

AI

STANDS TO BOOST RENEWABLE ENERGY EFFORTS and help achieve the world's climate goals, even as it increases the power consumption levels that threaten those goals.

These benefits are already being explored. In every aspect of energy creation and distribution, from better wind turbines to more efficient energy grids and batteries, AI is poised to make a huge contribution that could help further climate strategies. The speed with which these ideas can be implemented varies, but in almost all cases, researchers are expecting positive results within a few years.

Enhanced Generation

Improving the yield from renewable energy generation is key to unlocking more investment and accelerating rollout. AI is already playing a number of roles here from the design of better site-specific systems to the monitoring of energy through sophisticated data collection at every point in the process. This allows identification of falloffs in efficiency and the diagnosis of issues in real time.

Researchers for companies such as the Denmark-based Ørsted and Shoreline Wind are developing “intelligent modeling” tools for wind farms that can take in all factors related to weather, wind speeds and direction, and wave and tide patterns, as well as constraints on infrastructure and workforce, availability of vessels and ports, and other factors, to

create greater efficiency. The goal is to be able to rely more on these robust models, creating systems able to scale energy delivery while reducing the onsite need for costly expertise.

Energy Grids

Without AI, energy grids struggle to cope with the intermittency of renewable energy supply. The combination of AI and blockchain can enable smart grids that are more reliable, efficient and sustainable. Generative AI can be employed to analyze large amounts of data to calculate energy demand, renewable energy output, prices, storage optimization and more. Blockchain technology can also make them less susceptible to cyberattacks, enhancing resilience.

An unavoidable consequence of grid transmission is that some energy gets lost along the way—accounting for electricity losses of 5% in the US between 2018 and 2022. The greater the distance traveled, the higher the transmission loss. Increasing the transmission voltage can help to reduce the loss. AI can make real-time adjustments in power routing and voltage in order to lessen the impact.

From an investor perspective, introducing renewables as energy sources adds risk to energy trading. AI's promise of predictive analytics for

AI has the potential for a cornucopia of energy system benefits.

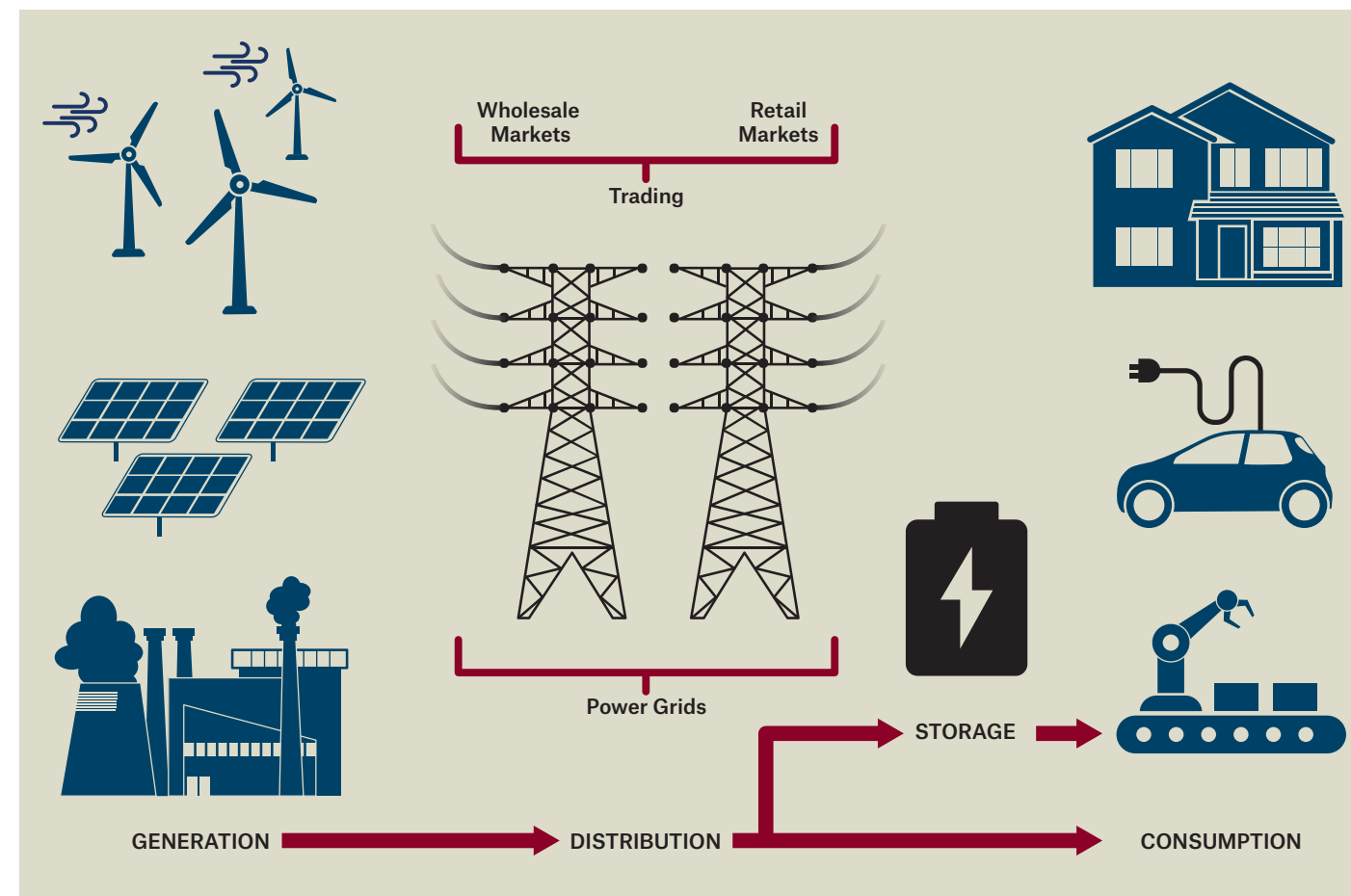
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demand, supply and price movements, and its ability to strengthen risk management, can help smooth the transition to renewables and could unlock new sources of capital.

Energy Efficiency

Reducing energy demand is a surefire way of tackling emissions—but global population growth and increasing living standards have been driving ever-greater energy use. This puts a premium on energy efficiency—doing more with less energy.

An example is energy efficiency in buildings, which account for 30% of global energy consumption and 26% of global energy-related emissions; in 2022, they consumed about 1% more than the prior



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year. AI has a huge role to play here by integrating data such as time of day, weather, air quality, asset type, occupancy, usage and other relevant factors to optimize demand for air conditioning and heating. Trials show that energy savings for buildings could reach around 30%.

Manufacturing Optimization

With one-fifth of the world's carbon emissions coming from manufacturing and production, AI is being employed to reduce energy consumption by 20% by 2025. Manufacturers are combining AI's analytical capabilities with the advanced monitoring of IoT (Internet of Things) sensors, with promising results: It becomes possible to adjust workflow

to optimize machine use and resource use, as well as spotting anomalies in energy use and predicting faults. This also reduces material waste in the production process.

Energy Storage

Storage is key to the energy transition—but battery technology development needs to accelerate. AI can use sensors inside the battery to continuously analyze subtle changes occurring in battery cells and infer their status in real time. This promises to increase lifecycles, and decrease discharge rates and re-charge times.

In addition, research into battery development is being boosted by AI assistance. Scientists announced early in 2024 that they had created a working battery prototype from an unusual combination of materials suggested by AI. Even more exciting for future research is the speed with which the new materials were identified and developed into a prototype. It took AI about 80 hours to identify 23 materials worthy of investigation from a candidate list of 32 million; from there, scientists had a working prototype in six months.

As one researcher noted, “That’s superfast.” ♦

TRIALS SHOW THAT ENERGY SAVINGS FOR BUILDINGS COULD REACH AROUND **30 PERCENT.**