



Energy Observatory JOURNAL

November 2025



تُعد نشرة مرصد الطاقة منصة معرفية دورية تقدم لمحات شاملة حول المستجدات في مجال الطاقة عالمياً ومحلياً

تهدف النشرة إلى تسليط الضوء على :

- أحدث التطورات في مجالات الطاقة المتجددة والذرية.
- استعراض التقنيات الحديثة والتحولت العالمية.
- مقالات خبراء
- ملخصات أوراق علمية بارزة
- تقارير متخصصة

تسعى النشرة إلى توفير محتوى غني ومتنوع يلبي احتياجات صناع القرار والباحثين والمهتمين بمجال الطاقة، مما يساهم في تعزيز المعرفة ودعم الابتكار في القطاع.

Renewable Energy News

Saudi-Korean Symposium Explores Cooperation in Technology and Energy.



Image: SPA

A symposium held in Riyadh, organized by the South Korean Embassy and the Gulf Research Center, focused on advancing cooperation between South Korea and GCC countries in technology and energy. Discussions covered artificial intelligence, smart manufacturing, renewable energy, and digital transformation, emphasizing shared opportunities in economic growth and sustainable development. The event aimed to support joint projects, deepen mutual understanding, and promote strategic partnerships. It also addressed evolving global trends and how both regions can collaborate in navigating energy transition and technological innovation, strengthening ties between Korean and GCC institutions across multiple strategic sectors.

Source

Renewable Energy News

Fraunhofer ISE builds first perovskite-silicon tandem solar cell with copper metallization.

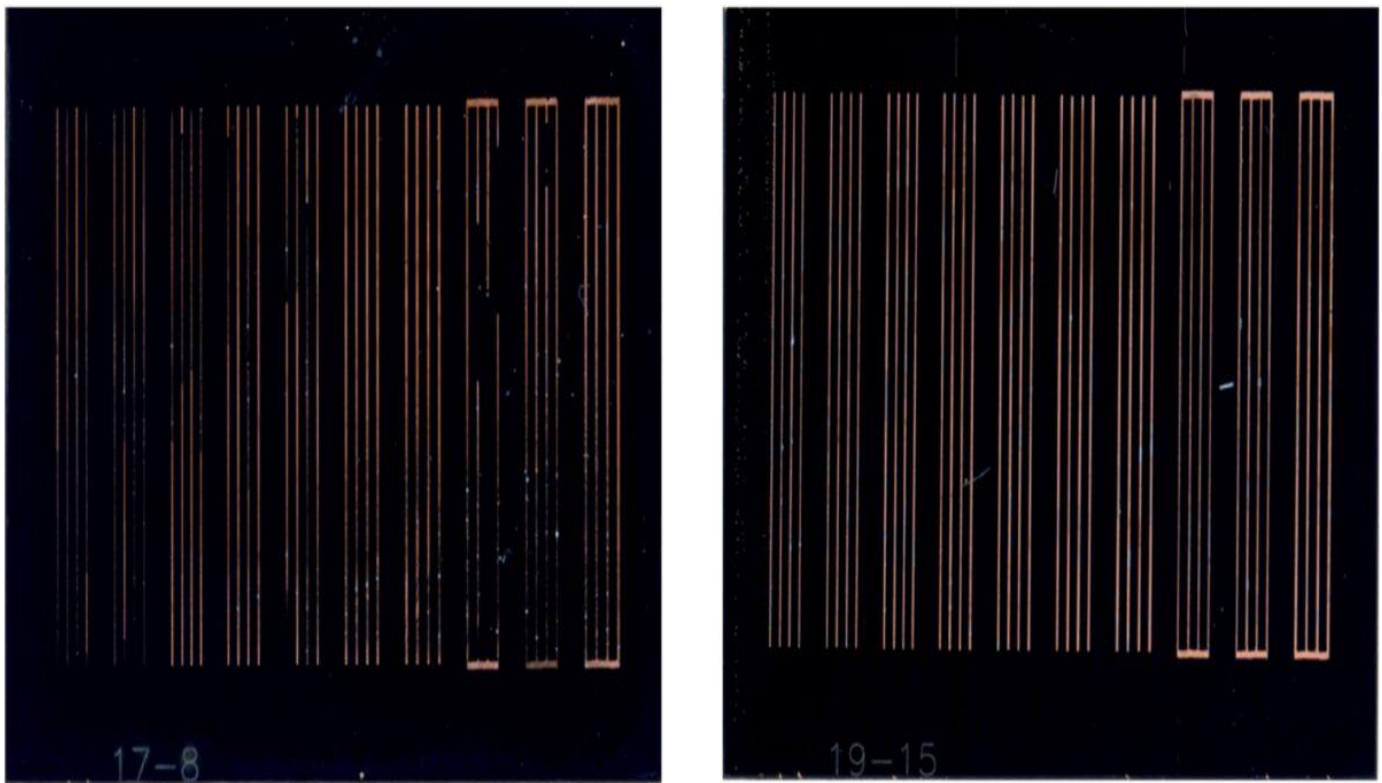


Image: Textured silicon heterojunction samples after mask and plate metallization – PV Magazine Fraunhofer

Fraunhofer ISE researchers developed a perovskite-silicon tandem solar cell using copper metallization via a mask-and-plate technique, achieving 19.35% efficiency, the highest reported for this cell type with galvanic front metallization. This process enables ultra-fine, cost-efficient copper contacts without damaging the perovskite layer. It replaces silver, reducing material costs while improving scalability. The team also fabricated a M6-sized heterojunction solar cell with 22.5% efficiency using the same method. The findings highlight the potential for industrial-scale, silver-free manufacturing of next-generation solar cells, as detailed in their publication in *Solar Energy Materials and Solar Cells*. Further validation is ongoing.

[Source](#)

Renewable Energy News

JA Solar builds inverted perovskite solar cell with 26.7% efficiency.

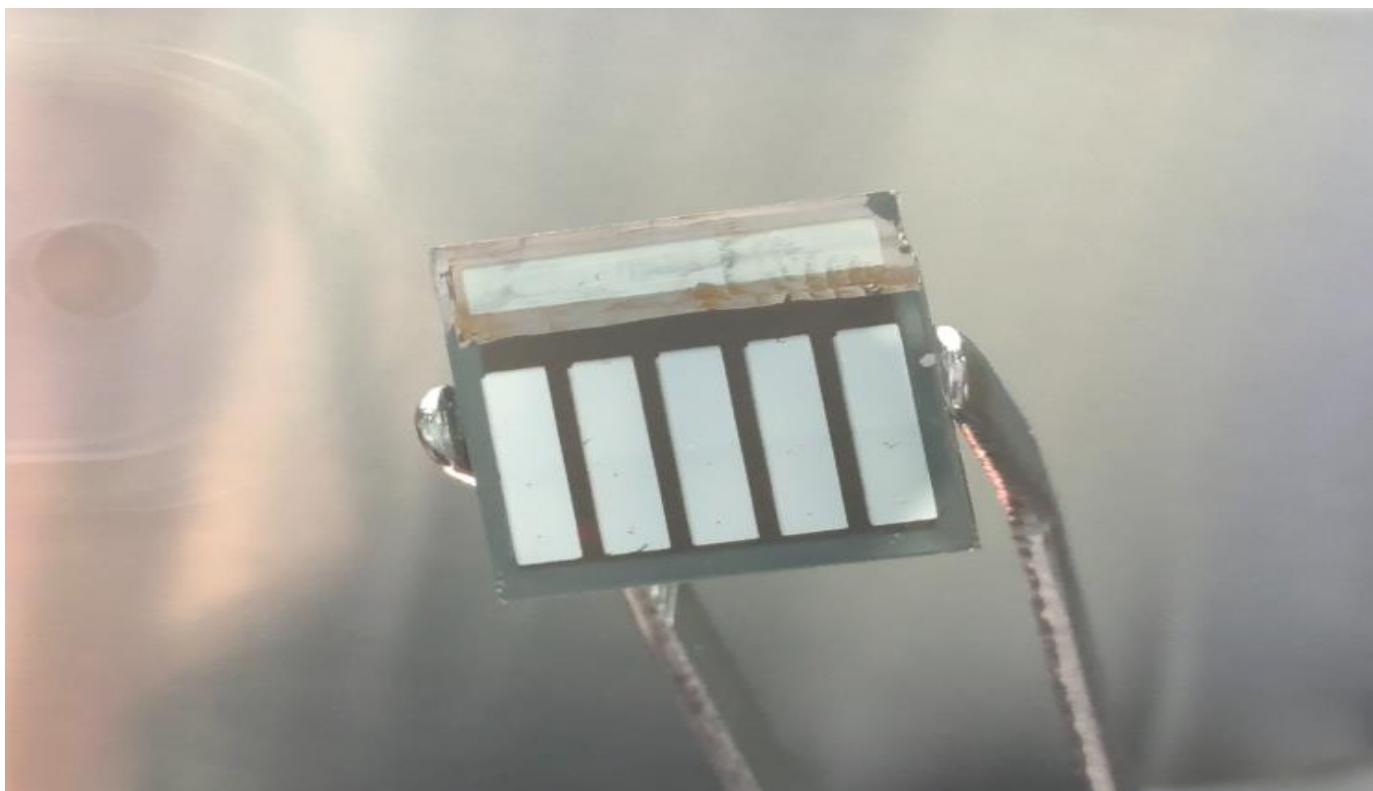


Image:JA Solar-PV Magazine

JA Solar researchers developed an inverted perovskite solar cell using a multifunctional ammonium salt (PMEAI) that enhances interface performance between the perovskite layer and electron transport layer. This advancement addresses recombination losses and improves carrier extraction. The cell reached 26.7% efficiency under standard testing and 24.5% when scaled to 1 cm². The PMEAI layer reverses the built-in electric field, boosting performance and minimizing energy losses. The device maintained 97% efficiency after 1,500 hours at 65 °C. Certified by China's NPVM, this development shows promise for high-efficiency, durable perovskite photovoltaics by refining molecular orientation at the material interface.

[Source](#)

Renewable Energy News

Sensor-free method for estimating photovoltaic (PV) module temperature using electrical parameters.



Image:JA Solar-PV Magazine

Researchers at the Dubai Electricity and Water Authority (DEWA) R&D Center have developed a sensorless Shift-Factor method that estimates PV module temperature using either open-circuit voltage (V_{oc}) or maximum power point voltage (V_{mp}). By correlating voltage shifts with irradiance and temperature, the approach provides a flexible and non-intrusive alternative to physical sensors and can validate existing sensor data. Benchmarking showed that the V_{oc} -based Shift-Factor model achieved the lowest RMSE (1.60 °C), outperforming Sandia, Faiman, and IEC 60904-5 models. The method is adaptable across PV technologies and is being integrated into DEWA's digital-twin platforms for predictive diagnostics and system optimization.

[Source](#)

Renewable Energy News

The European (ENTSO-E) publishes Phase II Technical Report on Grid Forming Requirements.



Image: <https://www.entsoe.eu/>

The European Network of Transmission System Operators (ENTSO-E) has released the Phase II Technical Report refining the Grid Forming (GFM) requirements proposed in the draft Network Code on Requirements for Generators (NC RfG 2.0). Building on the May 2024 Phase I findings and extensive input from the Technical Group on Grid Forming Capability, the report offers non-binding guidance to support future implementation.

The updated GFM requirements for Power Park Modules (PPMs) and Electricity Storage Modules (ESMs) are viewed as essential for maintaining a stable and resilient European grid as the system transitions toward renewable, storage-based, non-synchronous generation.

Source

Renewable Energy News

The European Commission has awarded €2.9 billion funds to boost net-zero technology projects.



Image:https://commission.europa.eu/index_en

The European Commission has awarded €2.9 billion from the Innovation Fund to 61 advanced net-zero technology projects under the first call for net-zero technologies (IF24 Call) with focus on energy intensive industries, renewable energy and energy storage, net-zero mobility and buildings, cleantech manufacturing and industrial carbon management.

The selected projects cover 19 sectors across 18 countries and expected to cut about 221 million tons of CO₂ equivalent over their first decade of operation, supporting EU's 2050 climate neutrality goal.

Source

Nuclear Energy News

Saudi Arabia and US sign a strategic framework for cooperation on securing supply chains for uranium, metals, permanent magnets, and critical minerals.



Image:<https://www.saudigazette.com.sa/article/656680/SAUDI-ARABIA/Saudi-Arabia-and-US-sign-strategic-minerals-deal-and-strengthen-bilateral-ties>.

To advance shared economic goals, the Government of the Kingdom of Saudi Arabia represented by HRH Prince Abdulaziz bin Salman Minister of Energy and Chair of the Saudi Side of the Saudi-U.S. Strategic Economic Partnership Committee, and the Government of the United States of America represented by U.S. Secretary of the Interior Doug Burgum, signed a Strategic Framework for Cooperation focused on strengthening and securing supply chains for uranium, metals, permanent magnets, and other critical minerals.

Source

Nuclear Energy News

Nuclear power is making a comeback, says IEA.



Image:IEA

Global nuclear power is entering a major resurgence, with the International Energy Agency's latest World Energy Outlook forecasting at least a one-third increase in capacity by 2035 after two decades of stagnation. Nuclear capacity rises from 420 GWe in 2024 to 728 GWe by 2050 under current policies, driven by surging electricity demand, energy-security concerns, and growing interest in small modular reactors. More than 40 countries now include nuclear in their energy strategies, with over 70 GWe under construction and USD100 billion annually expected in new investments. Although nuclear output is set to reach a record in 2025, tripling global nuclear capacity by 2050 will require major expansion of supply chains, skilled labour, and long-term policy support as electricity becomes central to global economic growth.

Source

Nuclear Energy News

UK selects Wylfa to host at least three Rolls-Royce SMRs.



Image:ONR

The UK government has announced that Wylfa on the island of Anglesey, North Wales, will host three Rolls-Royce small modular reactors. It said the site - where a Magnox plant is being decommissioned - could potentially host up to eight SMRs. "Sitting on the North Wales coast, Wylfa has a strong nuclear heritage dating back to the 1960s," the government said. "The first-of-its-kind project is expected to support up to 3,000 good jobs in the local community at peak construction, underpinned by billions of pounds of infrastructure investment out to the mid-2030s."

[Source](#)

Nuclear Energy News

Rosatom to 3D-print equipment elements for SMR.

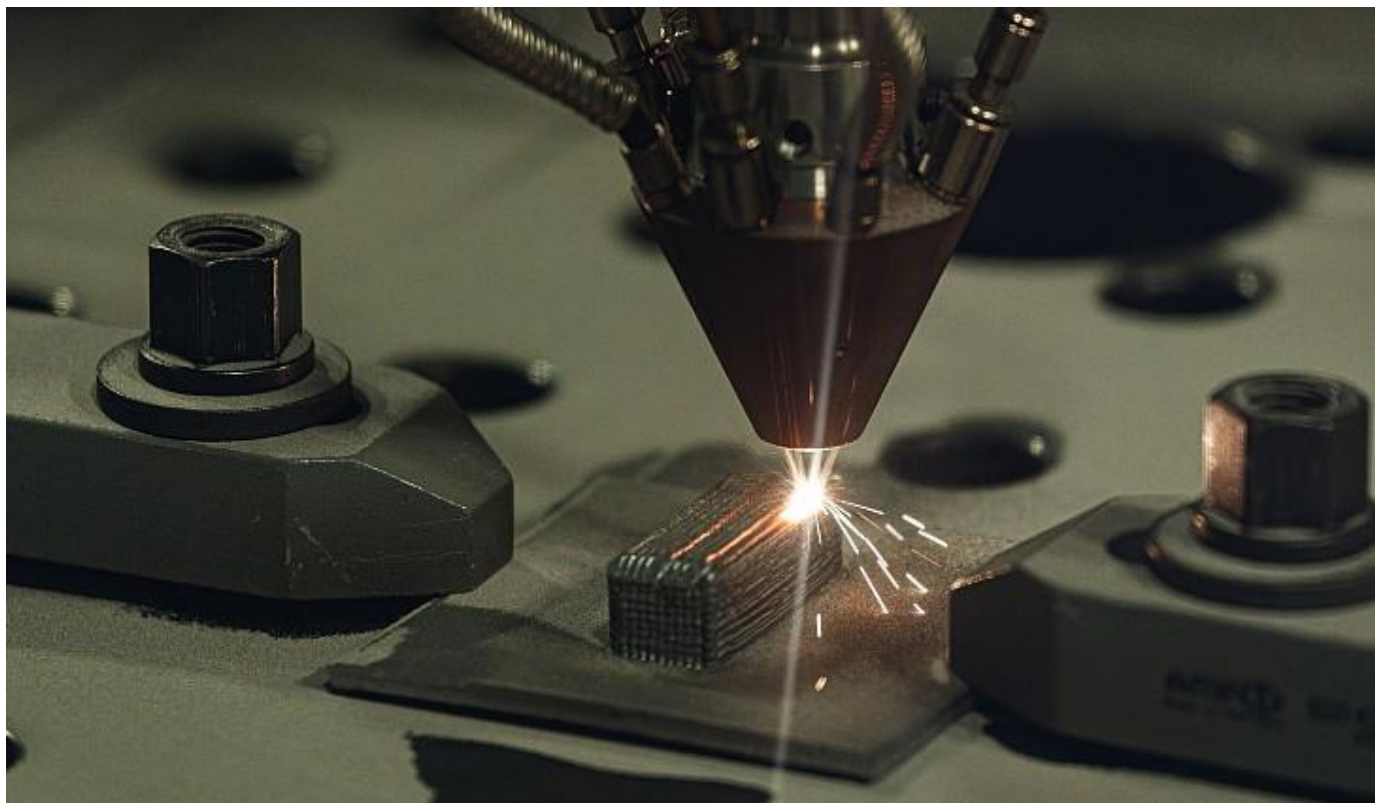


Image:Rosatom

Russia's Rosatom has received regulatory approval to produce the first 3D-printed components for its RITM-200 small modular reactor, marking a milestone for additive manufacturing in nuclear applications. The Afrikantov Experimental Design Bureau manufactured a terminal box using 3D printing, which passed full testing and secured certification from the Russian Maritime Register of Shipping. The RITM-200 reactor—used in Russia's latest nuclear icebreakers and the basis for upcoming floating and land-based SMR plants—will now be able to incorporate additively manufactured parts. Rosatom says the project provides essential experience for producing more complex reactor components with optimised geometry, reduced weight, improved performance, and lower cost. Globally, 3D printing is gaining traction in the nuclear sector, with similar advances seen in Slovenia, the USA, Sweden, South Korea and the UK.

Source

Nuclear Energy News

IAEA Completes International Physical Protection Advisory Service Mission in Kenya.



Image:Kenya Bureau of Standards

The IAEA completed its first International Physical Protection Advisory Service (IPPAS) mission in Kenya, reviewing the country's security of radioactive materials and related facilities as Kenya prepares for a research reactor and considers nuclear power. The team commended Kenya's progress, encouraged the adoption of pending nuclear security regulations, and recommended stronger coordination and resourcing for the regulator (KNRA). The mission provided guidance to enhance Kenya's nuclear security framework and identified good practices beneficial to other IAEA Member States.

[Source](#)

2 REPORT HIGHLIGHT

1) Report title: Embracing the benefits of hybrid PV systems for Europe's energy transition



SolarPower Europe released a report titled “Embracing the benefits of hybrid PV systems for Europe’s energy transition” in March 2025. The report aims to shed light on the benefits of combining solar with storage or wind in a hybrid plant and provide a roadmap for unlocking the full potential of hybrid renewable energy systems across Europe. The report is structured into five chapters: Introduction, Defining Hybrid PV, Benefits of Hybrid PV Projects, Hybrid PV European Market, and Regulatory Framework Assessment.

The key points from the report are as follows:

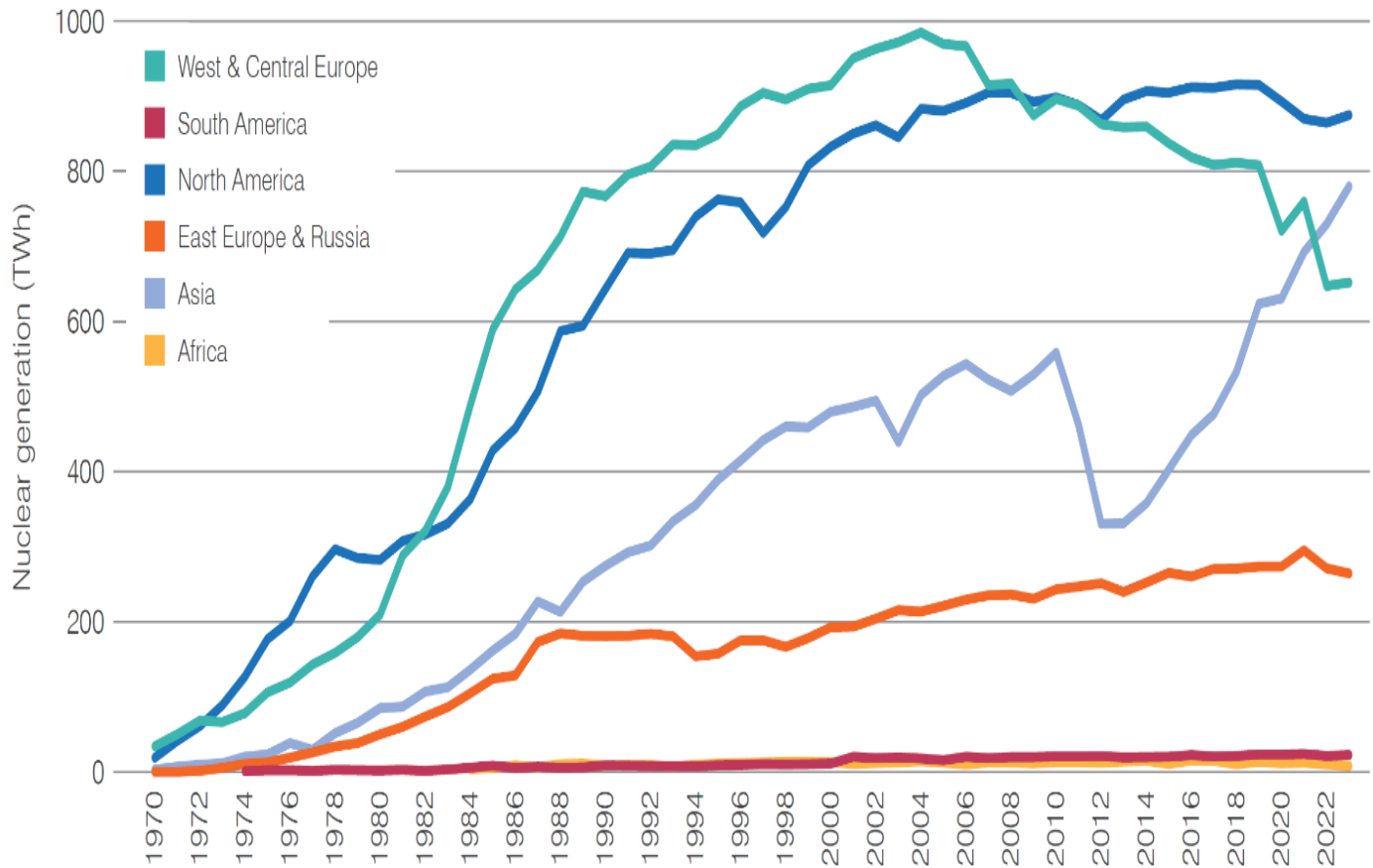
1. Hybrid PV projects benefits include enhanced energy security, improved grid stability, and economic advantages
2. Hybrid PV systems can be defined as the combination of technologies in the same facility and sharing a single grid connection access point
3. The most common hybrid PV systems combine solar with battery storage (PV+BESS) or wind (PV+Wind), where storage balances solar intermittency and wind complement solar output at night or during winter

2 REPORT HIGHLIGHT

4. Two different structures can be observed: Co-located systems, where assets operate independently but share a grid connection, and Fully Hybrid systems, where assets are jointly operated by the same entity to optimize grid use.
5. The benefits that hybrid projects bring to the system can be distributed in five categories:
 - Resources utilization, Efficient storage usage, Costs reduction, Curtailment avoided, Increased reliability.
6. In the EU, hybrid PV systems can reduce the Levelized Cost of Energy (LCOE) by up to 10% through:
 - Shared infrastructure, Optimized grid connection usage, Reduced curtailment and Enhanced revenue streams via capacity markets, and ancillary services
7. Examples from Poland, the Netherlands, Portugal, Denmark, Spain, and the UK show that supportive policies can effectively accelerate hybrid system deployment.
8. Grid-scale Battery Energy Storage Systems (BESS) have grown rapidly, with annual installations rising from under 100 MWh in 2015 to over 8.3 GWh in 2024, driven by technological advances, falling costs, and policy support; around 90% are standalone, while the rest are hybrid with solar or wind.
9. Six Policy Recommendations Hybrid PV Systems in EU:
 - Recognition of hybrid systems in energy planning, accelerated grid connection procedures, streamlined permitting processes, adapted support schemes, reformed grid tariffs that eliminate double charging, and updated Guarantees of Origin frameworks.

3 TAKE A LOOK AT DATA VISUALIZATION

1) Global Nuclear Industry Performance 2025



Source: World Nuclear Association, IAEA PRIS

Nuclear reactors generated a total of 2667 TWh of electricity in 2024, up 66 TWh from 2601 TWh in 2023. This is the highest ever generation from nuclear in one year, surpassing the previous record of 2660 TWh in 2006.

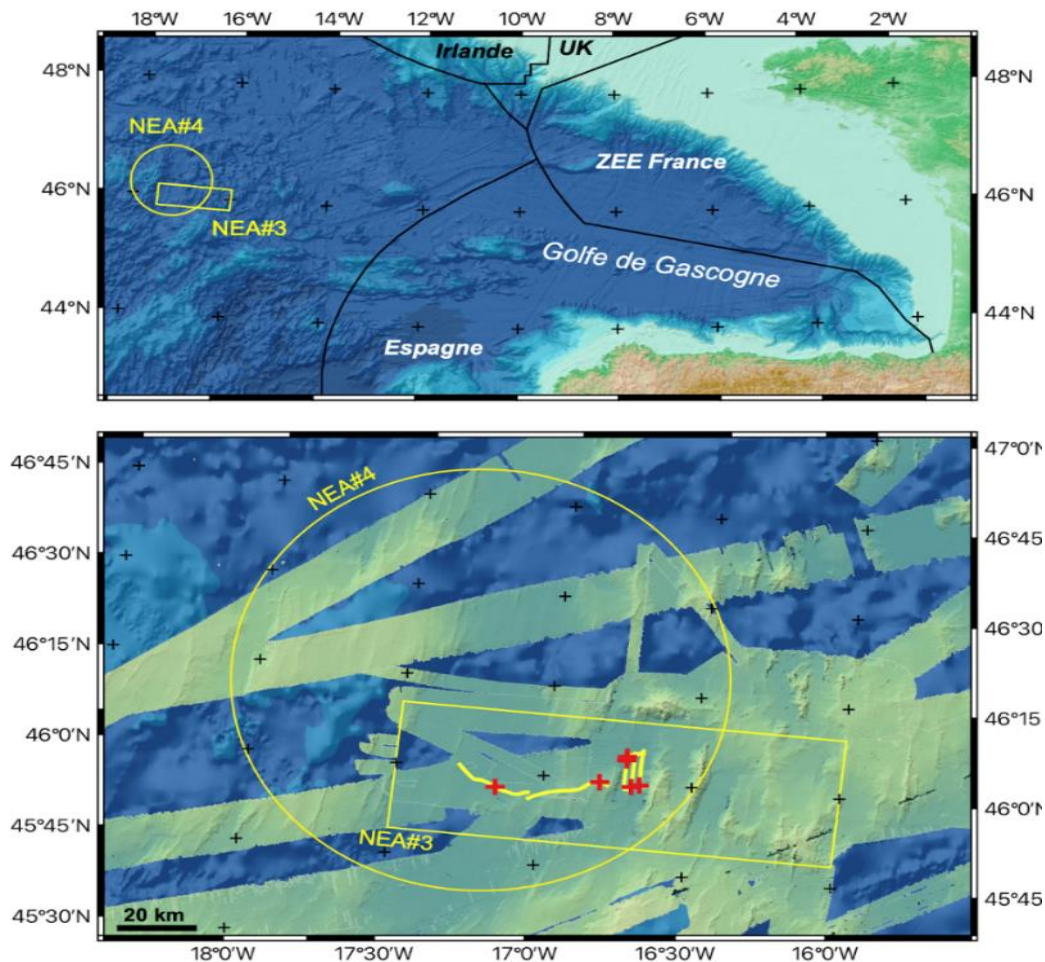
Generation increased in Asia, with five of the seven reactors connected to the grid in 2024 being located in that region. Generation also increased in West & Central Europe, with the return to service of reactors in France following outages in 2022 and 2023 contributing to this. In other regions, total generation in 2024 was broadly similar to the previous year.

In 2024 the end-of-year capacity of operable nuclear power plants was 398 GWe, up 6 GWe on the 392 GWe at the end of 2023. This includes 19 GWe of capacity in Japan and less than 1 GWe capacity in India where the status is categorized as 'Suspended Operation' by the International Atomic Energy Agency (IAEA).

The total number of operable reactors at the end of 2024 was 440, up three from the previous year.

3 TAKE A LOOK AT DATA VISUALIZATION

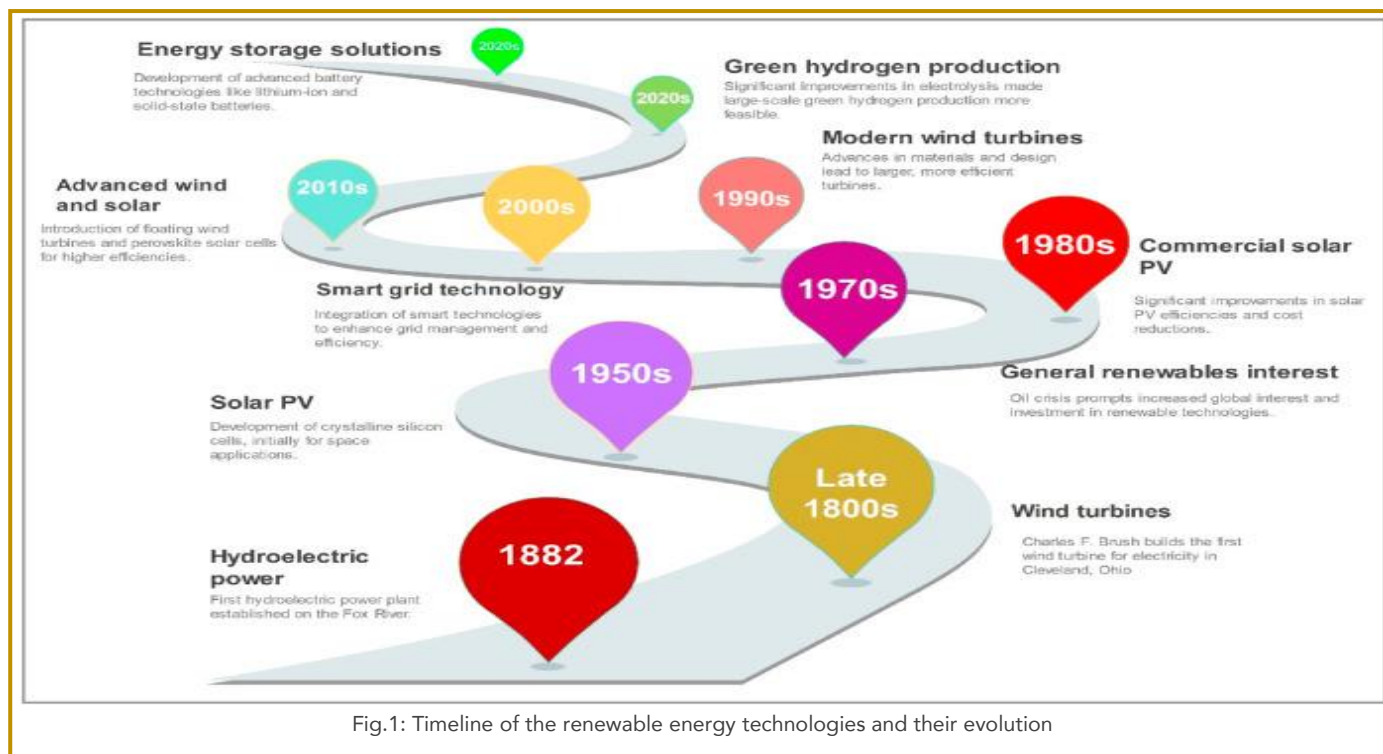
2) Radioactive waste: a scientific mission sets out to map submerged barrels in the Atlantic



Between the 1950s and 1990s, over 200,000 barrels of radioactive waste were deliberately dumped into the deep waters (3,000–5,000 m) of the Northeast Atlantic Ocean. The NODSSUM (Nuclear Ocean Dump Site Survey Monitoring) mission, led by CNRS in collaboration with Ifremer and other partners, embarked on its first cruise from June to July 2025 to map these submerged barrels and assess their condition. Using the autonomous underwater vehicle UlyX, equipped with high-resolution sonar and cameras, the team navigated about 70 meters above the seafloor to identify and photograph the barrels, and came as close as 10 meters for imaging. They also collected water, sediment, and biological samples (fish, crustaceans) at safe distances to study radionuclide behavior and environmental impact. No major radiation anomalies were found in the initial samples. A second mission is planned to more closely investigate the barrels using a manned submersible or a remotely operated robot to sample directly around them.

"Map of radioactive waste barrel dumping sites in the abyssal plain of the Northeast Atlantic (NEA#3 and NEA#4). The detailed map shows seafloor bathymetry and the locations of six barrels identified by the submersible Epaulard in 1985 during the EPICEA campaign, conducted by CEA/IPSN and Ifremer. © NODSSUM Project, 2025."

Paper Title: The role of artificial intelligence in accelerating renewable energy adoption for global energy transformation. **By:** Sameer Algburi, Salah Sabeeh Abed Al Kareem, I.B. Sapaev, Otabek Mukhitdinov, Qusay Hassan, Doaa H. Khalaf, Feryal Ibrahim Jabbar.



The paper bridges digital intelligence and energy systems by synthesizing how AI can catalyze the renewable energy transition; it surveys recent AI advances and proposes future architectures like autonomous grids and AI-driven electrolysis; it emphasizes system-level integration coordinating forecasting, control, grid operations, storage, and hydrogen; and by discussing limitations such as interpretability and regulatory constraints, it balances optimism with practical realism.

Background & Motivation

Renewable energy (RE) technologies (e.g. solar, wind, hydro, green hydrogen) face persistent challenges: intermittency, grid integration complexity, cost and operational inefficiencies, and the need for flexible energy storage and dispatch. The authors argue that Artificial Intelligence (AI) offers promising tools to mitigate those challenges and accelerate the transition to clean energy.

Scope & Approach

This is a review & conceptual synthesis rather than an empirical experiment. The authors survey recent AI methods applied to renewable energy systems and propose how AI can help across different layers:

- Forecasting & prediction (e.g. solar irradiance, wind speed, load demand)
- Optimization & control (e.g. resource allocation, dispatch, system scheduling)
- Operational efficiency / maintenance (e.g. predictive maintenance, fault detection)
- Grid integration & decentralized systems (microgrids, smart grids, peer-to-peer energy trading)
- Green hydrogen / electrolysis enhancement (optimizing electrolyzer operation)

Prepared by: Bandar Bahattab

Source

Major Findings & Insights

- **Forecasting gains:** AI models (machine learning, deep learning) significantly improve prediction of intermittent resources. Tighter forecast error margins allow better planning and less reserve margin.
- **Optimized operations:** Through AI-based scheduling and optimization, RE systems can better balance supply and demand, reduce curtailment, and maximize utilization of storage or hybrid systems.
- **Predictive maintenance & anomaly detection:** AI can detect equipment faults early (e.g. in turbines, inverters, grid components), reducing downtime and maintenance costs.
- **Decentralized & smart grid applications:** AI enables better coordination of distributed energy resources, microgrids, and local energy communities. This helps address grid stability, reverse flows, and local balancing.
- **Green hydrogen & electrolysis:** The authors highlight AI's potential to optimize electrolyzer operation (efficiency, dynamics, degradation), making green hydrogen more viable as an energy carrier.
- **Challenges & caveats**
 - Data limitations & quality: many sites lack rich historical datasets.
 - Model interpretability: "black box" AI models are less trusted by operators/regulators.
 - Computational and infrastructure cost: training large models can be energy-intensive.
 - Regulatory, cybersecurity, and governance constraints need to be addressed for deployment at scale.

Implications & Future Directions

- **For practitioners / industry:** AI tools should be integrated carefully with domain expertise (power systems, control engineering) rather than as standalone "black box" add-ons. Pilot implementations in microgrids, hybrid RE + storage + hydrogen systems would be valuable testbeds.
- **For researchers:** More work is needed on explainable AI (XAI) in energy systems (so operators can trust decisions), lightweight AI models for edge deployment, and transfer learning for data-scarce regions.
- **For policymakers / regulators:** Standards and regulatory frameworks should evolve to permit AI-driven control, ensure safety, encourage data sharing, and address cybersecurity.
- **For developing regions:** Since data and infrastructure may be limited, AI methods must be robust under sparse data, and deployment models should consider low-cost, lightweight AI architectures.

Quality Concept in Nuclear Industry.

Jean Luc Anderlini,

Senior executive in energy sector with 33-year experience in nuclear safety, security, quality, and environment.

30 November 2025



The quality concept was not created specifically for nuclear industry, but its root can be tracked back to the Mesopotamien empire, the cradle of civilization, in the 4th millennium BCE and was related to handicraft processes about transfer of knowledge and skills from one generation to the next. The approach remained almost untouched until the English industrial revolution era (19th century) when the need for mass production requires to develop further the concept. The current quality concept encompasses several sub-concept that needs to be clarified:

- **Quality:** "The totality of features and characteristics of a product, process, or service that bear on its ability to satisfy stated and implied requirements, especially those related to nuclear safety."
- **Quality Assurance:** "Quality Assurance is a process-oriented approach aimed at preventing defects by ensuring that all procedures, standards, and methods are properly implemented throughout the project lifecycle."
- **Quality Control:** "Quality Control is a product-oriented activity focused on detecting and correcting defects in deliverables through inspection, testing, and verification. It ensures that the final outputs meet established quality standards before delivery to the client. QC actions could occur at every stage of the production process."
- **Quality Management system:** "a management system that integrates safety, health, environmental, security, quality, with safety as the overriding priority. Lately, the concept evolves to integrate economic considerations and was called Integrated Management System (IMS)"

The quality management system or IMS shall describe the organization, the governance and the processes that enable the overall quality output and shall address as a minimum, the following topics:

Leadership and safety culture, process management, resource management, finance management, documentation and records, assessment and improvement, continuous learning...

Each organization involved in a nuclear project will develop and bear its integrated management system based on one or several system references: ISO 9001/19443, ASME NQA-1, GS-R, in accordance to a strong management system which will ultimately ensure and give confidence to Nuclear shareholders and stakeholders about:

- Consistent achievement of safety and quality goals.
- Clear accountability and documentation.
- Strong safety culture and regulatory confidence.
- Sustainable performance and continuous improvement.

60th Meeting of the Waste Safety Standards Committee (WASSC)

A key technical forum to review and develop international safety standards on radioactive waste management, attended by experts and regulatory bodies from IAEA Member States..

3–6 November 2025 | Vienna, Austria

[Source](#)

Technical Meeting on Stakeholder Engagement Around Nuclear Facilities

This meeting focuses on strategies to enhance cooperation and communication between municipalities, communities, and operators of nuclear facilities to improve social acceptance and transparency

3–7 November 2025 | Vienna, Austria

[Source](#)

Biban Forum 2025 – Entrepreneurship & Innovation Conference

Saudi Arabia’s largest SME and entrepreneurship event, bringing together startups, investors, government agencies, and global innovators to empower the Kingdom’s entrepreneurial ecosystem..

5–8 November 2025 | Riyadh Front Exhibition & Conference Center, Saudi Arabia

[Source](#)

Future of Utilities: Smart Energy 2025

A leading European event convening over 900 energy professionals and executives to explore the digital transformation of utilities focusing on smart grids, AI integration, customer engagement, and clean energy innovation.

1–2 December 2025 | London, UK

[Source](#)

Saudi Smart Grid Conference SASG 2025

A leading regional platform focusing on smart grids, renewable integration, digitalization, and grid modernization. The event features high-level panels, technical sessions, and industry exhibitions..

15–17 December 2025 | Riyadh, Saudi Arabia

[Source](#)