to therefore install floating turbines that connect to the seabed using mooring lines and anchors.

At the CEC's Nov. 12 business meeting, the commission approved about $9.2 million for research on deepwater HVDC substations and ocean monitoring methods capable of detecting entangled debris. As part of the funding, Alliance for Sustainable Energy will develop a standardized concept design for a floating HVDC substation. California's offshore wind farms may be in water that is 1,800 to 4,300 feet deep, making fixed-bottom substations infeasible, the CEC's resolution says.

HVDC equipment can be affected by the motions of a floating platform, so an HVDC substation's mooring system must be designed to constrain the motions. This design results in a complex system engineering problem that requires balancing considerations in platform stability, HVDC equipment robustness, mooring stiffness and cable excursions, the resolution says.

Alliance for Sustainable Energy will develop the first open-source floating HVDC substation design, which should reduce the cost of the substations and make them less environmentally harmful.

RTO Insider
http://www.rtoinsider.com/

18 November 2025

Energy Department Closes Loan to Restart Nuclear Power Plant in Pennsylvania

U.S. Secretary of Energy Chris Wright today announced the Department of Energy's (DOE) Loan Programs Office (LPO) closed a loan to lower energy costs and restart a Pennsylvania nuclear power plant.

The $1 billion loan to Constellation Energy Generation, LLC (Constellation) will help finance the Crane Clean Energy Center, an 835 MW plant located on the Susquehanna River in Londonderry Township, Pennsylvania.

Today's announcement, funded by the Energy Dominance Financing (EDF) Program created under the Working Families Tax Cut, highlights the Energy Department's role in advancing President Trump's Executive Order, Reinvigorating the Nuclear Industrial Base, by supporting the restart of nuclear power plants.

"Thanks to President Trump's bold leadership and the Working Families Tax Cut, the United States is taking unprecedented steps to lower energy costs and bring about the next American nuclear renaissance," said Energy Secretary Wright. "Constellation's restart of a nuclear power plant in Pennsylvania will provide affordable, reliable, and secure energy to Americans across the Mid-Atlantic region. It will also help ensure America has the energy it needs to grow its domestic manufacturing base and win the AI race."

This announcement marks the first project to receive a concurrent conditional commitment and financial close under the Trump Administration. The loan will partially finance the restart of a reactor which ceased operations in 2019 but was never fully

decommissioned. Once restarted, pending U.S. Nuclear Regulatory Commission licensing approvals, the 835 MW reactor will provide reliable and affordable baseload power to the PJM Interconnection region, powering the equivalent of approximately 800,000 homes. The Crane Restart project will help lower electricity costs, strengthen grid reliability, create over 600 American jobs, and advance the Administration's mission to lead in global AI innovation and restore domestic manufacturing industries.

DOE remains committed to fulfilling this mission to maximize the speed and scale of nuclear capacity in the United States, ensuring the American people's access to affordable, reliable, and secure energy.

DOE
http://www.energy.gov/

18 November 2025

Xizang wind farm with largest single-capacity turbines connected to grid

A wind power project equipped with the largest single-capacity turbines in Southwest China's Xizang autonomous region was connected to the grid on Monday, marking a breakthrough in the region's new energy development.

Built by the Xizang branch of Huadian New Energy Group Co Ltd, the project is situated at a maximum altitude of 5,370 meters in Qonggyai county, which is administered by Shannan city. It has 12 wind turbines with a total capacity of 60 megawatts, and is supported by a grid-forming energy-storage system. Once fully operational, the wind farm is expected to generate enough electricity to power approximately 120,000 households and cut carbon dioxide emissions by an estimated 128,700 tonnes each year.

Through the application of innovative engineering solutions, the construction team overcame challenges such as high altitudes of over 5,000 meters and drastic temperature changes. The project also involved the restoration of 360,000 square meters of local vegetation, ensuring infrastructure development progressed in step with ecological protection, according to its constructors.

Today, Xizang has established a comprehensive energy system with hydropower as its main power source, complemented by geothermal, wind and solar energy, among others. From 2015 to 2024, Xizang transmitted 15.8 billion kilowatt-hours of clean energy beyond the region.

China Daily
http://www.chinadaily.com.cn/

19 November 2025

Ofgem unlocks early investment for slew of fast-track clean power projects

Great Britain's energy security and clean power ambitions have received a major boost after Ofgem greenlit early construction funding for a number of major electricity transmission projects.

Today (Wednesday 19 November) Ofgem has approved Early Construction Funding (ECF) requests for the following projects:

- Eight Scottish Hydro Electric Transmission Plc (SHET) electricity transmission projects.
- Sealink, a proposed NGET transmission project between Suffolk and Kent to provide transmission system reinforcement in the south and east regions.

The projects are part of the Accelerated Strategic Transmission Investment (ASTI) framework, Ofgem's streamlined process will help achieve the Government's clean power goals including connecting 43 – 50GW of offshore wind by 2030.The funds will be used to finance early procurement of materials in high demand around the world such as HVDC cables. With many countries around the globe seeking to decarbonise their grids,

competition for such resources is fierce. Ofgem's ECF mechanism enables Transmission Operators (TOs) to get their orders in at the earliest opportunity and reduces the risk of costly procurement delays. ECF is also used to finance associated enabling works such as land purchases and surveys. Beatrice Filkin, Ofgem Director of Major Projects, said:

"Today's decision means that we'll be able to power more homes with homegrown clean power faster. Releasing early investment to suitable projects equips British Transmission Operators to compete globally, avoid delays caused by supply chain constraints and secure the sought-after materials and components to boost our energy security and power our homes and economy. It's important to underline that we are not handing projects blank cheques nor greenlighting the projects themselves – these are rightly decisions for the relevant planning authorities. We work with the TOs to ensure intelligent use of early investment, so that any losses are minimised, if projects are altered, cancelled or refused permission, and any unspent money is returned to consumers. TOs must also show us how the things they spent money on are expected to benefit consumers – if they can't, they can't pass on those costs to billpayers."

ASTI was launched by Ofgem in late 2022. It identified 26 projects key to achieving Government decarbonisation targets and reducing Britain's exposure to volatile international gas prices. The projects will enable more homegrown power to be harnessed and supplied to consumers, while also driving down the costs currently incurred when, for example, wind generators are paid to stop generating because there isn't the grid capacity for their energy.

Ofgem
http://www.ofgem.gov.uk/

19 November 2025

NERC: winter peak demand is rising faster than resource additions

Peak demand on the bulk power system will be 20 GW higher this winter than last, but total resources to meet the peak have only increased 9.4 GW, according to a report released Tuesday by the North American Electric Reliability Corp.

Despite the mismatch, all regions of the bulk power system should have sufficient resources for expected peak demand this winter, NERC said in its 2025-2026 Winter Reliability Assessment. However, several regions could face challenges in the event of extreme weather.

There have been 11 GW of batteries and 8 GW of demand response resources added to the bulk power system since last winter, NERC said. Solar, thermal and hydro have also seen small additions, but contributions from wind resources are 14 GW lower following capacity accounting changes in some markets.

NERC officials described a mixed bag heading into the winter season.

"The bulk power system is entering another winter with pockets of elevated risk, and the drivers are becoming more structural than seasonal," said John Moura, NERC's director of reliability assessments and performance analysis. "We're seeing steady demand growth, faster than previous years, landing on a system that's still racing to build new resources, navigating supply chain constraints and integrating large amounts of variable, inverter-based generation."

Aggregate peak demand across NERC's footprint will be 20 GW, or 2.5%, higher than last winter. "Essentially, you have a doubling between the last several successive [winter reliability assessments]," said Mark Olson, NERC's manager of reliability assessment. Nearly all of NERC's assessment areas "are reporting year-on-year demand growth with some forecasting increases near 10%," the reliability watchdog said.

The U.S. West, Southeast and Mid-Atlantic — areas with significant data center development — have highest growth rates, NERC said. “Demand growth is contributing to lower reserve margins and signaling need for more resources,” according to a presentation on the report. But some types of new resource additions are slow to come online. Just 3 GW of thermal or hydro generation was added since last winter. Solar nameplate capacity rose 11 GW since last winter, but is expected to contribute only about 1 GW towards meeting peak demand. Bringing resources online more quickly will require changes to policy and markets, according to the Electric Power Supply Association.

“We need permitting reform, predictable market rules, and policies that support private investment,” EPSA President and CEO Todd Snitchler said in a statement. The group represents competitive generators. An increasingly complex resource mix “brings additional challenges for operators,” NERC said, particularly in extreme or extended cold weather.

In the Maritimes region, imports may be needed to meet peak demand, NERC said. New England could see gas shortages in extended extreme conditions. In areas of the Southeast, reserves may not be sufficient for high demand scenarios, or resource shortages may occur during early morning hours with high demand. In the Electric Reliability Council of Texas footprint, “strong load growth is contributing to continued risk of supply shortfalls in extreme cold,” NERC said. In parts of the Northwest, resources may not be sufficient during wide-area cold weather that causes thermal plant outages and wind performance issues.

NERC’s assessment includes several recommendations: grid operators should review seasonal operating plans; generation owners should complete winter readiness and weatherization efforts; and balancing authorities should implement generator fuel surveys to monitor the adequacy of fuel supplies. “Gas production and supplies going to generators strongly impacts how well the bulk power system can perform during winter conditions,” Olson said. “These two systems are inextricably linked.”

Utility Dive
http://www.utilitydive.com/

19 November 2025

US loans Constellation $1 billion for Three Mile Island reactor reboot

The Trump administration said on Tuesday it has loaned Constellation Energy Corp, opens new tab $1 billion to restart its nuclear reactor at a Pennsylvania plant formerly known as Three Mile Island. Constellation signed a deal in late 2024 with Microsoft, opens new tab to restart the 835-megawatt reactor, which shut in 2019, and which would offset Microsoft's data center electricity use. The other unit at the plant, renamed the Crane Clean Energy Center, shut in 1979 after an accident that chilled the nuclear power industry.

U.S. power demand is now rising for the first time in two decades on technologies including artificial intelligence. Nuclear energy, which is virtually carbon-free, has become an option for technology companies with uninterrupted power needs and climate pledges. Critics point out that the U.S. has failed to find permanent storage for radioactive waste. Greg Beard, head of the Energy Department's Loan Programs Office, or LPO, said the restart would support the PJM regional grid. "This type of energy is important because it's large, stable, affordable base load power," Beard told reporters.

Constellation said the loan will help it lower the cost of financing and leverage private investment to restore power to the grid.

The LPO has more than $250 billion in capital, and "a large portion of that we expect to be deployed to help reinvigorate the large-scale nuclear reactor development," Beard said. Energy Secretary Chris Wright said this month that the bulk of the LPO money would go to nuclear projects. Constellation in June had moved up the timeline to restart the reactor

by about a year to 2027 after PJM fast-tracked its review process to connect the project to the grid.

Constellation said it has hired hundreds of workers, completed infrastructure inspections and ordered major equipment for the reactor. It will need to revamp cooling towers, install a main power transformer among other equipment, and re-fuel before producing electricity. It was the first time the LPO declared that a company had met all conditions for a loan and closed it at the same time, Beard said. Constellation is guaranteeing the loan, he said, and that loan structure would protect taxpayers if the project does not succeed.

Constellation is an "investment-grade" established nuclear operator that could have gotten a bank loan without the government's help, Beard said. "But we want to show support for affordable, reliable, stable, secure energy in the U.S., as directed by President (Donald) Trump." The plant also needs U.S. Nuclear Regulatory Commission and water-related permitting, Constellation said this year.

Reuters
http://www.reuters.com/

20 November 2025

Winter Outlook 2025-2026: Europe is well-prepared for the coming winter, with limited regional risks

As Europe approaches the winter season, ENTSO-E releases today its Winter Outlook 2025–2026. The report forecasts an overall favourable adequacy situation across the continent, with European Transmission System Operators (TSOs) continuing to monitor the situation throughout the winter period.

The report finds that some risks to electricity supply may occur in Cyprus, Ireland, and Malta. In Finland, Estonia and Lithuania, minor risks are forecasted in the event of exceptionally adverse operational conditions combined with cold weather and a high number of unplanned outages. Targeted non-market resources are planned to mitigate the risks in Ireland and Malta.

European power system trends since winter 2024–2025 show a decrease in conventional general and an increase in renewable energy sources (RES). Planned outages and demand patterns are comparable to last winter while hydro reservoir levels are higher than in previous years. These combined factors anticipate favourable adequacy conditions.

Since March 2022, Ukraine and Moldova have been synchronised with the Continental European power system. The situation in Ukraine remains uncertain due to attacks on energy infrastructure. European TSOs continue to support the coordinated effort to maintain grid stability in Ukraine.

ENTSO-E
http://www.entsoe.eu/

21 November 2025

Texas loan fund tops 3.5 GW of gas capacity secured with latest NRG deal

NRG Energy will develop a 455-MW gas plant near Houston, backed by a low-interest loan from the state of Texas, the company said Thursday.

It is the sixth loan finalized through the Texas Energy Fund program for the Electric Reliability Council of Texas market. Voters authorized the fund in 2023. The new generation will be built at NRG's existing Greens Bayou Generating Station in Harris County, and is expected online in 2028.

New generation backed by the Texas Energy Fund, across six projects, now exceeds more than 3.5 GW, said officials at the Public Utility Commission of Texas, which manages

the program. The Lone Star State is experiencing "unprecedented growth," NRG Executive Vice President, President of NRG Business and Wholesale Operations Robert Gaudette, said in a statement. Greens Bayou is NRG's third project to receive support from the loan fund, marking about 1.5 GW of total capacity and up to $1.15 billion in low-interest loans.

Under the loan agreement for Greens Bayou, total project costs are estimated to be less than $617 million and the PUCT will provide a 20-year loan up to $370 million, or 60% of total cost, at a 3% interest rate. In August, the PUCT tapped NRG for a TEF loan up to $216 million to develop two gas units totaling 456 MW of capacity at its existing TH Wharton Generating Station in Houston. And in September the company was selected for a loan of $562 million to develop a 721-MW gas plant near Baytown. There are another 11 Texas Energy Fund applications moving through a due diligence review process, said state officials, representing another 5.4 GW of possible new capacity in the ERCOT footprint.

Utility Dive
http://www.utilitydive.com/

24 November 2025

China's new hybrid heat pump slashes energy costs by 55% and grid reliance by 75%

Researchers in China have just unveiled a new hybrid wind-solar heat pump that significantly improves energy efficiency and can reduce household energy costs by more than 50 percent.

The innovative heat pump that runs on both wind and solar power was developed by a team of scientists from Shenyang Jianzhu University and Shanghai Jiao Tong University in China. The new system enhances energy efficiency in residential homes by integrating both thermal and electrical energy storage. It is also supported by seasonal energy-interaction framework, which features spring ground-source precooling, summer cooling, autumn ground-source preheating and winter heating. What's more the researchers developed an optimized energy management strategy for the heat pump, which they modeled using advanced software tools such as TRNSYS and SketchUp. According to the scientists, the project was based on a low-energy residential building (LERB) in Shenyang, northeastern China. The region's freezing winters and hot summers provided ideal conditions to test energy performance.

The two-story, 3,603-square-foot (334.8-square-meter) building featured about 1,400 square feet (130 square meters) of roof space suitable for solar panels. The hourly solar radiation at the site ranged from 0 to 0.3 kilowatt-hours per square meter (kWh/m2) over the year. The researchers integrated 550-watt (W) photovoltaic (PV) modules and three-kilowatt (kW) wind turbines into the system. The setup was supported by a 40-kilowatt-hour (kWh) battery and a water tank with phase-change materials (PCM) for thermal storage. Meanwhile, the system used two heat pumps, including a ground-source heat pump (GSHP) and an air-source heat pump (ASHP). It additionally included ground-source exchangers (GSEs) to transfer heat between the system and the surrounding soil.

The GSHP drew heat from underground during winter and released excess heat back into the ground during warmer months. The ASHP, in turn, supplemented the system when environmental conditions changed. To improve efficiency, the team introduced a two-stage optimization process. The first stage using the on-dominated Sorting Genetic Algorithm (NSGA-II algorithm) determined the ideal system configuration.

The second stage, which was powered by particle swarm optimization, managed battery charge levels on a weekly basis. This allowed the system to automatically balance renewable power generation, heating demand and battery storage, depending on the season. The researchers then tested four setups to evaluate system performance. They

started with a basic system and gradually added the interaction strategy, ASHP, two-stage optimization, PV and finally wind generation.

They discovered that the optimized hybrid system reduced the levelized cost of energy (LCOE) by at least 54.7 percent and increased overall performance by four percent compared to baseline systems. The system independence factor (SIF), a measure of grid reliance, dropped by 75 percent. Over 10 years, soil temperatures around the ground exchangers fell by only 0.76 degrees Fahrenheit (0.42 degrees Celsius). It helped prevent ground temperature imbalance in long-term GSHP operation.The optimal wind–PV heat pump setup included 13.12 kW of solar capacity, two wind turbines, 25.46 kWh of battery storage, a 6.17-kw ground-source heat pump and a 29.7-square-foot (2.76-square-meter) water tank.

Interesting Engineering
http://interestingengineering.com/

26 November 2025

Energy Secretary Secures Grid Reliability in Mid-Atlantic Ahead of Winter

U.S. Secretary of Energy Chris Wright today issued an emergency order to minimize the risk of blackouts in the Mid-Atlantic region of the United States. Secretary Wright's order directs PJM Interconnection (PJM), in coordination with Constellation Energy, to ensure Units 3 and 4 of the Eddystone Generating Station in Pennsylvania remain available for operation and to take every step to minimize costs for the American people. The production of electricity from the units will continue to be critical to maintaining reliability in PJM over the coming winter months.

"Thanks to President Trump's leadership, the Department of Energy is using all tools available to keep the lights on and heat running for the American people," said Energy Secretary Wright. "This emergency order is needed to strengthen grid reliability and will help provide affordable, reliable, and secure power when Americans need it most." As outlined in DOE's Resource Adequacy Report, power outages could increase by 100 times in 2030 if the U.S. continues to take reliable power offline.

Secretary Wright ordered that the two Eddystone Generating Station units remain online past their planned retirement date in a May 30, 2025 emergency order. Keeping these units operational over the summer strengthened energy security in the PJM region, as demonstrated when PJM called on the Eddystone Units to generate electricity during heat waves that hit the region in June and July. A subsequent order was issued on August 28, 2025. PJM's service area will continue to face emergency conditions both in the near and long term. In January 2025, PJM reached a new record peak for winter demand, exceeding the previous winter peak set in 2015. This order is in effect beginning on November 26, 2025, and continues until February 24, 2026.

DOE
http://www.energy.gov/

26 November 2025

China's solar-nuclear hybrid system reaches above 98% power reliability in tests

Researchers at China's Guangdong Power Grid have proposed a new hybrid microgrid system that achieves an operational cost reduction of approximately 18.7% and a drop-in carbon emission intensity of nearly 37.1%.

In a simulation covering a one-year operational horizon, the system combined solar and nuclear power to push critical load supply reliability above 98% across all tested uncertainty scenarios.

"The coordinated operation of hybrid photovoltaic (PV) and Small Modular Reactor (SMR) microgrids represents a promising pathway to achieve resilient, low-carbon energy supply in modern power systems," said the researchers in a new study.

The study utilized a simulated 100 MW microgrid serving an average industrial load of 85 MW, which exhibited daily peak fluctuations of up to 25%, and a residential average load of 15 MW, with a peak-to-average ratio of 1.6. The generation mix consisted of an installed photovoltaic (PV) capacity of 40 MW alongside a Small Modular Reactor (SMR) with a minimum stable output of 10 MW and a ramp rate limit of 5 MW per hour.

To address energy imbalances, the infrastructure included a 20 MWh lithium-ion battery with a 92% charge-discharge efficiency, plus a hydrogen unit with a maximum capacity of 15 tons. The researchers modeled solar variability using a normal distribution with a mean of 80% of nominal irradiance and a standard deviation of 12% to capture seasonal and diurnal shifts.

Moving beyond the statistics, the core of this proposal is the method for managing these diverse power sources. The team employed a scheduling framework that integrates multi-objective distributionally robust optimization (DRO) with a real-time reinforcement learning (RL)-assisted mechanism.

An Energy Management System (EMS) acts as the "brain" of the operation. The DRO generates baseline scheduling strategies that remain resilient even when weather forecasts are uncertain. Meanwhile, the RL modules adjust control signals in real time, enabling the system to adapt dynamically to immediate environmental changes. "The mathematical model addresses the multi-timescale coordination between variable PV generation, slow-ramping nuclear power, and dynamic battery and hydrogen storage operations," highlighted the study.

The researchers emphasized that the system provides a holistic solution rather than focusing on renewables or nuclear power in isolation. By using electrolyzers to produce hydrogen during surplus periods, the grid creates a "dual-layer" storage strategy. "The coordination between short-term battery storage and long-term hydrogen storage allows the system to manage both daily and seasonal energy imbalances," the researchers explained.

"The novelty of this research lies in the co-optimization of photovoltaic and Small Modular Reactor generation, combined with a robust uncertainty-aware dispatch mechanism." The optimization model was built in Python using Pyomo for mathematical programming, and Gurobi 10.0 was used to solve the mixed-integer programming formulations. "This work contributes an advanced, scalable framework for multi-energy hybrid microgrid management, providing valuable insights for resilient and low-carbon community microgrid development in the renewable-dominated era," concluded the study.

Interesting Engineering
http://interestingengineering.com/

27 November 2025

RWE and Apollo Global Management Close Transaction for German Power Grid

RWE, the German energy company, and U.S.-based Apollo Global Management announced on Wednesday that they have completed the formation of a joint venture focused on financing upgrades to Germany's electricity transmission network.

Under the agreement, Apollo will contribute 3.2 billion euros ($3.7 billion) in capital to support the expansion and modernisation of the country's power grid infrastructure. The joint venture includes RWE's 25.1 percent shareholding in Amprion, one of Germany's four transmission system operators responsible for transporting high-voltage electricity across large regions. "RWE retains operational control of the JV and continues to manage the Amprion stake while consolidating the joint venture in its financial statements," RWE stated

in its announcement. The partnership enables Amprion to access substantial additional funding required for major grid reinforcement projects. These investments are essential to accommodate growing volumes of renewable energy generation and to ensure stable electricity supply as Germany advances its energy transition.

The transaction provides RWE with fresh capital while allowing it to maintain strategic influence over a key infrastructure asset. At the same time, Apollo gains exposure to a regulated, long-term investment in European energy infrastructure.Completion of the deal follows regulatory approvals and marks one of the largest recent commitments by an international investor to German grid development. The strengthened financial base is expected to accelerate planned network extensions, supporting the integration of more wind and solar power into the national system in the coming years.

Reuters
http://www.reuters.com/

27 November 2025

Czech sev.en to Shut Three Major Coal-Fired Power Plants by March 2027

Sev.en Energy Group announced on Wednesday that it will shut down its coal-fired power plants in the Czech Republic by December 2026, or March 2027 at the latest. The decision will remove 2,400 megawatts of coal-based capacity from the national grid due to ongoing financial losses. The company, owned by Czech investor Pavel Tykač, operates large lignite-fired facilities at Chvaletice, Počerady, and Kladno. The Kladno plant also provides district heating to the local community.

Sev.en stated that continued operation is not viable because of low electricity prices combined with increasing costs for carbon emission allowances. Additional factors include uncertainty over winter gas prices and the slower-than-expected integration of new renewable energy projects. Increased generation from renewable sources has reduced the annual operating hours of the coal plants. While this lowers emissions, it raises the relative weight of fixed costs and further affects profitability

The Czech Republic, in line with European Union objectives, is gradually reducing coal use in electricity production. The country's main utility, ČEZ, intends to decrease the coal share of its generation from the current 30 percent to 9 percent by 2030. In 2024, Sev.en's coal plants, including the smaller Teplárna Zlín facility, delivered 7.6 terawatt-hours of electricity, compared with 8.8 TWh in 2023. Nationwide, the Czech Republic produced 69 TWh last year while consuming 58 TWh, according to data from energy regulator ERÚ.

In previous statements, Pavel Tykač had indicated that the plants could remain available if authorities introduced support measures to maintain reserve capacity for grid stability. Following Wednesday's announcement, transmission system operator ČEPS will have sufficient time to evaluate the impact and implement any necessary adjustments. No immediate comment was available from ČEPS or the Ministry of Industry and Trade in response to the planned closures.

Reuters
http://www.reuters.com/

28 November 2025

Continental European TSOs announce completion of synchronisation project with AST, Elering and Litgrid

The electricity transmission system operators (TSOs) of Continental Europe have confirmed the successful synchronisation of Estonia, Latvia, and Lithuania with the Continental Europe Synchronous Area. This milestone means Elering, Augstsprieguma tīkls (AST), and Litgrid, the TSOs of Estonia, Latvia, and Lithuania, now meet all key technical

requirements for permanent interconnection with Continental Europe's power system via Poland. The successful trial synchronisation of Estonia, Latvia, and Lithuania was confirmed by the Regional Group Continental Europe (RGCE) of the European Network of Transmission System Operators for Electricity (ENTSO-E). Since 9 February 2025, the Baltic States have been operating in trial synchronisation mode, during which all the parameters of the synchronous connection were monitored and evaluated.

As of 25 November 2025, AST, Elering and Litgrid are members of ENTSO-E's Regional Group of TSOs from Continental Europe. The Baltic synchronisation project formally began on 29 May 2019, when TSOs in Poland, the three Baltic States and the supporting countries of the Continental Europe Synchronous Area signed a Connection Agreement establishing the technical connection conditions that would make Lithuania, Latvia and Estonia part of the Continental European Network. Today's announcement signals the full implementation of the conditions included in this Agreement.

"The permanent synchronisation of Estonia, Latvia, and Lithuania with the Continental Europe Synchronous Area marks a major milestone in Europe's journey towards energy resilience, cooperation, and independence. It is the outcome of years of technical expertise, close coordination, and commitment by TSOs, supported by ENTSO-E and the EU. This achievement strengthens the energy security of the Baltic States and reinforces our shared goal of building a stronger, more reliable, and secure electricity system for all Europeans," says Zbyněk Boldiš, President of ENTSO-E.

"The transition from trial synchronisation to permanent synchronous operation mode status may seem like a formal step, but it is far more than that. It marks the culmination of years of continuous effort and professionalism by every employee in all TSOs. We deeply appreciate this recognition of our work and today's decision. I am confident that this achievement will significantly enhance the flexibility and reliability of our grid operations and establish new opportunities for cooperation. We are grateful to the RGCE TSOs community and ENTSO-E for their continued support and trust throughout this process," says Rokas Masiulis, CEO of Litgrid. The synchronisation enables the Baltic States to manage their electricity grids in close cooperation with all other Continental European countries, with stable and reliable frequency control, significantly enhancing regional energy security. Previously relying on the Russian system for frequency management, the Baltic States have joined the synchronous grid of Continental Europe, which serves over 400 million customers.

This process followed years of thorough preparation and cooperation among the Baltic transmission system operators and their counterparts in the Continental Europe Synchronous Area. A particularly important role of the Polish TSO Polskie Sieci Elektroenergetyczne (PSE) was the overall coordination and project management, as a direct neighbour and as the system which physically connects the Baltic States' systems to Continental Europe. Extensive infrastructure upgrades in the Baltic states and Poland were essential for this achievement. Amprion as Continental European Coordination Centre North supported the planning and coordination of synchronisation. This synchronisation has been strongly supported by the European Union and ENTSO-E, thanks to the co-financing of the European Union. Their contributions included technical guidance, operational and legal expertise.

ENTSO-E
http://www.entsoe.eu/

29 November 2025

UK Adds 1.9 GW of Solar in 12 Months

The United Kingdom added nearly 2 GW of solar capacity in the 12 months ending October 2025, driven primarily by several large-scale projects. The highlight was the July

connection of the 373 MW Cleve Hill Solar Farm, currently the country's largest operational solar facility.

Provisional government data show 111 MW of new capacity installed in October 2025 across 25,470 sites, bringing cumulative additions for the first ten months of 2025 to 1.78 GW. While lower than the 2.12 GW recorded in the same period of 2024, final figures are expected to increase as additional installations are reported. Ground-mounted and standalone projects continue to dominate total capacity. Approximately 58% of the UK's installed solar base consists of large-scale sites, including 8.2 GW accredited under the Renewables Obligation (RO), feed-in tariff, and Contracts for Difference (CfD) schemes.

Eighteen solar farms now operate under the CfD framework, with 16 commissioned during 2025. The pipeline of consented utility-scale projects has expanded significantly since mid-2024 following streamlined planning approvals for nationally significant infrastructure. In the November 2025 Budget, Chancellor Rachel Reeves announced that from April 2026 the government will fund three-quarters of the Renewables Obligation levy through general taxation for three years, reducing the direct cost passed to household electricity bills.

Solar Energy UK Chief Executive Chris Hewett welcomed the measure: "Reform of the renewables obligation is both a welcome and expected move by the Chancellor. Together with the rising proportion of power coming from cheap solar and other renewables sources, plus reform to the electricity markets, we can expect bills to fall further in the coming years." The change is projected to save the average household approximately £100 annually. The Department for Energy Security and Net Zero has also extended until 2 December 2025 its consultation on future inflation adjustments for payments under the RO and legacy feed-in tariff schemes.

These developments support continued growth in solar deployment while easing consumer energy costs and strengthening the economic case for renewable generation across the United Kingdom.

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