# Renewable Energy Industry – A Primer

The renewable energy sector stands at the forefront of a global shift towards sustainable and environmentally friendly sources of power. In response to the escalating concerns about climate change and the finite nature of traditional fossil fuels, there has been a surge in the development and adoption of renewable energy technologies. This sector encompasses a diverse range of clean and renewable resources, including solar, wind, hydropower, geothermal, and bioenergy. As nations worldwide strive to reduce their carbon footprint and transition to a more sustainable energy future, the renewable energy sector plays a pivotal role in reshaping the way we generate and consume power. This primer provides an overview of the dynamics and key trends within the renewable energy industry and explores where it is expected to be in the future as well as rising stars of the industry today.

## Growth and Expansion

The renewable energy sector is undergoing dynamic transformations, driven by technological advancements, policy shifts, and a growing global commitment to sustainability. As more investors and companies seek greater clarity and confidence in accounting for long-term climate risks and opportunities, businesses are adapting to the "energy transition" - a transformation of the global energy sector from fossil-based systems of energy production and consumption to renewable energy sources[1]. Switching from nonrenewable energy sources like oil, natural gas, and coal to renewable energy is made possible by technological advancements and a societal push toward sustainability. Spurred by structural, permanent changes to energy supply, demand, and prices, the energy transition also aims to reduce energy-related greenhouse gas emissions through various forms of decarbonization. Wind and solar power are breaking records, and renewables are now expected to overtake coal by 2025 as the world's largest source of electricity. Automakers have made electric vehicles central to their business strategies and are openly talking about an expiration date on the internal combustion engine.

According to a report by RMI, clean-energy technologies like solar power and batteries are on growth paths that will transform the electricity sector this decade[2]. Solar and wind are already the cheapest form of new energy for 85% of the world and we expect their costs to continue falling, if trends continue, by another 25% to 50% by 2030[2].

As countries aim to reach ambitious decarbonization targets, renewable energy is expected to become the backbone of the world's power supply. Along with capacity additions from major energy providers, new types of players are entering the market[3]. Today's fast followers include major oil and gas companies, which intend to shift their business models to profit from the increased demand for renewables and the electrification of vehicles, and private-equity players and institutional investors that make renewable energy a central component of their investment strategy. Also, leaders in the shipping industry are investing in renewables to enable the production of hydrogen and ammonia as zero-emission fuel sources while steel manufacturers are planning to use green hydrogen to decarbonize their steel production, with renewables providing the green electricity for the process.

[1] US News & World Report. "Energy Transition 2024: Investing Outlook for the Year Ahead" (January 2024).

[2] Wall Street Journal. "As the Planet Heated Up in 2023, Clean Energy Took Off" (December 2023).

[3] McKinsey & Company. "Renewable Energy Development in a Net-zero World" (October 2023).

Car manufacturing companies are also striking renewable-energy deals to help power their operations and manufacturing, as well as making investments in wind and solar projects.

McKinsey & Company estimates that by 2026, global renewable electricity capacity will rise more than 80 percent from 2020 levels (to more than 5,022 gigawatts)[2]. Of this growth, two-thirds will come from wind and solar, an increase of 150 percent (3,404 gigawatts). By 2035, renewables will generate 60 percent of the world's electricity. More than $1.7 trillion worldwide is expected to be invested in technologies such as wind, solar power, electric vehicles and batteries globally this year, according to the International Energy Agency, compared with just over $1 trillion in fossil fuels[4]. Such investments are driving explosive growth. China, which leads the world in the sheer amount of electricity produced by wind and solar power, is expected to double its capacity by 2025, five years ahead of schedule. In Great Britain, roughly one-third of electricity is generated by wind, solar and hydropower. Moreover, in the United States, 23 percent of electricity is expected to come from renewable sources this year, up 10 percentage points from a decade ago.

**U.S. Inflation Reduction Act**

The U.S. Inflation Reduction Act (IRA), which marked its first anniversary in August of 2023, is driving investment in clean energy with a broad range of tax incentives. In response to the act's clean-energy and climate provisions, companies had announced more than $110 billion in new clean-energy manufacturing investments since the IRA became law, according to the White House. These investments include over $70 billion in the electric vehicle (EV) supply chain and about $10 billion in solar manufacturing[5].(footnote)

Over the past two years, the IRA helped catalyze $227 billion of announced public and private investments in utility-scale solar, storage, wind, and hydrogen.[23] To date, $100 billion of these investments have materialized, in addition to $82 billion in distributed renewables and heat pumps. States also offered a record $24 billion in tax breaks in 2022 to attract projects. The bulk of investment flowed to states with ambitious decarbonization targets and mandates such as California as well as to states with greater renewable resources and lower development costs such as Texas and Florida. A large share of clean energy investment also flowed to energy, disadvantaged, and low-income communities identified in the IRA for additional incentives.

**Investing and Funding Patterns**

According to BloombergNEF, global new investment in renewable energy skyrocketed to $358 billion in the first six months of 2023, a 22% rise compared to the start of last year and an all-time high for any six-month period[6]. Of this total, $335 billion was for project deployment through both asset finance and small-scale solar. This investment was 14% greater than in the first six months of 2022 and reflects the continuing acceleration of the energy transition as renewable energy scales up.

[4] New York Times. "The Clean Energy Future Is Arriving Faster Than You Think" (August 2023).
[5] Goldman Sachs. "The US Inflation Reduction Act is Driving Clean-Energy Investment One Year In" (October 2023).
[6] BloombergNEF. "Renewable Energy Investment Hits Record-Breaking $358 Billion" (August 2023).

Renewable energy companies have also had success this year raising equity to support their growth and expansion. Venture capital and private equity expansion commitments to renewable energy companies reached $10.4 billion during the first half of 2023, up 25% from the first half of 2022[5]. New equity raised on the public markets totaled $12.7 billion during the first six months of the year, up 25% from the first half of 2022[5]. China was the largest market in 2023, with $177 billion of new investments, up 16% from 2022. The US secured $36 billion, while Germany drew $11.9 billion.

Market investments are surging, with renewables setting a record of $358 billion in the first half of 2023. Two-thirds of this total was in solar development, with projections suggesting that investment in solar may even overtake that in oil production this year. Solar is being developed in gigawatt-scale projects capable of powering whole cities. China, Egypt, India, Mexico, Spain and the United Arab Emirates are among the countries developing resources at this scale, with the U.S. closing ground. Similar scale wind farms have been developed in China, India, the United Kingdom and the U.S[2].

## Technological Advancements and Innovations

Renewable energy technologies have made significant progress in recent years, and ongoing research and development continue to drive innovation and improve efficiency.

### Electric Vehicles

Electric vehicles (EVs) represent a promising green technology for mitigating environmental impacts. EVs have gained significant attention in recent years as a promising solution towards reducing greenhouse gas emissions and mitigating the impacts of climate change. With advancements in technology and increasing environmental consciousness, EVs are becoming an integral part of the global effort to transition towards sustainable energy solutions.

One of the significant ways electric vehicles are impacting the renewable energy sector is by driving demand for clean energy sources. As the number of EVs on the road increases, the demand for electricity to power these vehicles also grows. As electric vehicle users are already environmentally conscious, there is a demand that this electricity is produced using green, non-renewable sources such as wind, solar, and hydropower. Harnessing energy using these sources produces little to no greenhouse gasses. As a result, the renewable energy sector is experiencing significant growth, with investment in clean energy sources rising and new projects being developed to meet the growing demand for clean electricity.

EV sales in the US have reached a record-breaking quarter, with 300,000 new EVs sold in the second quarter 2023, marking a 48.4% increase compared to the same period in 2022. In the second quarter of 2023, Tesla reported a 20% increase year-over-year in net income, with its most popular models competing on upfront sticker cost against similar internal combustion vehicles, while saving 50% to 75% on fuel with each mile driven[7]. Delivery trucks, buses and two- and three-wheelers all benefit from similarly compelling economics, and we are seeing a global migration to electric vehicles to save money as well as the benefits of cleaner air, lower carbon emissions and quieter cities.

[7] Reuters. "US Electric-Vehicle Sales Hit record high, Tesla loses market share, report says" (October 2023).

**Solar Power Technologies**

The IRA had some of the biggest impacts on solar and storage. Utility-scale solar captured the largest share of the announced investment of $92 billion and actual investment of $52 billion across 38 states. The month after the IRA passed, a record 72 GW of standalone solar was added to the interconnection queue, more than the preceding 11 monthly additions combined. Additionally, amid a venture capital industry slowdown, VC funding for solar and storage increased in the first three quarters of 2023, and the IRA boost blunted higher interest rates as public market and debt financing for solar also grew. Solar recorded 34% growth in actual investment over the past year, storage jumped 51%, and distributed renewables, storage, and fuel cells increased 31%.

Advancements in solar PV technology are increasingly expanding the suitability range for solar power, and projects now range in size from a few kilowatts for residential systems to more than 1,000GW for the largest utility-scale systems. The latest developments and breakthroughs in solar technology include longer-lasting solar cells, solar cells that you can print onto flexible surfaces, solar panels that track the sun from east to west throughout the day, and solar power plants that work at night.

Announced projects could more than triple this year's solar photovoltaic module capacity in 2024, and meet US demand before 2030, which is a reversal from U.S. import dependence for 85% of supply in 2022[8]. While China currently produces 83% of the cells and polysilicon and 97% of the wafers used in modules, new domestic polysilicon capacity and the United States' first cell, wafer, and ingot manufacturing plants are planned to come online in 2024. This reshoring is premised on balancing domestic panels' 40% price premium and the 40% tax incentive for manufacturers that use 40% domestic components[7]. Meanwhile, solar imports more than doubled in the first eight months of 2023 amid global overcapacity that drove prices to record lows, placing half the pipeline at risk of delays or cancellation. In 2024, final Treasury guidance will encourage upstream investment in wafers, ingots, and polysilicon.

**Rising Stars**

The renewable energy industry is rapidly evolving, with numerous companies making significant strides in advancing clean and sustainable energy solutions. These rising stars are pushing the boundaries of innovation and playing a crucial role in driving the transition towards a greener future. Notable renewable energy companies that are emerging as leaders in the industry are described below[9]:

**Enphase Energy (ENPH)**
Enphase Energy is a leading renewable energy company specializing in solar energy solutions. They are renowned for their microinverter technology, which maximizes the efficiency and performance of solar photovoltaic (PV) systems. Enphase Energy's innovative microinverters enhance the reliability and resilience of solar power generation, enabling homeowners and businesses to generate clean energy more effectively. The Company just announced that it has started shipping IQ8 Microinverters in Belgium, with peak output AC power of 384 W, to support newer, high-powered solar modules.

[8] Deloitte. "2024 Renewable Energy Industry Outlook" (December 2023).
[9] Enerdactics. "Rising Stars: Renewable Energy Companies" (June 2023).

**First Solar (FSLR)**
First Solar is a prominent player in the solar energy industry, focusing on the development and manufacturing of thin-film solar modules. Their advanced solar modules offer high efficiency and durability, making them suitable for large-scale utility projects. First Solar is committed to continuous research and development, driving down the cost of solar energy and promoting its widespread adoption. The Company's results for Q3 2023 demonstrated substantial net sales of $801 million, which results in an increase in net income per share to $2.50, up from $1.59 in the previous quarter.

**Ørsted (DNNGY)**
Ørsted, formerly known as DONG Energy, is a global leader in offshore wind energy. They have successfully transformed their business from a fossil fuel-based energy company to one that primarily focuses on renewable energy, particularly offshore wind power. Ørsted is involved in the development, construction, and operation of offshore wind farms, contributing significantly to the growth of clean and sustainable energy generation. The Company recently signed a 15-year power purchase agreement to supply 80MW of solar PV power in the US to media company Bloomberg, which is the largest solar project in its portfolio in the US.

**Vestas Wind Systems (VWDRY)**
Vestas Wind Systems is a Danish company that specializes in wind turbine manufacturing and installation. They are one of the largest and most established players in the wind energy industry. Vestas' advanced wind turbines offer high efficiency and reliability, enabling the cost-effective generation of clean energy. With a global presence and a strong focus on research and development, Vestas continues to be a key contributor to the expansion of wind power worldwide. The Company just partnered with ArcelorMittal, the world's leading steel and mining company, to launch a low-emission steel offering that is significantly reducing carbon emissions in wind turbine tower production.

**Sunrun (RUN)**
Sunrun is a leading residential solar and energy services company based in the United States. They provide homeowners with customized solar solutions, including rooftop solar panels and energy storage systems. Sunrun's innovative approach to solar energy enables homeowners to reduce their reliance on traditional utility grids and achieve greater energy independence. They are also actively involved in virtual power plant initiatives, which aggregate the solar and storage capacity of multiple homes to create a more resilient and distributed energy system. The Company recently announced a new storage offering for solar customers in California, reinforcing its commitment to providing sustainable energy solutions. With a focus on democratizing access to renewable energy, Sunrun's subscription service allows residential customers to embrace solar and storage without upfront costs.

## Outlook

Morningstar forecasts renewable energy in the U.S. will grow 12% annually during the next decade because of favorable economics, policymaking, and consumer demand[10]. Additional forecasts predict

[10] Morningstar. "Our 10-Year Utilities Forecast: Renewable Energy to Triple by 2032" (October 2023).

solar will be the fastest-growing clean energy technology during the next decade due to falling costs, location flexibility, and reliability. It is expected that solar energy will grow from 2% of U.S. power generation in 2018 to 22% by 2032, including distributed generation. In total, solar represents almost two thirds of the renewable energy growth in the Morningstar forecast. By 2032, solar energy is forecasted to comprise half of all U.S. renewable energy, up from 21% in 2018. Solar projects are by far the largest type of generation technology in the U.S. electric grid queues. In total, developers are planning or have already begun development of more than 90 gigawatts of new solar capacity, according to Rystad data, a near-doubling of current U.S. solar capacity[9].

In 2024, the renewable energy industry could expect to see the historic climate legislation take greater effect as tax credit guidance is finalized, more Loans Program Office loans are issued, and more programs release IRA grant funding, only 10% of which has been disbursed thus far.[7] The massive public and private investment and channeling of capital toward the clean energy transition could propel solar and storage deployments to continue soaring, onshore wind to recover, and residential technologies to pick up speed. Offshore wind and green hydrogen industries could establish a foothold, while underdeveloped renewables could play a greater role in clean energy portfolios. Meanwhile, a clean energy-driven manufacturing renaissance could provide opportunities to develop more resilient renewable supply chains across the country.

Additional signs of progress in 2024 could include the US Treasury's guidance on hydrogen and domestic content adders, the impact of IRA and IIJA funds on workforce development, and Federal Energy Regulatory Commission and DOE actions on grid reform and buildout[11]. This El Niño year may bring more extreme weather events that could call on renewable resources to support the grid. Finally, a quickly expanding range of use cases may grow generative AI's foothold in renewable operations, workforce planning, and distributed aggregations supporting resilience.

## Conclusion

Extreme weather events have defined 2023, from Cyclone Freddy sweeping across southeast Africa, to wildfires in Canada that blanketed eastern North America in smoke, to extreme heat around the world that made July the hottest month on record by a wide margin. The intersection of climate change and the renewable energy sector underscores the critical role that clean and sustainable energy plays in mitigating the adverse impacts of a warming planet. As climate change poses unprecedented challenges to ecosystems, communities, and global stability, the renewable energy sector emerges as a beacon of hope and a practical solution. The shift towards renewable sources not only addresses the urgent need to reduce greenhouse gas emissions but also promotes energy security, economic development, and technological innovation. The success of combating climate change relies on the widespread adoption of renewable energy technologies, coupled with concerted efforts in policymaking, international collaboration, and public awareness.

[11] US Department of Treasury. "IRS Release Guidance on Hydrogen Production Credit to Drive American Innovation and Strengthen Energy Security" (December 2023).

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