A renewable 24/7 energy supply: feasible, profitable and versatile

The transition to a renewable energy future is accelerating, driven by advancements in solar power, energy storage and smart grid technology. As these innovations continue to gain traction, the vision of a fully renewable, 24/7 energy supply is becoming not only technically feasible but also financially viable and increasingly versatile. The smarter E Europe and Intersolar Europe 2025 will serve as key platforms for showcasing the latest technologies that are making this transformation possible, highlighting new developments in efficiency, profitability and integrated energy solutions.

The rapid expansion of renewable energy has been remarkable. According to the International Energy Agency (IEA), nearly 940 gigawatts (GW) of renewable energy capacity will be added annually from 2030 onwards, with solar power leading the way. Photovoltaics (PV) alone will account for approximately 80% of all renewable energy capacity installed between 2024 and 2030.

Even as the immediate pressures of the energy crisis ease, the dominance of renewable energy in global power generation continues to grow, proving that it is the most sustainable and cost-effective solution for meeting the world's energy needs.

Solar power leads the way

One of the main factors driving this rapid growth is the decreasing cost of solar energy. A 2023 report by the International Renewable Energy Agency (IRENA) found that solar power is now 56% cheaper than the most affordable fossil fuel-based energy source. As a result, PV systems, particularly when paired with battery storage, have become increasingly competitive.

Research from the Fraunhofer Institute for Solar Energy Systems (ISE) reveals that the levelized cost of electricity (LCoE) for utility-scale PV and storage in Germany in 2024 ranged between 6.0 and 10.8 euro cents per kilowatt-hour (kWh), significantly lower than the 15.1 to 32.6 euro cents per kWh for coal and gas-fired power plants. This cost advantage, coupled with the global push for decarbonization, is positioning solar energy as the backbone of the new energy economy.

Europe's solar boom

Nowhere is this shift more evident than in Europe, where the solar market is undergoing unprecedented expansion. According to SolarPower Europe, the continent installed a record breaking 65.5 GW of new PV capacity in 2024 alone. By 2030, total PV capacity is expected to soar to 816 GW, nearly three times the 338 GW installed in 2024.

Germany, one of the key players in the European solar industry, recently surpassed the 100 GW milestone, with solar energy now supplying approximately 14% of the country's electricity consumption.

This rapid expansion is being accompanied by new applications for solar technology across various sectors, including building-integrated photovoltaics (BIPV), which is increasingly being adopted for both residential and commercial properties. Innovations such as colorful solar cells are turning PV into an architectural feature, blending aesthetics with functionality.

Meanwhile, agricultural PV is gaining momentum as a dual purpose solution that maximizes land use efficiency while helping to mitigate the impact of climate change related weather shifts. At the consumer level, more households are becoming energy producers by installing PV systems with integrated storage, heat pumps and electric vehicle (EV) charging stations.

The importance of smart system integration

As renewable energy penetration increases, integrating these sources into the grid efficiently and intelligently is becoming more critical. The transition to a decentralized energy system brings challenges such as grid congestion, mismatches between energy generation and consumption and delays in the electrification of various sectors.

Addressing these issues requires advanced digitalization of energy infrastructure. A smart, digitalized grid allows for better utilization of existing flexibility, balances supply and demand in real time and optimizes the flow of electricity.

Hybrid power plants, which combine solar with wind, hydropower, or battery storage, are reshaping the industry by ensuring a stable and diversified power supply. Additionally, green hydrogen is emerging as a key player in storing and transporting renewable energy, offering a solution for hard-to-electrify sectors such as heavy industry and long-haul transportation.

By integrating multiple energy sources into a single, intelligent network, the industry is moving toward a more resilient and self-sufficient power system.

Energy storage: a critical component

The expansion of renewable energy sources must go hand in hand with the development of storage solutions. Energy storage systems help mitigate grid congestion, stabilize frequency and optimize yields from solar farms. The global storage market grew by 76% in 2024, reaching 69 GW/169 GWh, highlighting the growing demand for large-scale storage.

Beyond traditional storage, battery systems are playing an increasingly strategic role in grid management. They can function as virtual transmission lines, storing excess electricity at one location and discharging it at another, effectively increasing transmission capacity without the need for physical infrastructure expansion. Moreover, as fossil-fuel based spinning reserves are phased out, batteries equipped with grid-forming inverters are stepping in to provide the grid stability traditionally maintained by thermal power plants.

Artificial intelligence (AI) is further enhancing storage system efficiency. AI-driven platforms analyze electricity market data to optimize charging and discharging cycles, ensuring profitability while stabilizing the grid. Modern software solutions allow for real-time switching between trading electricity on the futures market and providing grid balancing services, making storage systems an integral part of the renewable energy landscape.

Unlocking flexibility for a more stable grid

Flexibility has become a crucial currency in the energy market. Consumers can now actively contribute to grid stability by managing their energy consumption and feeding electricity back into the system when needed. Flexibility intermediaries, such as the Epex Spot power exchange, are enabling flexibility service providers to market their installations and help balance the grid.

One of the most exciting developments in this space is bidirectional charging, which allows EVs to discharge electricity back into the grid when demand is high. Research by the Fraunhofer Institute for Systems and Innovation Research (ISI) and the Fraunhofer ISE suggests that integrating EV batteries into the grid could save the EU up to 22 billion euros per year while reducing the need for stationary storage by up to 92%.

Innovative business models are emerging in the vehicle-to-grid (V2G) space, allowing EV owners to monetize their car batteries by selling stored energy back to the grid. In France, for example, a specialized EV charger offers free charging in exchange for making the car battery available for grid support. As technology advances, bidirectional charging is expected to play a major role in the future of energy flexibility.

Start-ups driving innovation

The renewable energy industry is increasingly looking to start-ups to drive innovation. At the smarter E Europe 2024, around 130 start-ups showcased their ideas in energy generation, storage optimization, smart grids and software solutions. In 2025, this number is expected to rise to 180, with over 4,000 square meters of dedicated exhibition space.

Emerging companies benefit from initiatives such as the Young Innovators program, organized by the German Federal Ministry for Economic Affairs and Climate Action (BMWK), which covers up to 60% of participation costs. Additionally, the Start-up Stage offers 10-minute slots for entrepreneurs to present their solutions to industry leaders. With the backing of such programs, start-ups are well positioned to disrupt the energy market with breakthrough innovations.

The smarter E Europe 2025: a must-attend event

As the largest exhibition alliance for the energy industry, the smarter E Europe brings together Intersolar Europe, ees Europe, Power2Drive Europe and EM-Power Europe. In 2025, it is expected to welcome over 110,000 visitors and 3,000 exhibitors across 206,000 square meters in Munich.

Key topics at the event will include large-scale storage systems, green hydrogen, solar hybrid systems, agricultural PV, and bidirectional charging. Alongside the exhibition, four high-level conferences will take place from May 6th to 7th, providing expert insights and networking opportunities. The event will also feature the smarter E Award, recognizing groundbreaking innovations in photovoltaics, energy storage, e-mobility, smart integrated energy and outstanding projects.

With the energy sector evolving at an unprecedented pace, the smarter E Europe serves as a crucial platform for industry professionals to exchange knowledge, form strategic partnerships and drive the global energy transition forward.

Events like this play an essential role in shaping the future of sustainable energy, ensuring that the transition to a renewable, 24/7 energy supply is not only possible but inevitable.

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