Dow Schofield Watts
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The Energy Transition 2023

Fuelling Net Zero

M&A in the Renewable Energy Sector

Contents

About Us

Dow Schofield Watts is a prominent independent advisory business which, for over 20 years, has delivered partner-led financial advice to a diverse range of clients and industries.

Established in 2002, the firm has a talented team of over **95 professionals** across offices in Aberdeen, Edinburgh, the North West of England, Leeds, London and Reading.

It provides a broad range of professional services, including corporate finance, transaction services, business recovery, tax advisory, forensic services, debt advisory and wealth management.

The network also includes venture capital with DSW Ventures, private equity through PHD Industrial Holdings and an international network of corporate finance firms via Pandea Global M&A, which now covers over 30 different countries.

Companies are under ever-increasing pressure to deliver growth and sustainable results. At DSW, our professionals think strategically like entrepreneurs and investors, looking at opportunities to preserve and add value through strong relationships as trusted advisors to buy, sell, fund, strategically advise, invest, and fix businesses. Our teams can assist with deep sector knowledge providing analytical advice to navigate complicated processes.

The DSW team and the author (Connor Monaghan) have significant experience across energy and utilities, particularly renewable energy, remaining committed to playing a role in the path to net zero. We work across the entire renewable spectrum with all participants, from venture capital innovators to developers, operators, investors, and utilities. A crucial part of being the trusted advisor for our clients is providing strategic advice and innovative solutions to ambiguous problems while identifying value add opportunities.

Connor is a Corporate Finance Manager at DSW with several years of experience across a vast range of M&A transaction and lead advisory services, audit, and strategic advisory projects. He has experience across the utilities and renewable energy sector across development, investment, operation, and divestment cycles across various technologies such as gas, wind, solar and bioenergy and across a mix of clients. Including relevant experience in valuation and financial consulting engagements for mergers and acquisitions, financial reporting, project financing, financial modelling, and strategic advisory services.

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Methodology

For the purposes of this report and analysis, 'renewable energy' is power generated from the following sources: Solar Photovoltaic (PV), Concentrated Solar Power (CSP), Offshore Wind, Onshore Wind, Hydropower, Bioenergy and Geothermal. The report focuses on the UK, Europe, and the 'major players' based on historical M&A deals and market data volumes such as China, the US, Germany and India.

M&A data was analysed by the following categories:

- Solar;
- Wind (both offshore and onshore);
- Bioenergy;
- Hydropower;
- Geothermal; and
- Associated renewable energy infrastructure such as storage technologies, hydrogen, smart grid technologies, and professional enablement services such as renewable energy consultancies and infrastructure developers providers that unlock access to renewable opportunities.

The forecasts for renewable energy capacity additions for 2022-2027 have been taken from the International Energy Agency: Renewables 2022 – Analysis & Forecast to 2027[1]. The raw renewable energy capacity data has been taken from the IEA's database of data and statistics[2].

Renewable capacity statistics are released annually by the International Renewable Energy Agency (IRENA) in March/April[3] and can often be subsequently updated. Renewable power generation and energy balances data sets are released annually in July. Therefore the latest data sets available for this report are for 2021 for power generation and renewable energy balances and 2022 for capacity statistics; updated 2022 data is due for release in July 2023.

The raw deal data for M&A utilised throughout the report is taken from Mergermarket databases with corresponding results collated and analysed by DSW.

Foreword

Renewable energy will be the central pillar of the worldwide energy transition and is vital to achieving net zero globally. As the world progressively shifts away from fossil fuels toward decarbonisation of the energy system, understanding renewables' role is critical to ensuring an efficient route to net zero.

While renewables continued to increase capacity at a robust pace through the Covid-19 pandemic and its subsequent fallout, they now face new unforeseen challenges and opportunities.

The next decade is pivotal for laying the foundations for success. It is vital for governments, businesses, and individuals to take responsibility and engage with the complexities in the transition to a net zero future. The transition to net zero is not a single-entity problem but all-encompassing and will take strategic collaboration between governments, industries, and individuals who all must play their part. Significant expertise will be required to manage the ambiguous problems associated with scaling up the transition and managing capital and technical resources to create momentum.

Technological advances in renewable energy, hydrogen, and storage solutions will drive the transition from a fossil fuel system to a clean energy system. However, whilst the industrial revolution and the associated fossil fuel system have significantly contributed to rising global temperatures over the past 140 years, the transition to net zero and the new energy system has a much shorter lead time to reverse this impact. The energy transition is now, and renewable energy, technological innovation and energy efficiencies require rapid action across the current decade to set a platform to achieve net zero by 2050.

Executive Summary

Renewables are increasingly popular, with significantly more players entering the market to invest in the renewable energy sector, deploying capital beyond the generational assets into new and expanding business models, including new technological infrastructure and innovations. **Investment increased to $1.3 trillion in 2022, a new record high**; however, this increase still needs to catch up to the expected $131 trillion required between 2021-2050 across the sector to reach net zero[4]. Investors are no longer a small, specialised pool of developers but now include several specialised green funds, utilities, large corporates, financial investors and private equity. The increase in the number of specialised 'ESG', 'Impact' and 'Green' funds over the past decade is noteworthy alone. DSW estimates that the **M&A market could be worth just shy of £2 trillion, with almost 3,000 deals annually, by 2030**.

Some regions are more attractive than others due to their historically stable regulatory environment and continuous support for renewable energy policies providing consistent positive returns for investors. Historically, European nations, mainly the **UK, Germany, and the Netherlands** have been leaders for many other regions that have sought to replicate their policy and support frameworks. However, **China continues to dominate capacity deployment**.

Some technologies are more popular than others due to technological maturity, scale and value. The sheer scale of **offshore wind allows investors to deploy large amounts of capital for significant returns** that can't be deployed through other technologies and opportunities, such as onshore wind. Both **offshore wind and solar will remain pivotal** and extremely popular for large capacity deployment, as will investment in new technological advances and innovations in **hydrogen, energy storage and digitalisation**.

Net Zero and decarbonisation of the worldwide economy will continue to drive and accelerate further investment into renewable energy. This has been compounded particularly by the fallout of the Ukraine war and the subsequent energy crisis, particularly for nations that rely significantly on fossil fuel imports which drives the desire for governments to improve their energy sovereignty (principally across Europe). Many **countries have consequently accelerated and strengthened their policies to support renewables**, underlining the importance of **domestic renewable energy security** and reducing reliance on Russian imports.

Introduction

Despite ongoing logistical challenges and spiralling energy and commodity prices, renewable electricity capacity additions and the market for renewable energy assets, platforms, portfolios, and associated infrastructure bolt-ons remained resilient. They maintained their momentum throughout the pandemic into 2023 and forecasted beyond.

Overall, M&A activity globally (particularly in the UK and Europe) reached record levels in 2021, with 2022 remaining ahead of pre-pandemic levels. The renewable energy sector expanded again in 2022. It was no outlier to this trend and contributed to the total – both in terms of high deal volume and historically significant transactions – while supported by strong core fundamentals and a supportive policy environment.

The energy sector is under extraordinary pressure to perform, following the worldwide accelerated net zero targets, and exacerbated by an unforeseen energy crisis from Russia's invasion of Ukraine, which continues to have a long-reaching impact on the energy markets and beyond. This unprecedented global energy crisis has led to an exceptional uplift in momentum for renewable energy capacity. As governments worldwide seek to protect consumers and businesses from the energy crisis while reducing reliance on Russian fossil fuel supplies, aggressive policies and support to accelerate the roll-out of renewable energy sources, decarbonisation, and the transition to clean energy technologies are all being implemented at a rapid pace.

Demand in the sector has been buoyantly supported by continued aggressive renewable energy and decarbonisation targets from governments, historical low-interest rates (although this historical trend is currently reversing and may become a future challenge) and Environmental, Social and Governance (ESG) considerations worldwide.

Rapid technological developments and the historical trend of decreasing costs of renewable energy technologies, alongside increasing competitiveness of energy storage, have allowed renewable energy to become one of the most competitive power sources across the energy sector.

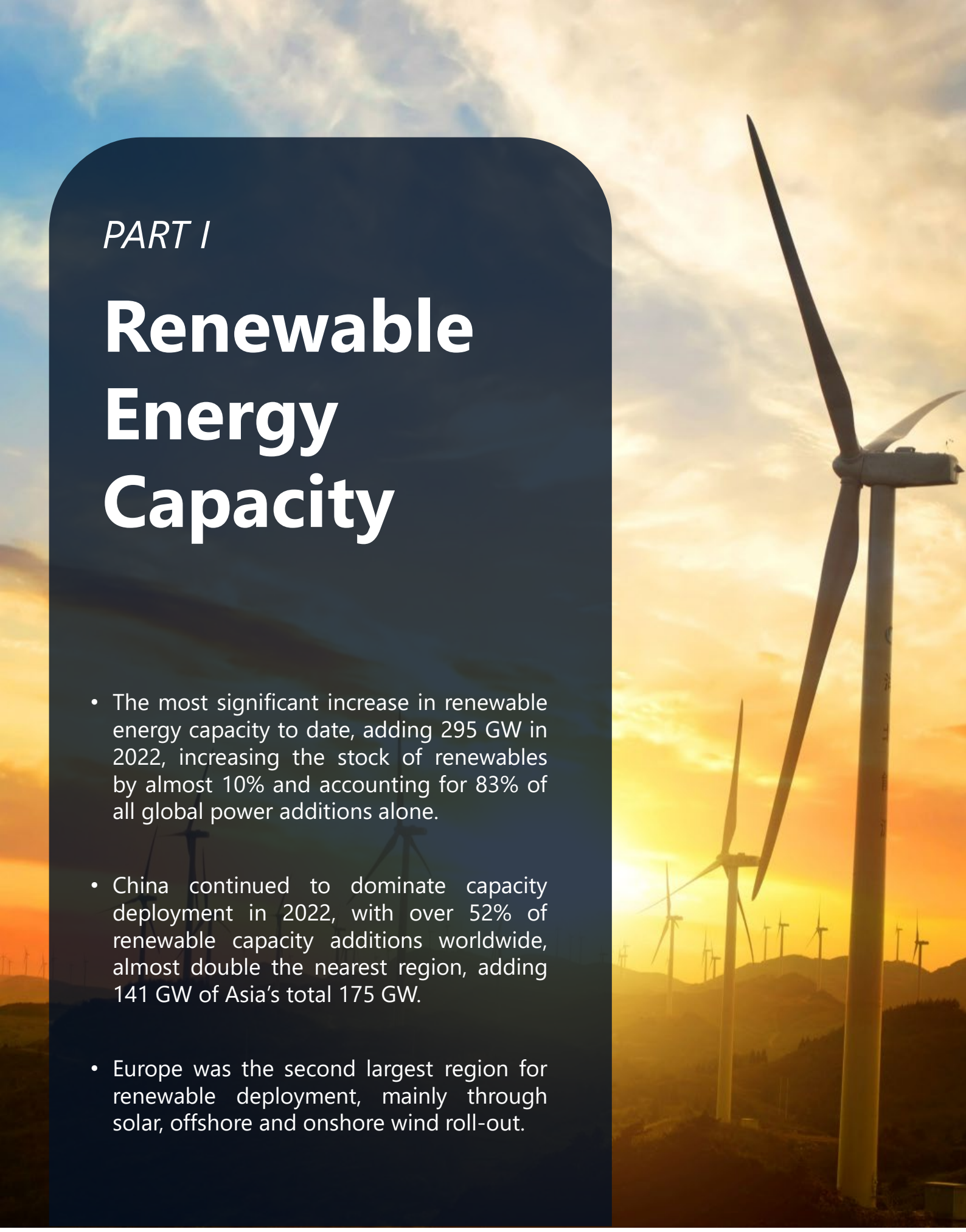
However, achieving historical returns may become more challenging beyond 2023 with increasing market competition, interest rates, supply chain hangover issues from the pandemic, and trade issues in China. Moreover, short to medium-term international relations concerns and the continued fallout from the Ukraine war will prove both a key challenge for the overall energy market and a key driver in the renewable sector.

Introduction

Despite costs for new solar and wind installations slightly increasing during 2022 (a reversal of a continued cost-reduction trend) due to increases in commodity prices and logistics costs, natural gas, oil, and coal prices continue to rise much faster. This, therefore, has accelerated increasing energy prices, which only increases the competitiveness of renewable energy generation comparatively.

The accelerated strengthening of renewable energy policies worldwide following the Russian invasion, particularly within Europe and from the EU, alongside record-high fossil fuel prices compared to generation from renewable sources, particularly solar and wind, will speed up the roll-out of renewable capacity and add further demand to the market for incumbents and new entrants to seize upon opportunities.

Moving forward into 2023 and beyond, we expect renewable energy growth to experience an unparalleled acceleration as concern for energy security, net zero, and ESG considerations grow. Furthermore, national energy sovereignty and demand for cleaner energy sources from all stakeholders will only continue to increase and mount further pressure on nations, governments, businesses, and individuals.



PART I

Renewable Energy Capacity

- The most significant increase in renewable energy capacity to date, adding 295 GW in 2022, increasing the stock of renewables by almost 10% and accounting for 83% of all global power additions alone.

- China continued to dominate capacity deployment in 2022, with over 52% of renewable capacity additions worldwide, almost double the nearest region, adding 141 GW of Asia's total 175 GW.

- Europe was the second largest region for renewable deployment, mainly through solar, offshore and onshore wind roll-out.

Renewable Energy Capacity

As a result of the pandemic, there was a multitude of issues that negatively impacted the worldwide economy. This included supply chain issues, construction delays, and exceptionally high raw material and commodity prices. Despite this, however, data for renewable energy additions in 2022 shows another 9.6% increase continuing to break records adding another 295 GW of additional renewable energy capacity; this is forecast to be between 350-400 GW installed during 2023 with at least another 18% increase compared to 2022, according to the IEA, driven mainly by both solar and wind additions[5].

Capacity expansion in 2022 was mainly driven by increases in solar and wind installations accounting for 90% of all additions, alongside bioenergy and hydropower, combined with steady geothermal capacity installations.

In terms of the speed of this capacity growth, net capacity expansion increased in 2022, compared to a slowdown in 2021 following an extraordinary jump from 2020 when Chinese developers rushed to roll-out the commissioning of projects before the phase-out of some subsidies, particularly for onshore wind. However, 2022 saw an acceleration due to the ongoing energy crisis following the invasion of Ukraine, which is forecast to increase annual capacity roll-out at speed in 2023 and beyond.

Nevertheless, overall, China continued to dominate the market share of deployment in 2022, with over 52% of worldwide net renewable capacity additions[6]. New capacity growth increased by almost 17% annually in China, supported by an increase in solar and wind installations, 61% and 100% higher than in 2021, respectively, following a hangover in 2021 from subsidy expirations[7]. However, subsidies available in 2022 meant offshore wind, residential solar, and bioenergy capacity additions broke new records. This was supported by hydropower capacity increases from multiple units at the Chinese Baihetan hydropower plant being commissioned, increasing capacity by 6% alone.

Excluding China, Asia's annual installations increased by 13% annually, following a decline in the roll-out of additions in recent history from the phase-out of the generous Feed-in-Tariff (FiT) scheme for solar and wind in Vietnam; success now will largely depend upon the implementation and success of the roll-out of Vietnam's Power Development Plan and auction scheme.

As a region, Europe was the second-largest market in terms of increased capacity, once again breaking annual historical records. It was driven mainly by the roll-out of increased solar installations and project acceleration across Spain, France, Poland and Germany, with a combination of government-led auctions and distributed solar incentives.

Renewable Energy Capacity

The US saw an expansion increase for wind additions by c. 6% due to the reversal of the forecasted phase-out of Production Tax Credit (PTC) rates squeezing the economic viability of projects; solar expansion continued to accelerate due to the support from Investment Tax Credits (ITC), ITC and PTC are now available until 2032, offering a comparatively stable policy environment for both wind and solar, despite growth being dampened by supply chain and logistical challenges[8].

India recently saw a slowdown in 2020 due to Covid-19 challenges causing project delays; however, during 2022, its growth recovered by another 25% after almost doubling capacity compared to 2020 in 2021[9]. This was due to the commissioning of previously auctioned utility-scale projects and the acceleration of the roll-out of distributed solar supported by improvements in government policy, making it more economically attractive.

As the most developed economy in Latin America, Brazil continues to dominate the headlines for renewable energy across the region. Its generous net metering incentives for distributed solar applications make it very economically attractive, increasing installations and supportive policies accelerating onshore wind additions due to supportive economics from its free market bilateral contracting.

Australia's annual installations continued to increase its capacity by over 5 GW in 2022, a 13% increase from 2021, although slower than historical expansions[10]. This aligns with state-level targets and PPAs expanding utility-scale capacity expansions, thanks to state-level auctions for new capacity and emerging Renewable Energy Zones (REZs).

Mergers & Acquisitions in Renewable Energy

- The energy sector is under extraordinary pressure, compounded further by the energy crisis and the Russian invasion of Ukraine.
- M&A deal volume continued to rise in 2022, increasing by 63% with 1,036 deals worth £118.7bn from 491 deals with disclosed values.
- Net zero & ESG targets drive further roll-out and M&A activity worldwide.
- Energy storage, Energy-as-a-Service and hydrogen innovations will be future industry trends that will further drive investment into the renewable sector.

Mergers & Acquisitions in Renewable Energy

As already discussed, the energy sector is under unprecedented pressure to perform, with renewable energy offering a safe haven and an exciting prospect for governments and, by proxy new opportunities for incumbents and new market entrants.

Governments are seeking to quickly adapt their energy policies to counter the ongoing impact of the energy crisis, alongside ongoing decarbonisation and net zero targets, following the fallout from the Ukraine war. Countries worldwide are seeking shelter from the energy crisis, for economic stability and consumer protection, by securitising national energy sovereignty and avoiding an overreliance on external parties.

This further accelerates and adds momentum to the net zero movements that many nations worldwide aim towards (at differing timescales) to address the challenges posed by climate change. This impact is also being felt by companies that must play their part in the energy transition through increasing decarbonisation and ESG targets. In addition to increasing pressure on energy suppliers and governments from consumers who want 'green energy' options at price parity with fossil fuel generation. This energy transition and its acceleration are playing out in many ways worldwide.

The energy sector itself is an ever-changing market, undergoing consolidation in some countries, while in others, new, smaller and more agile providers are entering the market at a steady pace.

Both corporate and financial buyers are searching for the deals that will give them the most favourable returns and are still looking for an opportunity to get in on the ground floor of the next big renewable innovation breakthrough. This 'renewables revolution' offers technologically-driven energy generation and distribution consistently and increasingly towards grid parity through innovative technologies designed to increase and maintain the security of supply by increasing efficiency through smart grid technologies and to meet growing consumer demand, which is being introduced at a remarkable speed.

The renewable energy market is unlike many other M&A markets as its activity is predicated on additional capacity continually being commissioned or upgraded. This fragments the market for both initial developers and a secondary market, providing a mechanism for investors to extract returns at project development or operational stages. Ultimately, through M&A transactions, assets find a new 'home' with long-term investors and pension funds, private equity, utilities and other large corporates.

Increasing annual capacity, supportive policy environments, demand from stakeholders and technological innovation continue to drive capacity growth and deal activity as an increasing number of market players strive to stay ahead of the curve whilst increasing returns.

Mergers & Acquisitions in Renewable Energy

There has been a continuation of the trend in deal being fuelled by utility companies looking to acquire further renewable assets and 'green' capabilities alongside institutional investors looking for consistent and predictable returns. However, acquirers continue diversifying with new entrants alongside incumbent consolidators, including utilities, large multinational corporations, oil and gas majors, private equity, and new energy transition businesses.

As pressure mounts on governments for energy security, a transition to net zero and a diversification of power resources, alongside pressure from consumers, governments are pushing ahead with aggressive renewable targets, strategies and policies. This adds further pressure on utilities and oil majors who are pivoting to play their part in the energy transition whilst looking to compete with specialist institutional investors seeking a long-term return for their funds.

Another primary driver of deals in renewable energy is the new energy transition beyond mere generational assets. The transition seeks to combine the assets, hardware, software and services to enable further integration, demand management, energy efficiency services, adoption of decentralised resources and optimise the fragile balance of demand and supply of the energy grid.

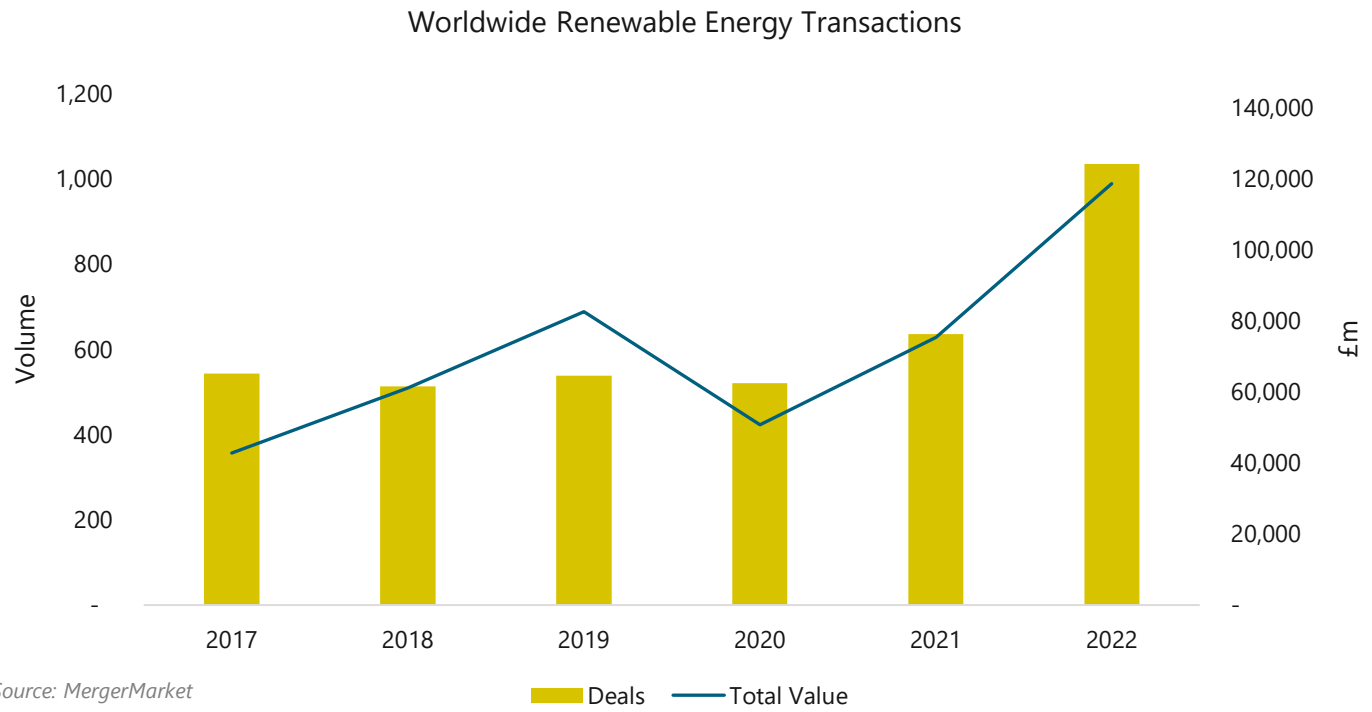
Investors are looking to capitalise on this new energy transition, with an opportunity for all parties in the market, from traditional capital-intensive businesses to technology-driven businesses, storage and hydrogen infrastructure and everything in between. They're looking at the new physical, digital and communication service model and infrastructure from which the renewable energy asset base will continue to grow.

The combination of high prices of fossil fuel generation, decreasing relative costs for renewable generation and worldwide pressure on nations to reach net zero will accelerate further investment and deal activity worldwide. With markets transitioning away from a focus on subsidies and tax relief to power the demand for investment in renewable energy (although major stakeholders will continue to lobby for maintaining such incentives), demand is now bolstered by the competitiveness and investment returns available from renewable assets. Further positive policy environments and consumer demand for renewables mean that further capital deployment into the sector is predicted over the coming years.

Mergers & Acquisitions in Renewable Energy

Renewable energy deal activity maintains momentum, with a record number of deals in 2022 and an impetus expected to grow through 2023 and beyond.

The world's energy mix continues to turn green with an addition of 295 GW of renewable generating capacity and an estimated 8,567 TWh of generation from renewable sources in 2022. Capacity is forecast to add a further 350-400 GW in 2023 and is expected to expand further by over 2,400 GW between 2022-2027, according to the IEA's forecasts[11].



Source: MergerMarket

Overall, renewable electricity generation is expected to increase by almost 60% reaching over 12,400 TWh by 2027, accounting for nearly 40% of global electricity generation, with hydropower remaining the primary source of renewable electricity generation throughout 2022-2027 despite its capacity expanding less than that of wind and solar[12]. Renewables will become the primary energy source for electricity generation globally by 2025, overtaking coal[13].

Deal volumes are on the rise, with 1,036 deals in 2022 globally worth £118.7bn, with an average deal value of £115m from 491 deals with disclosed values. Compared to the same period in 2021, deal volume increased by 63% and total value increased by 57%.

This impetus will continue in 2023 as investors seek further returns and new opportunities in positive policy environments. This is consistent with the ongoing trend of increasing deal volumes, reflecting the continued expansion of capacity and the latest innovative associated energy transition technologies.

The Big Deals in Renewables in 2022

The largest deal during 2022 was the acquisition of a minority stake in the Asian Renewable Energy Hub (one of the most significant renewable power generation development and operations companies worldwide) by BP plc for over £10bn, in a project valued at $36bn, from Macquarie Group the Australia based global investment bank and diversified financial services group. The Asian Renewable Energy Hub is located in Western Australia and is the most advanced green hydrogen project at scale, comprising 26 GW of upstream wind and solar, capable of producing approximately 1.6m tonnes per annum of green hydrogen.

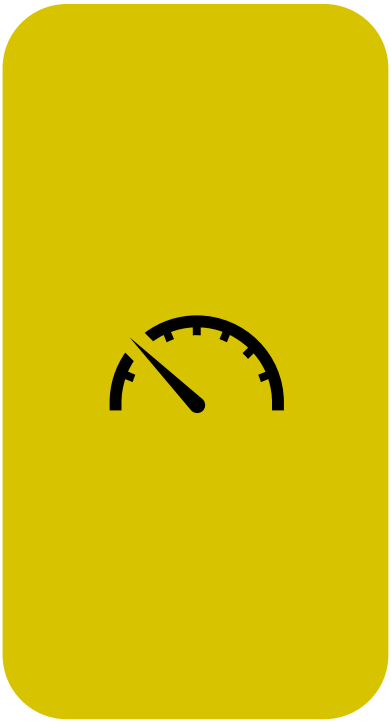
There were two deals larger than our top deals in the table for 2022; however, we have excluded them from the top ten. Firstly, the acquisition of AusNet Services Limited by Brookfield Asset Management for £9,751m. We have excluded this deal as whilst a proportion of the business is related to renewables generation and deployment, the vast majority is electric power and gas distribution and transmission – including non-renewable resources. Secondly, we have excluded Chevron Corp's, the US-based oil and gas major, acquisition of Renewable Energy Group Inc, an international sustainable biofuel producer and distributor, for £2.4bn. Whilst a renewable energy source and biofuels remain essential to reach net zero, this report is focused on renewable generation.

The Big Deals in Renewables in 2022

Completed	Target Company	Target Country	Acquirer Company	Acquirer Country	Deal Value GBP(m)
December 2022	Asian Renewable Energy Hub (40.5% Stake)		BP Plc		£10,059
December 2022	Archaea Energy Inc. (100% Stake)		BP Plc		£3,585
September 2022	Ørsted A/S (1.3 GW Hornsea 2 Offshore Wind Farm) (50% Stake)		AXA SA; SAS Rue La Boetie; Credit Agricole Assurances SA		£3,000
May 2022	Falck Renewables SpA (100% Stake)		The Infrastructure Investments Fund		£2,852
December 2022	Brookfield Asset Management Ltd (25% Stake)		Existing Shareholders		£2,848
August 2022	450 MW Neart na Gaoithe Offshore Wind Farm (100% Stake)		EDF Renewables Limited		£2,690
January 2022	Invenergy Renewables LLC		Blackstone Infrastructure Partners		£2,213
September 2022	Albioma SA (100% Stake)		KKR & Co. Inc.		£2,148
July 2022	Reden Solar SAS (100% Stake)		Munich Re; British Columbia Investment Management Corporation; Macquarie Infrastructure and Real Assets		£2,064
March 2022	Eolia Renovables de Inversiones, S.C.R., S.A. (97.33% Stake)		ENGIE SA; Credit Agricole Assurances SA		£1,712

Source: MergerMarket

Renewable Energy Market Trends



Net Zero

- The UN defines net zero as *"cutting greenhouse gas (GHG) emissions to as close to zero as possible, with any remaining emissions re-absorbed from the atmosphere by oceans and forests"* [14].
- Transitioning to net zero remains one of society's biggest challenges to date. An increasing number of supranational bodies, countries, companies and other institutions are pledging net zero targets, with over 70 countries, including the EU, the US and China. This drive for net zero will influence government policy and investment and, by proxy – companies operating within the frameworks set by governments.
- The key to net zero is particularly heavily burdened by the energy sector, which emits around 75% of all GHGs[15]. Replacing fossil fuel energy with renewable sources like solar and wind will dramatically impact the transition to net zero.
- We believe that this race to net zero will be the most significant influence on investment worldwide. As the 2050 target date looms, this will only further accelerate the roll-out of renewables and investment.

ESG

- ESG principles are becoming more prevalent throughout companies and the wider economy; ESG strategies have also become more commonplace in investment criteria and (in some cases) in fund requirements.
- ESG will become a much larger part of the overall future puzzle for companies, utilities and governments, influencing both policy and further investment into renewable energy and related industries.

Renewable Energy Market Trends

Energy Storage Technologies

- Energy storage continues to be a significant area of focus and investment. Technology has come on leaps and bounds in recent years, with a steep trajectory of decreasing costs alongside enhanced storage capabilities enabling renewables to compete with fossil fuels.
- Batteries are well known to play a critical role in offsetting the intermittency of renewable generation and reducing curtailment, but the power and ubiquity of the desire for clean energy amongst energy consumers is growing. This trend will see continued capital deployed into renewable assets alongside storage technologies to assist in integrating greater distributed renewable sources.
- Energy storage goes hand-in-hand with the increasing modernisation of grid technologies, including the transition to smart grids. Digitising the grid enables further prosumer[1] participation in the market (particularly following the phase-out of FiTs), intelligent system configurations, predictive maintenance, and self-healing. This then paves the way for implementing tiered rate structures – all of which create a further value-added proposition for batteries by adding capacity, shifting load, and improving power quality. Batteries will assist in unlocking the full potential of both renewable energy and the smart energy transition.

Energy-as-a-Service (EaaS)

- The energy transition combines energy storage and smart grid technologies alongside multiple other facets of a new highly synchronised and sustainable platform that interconnects the physical and digital elements of the energy transition to the power and utility sector. This means the consumer is benefiting from a simplification of an increasingly multifaceted interconnected service offering.
- EaaS is a delivery model that combines hardware, software and services. Solutions that combine demand management and energy efficiency services; facilitate the adoption of renewables and other decentralised supply sources and optimise the balance of demand and supply.
- The physical, digital and communications infrastructure required means that various players can participate in the EaaS market: utilities; industrial companies; tech companies; oil & gas majors; specialist renewable providers; telcos and start-ups. All of which will further increase the volume and value of deal opportunities.

[1] Prosumers are both consumers and generators/producers of energy.

Renewable Energy Market Trends

Grid Technology

- Smart grids are one of the energy and utility industry's most significant revolutionary developments worldwide. Smart technologies offer the potential to significantly reduce grid inefficiency, forecast and enable more interactive demand management, better integrate distributed power supply sources into the grid, change the customer experience and facilitate new uses for renewables.
- Digital technologies also enable further enhancement through solutions for real-time load management and controls enabled by highly interconnected and smart devices. Analytics from the data generated through smart devices and interconnected systems allow for a clearer understanding of demand and supply in real-time and to forecast future requirements. This can further enhance the effective management and distribution of energy resources.
- Different elements of the smart grid puzzle, such as smart metering and high voltage direct current (HVDC) transmission systems (a power 'superhighway'), are being rolled out at differing speeds worldwide.

Hydrogen

- As capacity continues to expand in the renewable energy sector and we transition towards a decarbonised economy, the variability of renewable energy generation requires a more flexible smart grid and power system. Whilst energy storage and smart grid technology will assist with this, hydrogen can offer a long-term energy transition solution for storing large quantities as an energy carrier, particularly green hydrogen, which may provide an answer to the volatility of energy generation and supply.
- Hydrogen produced through renewable sources can serve as a channel for storing large amounts of this renewably produced energy from particularly windy or sunny days, which then can be stored for use to smooth out generational differences, balance the grid or use in particular industries whereby electrification directly remains difficult.

Renewable Energy Market Trends

Offshore Wind

- Offshore wind is expected to continue to expand in the coming years. Whilst historically not always the most popular choice for investors as it was previously regarded as comparatively riskier to both onshore wind and solar.
- Technological progress and expansion of the offshore wind market will continue to be a future trend in the renewable energy market as investors can deploy vast sums of capital into large-scale projects whilst reducing risk and increasing returns.
- The UK & Europe have established markets with vast swathes of available opportunities; however, new large markets such as the US are prime for investment.

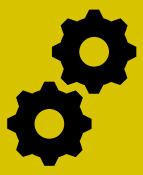
Emerging Economies

- As platform development opportunities become saturated in the mature renewable market regions and these markets turn towards consolidation, the accessibility of renewable capacity and further deal opportunities will be expanded throughout the emerging economies. This will continue to provide the required returns for investors – particularly across Latin America, Asia, and Africa.
- With ideal environments for deploying solar and wind across these economies and the vast opportunity in hydropower assets in Latin America and Asia.
- This market expansion will open the door to affordable energy for consumers and further economic development, which will gather government support and momentum to roll-out additional investment.

Renewable Energy Market Trends

Institutional Investors

- Historically, institutional investors have sought a haven in low-risk, fixed-income government and corporate bonds. However, they're now seeking higher returns to satisfy specific retirement funding levels (partly due to an ever ageing population) through alternative assets such as renewables.
- Renewables offer many advantages to investors, making them a wise choice. Including an attractive annual yield, long-term investment horizons (often matched with institutional investment periods), and large-scale and long-term security of income, which is usually in a particularly attractive policy environment with FiTs or similar tariffs or tax breaks.
- Some institutional investors have taken this a step beyond deploying capital into alternative asset management funds and are pursuing a direct investment model. To increase net returns from lower associated investment costs, they have developed in-house capabilities and knowledge to directly and actively manage portfolios of renewable assets.



Development Platforms

- Investment through framework and platform agreements with developers has become increasingly popular. Allowing investors to provide financial support via debt and/or equity instruments during the development phase, as opposed to acquiring operational assets, with an option to acquire the assets broadly at market price, either pre- or post-construction, removing additional risk. This particularly assists cash-constrained developers to share in the risk and remove some balance sheet risk during planning, permitting and development.

DSW's Perspective on The Market

M&A in the renewable energy sector is extremely strong, with some sub-sectors and regions particular hotspots for deal-making. Investment increased to $1.3 trillion in 2022, a new record high. However, this increase still needs to catch up to the expected $131 trillion required between 2021-2050 across the sector.

Renewable energy is an attractive investment proposition for many different investors, including institutional investors such as life and pension funds, utilities, corporates, infrastructure and energy funds, and family offices. The significant growth in specialised 'ESG', 'Impact', 'Green' and renewable energy-focused funds and investors is noteworthy in itself.

As mature renewable market economies continue to develop a subsidy-free market (or substantially reduced subsidies), this raises new challenges for investors as it increasingly exposes investors to volatile market dynamics; however, demand is now being driven by competitiveness from government policy, consumer demand, innovation, and investment returns available from renewable assets.

Renewable capacity expansion is forecast to grow at an extraordinary rate, by almost 2,400 GW between 2022-2027, according to the IEA, who have uplifted their forecast by c. 30% compared to their 2021 forecasts, mainly owing to improved policy environments due to the ongoing energy crisis and the fallout from the Russian invasion of Ukraine.

European nations, China, the US and India, are all swiftly implementing accelerated policies and regulatory and market reforms partly in response to the global energy crisis. The RePowerEU plan, China's 14th Five-Year Plan (FYP) and the US Inflation Reduction Act (IRA) drive an accelerated forecast for capacity expansion.

The global energy crisis has caused high fossil fuel and electricity prices, which in turn has made renewable energy technologies more economically attractive from a generational viewpoint; in combination with this, the Ukraine war has forced fossil fuel importers (primarily across Europe) to increasingly focus on the value of energy sovereignty from domestic renewable energy generation.

During the forecast period, fossil fuel generation from coal, natural gas, and oil, in addition to nuclear generation, are all forecast to decrease their share of overall generation, whereas renewables will continue to grow, accounting for 90% of the overall capacity expansion, reaching 38% of overall generation by 2027, a ten ppt increase[16].

Competitive auctions remain the primary driver of IEA forecasts, with increasing contributions for offtake from corporate PPAs, bilateral contracting and merchant activity. There was a 70% increase in new renewable auction capacity awarded for Q1-Q3 in 2022 compared to 2021, mainly in solar and wind, with China and Europe accounting for 75% of the overall total awarded[17].

DSW's Perspective on The Market

The competitiveness of renewables continued to improve in 2021, according to the data from IRENA[18], showing a continuous declining trend in the cost of renewable electricity generation and confirming their critical role on the path to net zero.

However, in 2022 the market saw a reversal of the last decade-long declining trend with drastic increases in raw materials, commodity prices, and logistics costs compounded by ongoing supply chain disruptions. These price increases peaked during Q2 of 2022, with freight costs and PV-grade polysilicon quadrupling, whilst aluminium doubled, copper increased by 90%, and steel by over 40%. Since the Russian invasion of Ukraine and the resultant economic slowdown during Q2, prices have begun falling; however, these decreasing prices are not yet reflected in the market as developers, companies, and manufacturers adjust to the new normal.

According to Francesco La Camera, the Director-General of IRENA, *"Renewables are by far the cheapest form of power today, 2022 is a stark example of just how economically viable new renewable power generation has become. Renewable power frees economies from volatile fossil fuel prices and imports, curbs energy costs and enhances market resilience – even more so if today's energy crunch continues".*

These rising commodities have begun to impact projects as they are commissioned, with investment costs increasing for new onshore wind by 15-25% and solar by 10-20% from pre-Covid levels[19]. Given the delay between the awarding from auction or investment decision and ultimate commissioning, auction prices reflect the increased cost, with prices in Europe increasing by 21% and 44% for onshore wind and solar[20]. However, given record-breaking exceptionally high fossil fuel prices, any cost increases for renewable assets will be overshadowed by their cost-competitiveness and economic benefits compared to fossil fuel generation.

The energy crisis, particularly throughout Europe, has seen the high fossil fuel generation costs continue into 2023; this has further undermined fossil fuels' historical competitive edge, making renewables an even more attractive proposition as their comparative cost of generation is much lower.

DSW's Perspective on The Market

Over 60% (163 GW) of newly installed renewable capacity in 2021 had lower costs than the world's cheapest coal-fired options in the G20, underscoring the importance of renewables in the energy transition and their cost-competitiveness[21].

Renewable energy has seen an unprecedented swing in its competitiveness since 2010. The global weighted average levelised cost of electricity (LCOE) of newly commissioned utility-scale solar projects and CSP declined by 88% and 67%, respectively – while onshore and offshore wind fell by 68% and 60%, respectively, during the period 2010-2021[22].

This LCOE trend continued in 2021 compared to 2020, with solar falling 13%, whilst onshore and offshore wind declined by 15% and 13%, respectively[23].

The LCOE of utility-scale solar and hydropower were 11% lower, whilst the onshore wind was 39% lower than the cheapest new fossil fuel generators in 2021. However, geothermal and bioenergy remained slightly more expensive than the most inexpensive fossil fuel generators, although comparatively highly competitive in some regions[24].

Renewable energy has a critical role in the path to net zero in the long term. In the short term, renewables will also be vital for countries to improve their energy security, reduce reliance on imports of fossil fuels, and reduce the impact of high energy prices on consumers and businesses. Renewables offer the key to unlocking the global energy crisis and energy transition.

DSW's Perspective on The Market

The renewable energy industry is moving into a new dawn following the impact of a once-in-a-lifetime pandemic and the fallout from the Ukraine war, with accelerated and supportive policies for clean energy and growing demand across all sectors, including utilities, investors and consumers.

However, this growth may be tempered by some of the same drivers accelerating support and demand – such as inflationary pressures, increasing interest rates, raw material prices, supply chain constraints and commissioning delays. Due to these pressures, renewable energy costs could continue to rise in the short term; however, it is expected to return to the historical trajectory of declining costs driven by technological advances and scale. However, the increasing fossil fuel prices means that wind and solar remain the cheapest energy sources for overall generation and renewable generation technologies. This price disparity is only expanding.

M&A and investment across the renewable energy sector has historically focused on generational assets and concentrated on specific technologies, particularly solar and wind. Whilst overall investment and deal volumes are rising globally, there continues to be a focus across Asia, primarily led by China, alongside the US being driven by PTC and ITC, followed by Europe driven by energy sovereignty and net zero policy commitments driving regional investment. While China is expected to dominate investment in the roll-out of generational capacity, it is likely that the US and Europe won't be too far behind, aided by the IRA and an easing of tax credit restrictions across Europe for green investments to remain competitive with the US.

The most significant deals are expected to continue to be dominated by China in the short term and longer term as the renewable market matures and settles across the US; the US is expected to see an increase in inbound M&A and, consequently, an increase in outbound M&A across Europe.

The sector will continue to be dominated by the private sector, mainly through financial institutions; however, private and public utility investment will continue to rise throughout the period for generational capacity. Additionally, both private equity and venture capital investment are expected to increasingly flow into the sector, primarily supporting innovation through research and development (R&D) into energy transition technology (particularly hydrogen and storage) and digitalisation platforms. The increasing innovation across the transition indicates that there will be a continued M&A consolidation strategy from the traditional energy utilities and oil and gas sector, in addition to their own investment vehicles and innovation growth hubs (such as BP and Octopus Ventures).

During 2023 and beyond, the industry is expected to maintain its general growth trajectory while accelerating capital deployment and investment into new innovations and technologies, including further expansions of offshore wind, new energy storage capacity and developments in smart grid technologies and hydrogen. It is expected that most investment into the renewable energy sector will be into the future transition through new 'green tech' aligning a digital transformation alongside mass expansions of generational capacity alongside more efficient storage and usage mediums to support the clean energy transition. We anticipate a very buoyant and active M&A market across the sector aligned with mass innovation for many years to come, as the generational capacity to be commissioned will significantly increase across all markets and continue to accelerate as national timelines loom closer to net zero targets. DSW estimates that the M&A market could be worth just shy of £2 trillion, with almost 3,000 deals annually, by 2030.

Overall, as the industry navigates 2023, accelerated policies, increasing demand, and attractive long-term incentives generate a robust environment for expansion, but there remains some instability to work through.

PART II

Technological Sub-Sector Analysis

- Solar and wind continue to dominate the vast proportion of renewable energy deal volume.
- Renewable infrastructure beyond the generational assets continues to increase annual deal volumes, driven by storage technologies, EaaS and environmental consultancies that drive permitting, development and monitoring.
- Renewable energy's levelised cost of electricity generation continues to decrease.

Renewable Energy Sub-Sectors

According to the IEA, renewable capacity is expected to increase by over 18% in 2023 compared to 2022, adding around 350 - 400 GW of capacity.

Renewable energy generation consists of a range of sub-sectors; however, the field is dominated by three clear sub-sectors in terms of deal volume:

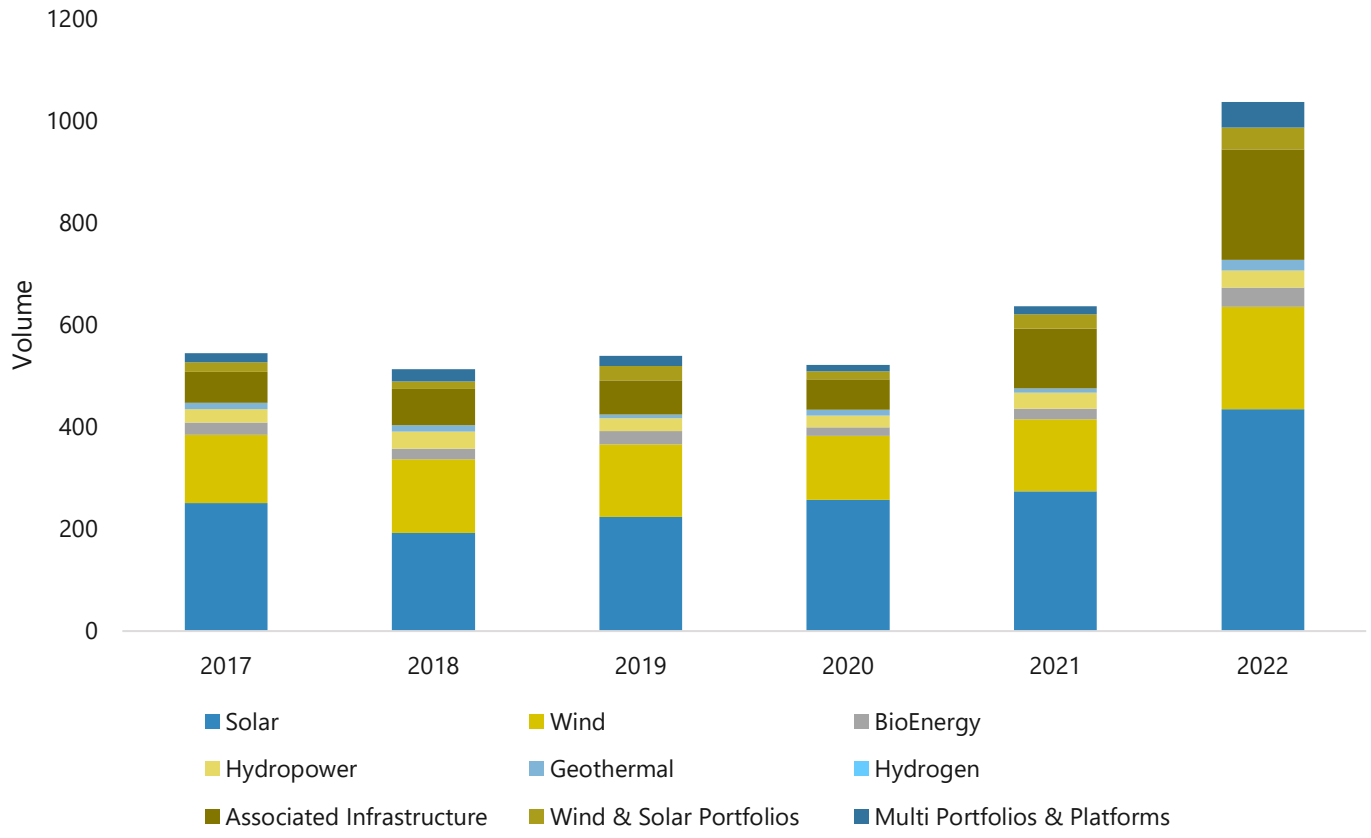
- Solar (41.9%);
- Wind (19.4%); and
- Bioenergy (3.7%).

Deals involving solar and wind or a portfolio including both technologies accounted for over 70% of all deals in 2022.

There has been a marked increase in deal volume, but some technologies lead that increase by a clear margin. Unsurprisingly, the well-established technologies which have seen historical price decreases in their installation costs lead the way – both solar and wind have seen annual increases and remain the dominant renewable technology sub-sector.

There has also been an apparent increase in the volume of deals in the associated infrastructure and innovation, accounting for over 20% of all deals, including deals associated with EaaS, storage technologies, and smart grid infrastructure.

Worldwide Renewable Energy Transactions by Technology



Source: MergerMarket

Solar

Solar is expected to account for 60% of the forecast global renewable capacity increase, evidenced by a 22% net increase in additions, commissioning a further 192 GW in 2022[25]. Overall annual additions in 2023 are forecast between 350-400 GW, with solar and wind accounting for almost 90% of this increase alone. Utility-scale projects are expected to account for over 60% of this increase, driven by a robust renewable policy environment throughout Europe and China driving additions. As capacity increases, we expect to see increases in the number of deals in the sector as secondary assets trade from original owners through to long-term investors.

Solar remains an industry the IEA forecasts to grow significantly over the next five years, increasing annually by almost 1,500 GW during 2022-2027, exceeding natural gas by 2026 and coal by 2027[26]. Solar and wind will account for c. 95% of all renewable energy capacity additions by 2027. They stem from a favourable policy environment, technological improvements, and lower costs relative to other generation sources despite increased raw materials and supply chain issues.

Despite higher investment costs due to increased commodity and module prices during 2022, utility-scale solar remains the cheapest option for new electricity generation across most of the market. However, high prices for coal, oil and natural gas continuing from the fallout of the Ukraine war also contribute to the rising production costs for renewable assets since they are used in power generation and industrial processes.

However, whilst this increase in costs of renewables is significant in absolute terms, this has kept their competitiveness strong as the price of coal, oil, natural gas, and electricity as a whole has continued to increase throughout 2022 and is expected to continue late into 2023. With global power prices continuing to break record prices worldwide where fossil fuels are in primary use, electricity and natural gas are the marginal technologies that set the wholesale electricity price. This is particularly rampant throughout Europe, where the UK, Germany, France, Italy and Spain have seen increases of almost 20x in natural gas prices from 2020.

Historically, long-term contract prices for solar and wind auctions have been higher than wholesale prices throughout Europe. However, even the most expensive wind and utility-scale solar contracts signed over the last five years are less than half the average wholesale prices[27]. Despite the cost increases, newly contracted projects offer long-term contracts significantly lower than the average wholesale price over the past year. As technology has improved for energy storage, costs have decreased, contributing to solar becoming even more cost-effective as a renewable energy source.

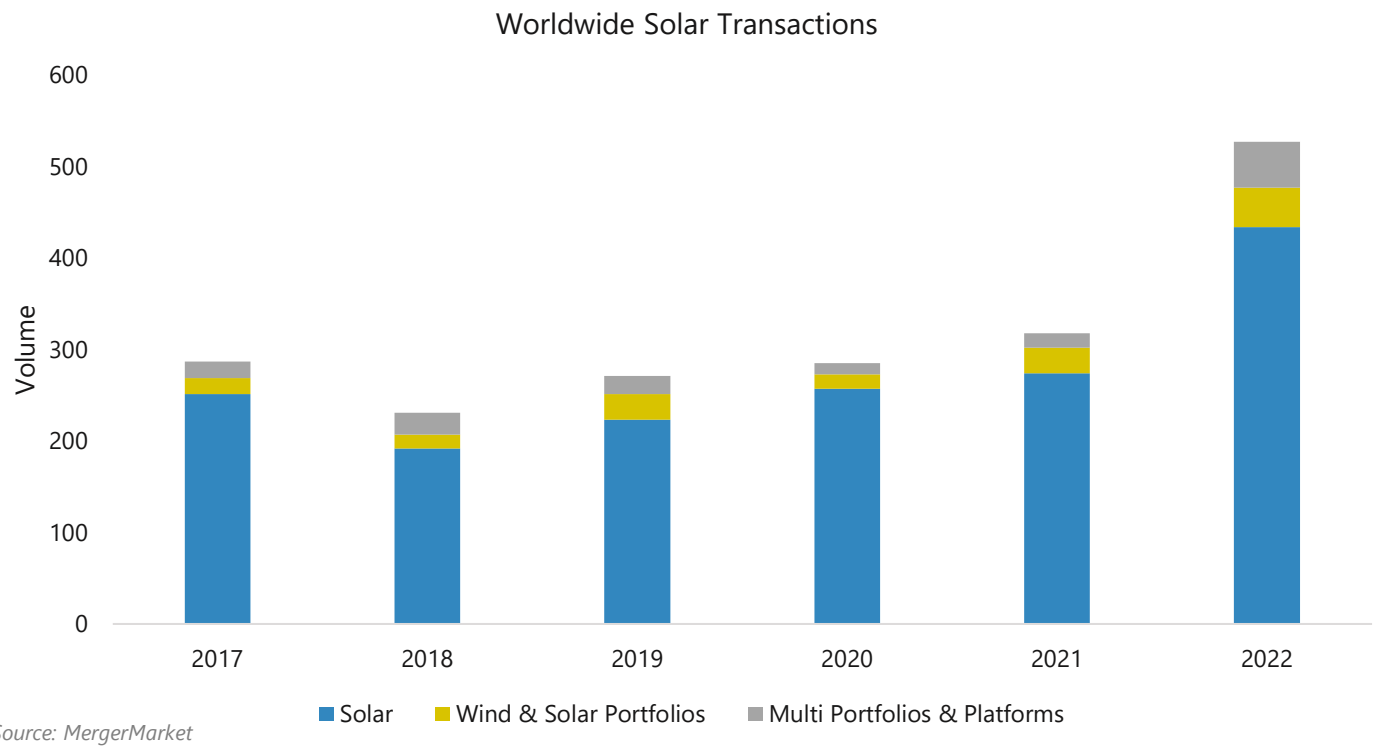
Solar

Solar continues to undergo expansion throughout Europe as countries intensify their efforts to reach climate goals, particularly in Germany, Spain, France, the Netherlands, and Poland, alongside continued solar growth in China through its sheer scale of utility projects. China's 14th Five-Year Plan added new targets and policy schemes, alongside cost reductions, which are expected to enormously boost solar expansion in China through both utility-scale projects and distributed solar, driven by new auctions for commercial and industrial applications and subsidies for residential systems.

Both India and the US, through the Production Linked Incentives (PLI) initiative and monetisation of the manufacturing tax credits, respectively, are closing the gap to bring solar manufacturing to cost parity with the lowest-cost manufacturers in China. The governments have also implemented tariffs on imported solar equipment and local-content premiums to encourage developers to purchase domestic production. However, China will continue to dominate the supply of global solar manufacturing, as it is forecast to invest $90bn over the next five years, over three times the rest of the world combined[28].

Distributed solar is also set for a resurgence of increased growth, with commercial and residential solar additions expected to make up 26% of the overall increase in renewable capacity between 2022-2027 due to higher retail electricity prices and growing policy support for prosumers for both individual consumers and businesses to save money on their energy bills.

Solar deal volumes have continued to increase year-on-year, with another increase in 2022 to 527 deals. This increase of almost 66% compared to 2021 includes solar PV; CSP; and portfolios that include solar alongside other technologies, most notably wind.



Source: MergerMarket

Wind

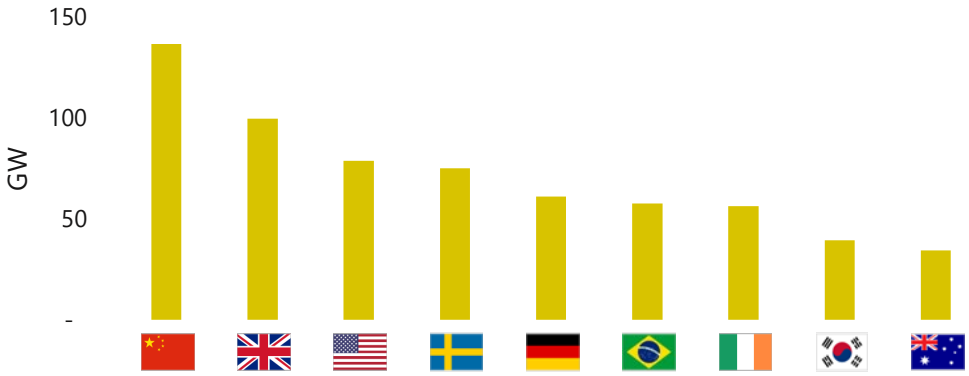
Overall annual additions in 2023 are forecast between 350-400 GW, with solar and wind accounting for almost 90% of this increase alone. Onshore wind additions account for 66 GW of net additions to renewable capacity, with offshore wind additions slower in 2022, adding 9 GW of net capacity (16%), a 55% lower roll-out than in 2021; however, this remains almost twice the additions seen in 2020 after an unprecedented 2021 increase of over 400% due to the national subsidy phase-out in China[29]. The IEA forecasts over 570 GW of new onshore wind capacity between 2022-2027, increasing annually from 74 GW of additions in 2021 to 109 GW in 2027[30].

Onshore wind additions are accelerating rapidly in countries with supportive, stable policy and regulatory environments that provide long-term investment, revenue certainty, policies that address permitting challenges and grid expansion plans. China, Germany, and Spain are leading the charge for improvements in supportive policy frameworks for onshore wind.

Continued development of the offshore wind sector throughout Europe and provincial incentives in China will see the offshore wind sector accelerate globally, increasing annual installations to over 30 GW by 2027, whilst Europe's proportion of offshore installed capacity is expected to reduce by 20 ppt to 30% by 2027 as China's provincial policy supports faster expansion alongside the US entering the market as a significant player.

Offshore wind remains an apparent driving force of future deal activity, evidenced by the rise in deals in 2022 and the expected increases in offshore capacity over the next five years. The technology has surpassed its infancy to become a more reliable investment proposition with reduced development, manufacturing and operating costs. New projects are being considered worldwide by China, the UK, France, Germany, Netherlands, Sweden, Ireland, the US, Poland, Canada, Vietnam, South Korea and many others as the technology continues to impress.

Global Offshore Wind Pipeline



Source: Renewable UK

Wind

Large-scale wind farm projects are already well established. Those such as:

- Hornsea Project One, Moray East, and Tron Knoll in the UK;
- Jiangsu Qidong in China;
- Borsselle and Gemini farm off the coast of the Netherlands; and
- The Gode Wind farm and the newly commissioned Borkum Riffgrund off the German Coast are expected to be operational by 2025.

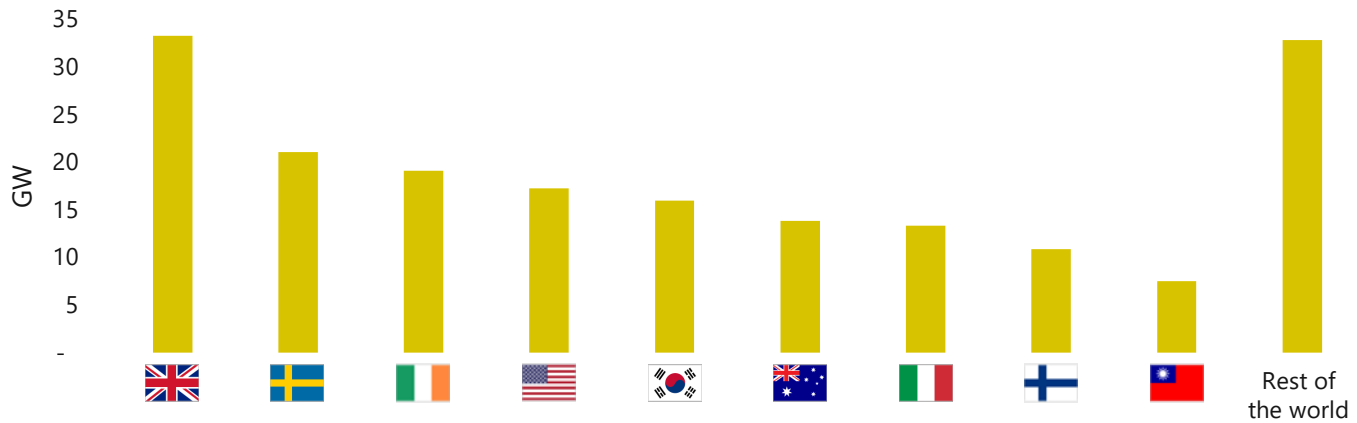
The global pipeline for offshore wind projects has increased over 76% over the past 12 months, up to 1,174 GW from 666 GW last year. These major offshore wind markets with significant pipelines include China 137 GW; UK 100 GW; US 79 GW; Sweden 75 GW. The UK retains the second largest pipeline once more, with 8.5% of the overall pipeline; however, it is the first time it has fallen below 10%, reflecting the growing markets in the US, Australasia and Latin America[31].

The UK has both the largest offshore operational floating capacity and pipeline at 80 MW and over 33 GW, respectively. The pipeline for floating offshore wind remains healthy, including Sweden with 21 GW; Ireland with 21 GW; the US with 17 GW; South Korea with 16 GW. Floating offshore wind pipelines are also abundant in Australia, Italy and Finland.

Despite its subsidy phase-out, China remains a favourable policy environment for offshore wind and will continue to add to the overall offshore wind capacity worldwide. Europe remains a popular destination for offshore wind investments, mainly the UK, Germany and the Netherlands.

Meanwhile, the industry in the US remains in its infancy, despite its coastal regions nationwide offering excellent conditions. Political, permitting and bureaucratic issues have stymied growth. Although US offshore wind faces significant planning, siting, and permitting challenges, interest in developing offshore wind exists in coastal areas because of the proximity of offshore wind resources to population centres, the potential for local economic development benefits, and superior wind resources. In the long run, the US will see a vast expansion in offshore wind. The US Department of Energy quantified the potential offshore wind installed capacity as 30 GW and 110 GW by 2030 and 2050, respectively, stating that offshore wind could be installed in all coastal regions nationwide[32].

Global Floating Offshore Wind Pipeline

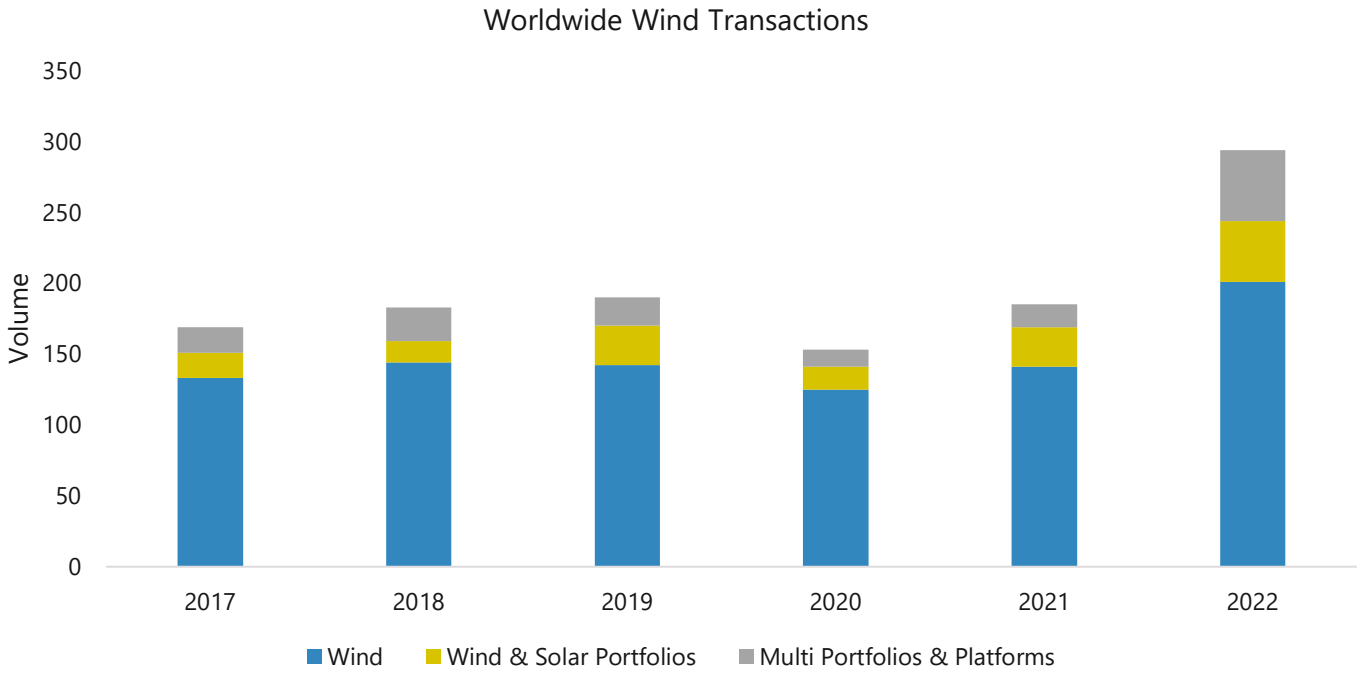


Source: RenewableUK

Wind

Fundamentally, the attractiveness of offshore wind remains to be its sheer scale for investors to deploy large sums of capital for attractive returns, which scale cannot be found in other renewable projects. Offshore wind continues to be a superpower, with major participants such as Ørsted, Vattenfall, Iberdrola, Innogy, Equinor, SSE Renewables, ENGIE, and GCN, leading the charge.

Wind deal volumes went from strength to strength following a fall in 2020, bouncing back in 2021 and growing further in 2022 by 59% with 294 deals, including offshore wind; onshore wind; and portfolios that include wind technologies alongside other technologies, particularly solar.



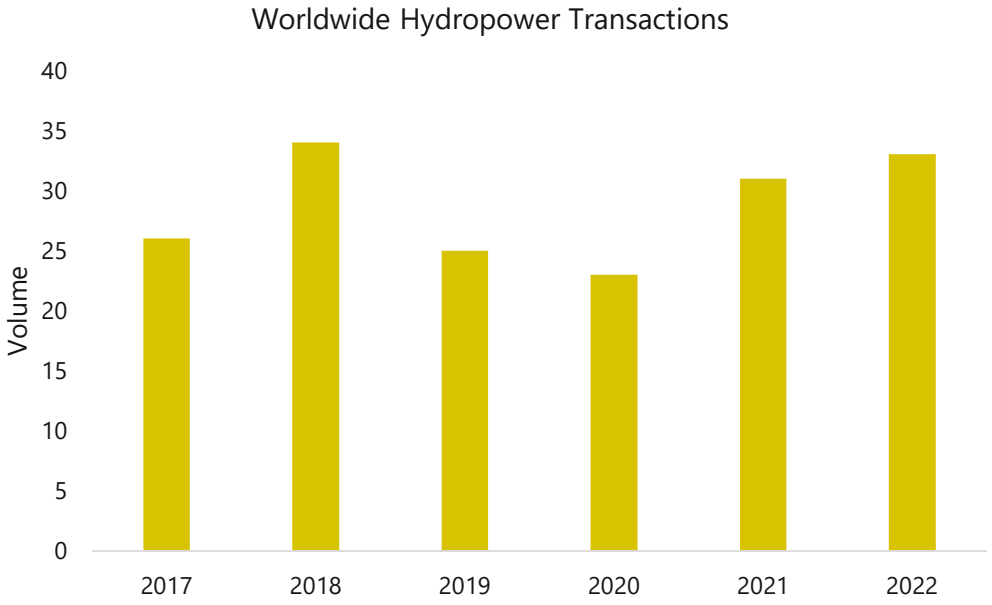
Source: MergerMarket

Hydropower

Whilst hydropower is the oldest and most mature renewable technology, there remains plenty of upside and capacity potential, particularly in Asia and Latin America, alongside improvements in hydropower technologies to improve generational efficiencies and output. Capacity additions are expected to continue but at a lower rate of growth due to limited policy support as well as the scale and geographical requirements of hydropower. Additions are forecast to be 141 GW over 2022-2027, with annual additions volatile, ranging from 17 GW to 33 GW, dependent upon the commissioning of large reservoir projects in China, India and Turkey[33].

Particularly after the rapid expansion of multiple units at the Chinese Baihetan hydropower plant, which added to the global acceleration of hydropower additions. China's geographic scale, again, allows it to commission more capacity than any other country, accounting for almost two-thirds of additional capacity alone, particularly emphasising its pumped storage schemes.

Hydropower deal volumes remain a small proportion of overall renewable deal volume, mainly owing to their required scale and geographical limitations. However, the number of deals in 2022 increased by over 6% to 33 transactions compared to 31 in 2021, continuing an increasing trend in deal volumes.

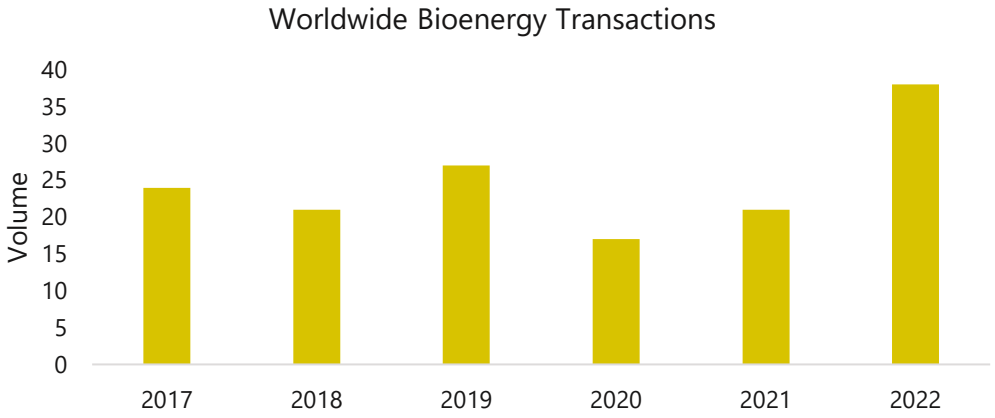


Source: MergerMarket

Bioenergy & Geothermal

Bioenergy again increased deal volumes in 2022 to 38 transactions worldwide, surpassing historical records.

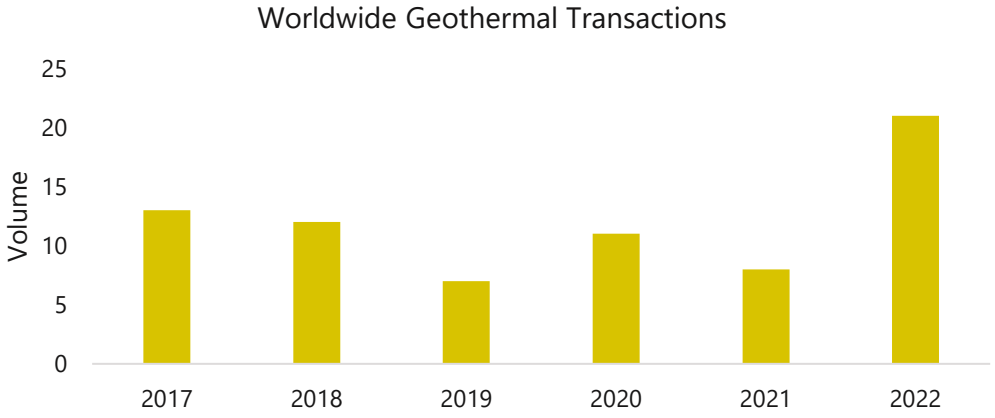
Bioenergy expansions are focused across particular geographies with ongoing policy support for waste-to-energy projects in China, Turkey and Brazil.



Source: MergerMarket

Geothermal deal volume surpassed historical records, increasing almost three-fold in 2022 compared to 2021; however, geothermal remains a relatively small sub-sector technology overall.

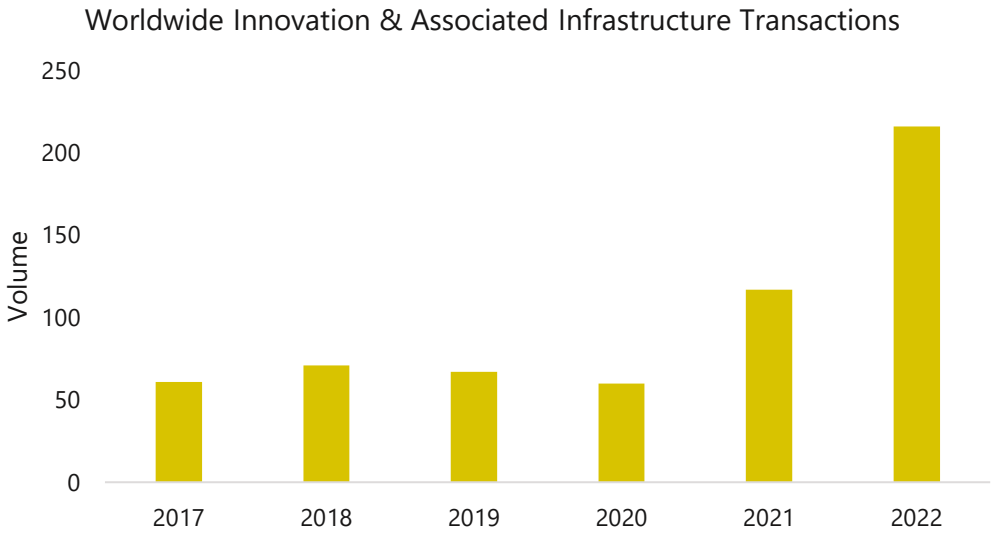
Geothermal expansion is limited by a need for more policy support to address pre-development and resource exploration risks. Future capacity expansion is limited to a 6 GW forecast between 2022-2027, concentrated in Africa and South East Asia[34].



Source: MergerMarket

Innovation & Associated Infrastructure

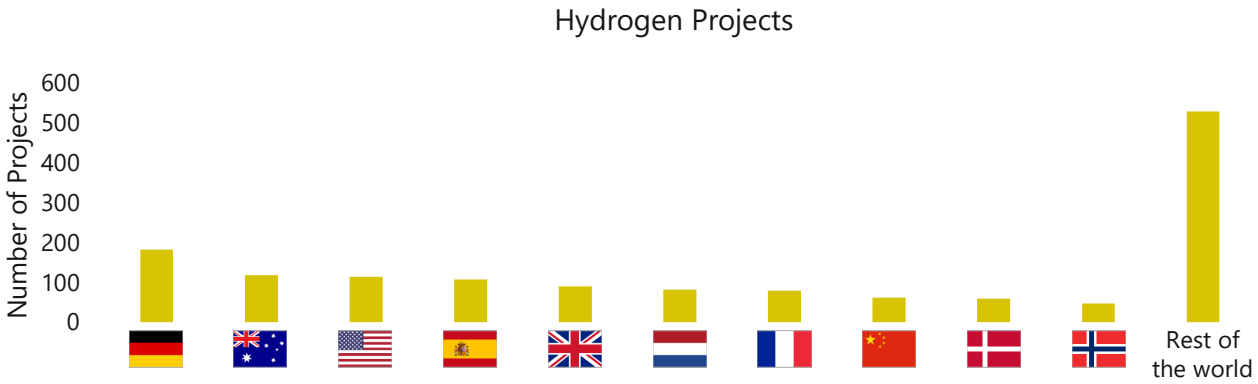
Innovation and associated infrastructure in renewable energy include storage technologies, hydrogen, smart grid technology, specialist renewable energy consultancies and developers that enable the transition to continue its growth momentum in 2022, almost doubling, with 216 transactions. Continued innovation is expected to play a vital role in the future energy transition, and we will see continuous increases in deal volumes and values.



Source: MergerMarket

Innovation & Associated Infrastructure

The global pipeline of hydrogen projects is marginally shy of 1,500 projects worldwide, with over 60% of those dedicated purely to renewable energy technologies[35]. Germany (the first hydrogen-powered trains), Australia, the US, and Spain have over 100 projects each.



Source: Hydrogen Project Database

Hydrogen has a growing momentum, with nine more countries releasing national strategies over the past two years, taking the total to 26 governments – targeting 145-190 GW of electrolysis capacity[36]. However, the growth in hydrogen projects is from a low base. It requires deeper investment and R&D to accelerate production scale-up and commissioning of infrastructure for countries to reach net zero by their target dates.

Public funding for hydrogen R&D increased by 35% in 2021, accounting for c. 5% of the total R&D for clean energy technologies, with European nations almost doubling their investment, attributing the vast majority of this increase[37].

Support and investment for hydrogen R&D include:

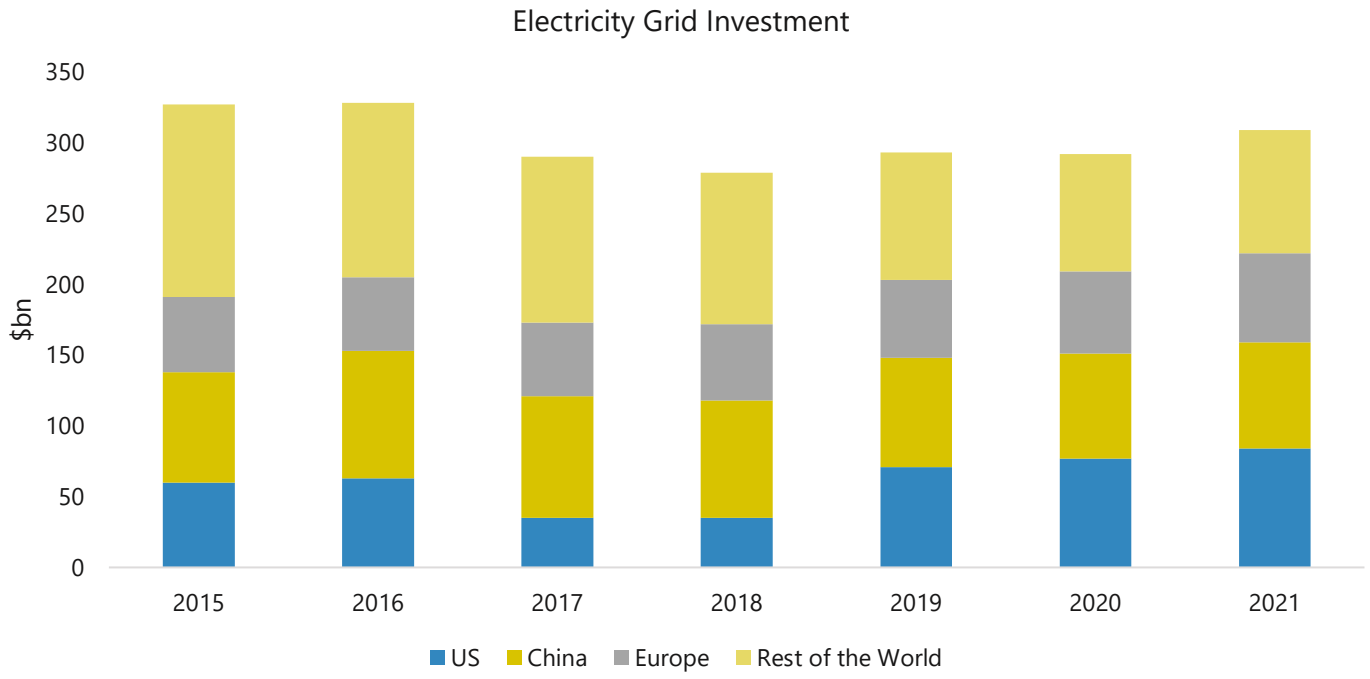
- €3bn of funding from the REPowerEU plan, including five projects approved in 2021 and 2022, across the Netherlands, Germany, Spain, Sweden, Finland, Poland, and Italy, with almost €600m invested[38].
- The US has provided further R&D support through its Bipartisan Infrastructure Law, providing $1.5bn of support for clean hydrogen technologies and $8bn for hydrogen hubs to support the development of demonstration projects[39].
- Australia has made available $300m (AUD) to support the hydrogen industry as part of its National Hydrogen Strategy to support R&D and commercialisation of the technology[40].

Innovation & Associated Infrastructure

Investments into intelligent technologies such as smart grids increased by 6% in 2021 to over $309bn[41], with the larger, more advanced economies accelerating investment into the sector to support its growth, including:

- The US invested $84bn into the electricity grid to strengthen the infrastructure by replacing and upgrading equipment to improve reliability[42].
- China invested $75bn in 2021; however, this is expected to accelerate through the 14th FYP with a further $75bn budgeted for HVDC projects, smart digitalisation of the grid and upgrading its distribution network[43].
- Throughout Europe, $63bn[44] was utilised to connect distributed energy generation, smart grid digitalisation and upgrade infrastructure.
- The UK National Grid has also launched an ambitious strategy for the digitalisation of the energy system, called the 'Virtual Energy System' in combination with the UK Governments Ten Point Plan to deliver net zero by 2050 to enable the creation of an ecosystem of connected digital twins of the entire energy system in the UK[45].

However, the IEA believe that this investment into the grid needs to almost double to $600bn annually through 2030 to get on the net zero path – particularly across smaller economies where investment lags significantly behind[46].



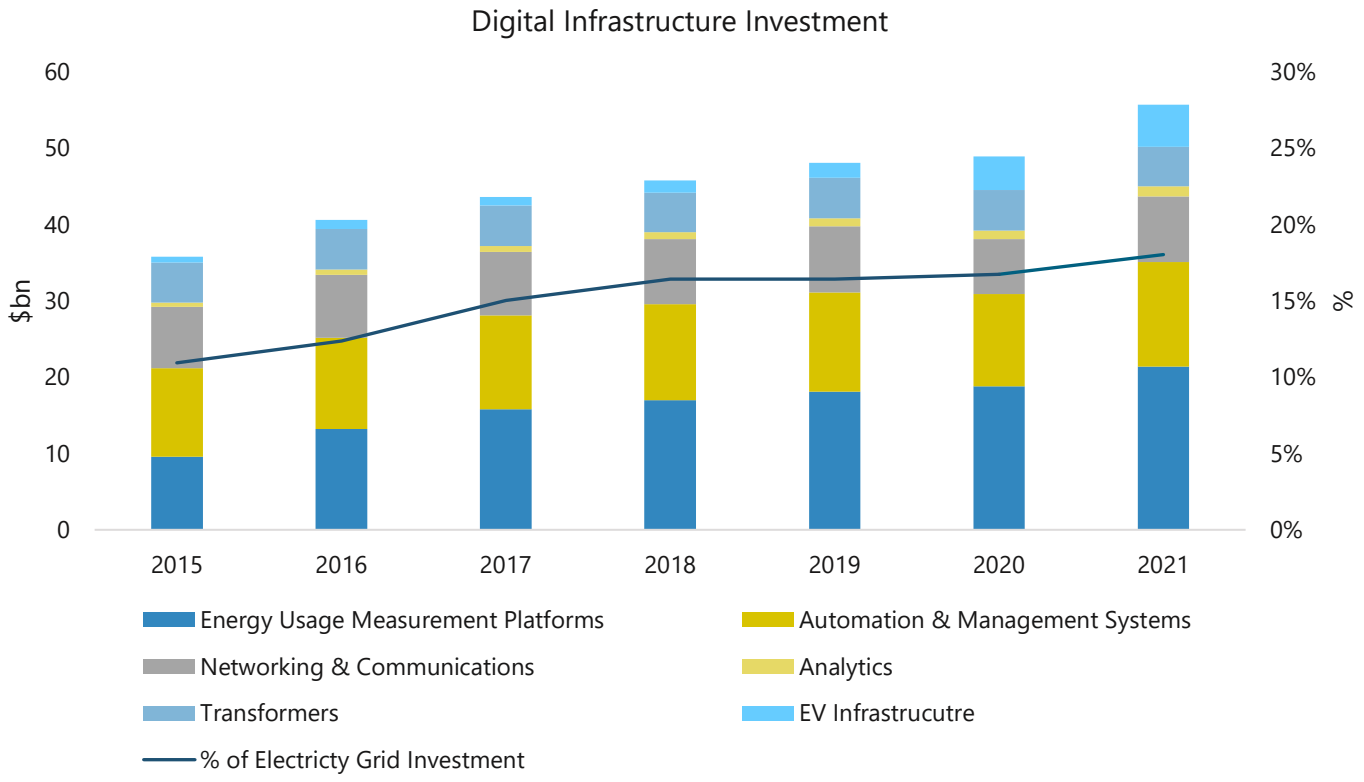
Source: IEA - Smart Grids

Innovation & Associated Infrastructure

Investment into digital infrastructure alone accounts for almost $56bn of investment in 2021[47], increasing by 14% compared to 2020, with a CAGR of 8% since 2015. This investment has been focused on the following:

- Energy usage measurement platforms.
- Automation of substations, feeders, lines and transformers through advanced sensors and monitoring devices, and development of flexible alternating-current transmission systems (FACTS).
- Network digital twins and non-wire alternatives, such as flexibility services and stand-alone distributed storage systems.
- Digitalisation of power transformers.
- EV charging infrastructure.

Despite starting from a low base, investment in EV infrastructure has increased almost six-fold over the past six years.



Source: IEA - Smart Grids

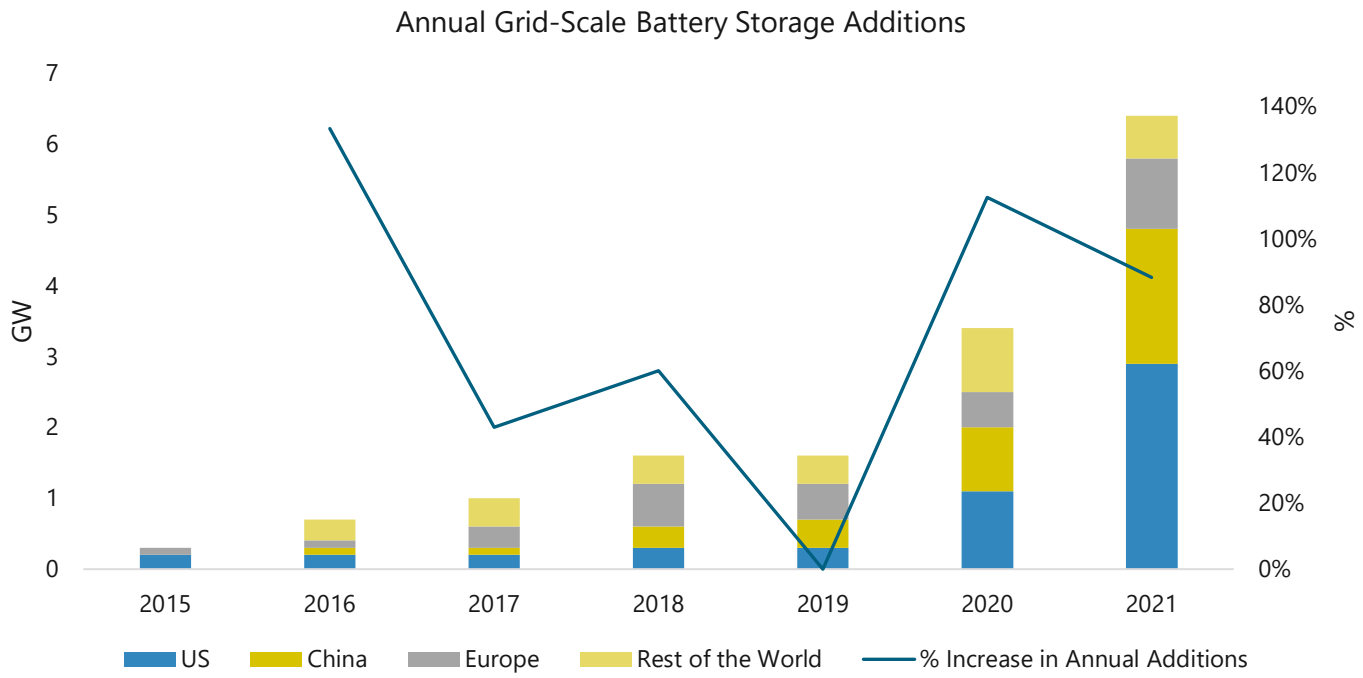
Innovation & Associated Infrastructure

Whilst pumped-storage hydropower remains the most utilised storage technology (160 GW in 2021) with potential across suitable geographies, grid-scale battery storage (16 GW in 2021) remains the most scalable with the potential to account for the majority of storage worldwide with increasing investment and innovation[48]. Furthermore, as discussed elsewhere in this report, hydrogen remains a crucial component for net zero and for storing renewable energy.

Global investment in battery energy storage was reportedly over $26bn in 2022, more than double that reported by the IEA in 2021 ($10bn)[49].

Once more, China, the US and Europe have led the way with investment and policy support, including:

- China's plan to install over 30 GW of energy storage (exclusive of pumped-storage hydropower) by 2025[50].
- The US IRA includes ITC for standalone storage, which could lower the cost of new equipment by c. 30% alongside PTC for domestic production[51].
- In Europe, Germany has incentivised further investment through its 'innovation auction', which rewards the combining of storage technologies alongside renewable installations[52]; the UK government has also committed almost another £33m to five new energy storage technology projects building upon the aims of the UK Energy Security Strategy[53].



Source: Grid-Scale Storage - IEA

Energy Storage

Large, grid-scale batteries are a crucial aspect of the future of the energy transition. They make storing vast amounts of renewable energy feasible to maintain grid reliability from distributed, inconsistent and variable sources. Crucially, when coupled with renewable assets such as utility-scale solar, wind, and hydropower, it offers the ability to store a cost-competitive supply of renewable energy to use in times of high demand or power shortages with the ability to balance the grid.

The energy storage market is crucial to achieving targets and diminishing countries' reliance on fossil fuels as net zero targets become more aggressive and government renewable energy targets and policies become more focused on energy security, particularly following the fallout of the Ukraine war.

Rapidly scaling up energy storage systems remains critical to addressing the variability of wind and solar supply, particularly as their share of the overall renewable generation market increases. Meeting flexibility requirements whilst decarbonising electricity generation remains a crucial challenge for the power sector.

The energy storage market is becoming increasingly important and is set for an unprecedented increase in activity. The IEA believes the potential growth of the grid-scale market is predicted to grow significantly from 16 GW in 2021 to 300 GW in 2025 and 680 GW by 2030[54].

Energy storage has benefited from the excellent R&D of the automotive industry based on lithium-ion batteries. The technology has developed exponentially, reducing the price of batteries and making them more accessible and competitively priced. With the market becoming increasingly competitive, this presents further R&D opportunities for technologies in energy storage that can maintain a larger capacity whilst remaining competitively priced.

With increasing policy support for energy storage and investors' willingness to commit capital, the energy storage sector will play a vital role in the energy transition and is in a prime position for future growth and innovation.

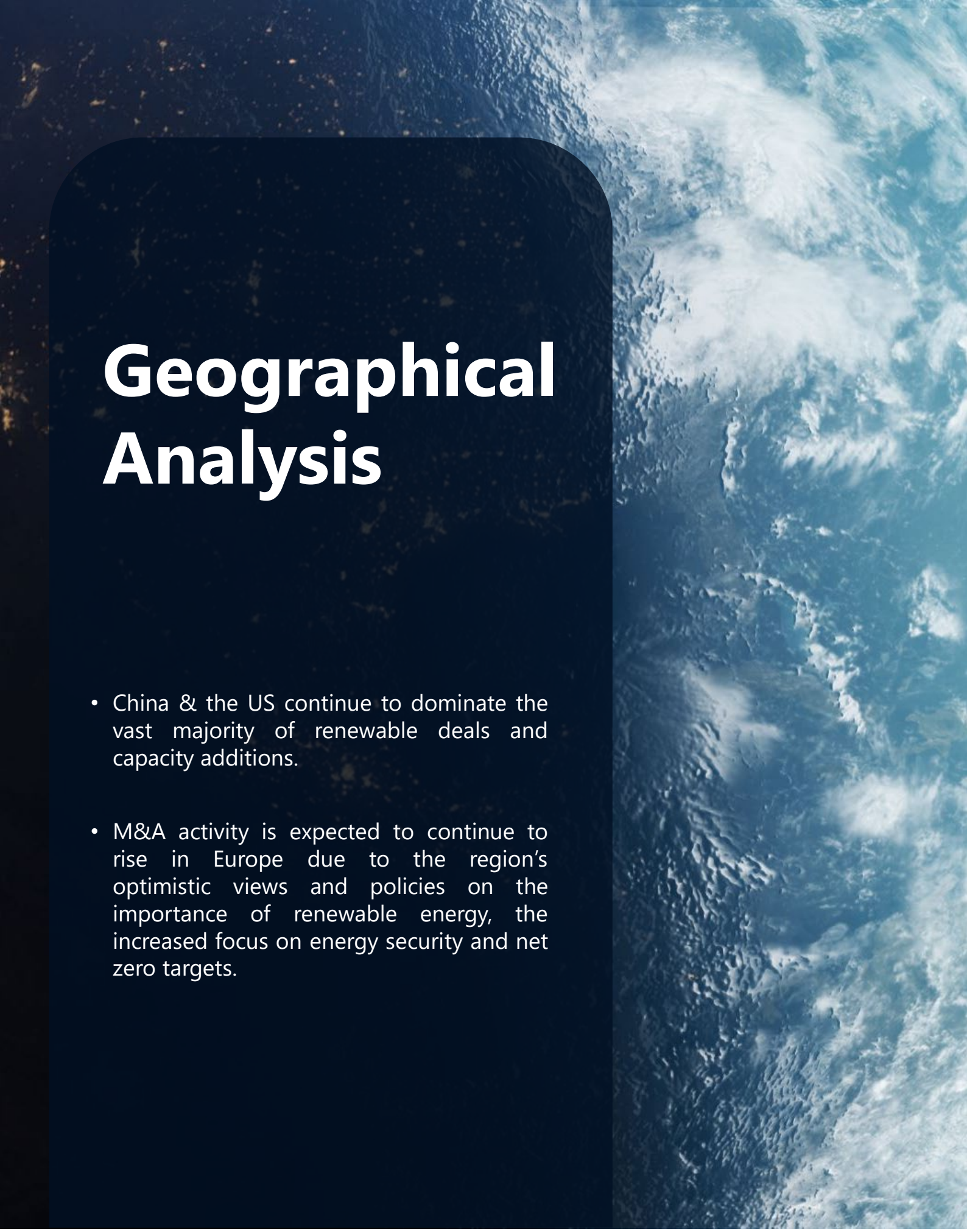
Hydrogen

Hydrogen offers an alternative means of making the most from the electricity that may otherwise be lost through 'power-to-gas' technology. Through electrolysis, converting electricity to hydrogen, the gas can be used as an alternative to fossil fuels and natural gas. Hydrogen has many benefits, but mainly, it can be indefinitely stored, has a high energy density and is emission-free at the point of use. Hydrogen is extremely versatile, with many uses in the renewable energy sector. It will be vital to unlocking the pathway to net zero.

Hydrogen can store low-cost excess renewable energy, increasing system flexibility from the variability of production and supporting the integration of further renewable generation across the grid.

Hydrogen will be crucial in decarbonisation efforts across several challenging sectors, including transport, industrials, and heat. However, further investment and policy support are required to establish demand, scale deployment, and reduce costs.

Policies and targets introduced globally are expected to result in 50 GW of wind and solar capacity focused on producing hydrogen between 2022-2027, led by China, Australia, Chile and the US[55].



Geographical Analysis

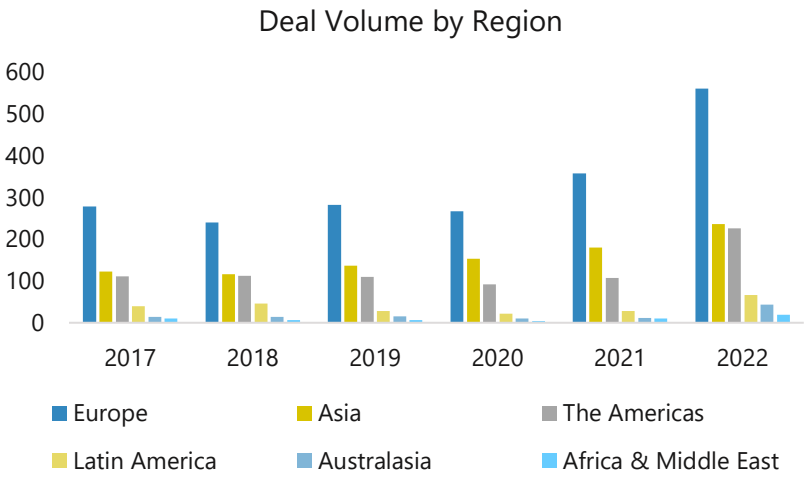
- China & the US continue to dominate the vast majority of renewable deals and capacity additions.

- M&A activity is expected to continue to rise in Europe due to the region's optimistic views and policies on the importance of renewable energy, the increased focus on energy security and net zero targets.

Regional Renewable M&A

The analysis of acquisition targets by country shows a consistent trend across the top ten countries.

2017			2018			2019			2020			2021			2022		
Country	#	%	Country	#	%	Country	#	%	Country	#	%	Country	#	%	Country	#	%
	100	17.3%		96	17.9%		96	16.5%		90	16.4%		120	17.2%		58	15.8%
	79	13.7%		58	10.8%		78	13.4%		84	15.3%		98	14.1%		37	10.1%
	65	11.2%		46	8.6%		57	9.8%		61	11.1%		74	10.6%		30	8.2%
	40	6.9%		35	6.5%		41	7.1%		31	5.6%		40	5.7%		23	6.3%
	30	5.2%		28	5.2%		38	6.5%		23	4.2%		35	5.0%		19	5.2%
	29	5.0%		27	5.0%		27	4.6%		21	3.8%		29	4.2%		18	4.9%
	28	4.8%		27	5.0%		26	4.5%		19	3.5%		23	3.3%		17	4.6%
	22	3.8%		21	3.9%		22	3.8%		17	3.1%		21	3.0%		13	3.5%
	21	3.6%		16	3.0%		14	2.4%		16	2.9%		21	3.0%		11	3.0%
	14	2.4%		15	2.8%		14	2.4%		14	2.5%		20	2.9%		11	3.0%



Source: MergerMarket

Interestingly, the US tops the table for deal activity despite Europe and Asia dominating the capacity roll-out. However, Europe and Asia continue to dominate overall as the most prominent regional deal-doers. The same countries continuously appear as M&A hotspots, including the US, UK, China, Germany, Spain, Italy, France, India, Brazil and Australia in the top ten. New entrants such as Canada, Japan, Sweden, Poland, and Norway are also emerging. Overall, deal volume remains over 60% of the top ten contributors.

Europe

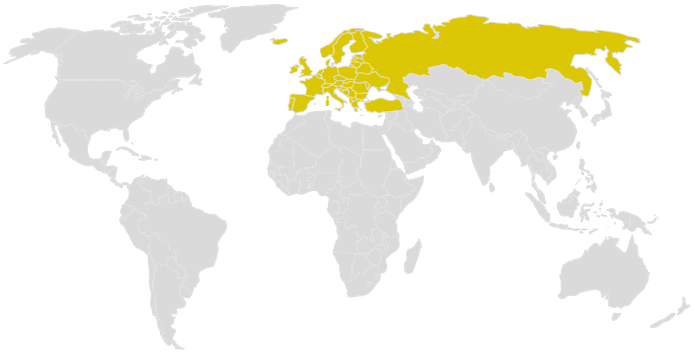
- Europe is the second-largest growth market after China and is expected to double its pace of expansion between 2022-2027, increasing capacity by 425 GW (60%).

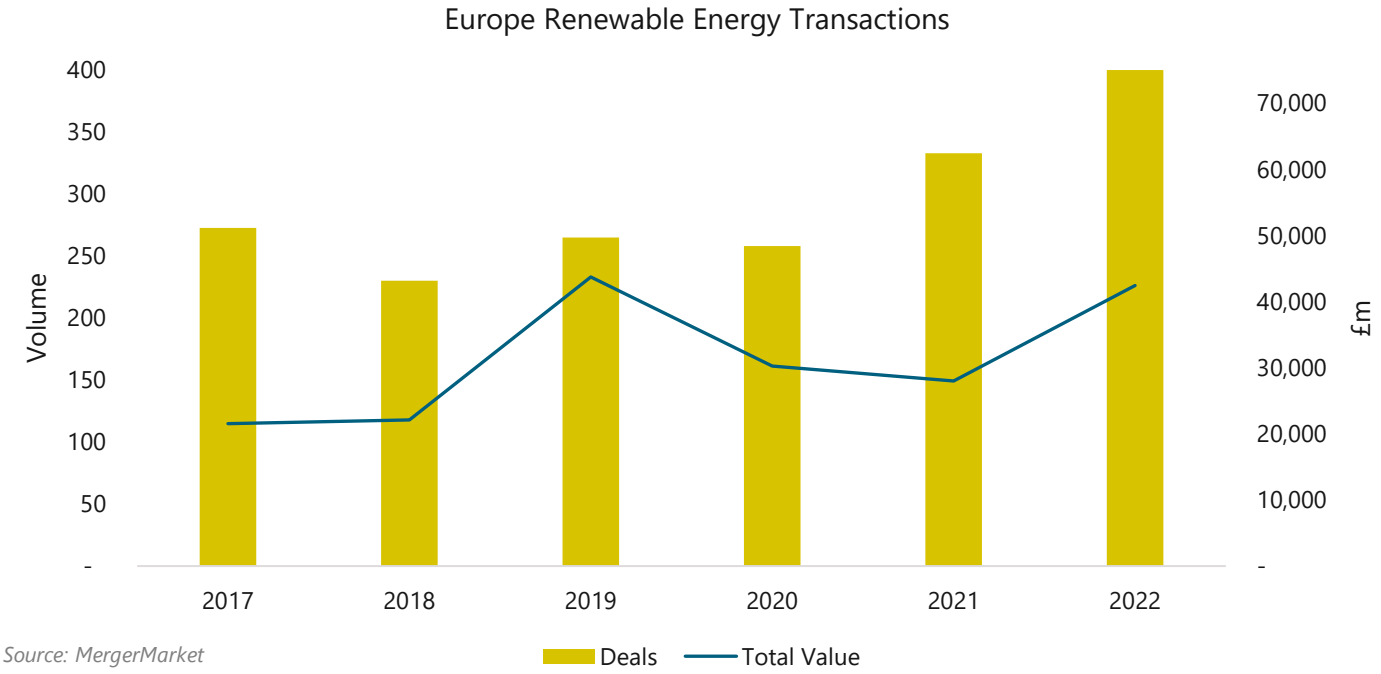
- The Russian invasion of Ukraine and subsequent energy crisis exacerbated energy security concerns to accelerate renewable energy expansion. The EU consequently released the REPowerEU plan to end reliance on Russian fossil fuels by 2027.

Regional Renewable M&A

Deal activity is expected to continue to rise across Europe due to the region's optimistic views and policies regarding the importance of renewable energy, the increased focus on energy security and net zero targets.

Many European economies, such as the UK, Germany, Spain, and France, have well-established and developed renewable energy industries that contribute annually to further capacity, deal activity and innovation. The European policies are a beacon to others and essential to maintaining the momentum in this sector and are a clear green light for investors to deploy future capital throughout the region.





Source: MergerMarket

Europe

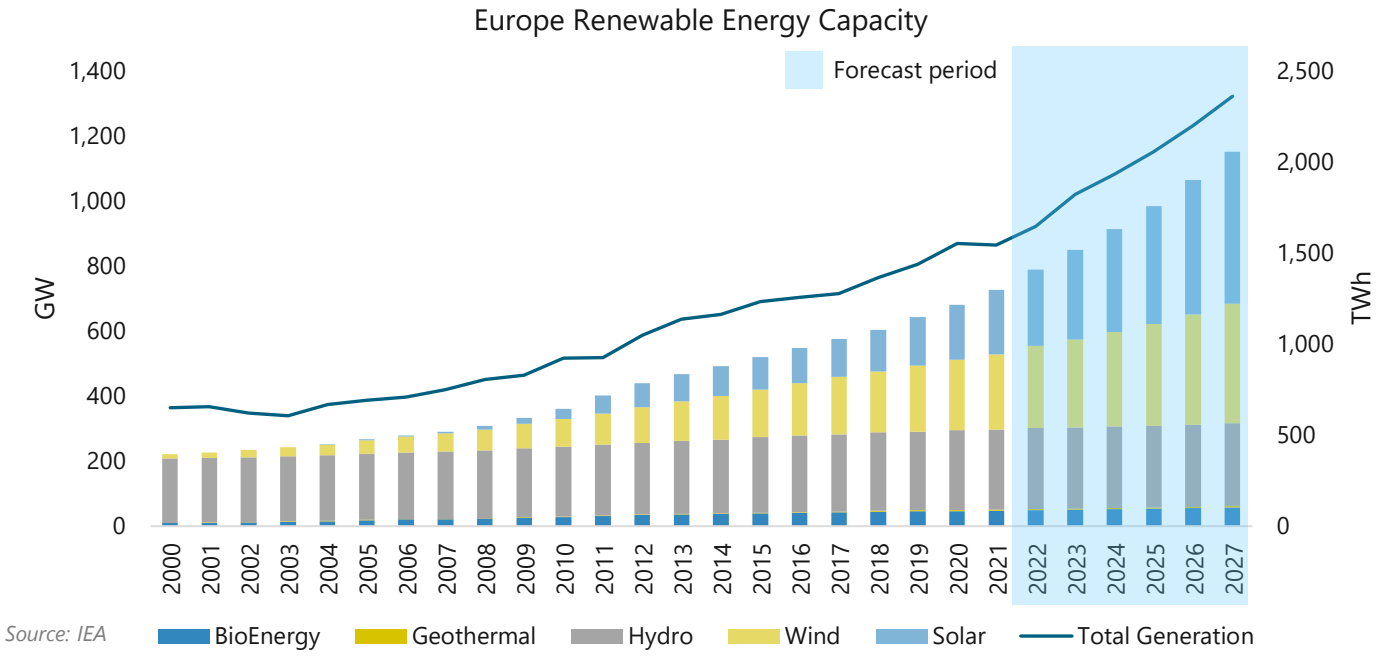
Europe is the second-largest growth market after China. It is expected to double its pace of expansion between 2022-2027, increasing capacity by 425 GW (60%) led by solar, onshore and offshore wind, bioenergy, and hydropower[56], with over 75% of the expansion concentrated across Germany, Spain, the UK, Turkey, France, the Netherlands, and Poland.

Policy momentum and market conditions indicated increasing renewable energy growth before the energy crisis, prompted by policy reforms to reach more ambitious climate goals. The EU's Fit for 55 policy proposed to raise the EU's renewable energy share target from 32% to 40% by 2030 on the path to net zero by 2050.

The Russian invasion of Ukraine and subsequent energy crisis hit Europe while it considered ambitious renewables targets under the EU's Fit for 55 policy; the war exacerbated energy security concerns to accelerate renewable energy expansion. The EU consequently released the REPowerEU plan, which aims to end reliance on Russian fossil fuels by 2027 and increase renewable energy consumption to 45% of overall consumption (increased from 40%)[57].

European nations have since proposed their own ambitious plans for National Energy and Climate Plans (NECPs) to reflect the EU's policies for renewable energy policy support and addressing historical challenges.

Germany has increased renewable energy targets, introduced further auction volumes, improved distributed solar remuneration, and cut bureaucratic permitting processes. Germany raised its 2030 renewable targets from 65% to 80% by 2030 and accelerated the roll-out of solar and wind expansion, aiming for 360 GW by 2030[58]. Spain has also streamlined its permitting processes for solar and wind whilst increasing grid capacity for further renewable energy expansion. Italy increased its targets from 55% to 72% for renewable electricity consumption by 2030 and 100% by 2050 through the National Resilience and Recovery Plan (NRRP), investing €59bn[59].



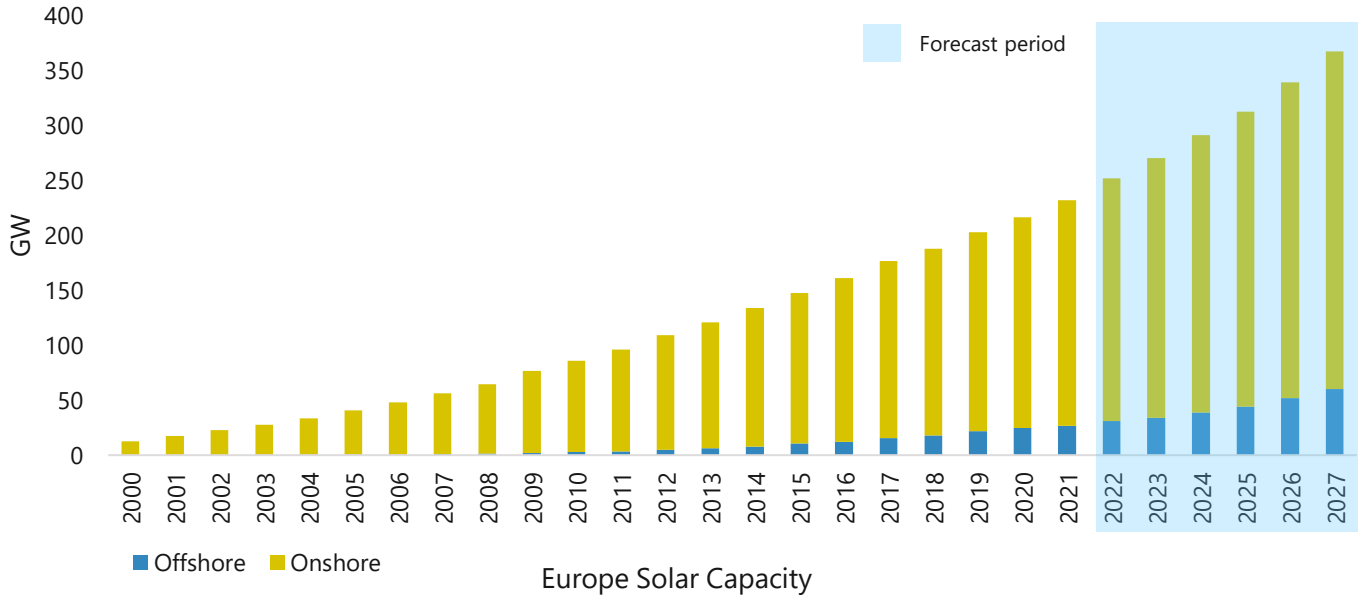
Source: IEA

Europe

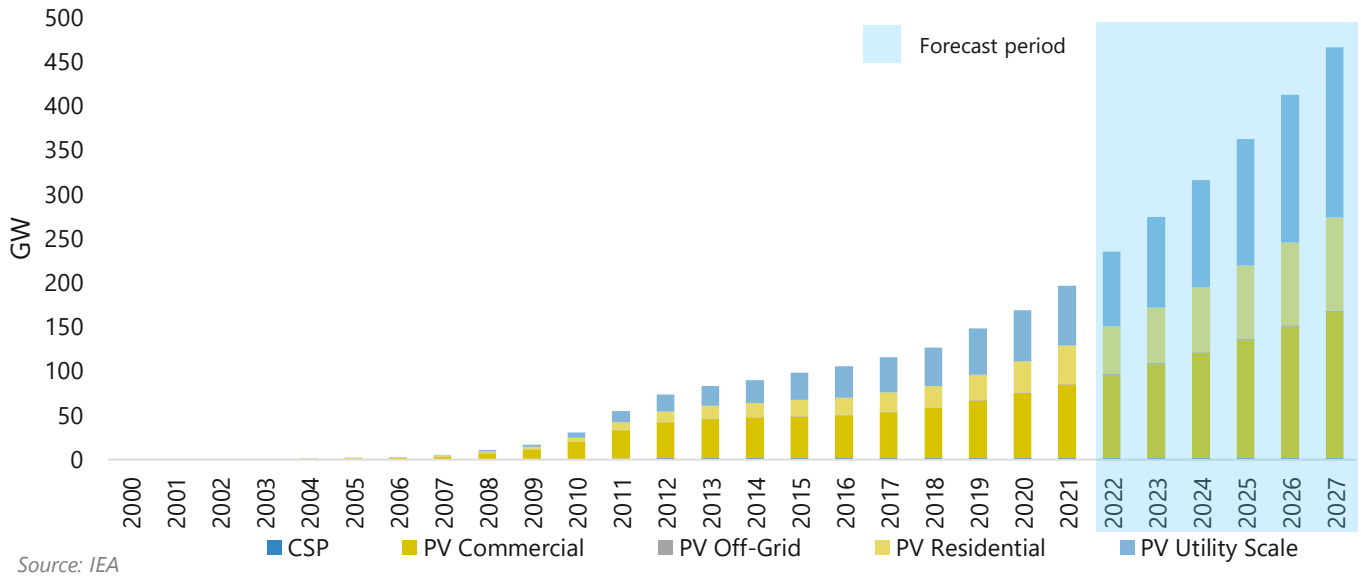
Wind and solar capacity expansion remain one of Europe's most effective ways to reduce fossil fuel reliance, with record-high fossil fuel generation prices continuing to improve the competitiveness of utility-scale renewables. Whilst distributed solar continues to expand, helping commercial and residential consumers reduce their energy bills through self-consumption, which significantly increased during the energy crisis.

Despite an increase in Q4 of 2022 in both solar and wind average contract prices across Europe, the price remained over 73% below wholesale market prices. During this same period, auction volumes significantly increased, mainly due to 11 GW of renewable capacity awarded in the UK.

Europe Wind Capacity

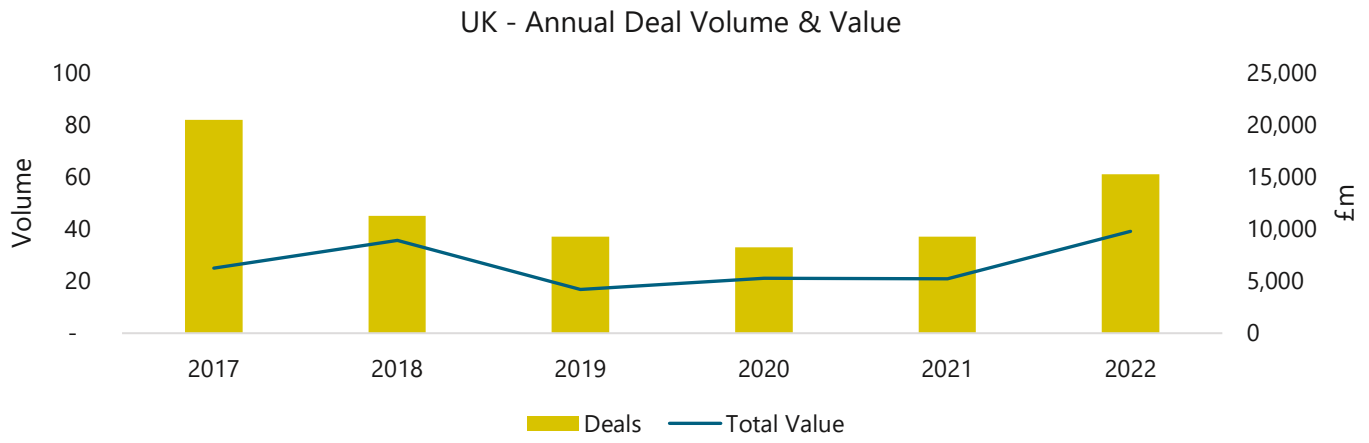


Europe Solar Capacity



Source: IEA

UK



Source: MergerMarket

The UK has adopted a binding net zero GHG emissions target for 2050, with a 2035 interim target of 78% emissions reductions compared to 1990[60].

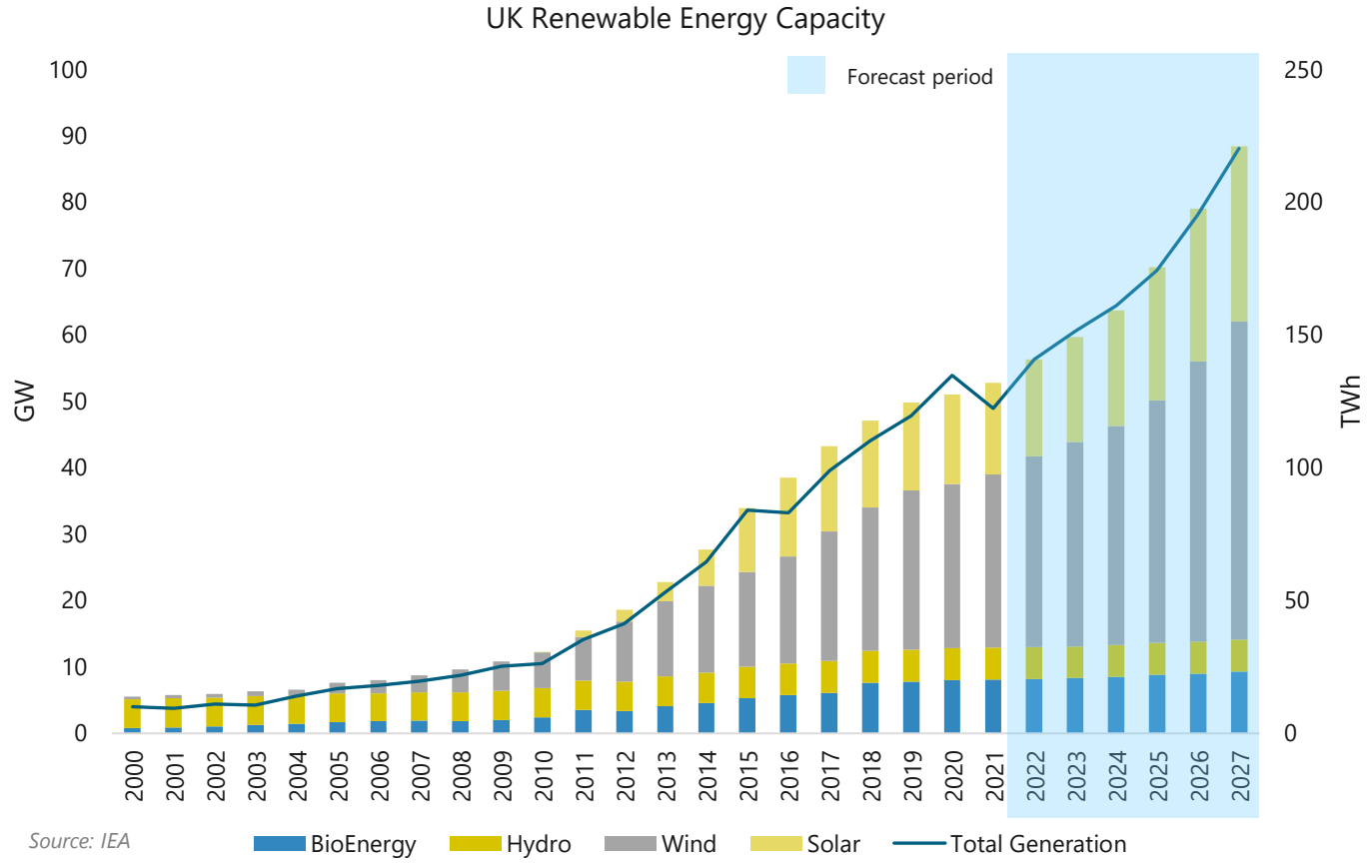
The UK is viewed as an appealing mature market, as investors' appetite aligns with government policy and opportunities across the renewables sector. The ongoing energy crisis across Europe and further consumer pressure for energy providers to provide renewable energy at a competitive price create a vast opportunity for additional investment.

The UK government's Roadmap to Sustainable Investing[61] sets out the government's ambitions to make the UK the most attractive place for green and sustainable investment, aligning capital deployment to net zero targets and ensuring that investment decisions account for climate change and the environment, including sustainability disclosure requirements for UK companies.

UK

The energy crisis, exacerbated by the Russian invasion of Ukraine, is undoubtedly accelerating the volume of capacity deployment being auctioned as governments look to hedge against the volatile market conditions and improve domestic energy security. This is also garnering further support from the government as *"eye-watering gas prices are hitting consumers across Europe, the more cheap, clean power we generate within our borders, the better protected we will be from volatile gas prices that are pushing up bills"*, stated the UK Business and Energy Secretary[62].

Contact for difference (CfD) auctions are considered one of the main drivers of renewable capacity growth in the UK, with auctions delivering almost 11 GW in 2015, 2017, and 2019 and a further 12 GW in 2021 – these auctions will be held annually from 2023 onwards[63]. The CfD auctions guarantee fixed prices to sell electricity for the following 15 years, and if the market price dips below the contract price, the government subsidises the difference. Alternatively, if the price is higher, the companies pay the money back to the government; this gives investors peace of mind and removes another variable in their investment modelling.



Source: IEA

UK

Offshore wind remains the primary driver of renewables in the UK and a vital tool for decarbonisation and net zero. Overall, renewable capacity is expected to grow by 70% in the UK, by c. 36 GW from 2022-2027, almost double the pace of the previous period, with offshore wind accounting for over half of all the renewable growth, followed by solar and onshore wind[64].

The UK aims to be at the forefront of offshore wind worldwide by installing 50 GW of offshore wind capacity by 2030[65], increased from previous targets of 40 GW, which would dwarf Europe's current total installed capacity (25 GW).

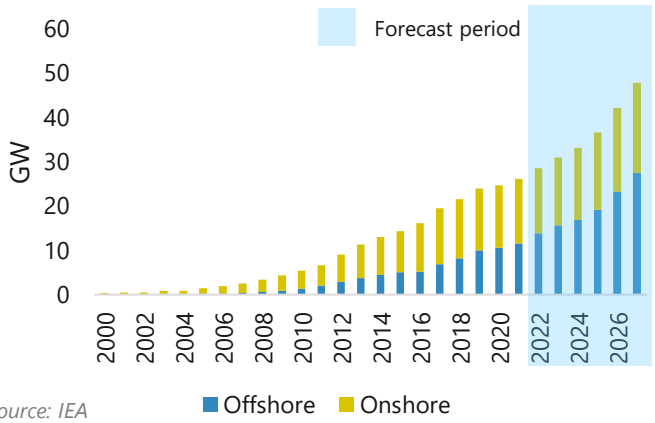
The price of offshore wind in the UK has continued to decline, with the contract price at £37.35/MWh[66] in the most recent auction, almost 6% lower than previous auctions in 2019 despite extraordinary inflationary cost pressures for raw materials and renewable equipment.

Ørsted, one of the market leaders in offshore wind, won the contract for the world's largest offshore wind project to date, Hornsea Three, just shy of 3 GW of additional capacity. Meanwhile, Vattenfall secured the Norfolk Boreas offshore contract (1.4 GW). Whilst Scottish Power acquired the contract for East Anglia Three offshore (1.4 GW), five onshore (396 MW) and an additional ten solar projects (326 MW).

"Eye-watering gas prices are hitting consumers across Europe, the more cheap, clean power we generate within our borders, the better protected we will be from volatile gas prices that are pushing up bills" **stated the UK Business and Energy Secretary.**

Offshore wind remains the critical piece of the renewable energy jigsaw in the UK's net zero targets; since the UK was an early adopter of offshore wind technology, it is in an ideal position to capitalise upon its experience and knowledge as a market leader. The UK's project pipeline for offshore wind, as of 2023, stands at 100 GW, behind China's mega 137 GW pipeline but ahead of the US (79 GW) and Sweden (75 GW). The UK government plans to halve offshore development timelines by streamlining permitting processes to meet its 2030 targets.

UK Wind Capacity

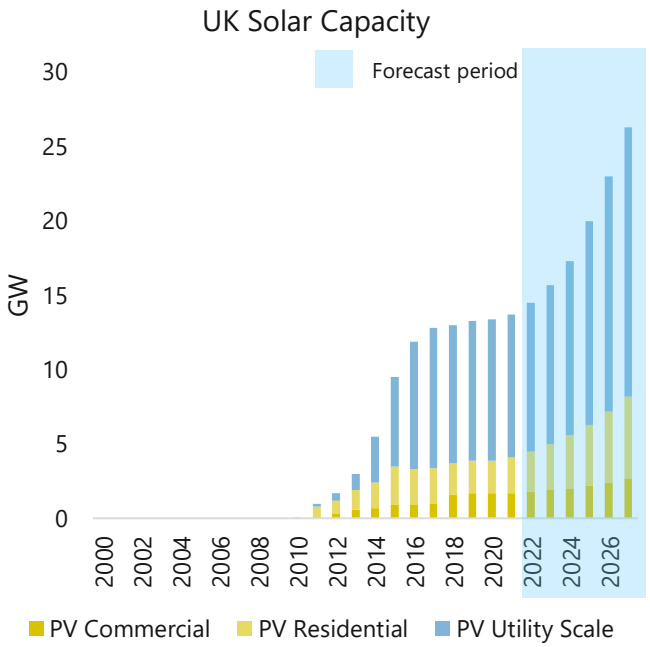


Source: IEA

After the recent 2020 reversal on the ban of new onshore wind and solar being included in CfD auctions in the UK from 2015, causing a vast decline in onshore wind installations, their inclusion will now allow further cheap renewable sources to compete in CfD auctions and enable more significant deployment. The auctions will let a previously paused pipeline of projects that have secured consent to almost immediately commission projects – the majority of these projects moving forward will be in supportive regions with excellent wind resources, primarily in Wales and Scotland. The UK's wind focus will remain primarily offshore due to the current government's lack of support for onshore projects and the sheer scalability of offshore wind.

UK

The UK solar market added 613 MW in 2022[67], mainly through distributed solar, which remains economically attractive despite being almost entirely subsidy-free. The UK government established a solar target for the first time, aiming for 70 GW by 2035 in the new British Energy Security Strategy. The solar market has matured into a mostly subsidy-free market and continues growing. The UK's strategy to support distributed solar includes introducing design standards to encourage rooftop solar, increasing the viability of low-cost finance options and facilitating permitting. The economic attractiveness is expected to continue as installation costs remain competitive and generation costs below that of fossil-fuel, due to the energy crisis, with consumers seeking refuge from extraordinarily high energy bills. Industries are also seeking to hedge against the volatility of fossil fuels and meet emissions reduction targets by installing solar and through corporate PPAs. These attractive PPAs are expected to drive growth in utility-scale solar in the UK.

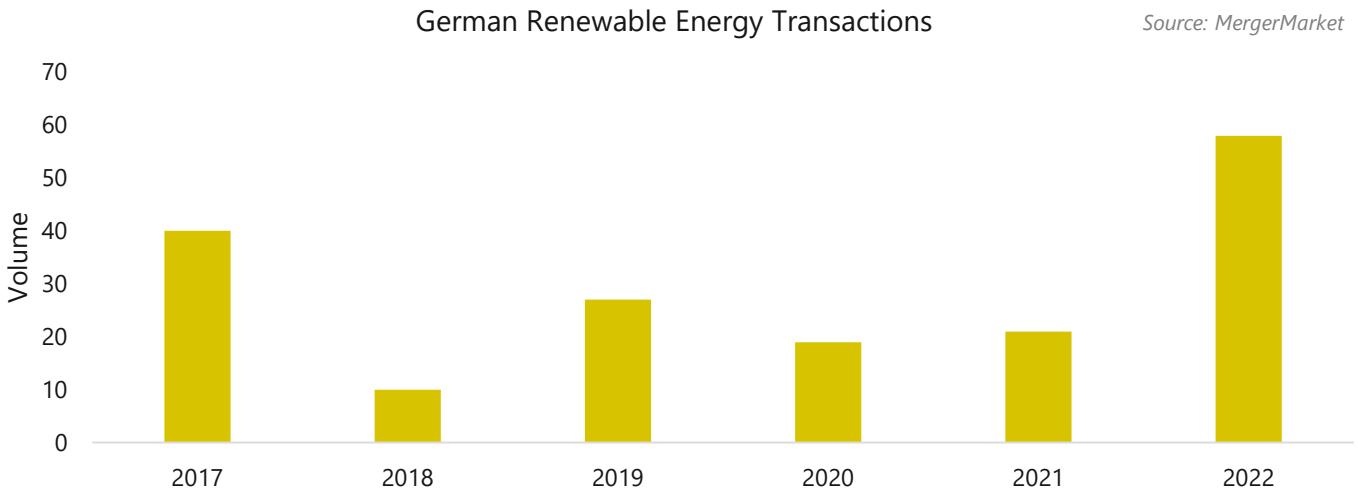


Source: IEA

However, distributed solar overall is expected to remain relatively limited throughout the UK due to the FiT replacement being a relatively low financial incentive; the Smart Export Guarantee (SEG) introduced in 2020 mandates power suppliers to purchase exported electricity from systems with a capacity of up to 5 MW at retailer-set tariffs that range from 50-100% of average wholesale electricity prices. This limits the attractiveness as costs remain relatively high compared to other regions due to the low average solar irradiation in the UK. However, despite the SEG and low average solar irradiation, current energy prices from the energy crisis make distributed solar economically viable and attractive for many consumers.

The UK is also investing in overhauling the national grid, with a £54bn upgrade, including connections to the grid for offshore wind through 15 connection points to 18 offshore wind projects[68]. This proposal should reduce grid access costs and ease disturbances to coastal populations by reducing the volume of cables and pylons required.

Germany

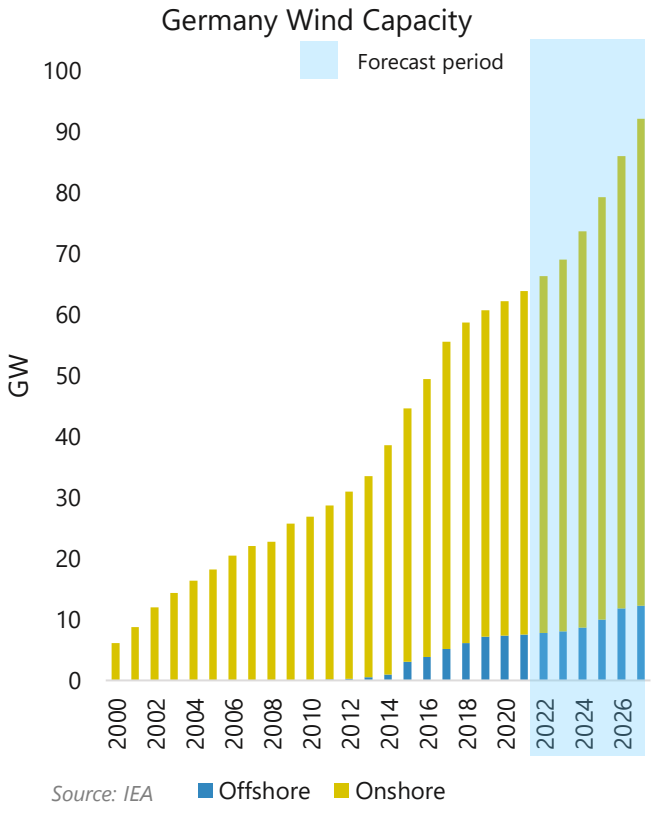


Germany's renewable capacity is forecast to increase by 67% (97 GW) between 2022-2027, doubling that of the previous period, led by solar, onshore and offshore wind expansions, and bioenergy[69]. This growth is driven by Germany's excellent renewable energy support policies to meet its long-term energy transition and ambitious new energy targets designed to decrease reliance on imported Russian gas and achieve net zero.

Germany revised its Renewable Energy Sources Act (EEG 2023) to increase renewable energy targets from 65% to 80% by 2030, increasing solar and wind targets substantially. Policy improvements, including higher auction volumes, increased remuneration for distributed solar, and reduced permitting processes, support this.

Government-held auctions drive the majority of the utility-scale renewables, alongside distributed solar being supported by FiTs, self-consumption, and remuneration for any surplus generation.

Solar accounts for 70% of the renewable expansion in Germany, led by distributed solar, owing to more significant support from the new EEG 2023 increasing the economic attractiveness of self-consumption and the commercial market. Onshore wind has also seen regulatory reforms tackle permitting challenges to ensure government-held auctions are fully subscribed.



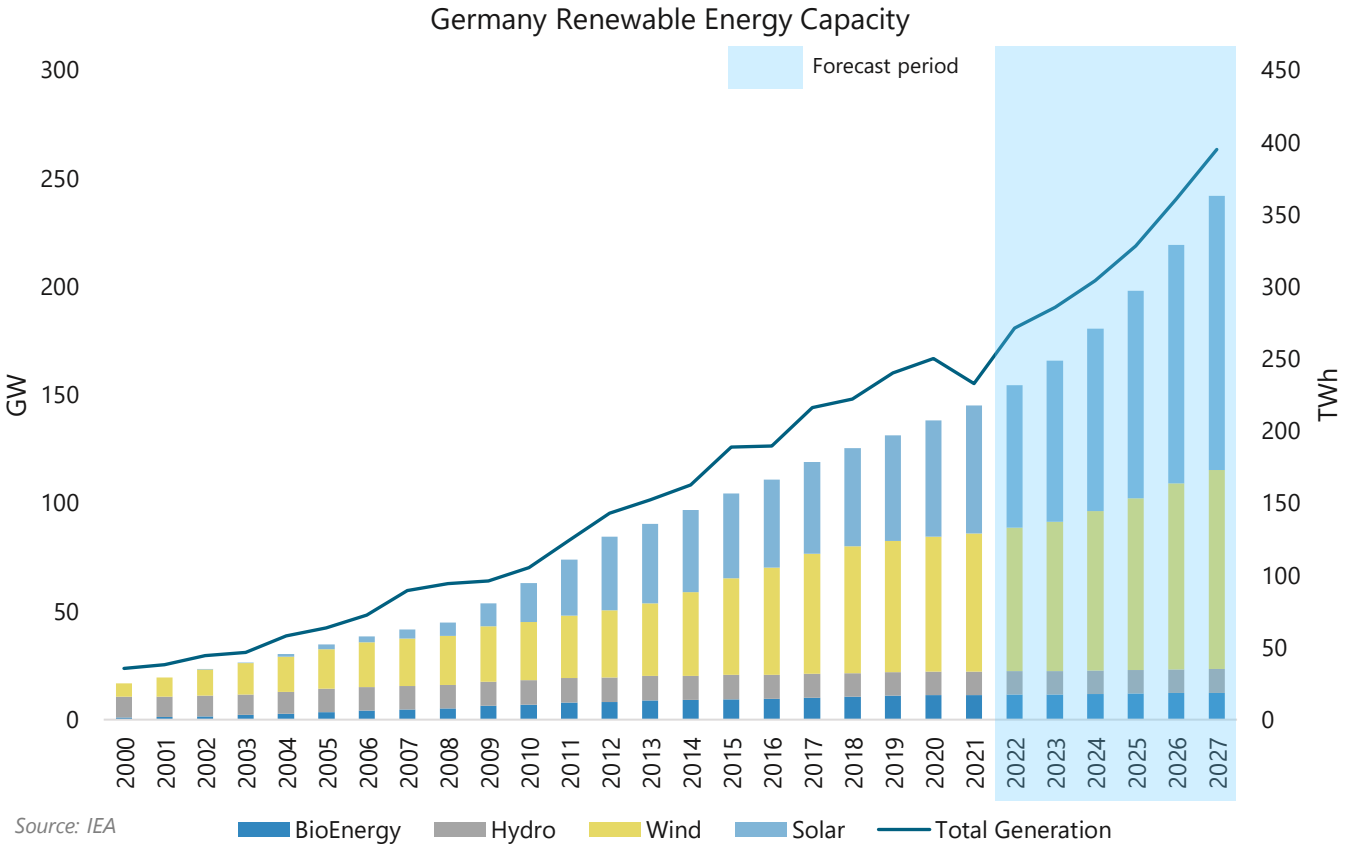
Germany

Progressive and consistent renewable energy policies make Germany one of the key renewable M&A markets. Germany has a long-term strategy to fundamentally alter its energy supply, pivoting away from fossil fuels and nuclear energy and towards renewable energy – previously aiming for 40-45% by 2025 and 80% by 2050 to be sourced from renewable energy[70], which have recently been increased again by the EEG 2023.

The German energy transition (previously termed Energiewende[2]) is the country's planned transition to a low-carbon and nuclear-free economy, with an ongoing system and framework implemented and continually revolutionised and expanded to maintain momentum. Policies are designed and implemented in a manner which makes it attractive for investors to deploy further capital into the renewable sector quickly and easily.

The government now see renewable energy as a "matter of national security" for energy independence. Also, whilst accelerating its deployment of renewable energy through its "biggest energy policy reform in decades", according to the government's "Easter Package"[71]. This policy advancement is wide-reaching across Germany's EEG 2023 with its energy industry law, offshore wind law and legislation to accelerate grid development updates.

The policy aims for a complete step change by increasing new land available for renewable energy additions, speeding up permitting, and vastly expanding both wind and solar capacity, aiming for 80% renewable energy by 2030 and 100% by 2035.



Source: IEA

[2] German for 'Energy Turnaround'.

Germany

Key Points[72]		
Solar	Wind	BioEnergy
Both expansion targets and tender volumes will be split between deployment via rooftops and open space 'solar parks'.	Funding through CfD will be implemented for the auction process, with the successful bidder receiving a 20-year fixed-priced contract – reducing the variability of returns for investors.	Tender volumes for biogas will be increased to 600 MW per annum from 2023, whilst biomass volumes will be slowly reduced.
Commissioning outside of the tender scheme for smaller rooftops will receive an increased element of remuneration.	Improved planning, permitting and connection processes to reduce timescales from 5-8 years to 2-3 years by reducing requirements and speeding up assessments and processes.	Subsidies and consumption of biogas will be targeted toward highly flexible power stations.
Rooftop installations that feed 100% of generation into the grid will receive higher subsidies than those who self-consume generation.	Repowering existing wind turbines to increase capacity quickly.	
Declining remuneration rates will be stopped until 2024, with subsequent decreases implemented bi-annually.	The Onshore Wind Act (Wind-an-Land-Gesetz), requiring a reservation of 2% of land to onshore wind development by 2032 for each federal state.	
Agricultural and peatland solar projects will receive an increased bonus payment to make them more economically viable .	Revised Species Protection Act, standardising species protection assessments nationally alongside a finite list of endangered species, whilst reducing permitting times.	

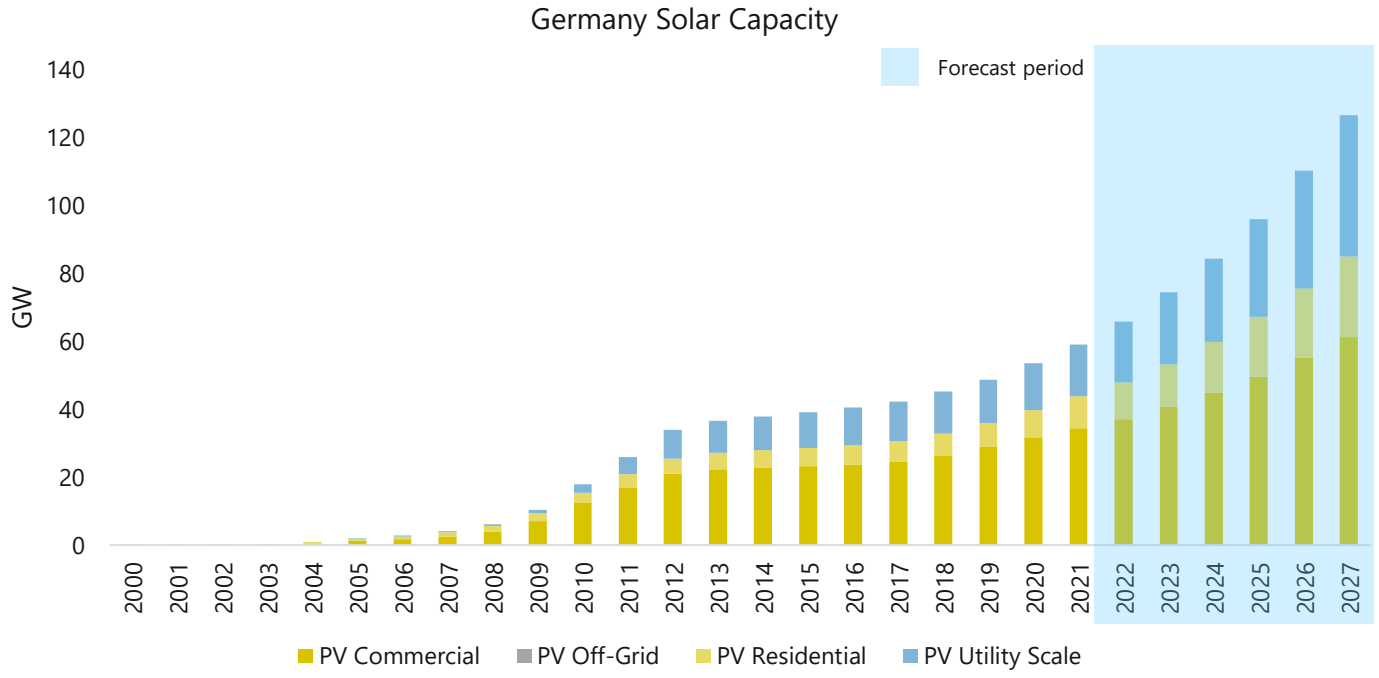
Germany

Germany's renewable deployment will be bolstered by consistently increasing annual capacity. Targeting solar capacity of 215 GW by 2030, 309 GW by 2035 and 400 GW by 2040 whilst also increasing onshore wind to 115 GW by 2030 and 70 GW by 2045, and offshore wind to 30 GW by 2030 and 70 GW by 2045[73].

To reach these targets, the government are implementing a fundamental theory of "overriding public interest" for renewable energy that will be given priority over bureaucratic planning and permitting processes, local opposition and contradictions with other biodiversity targets until it achieves net zero.

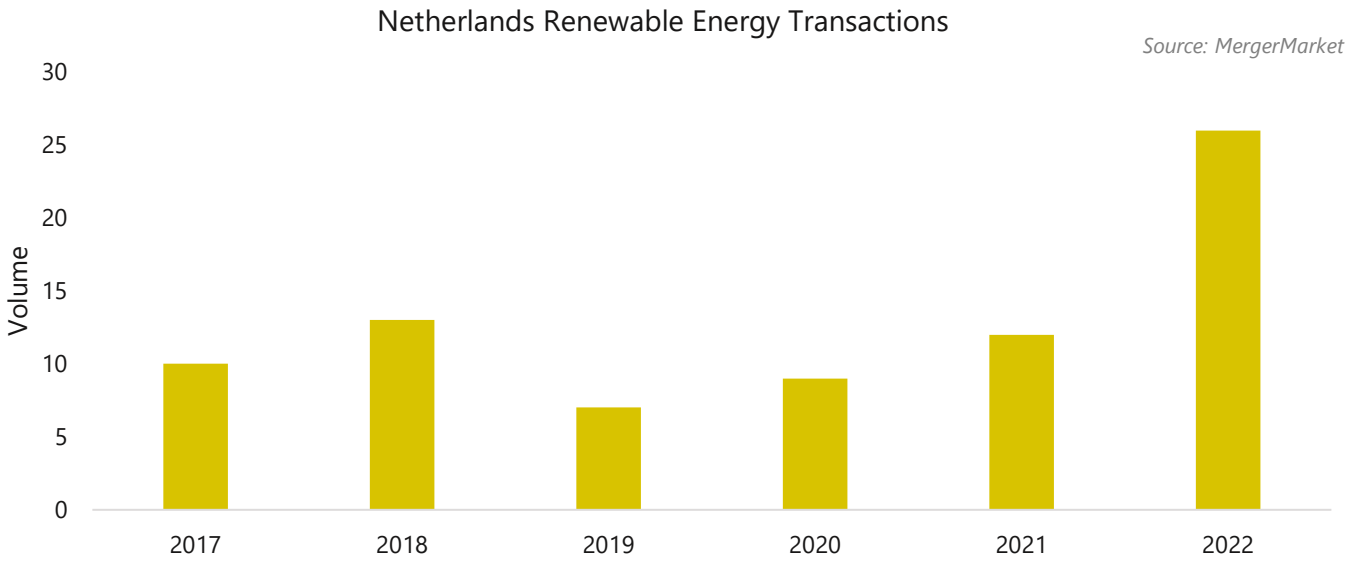
Germany aims to accelerate its grid development in parallel with its renewable expansion by streamlining planning and approval procedures for 19 new grid expansion projects and amending a further 17 to align energy transition goals[74].

Germany's receptive and proactive attitude and swift action to the present macroeconomic trends concerning the energy sector and the environment are a pathway through which other nations should seek to emulate their energy transition strategy.

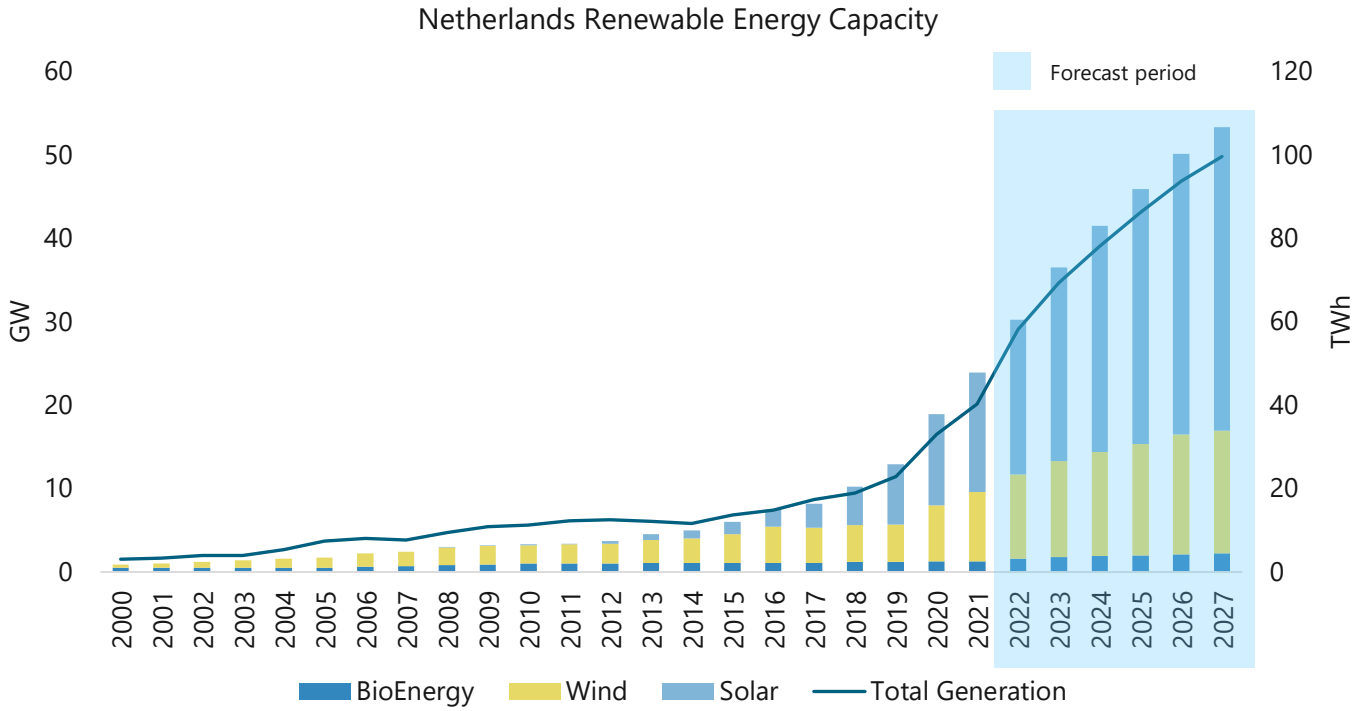


Source: IEA

Netherlands



The Netherlands is often viewed as the gold standard by investors and developers owing to its stable regulatory environment and returns offered from projects. The Netherlands is forecast to more than double its overall capacity by 2027 adding almost 30 GW, led by solar and offshore wind additions[75].



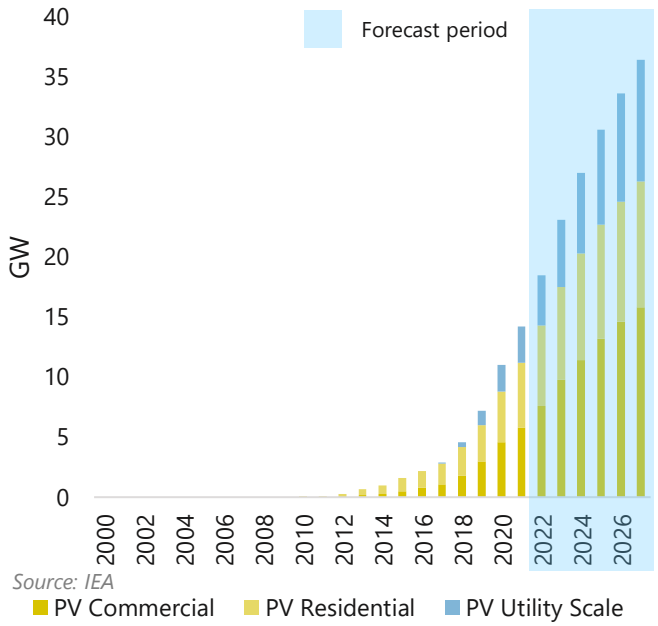
Source: IEA

Netherlands

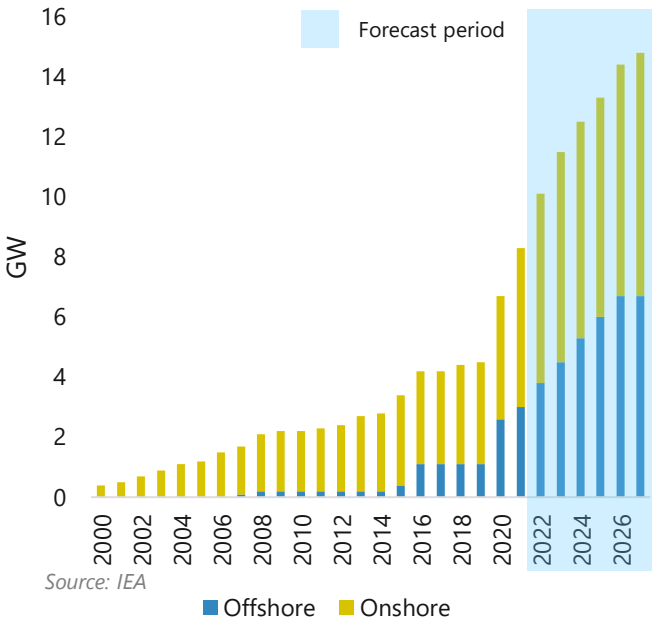
The Netherlands offers stable returns for operators through its SDE+ and SDE++ operating subsidy programmes, which last for 15 f. According to Ember, the Netherlands was the European leader in solar production, producing 14% (17 TWh) of its power from solar alone, 2ppt more than the previous leader Spain (which has a much higher average solar irradiation) – overtaking coal generation for the first time[76].

As the roll-out of offshore wind gains momentum, these farms will be located further and further offshore; as such, not all will be needed to connect to the onshore grid; thus, these energy hubs can be linked together to produce green hydrogen to be transported onshore and utilised for decarbonisation.

Netherlands Solar Capacity by Segment



Netherlands Wind Capacity by Segment

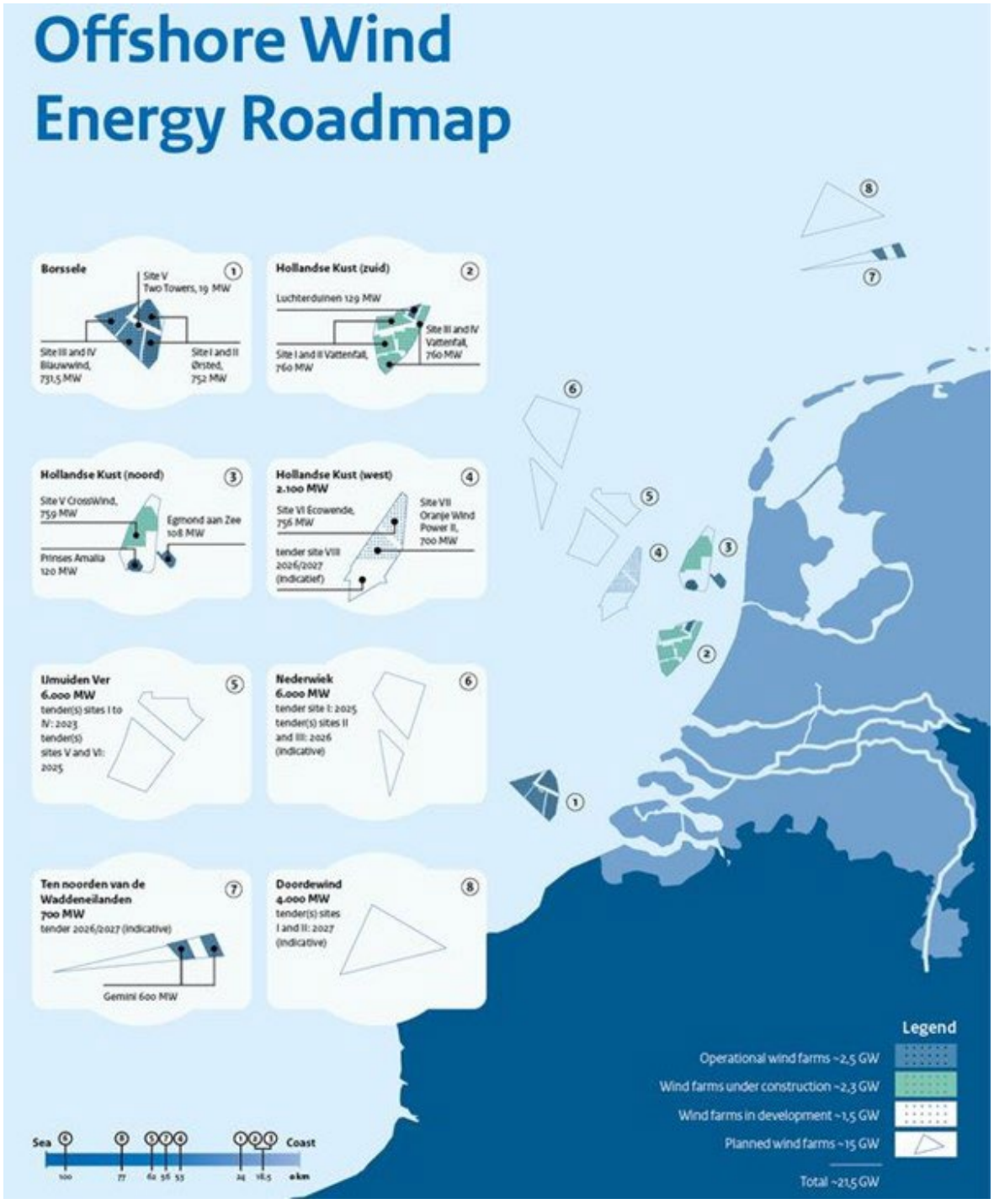


The Netherlands is aiming for a reduction of GHG of 55% by 2030 (increased from 49%) and net zero by 2050 (increased from 95%). It aims to do this through bold targets such as 70 GW of offshore wind by 2050 and installing 50 GW by 2040, in combination with utilising this capacity for large-scale green hydrogen production[77]. The offshore wind energy roadmap of the Netherlands shows a total of 21.5 GW of capacity currently planned by 2030, increased by over 80% to reduce dependency on fossil fuel imports from Russia, with 2.5 GW operational and another 3.8 GW in construction or development and 15 GW to be tendered[78].

The Netherlands installed almost another gigawatt of onshore wind in 2022, surpassing its 6 GW target from its 2013 Energy Agreement, albeit two years late. However, the maximum onshore capacity is estimated to be between 7-8 GW due to social issues and spatial concerns[79].

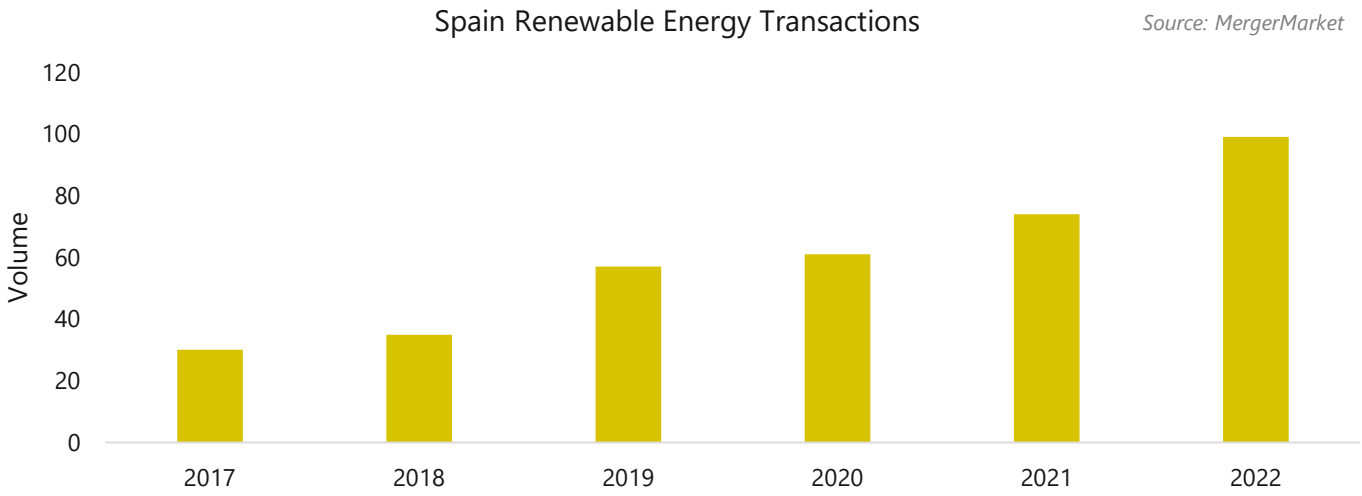
Accelerating the speed of grid upgrades and digitalisation could increase the pace of the roll-out for both onshore and solar projects and increase the appetite for associated investment and deal activity.

Netherlands



Source: Netherlands Enterprise Agency

Spain

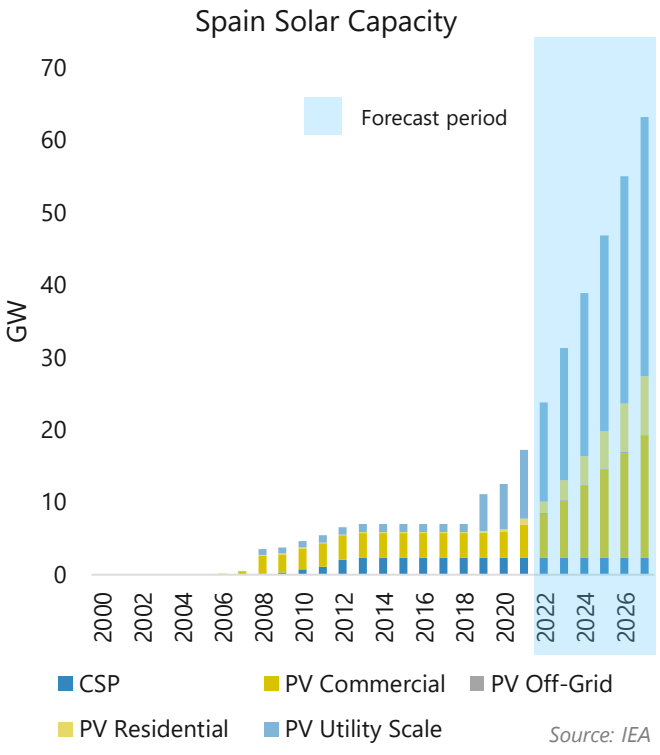


Spain's renewable capacity is forecast to almost double (58 GW) between 2022-2027 from competitive auctions, corporate PPAs and merchant projects, led by expansions of solar, wind, and pumped-hydro[80]. Spain is the second largest country within the EU, with vast swathes of renewable resource potential.

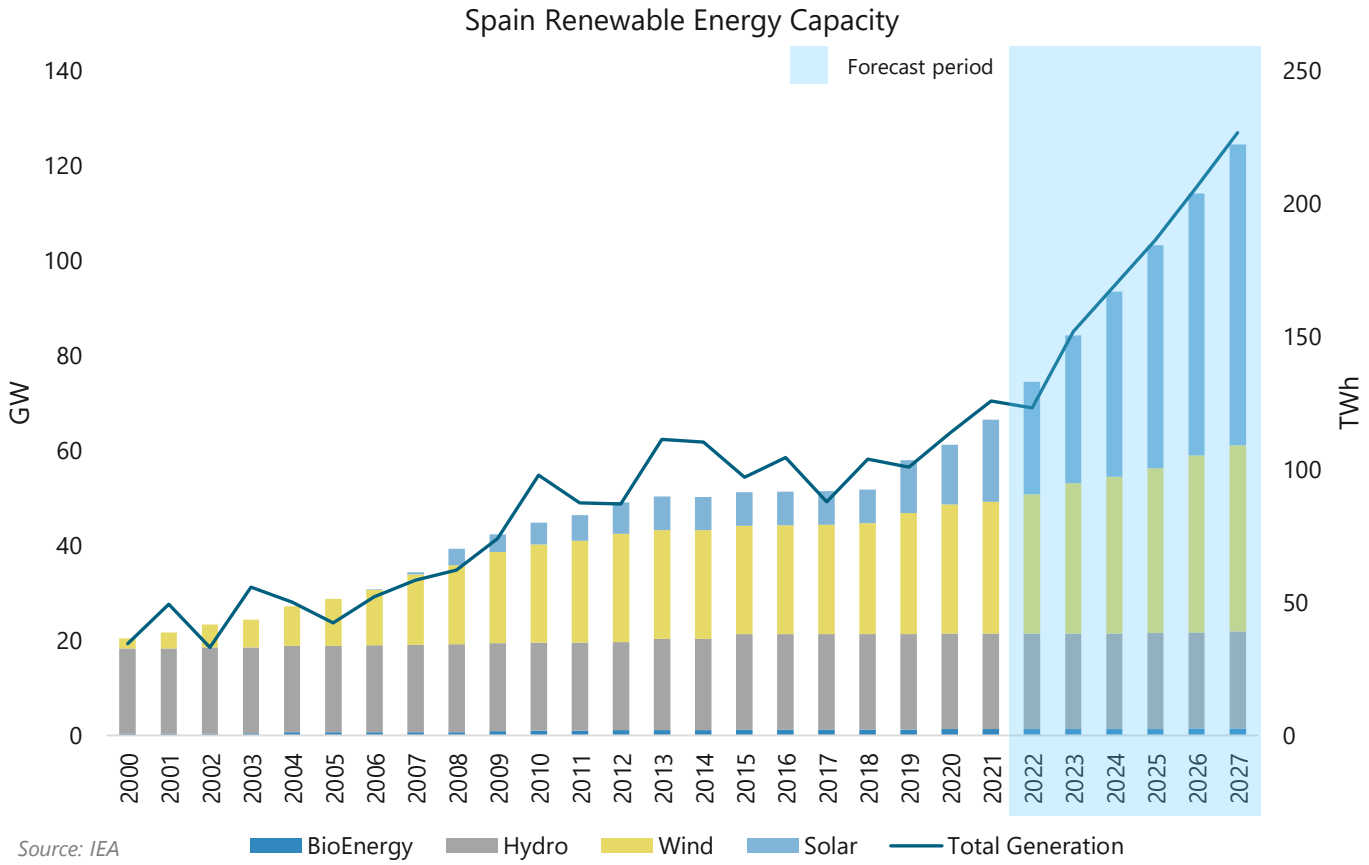
Like other European countries, Spain is looking to improve its energy sovereignty by transitioning away from importing fossil fuels in the wake of the Russian invasion of Ukraine.

The Spanish government passed a series of regulatory reforms to accelerate renewable energy capacity growth in response to the Ukraine war, streamlining permitting processes for solar and wind, increasing grid capacity for new projects and providing clarity over the clawback of windfall profits[81]. The main policy driver for capacity expansion in Spain is the resumption of government-held auctions after a three-year hiatus and to support the roll-out of solar and wind deployment. Spain's onshore wind and utility-scale solar expansion are driven by a pipeline external to the auction process, in the free market, from corporate PPAs and the wholesale market.

The Spanish government's Régimen Económico de Energías Renovables (REER) policy for renewables has begun accelerating Spain's energy transition, aiming for 74% of electricity from renewables by 2030 and reaching net zero by 2050[82].



Spain



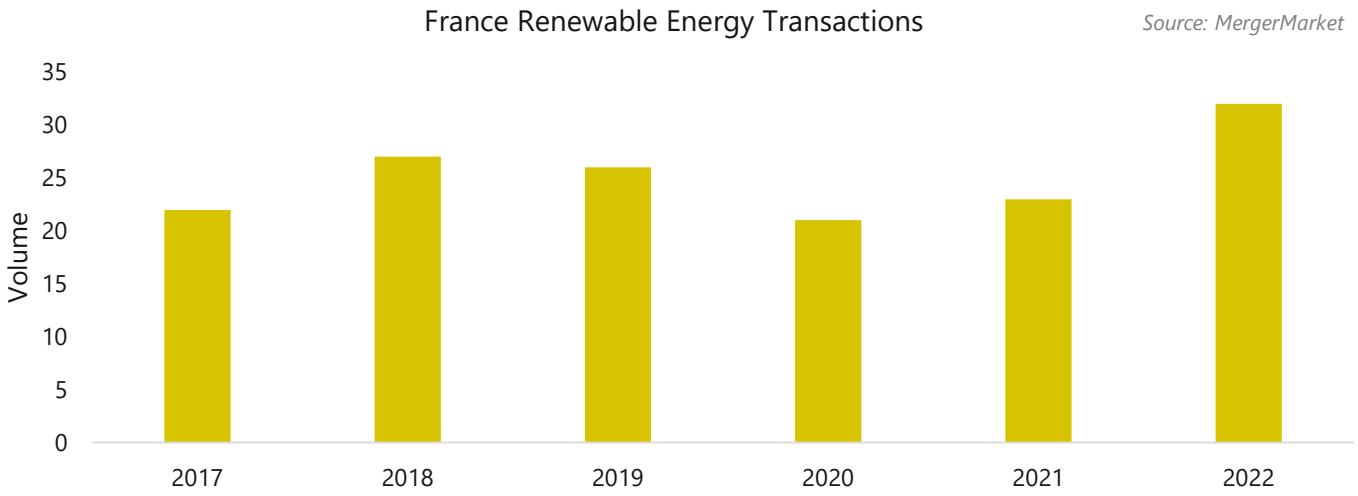
Source: IEA

After a decline in renewables due to a lack of financial incentives between 2013-2018 and the 'impuesto al sol', or sun tax, that previous governments introduced, investments began to accelerate again in 2019, improving the economics for commercial and residential applications, increasing capacity additions from 2020 onwards. Higher electricity prices will only make this more economically attractive, combined with regulatory reform making applications more accessible.

Spain also plans to allocate EU stimulus money to increase renewable self-consumption with €40bn towards climate transition targets and €28bn targeting digital transformation, improving energy efficiency, sustainable mobility in urban and long-distances, and decarbonisation of the energy sector - including accelerating renewable development, energy storage, hydrogen technologies and grid developments[83].

Spain plans to utilise €140bn from the EU's Next Generation Fund for the green transition of Spain's economy, including the production of green hydrogen[84]. This links back to the ambitious plans to revive the Midi-Catalonia (MidCat) Pipeline project after the failure of Nord Stream Two, a gas link between Spain and France with a capacity of 7.5bn m^3 [85]. Suppose Spain continues to invest in green hydrogen alongside its solar and wind resources. In that case, it is well positioned to consume this domestically and geographically to export this via the MidCat pipeline to France and beyond, also through to North Africa via Morocco and Algeria.

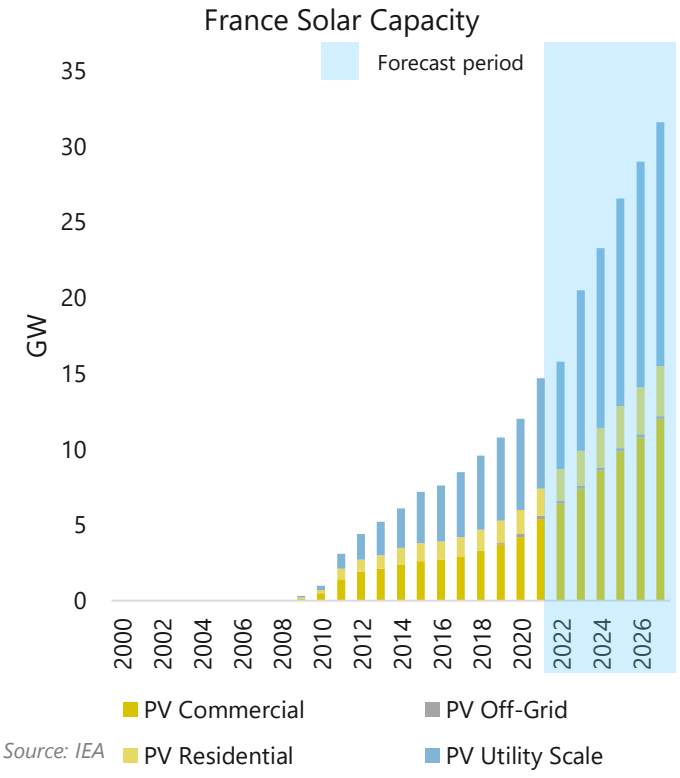
France



France's renewable capacity is forecast to grow by 50% (31 GW) between 2022-2027[86]. Solar and wind account for most of this growth, with 2.8 GW and 2.3 GW annual additions, respectively, over the forecast period, with 75% of the wind additions expected to be onshore, whereas utility-scale and commercial-scale represent the vast majority of solar additions[87].

Renewable expansion is driven mainly by the country's multiannual energy plan (Plan de programmation pluriannuelle de l'Energie, or PPE), which has set technology-specific targets for 2023 and 2028 alongside indicative auction schedules[88].

The French government will continue long-term support for renewable energy and decarbonisation of the energy sector after Emmanuel Macron recognised that it had *"fallen behind"*[89], particularly in the face of the energy crisis and exponential rise in fossil fuel prices, and a requirement to improve energy security domestically. France re-elected Macron, who, with a clear appetite for increased renewable energy investment, stated that *"the production strategy that I wish to implement for the nation is essentially based on three main points: to continue investments aimed at reducing consumption, to deploy massively renewable energies based on solar energy, offshore wind power and onshore wind power, (...) and to produce nuclear power with the immediate implementation of a new reactor construction plan"*. Alongside, he declared a €50bn ecological transition plan[90].



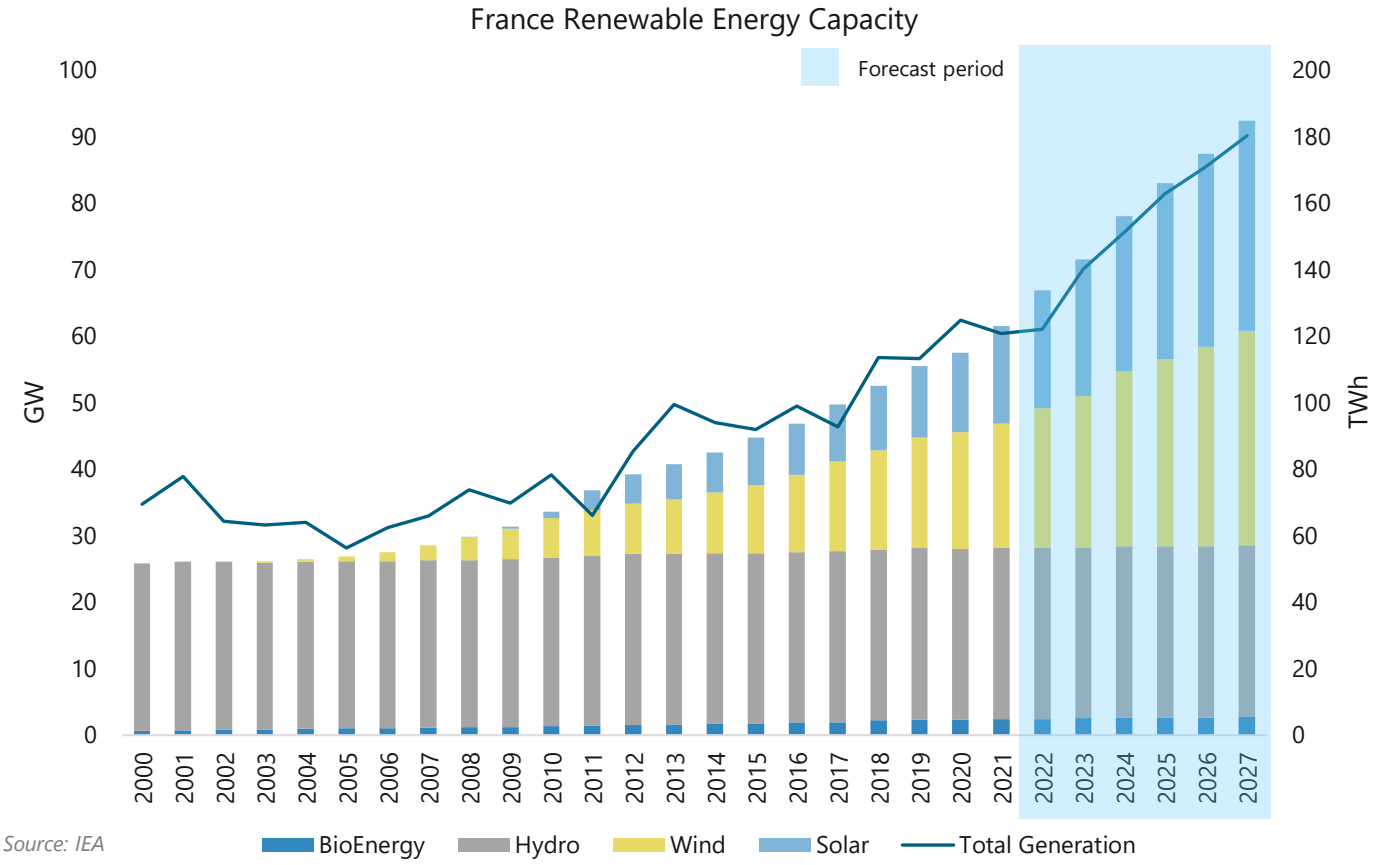
Source: IEA

France

Macron wishes to devolve further power and resource at a regional level, to remove regulatory and bureaucratic barriers so long as projects are locally accepted. The French government is looking to increase the speed of renewable deployment, unhappy that *"offshore wind turbines take twelve or fifteen years to develop in France, while it takes seven years in Germany"*[91].

Compared to its European peers, France is now behind the curve when it comes to offshore wind; however, it is now particularly focused on developing its offshore wind capacity. The government has signed an offshore sector deal with the French wind industry, recognising the scale of the opportunity available and committing to commissioning 40 GW of offshore wind by 2050 over 50 wind farms, increasing solar capacity tenfold by 2050, and doubling onshore wind capacity[92]. To meet these targets, France aims to auction 1 GW of offshore wind annually, rising to 2 GW annually from 2025. Transparent timelines and capacity will provide potential investors with a long-term strategy for deploying their capital into these opportunities. This would make offshore wind France's second-largest source of renewable electricity behind solar as it also aspires for 100 GW of solar and 37 GW of onshore wind by 2050[93].

France also sees the long-term value and implications of supporting investment in hydrogen development through new support for renewable hydrogen operators, targeting 6.5 GW of electrolysis capacity by 2030, investing €7bn to decarbonise industries, develop hydrogen mobility and increase research capacity[94].



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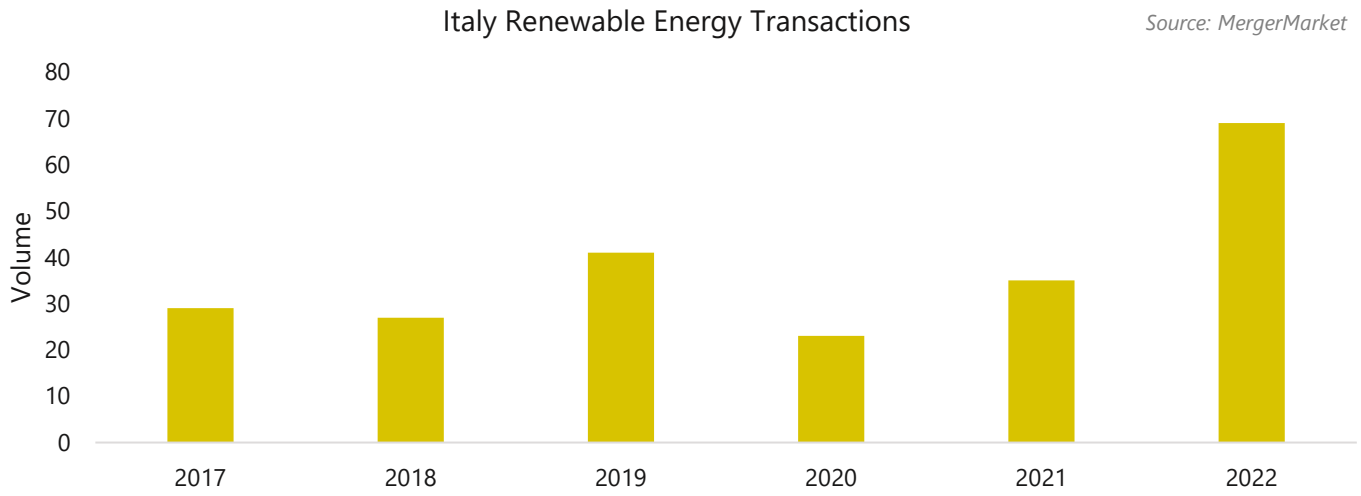
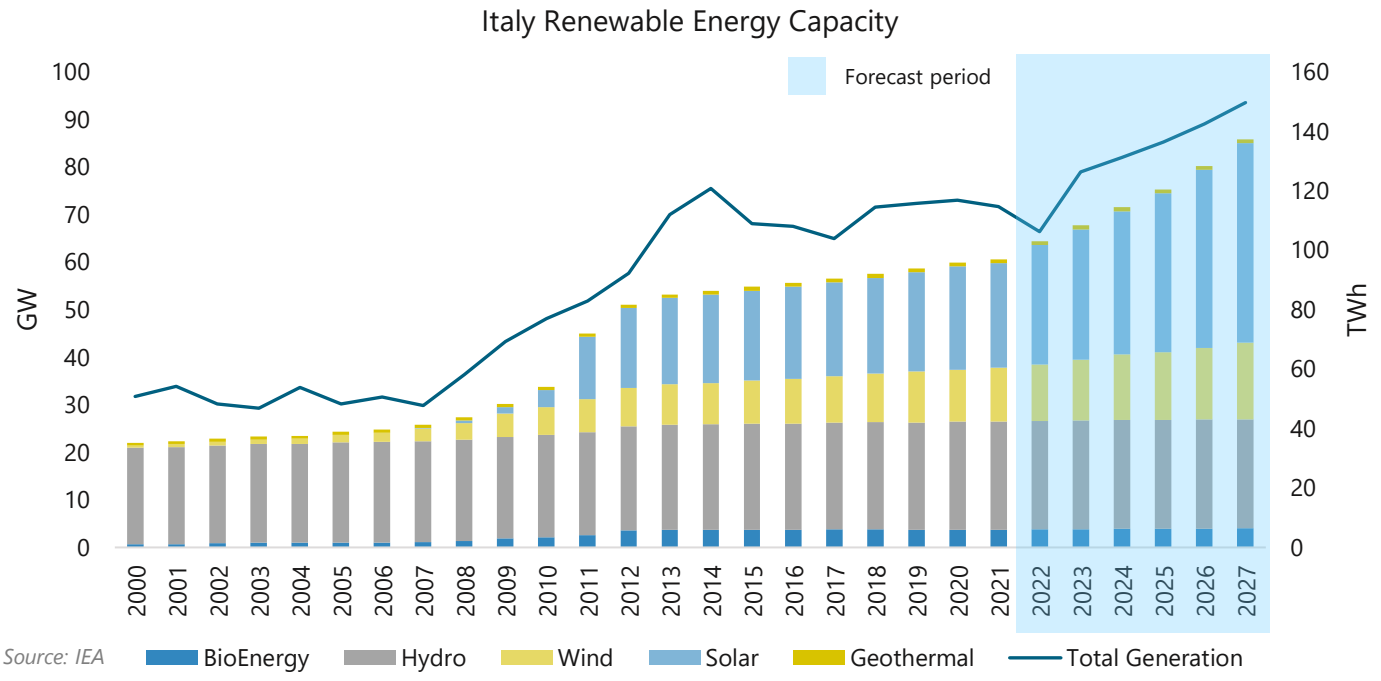
Italy



Renewable capacity in Italy is projected to grow by 40% (25 GW) between 2022-2027, solar accounts for 40% of this growth between utility-scale and distributed projects, with the remainder coming from onshore wind[95]. In 2021 Italy had almost 41% of its electricity powered by renewables; however, it aims for 72% by 2030, which lags behind its European peers with targets of over 75%.



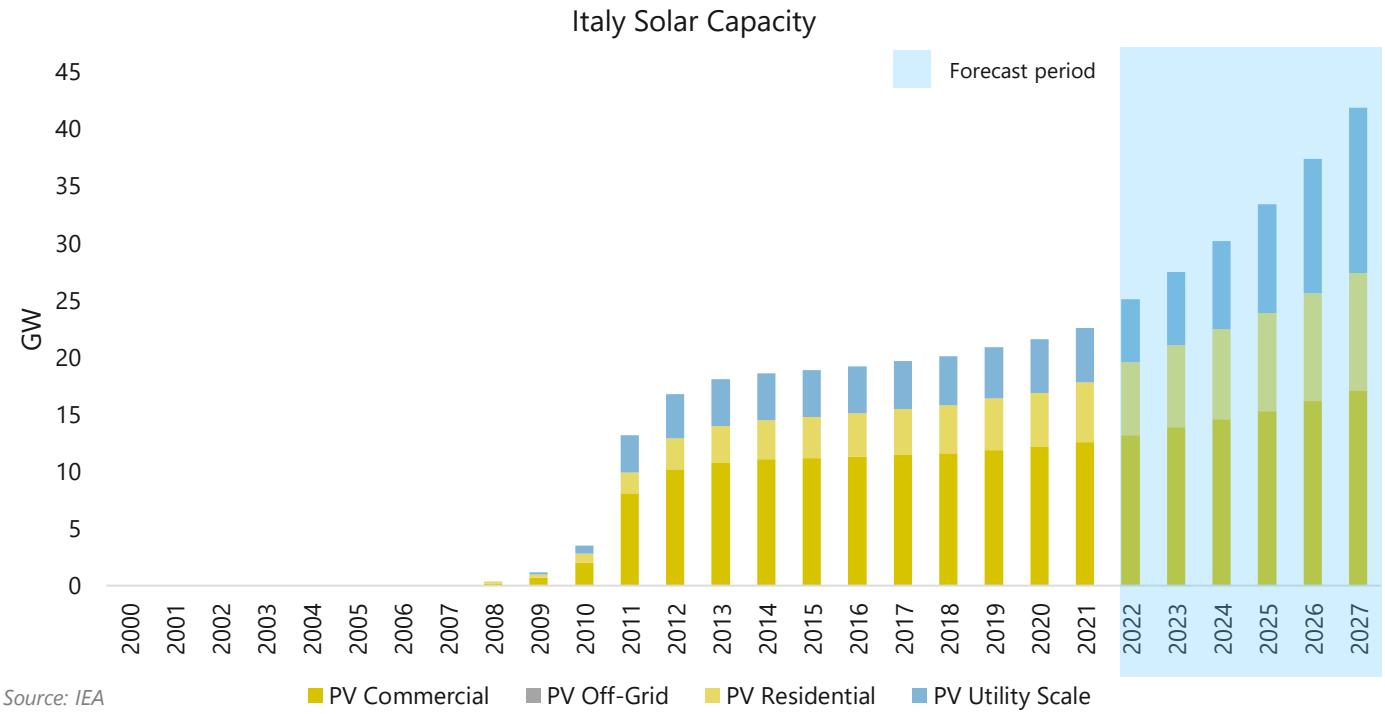
Italy

Government-held auctions, bilateral PPAs and merchant projects drive utility-scale solar expansion. Whereas distributed projects continue to be driven by the net billing scheme and excellent tax incentives in the residential sector, with higher electricity prices improving the economic attractiveness, coupled with self-consumption with a guaranteed export price in the commercial and industrial sectors.

The renewable electricity sector is expected to receive a capital injection from the REPowerEU €225bn fund to contribute towards renewable project financing.

Italy's renewable energy expansion will primarily be through solar due to its excellent solar irradiation. Italy is also seeking to diversify its renewable portfolio, including its first offshore wind project, which is now operational with 30 MW capacity[96] alongside onshore wind projects with a capacity of 418 MW[97].

Bureaucratic, lengthy and complicated permitting processes throughout Italy previously made renewable deployment difficult, as developers held back from participating in government-held auctions. However, the government aims to simplify and streamline the process, which would achieve faster renewable deployment by encouraging the participation of developers. Policies introduced in response to the energy crisis, such as streamlining and simplifying permitting processes alongside attractive tax incentives, should see expansions in distributed solar capacity.

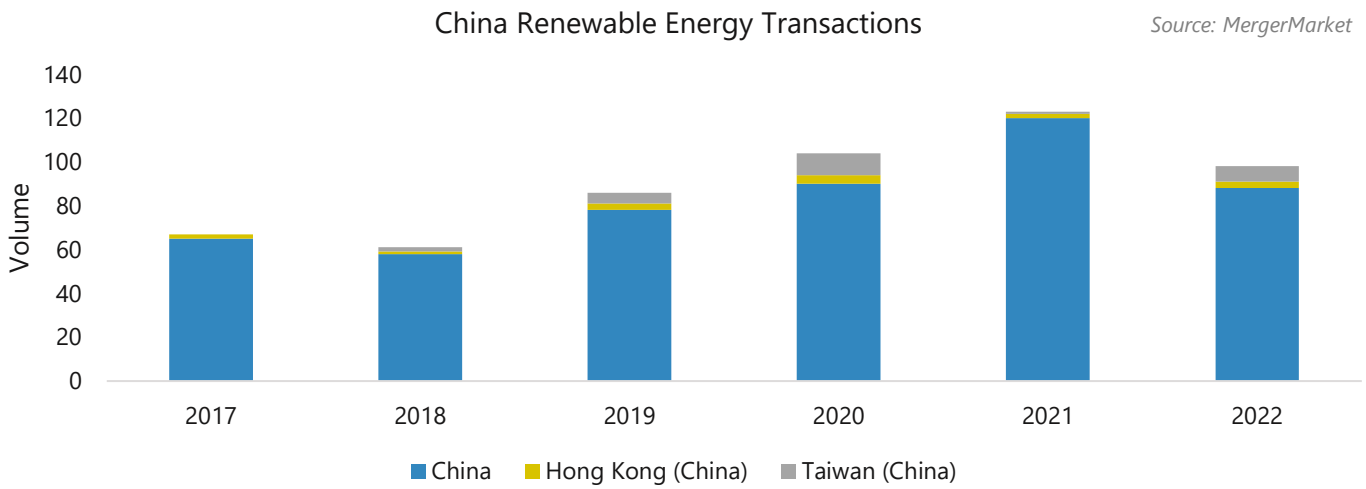


Source: IEA

Asia

- China continues to be the leading developer in the renewable market and is projected to double (1,070 GW) between 2022-2027, led by solar and wind additions accounting for 90% of the expansion.
- China's 14th Five-Year Plan (FYP) targets an increase of 32 GW of offshore wind capacity, a 60% increase from the 13th FYP final installed offshore wind capacity of 2020.
- India remains a growing market for renewable energy; however, its potential is enormous and comparatively untapped across multiple sub-sectors. The Indian Ministry of New & Renewable Energy (MNRE) estimates a potential renewable energy capacity of around 1,700 GW.
- However, the financial viability of India's distressed distribution companies (DISCOMs) remains the weakest link in India's renewable energy expansion.

China



China continues to be the leading developer in the renewable market, with the largest installed capacity of hydropower, solar, onshore, and now also offshore wind, and is projected to double (1,070 GW) between 2022-2027, almost half of all new global renewable capacity in the period, led by solar and wind additions accounting for 90% of the expansion, despite the phasing out of solar and wind subsidies[98].

The country has set very ambitious new renewable energy goals, with market reforms and provincial government support providing a clear long-term revenue certainty for investors. China's 2060 net zero target has accelerated its renewable energy targets, setting the goal of 40% electricity consumption from renewable energy by 2030 (up from 35%), including 1,200 GW of installed solar and wind capacity[99].

China

With FiT and central renewable capacity auctions ending, being transitioned and replaced by provincial auctions and centrally set Renewable Portfolio Standards (RPS), which will set regional guidance to achieve a ratio between hydropower and non-hydropower renewables to reach 40% renewable electricity[100]. Since the end of solar and wind subsidies in 2020, developers now have two options:

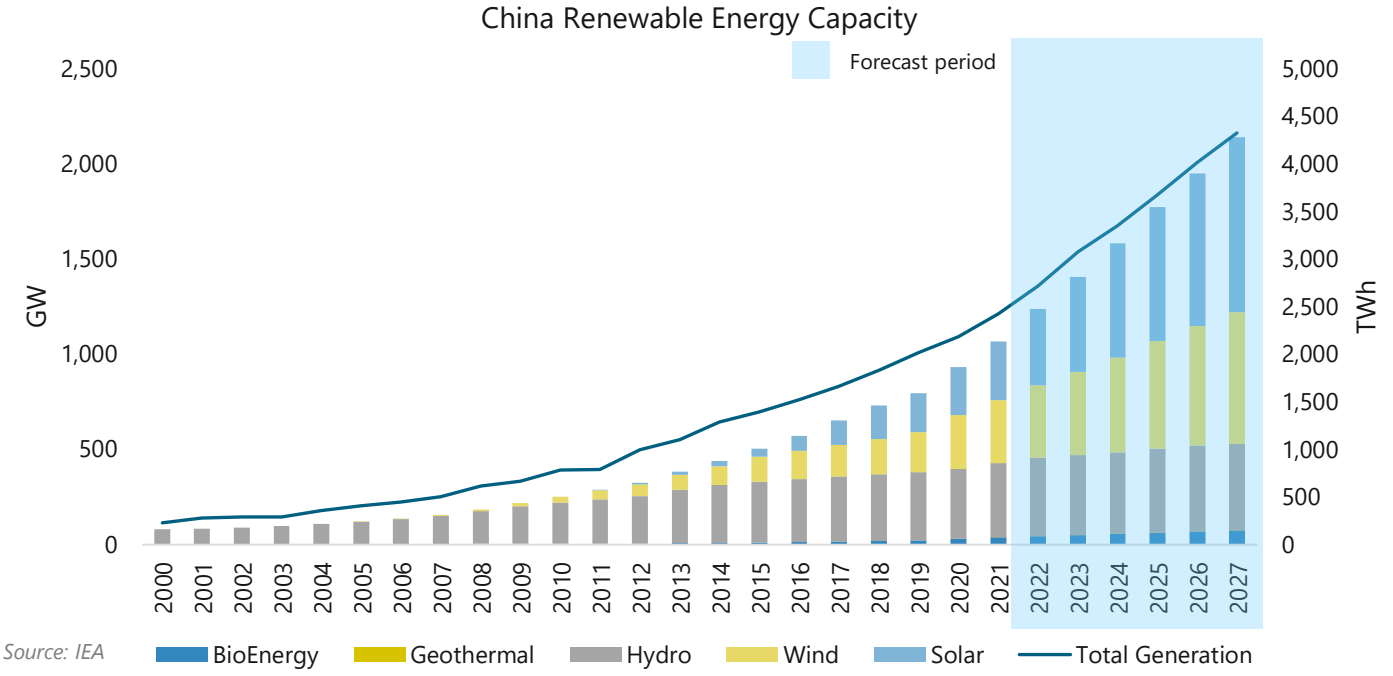
- A 20-year PPA at the provincial benchmark coal power price; or
- Selling electricity in the provincial wholesale power pools and receiving green certificates as a premium as part of the green certificate system from the newly established RPS.

China's 14th Five-Year Plan lays out a framework with a series of targets and actions for renewable energy, shifting its sole focus away from the installed capacity to the share of renewable energy generation, aiming for 33% of renewable generation, including 18% solar and wind by 2025[101].

The 14th Five-Year Plan has four main themes:

- Accelerating large-scale renewable energy capacity expansion;
- Increasing the share of renewables in overall energy generation;
- Shifting away from subsidy focused to free-market-orientated renewable energy deployment with fixed prices;
- Improving the stability and security of the electricity system.

The speed of implementation of China's ongoing policy and market reform remains critical to China adding additional renewable capacity. To support large-scale deployment, the plan proposes that new ultra-HVDC transmission lines be built to increase power export capacity by 2025 from 200 GW to 300 GW[102]. China has consistently outperformed its renewable energy development goals in the last three FYPs, especially wind and solar capacity growth targets.



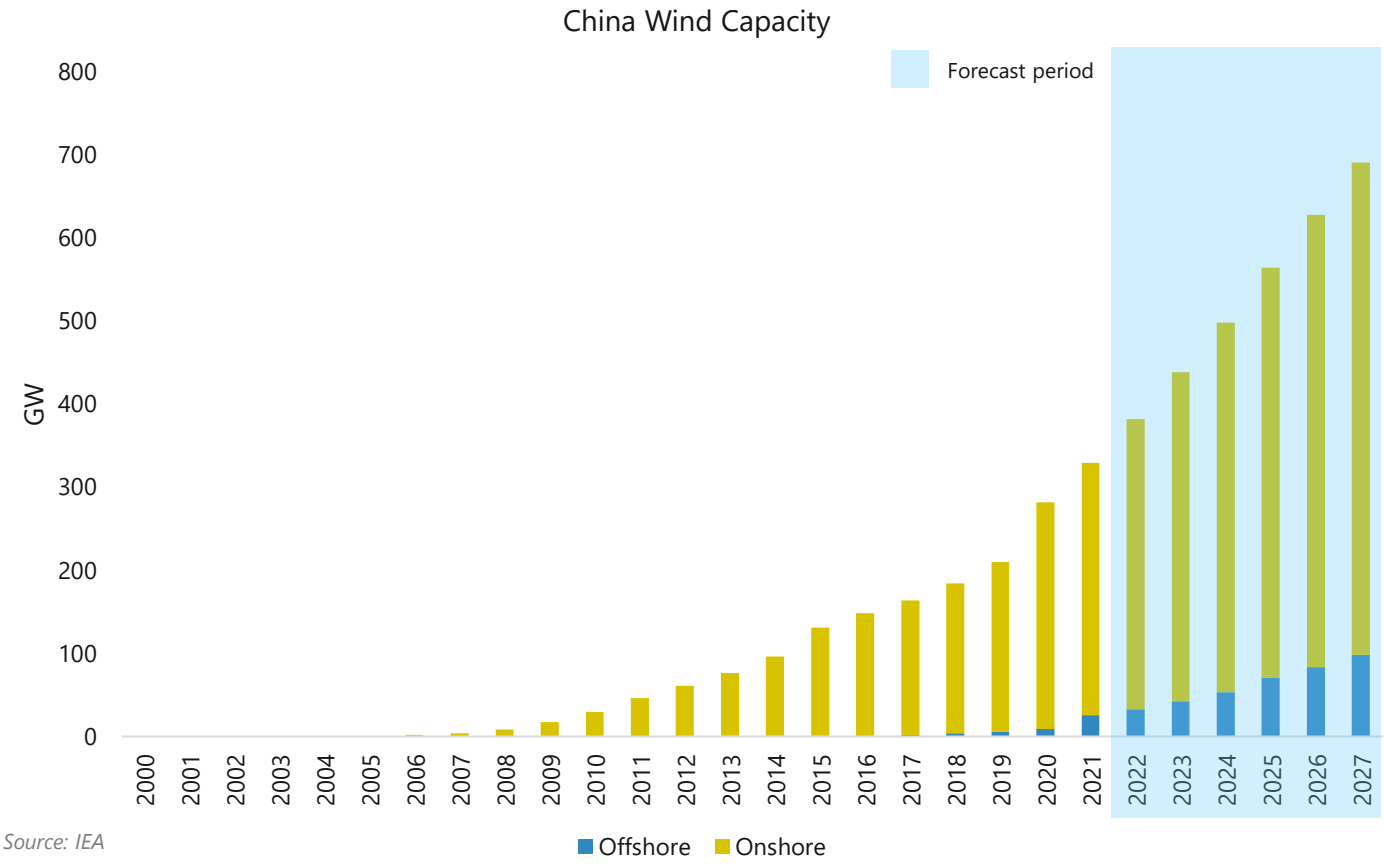
Source: IEA

China

China also aims to increase both onshore and offshore wind, building offshore power "bases" across five regions and easing project permitting. The 14th Five-Year Plan (FYP) targets an increase of 32 GW in offshore wind, a 60% increase from the 13th FYP final installed capacity, within six coastal provinces' energy development plans[103].

The Chinese government have also introduced new targets requiring at least 50% of all new large public buildings and factories to include rooftop solar installations by 2025[104].

The liberalisation of market reforms has enabled new business models for solar and wind projects. This includes large commercial and industrial consumers exposed to the free-market traded electricity prices, dealt with mainly through provincial contracts, corporate PPAs, and bilateral contracting. Whereas residential consumers are relatively sheltered through regulated low electricity prices, provincial incentives via rural economic development programmes support small-scale solar deployment. Additionally, large consumers can sign clean energy PPAs with new projects developed without subsidies; these projects receive a premium through green certificates or environmental attributes above market pricing, improving the economic viability of projects.



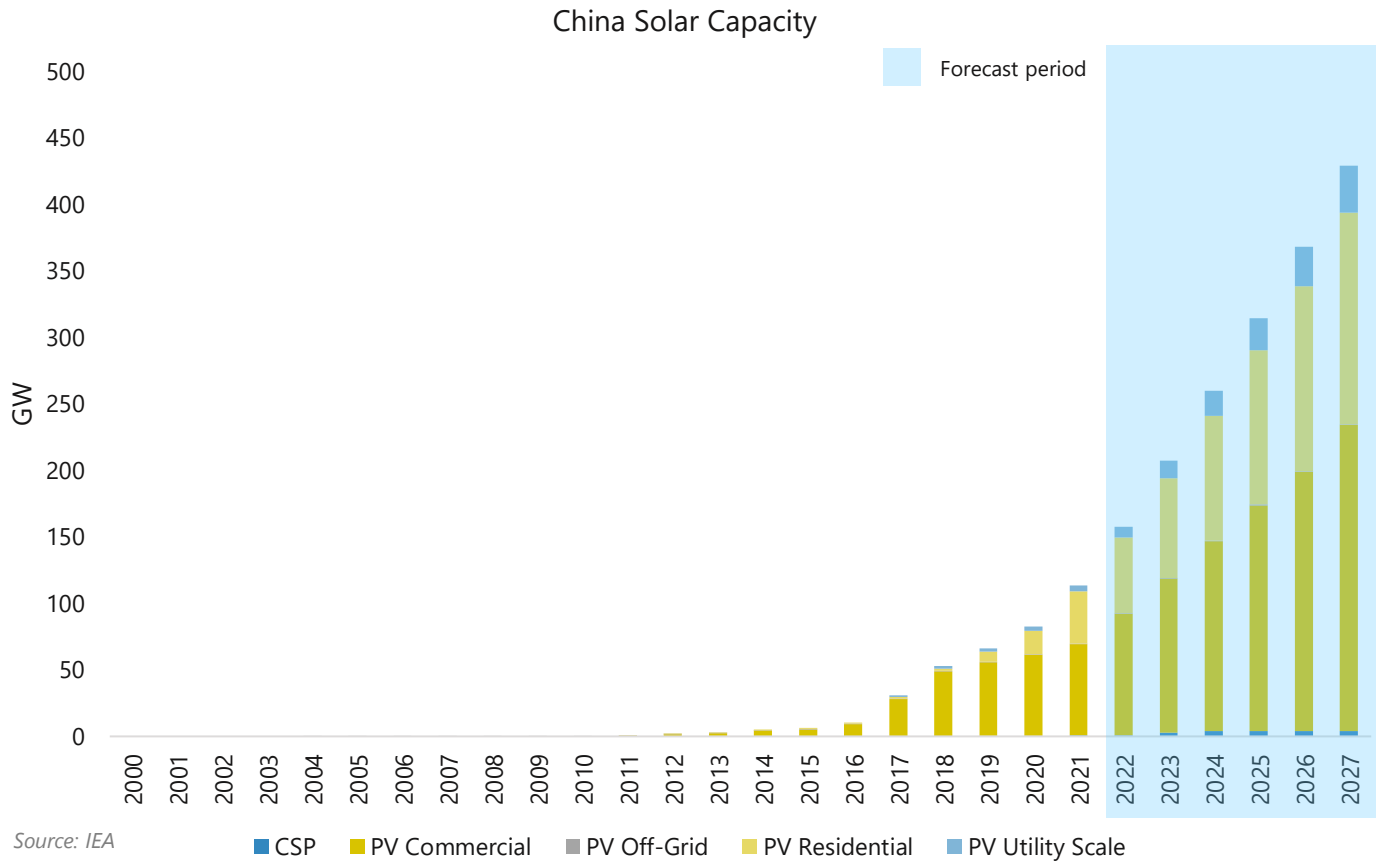
Source: IEA

China

Depending on policy reforms to provide more stable remuneration and further availability of financing capacity, residential and commercial solar could accelerate beyond current forecasts. On the other hand, offshore wind could see further upside with improvements to the supply chain and cost reductions.

China's renewable investments continue contributing to its rising renewable capacity and generally boost economic growth by driving down wind and solar costs and creating economic opportunities in manufacturing and deployment.

Renewable investment has been a crucial economic boost to China, and it will continue to play a significant role in boosting the economy following the fallout of Covid-19 and the impacts of the Russian invasion of Ukraine.



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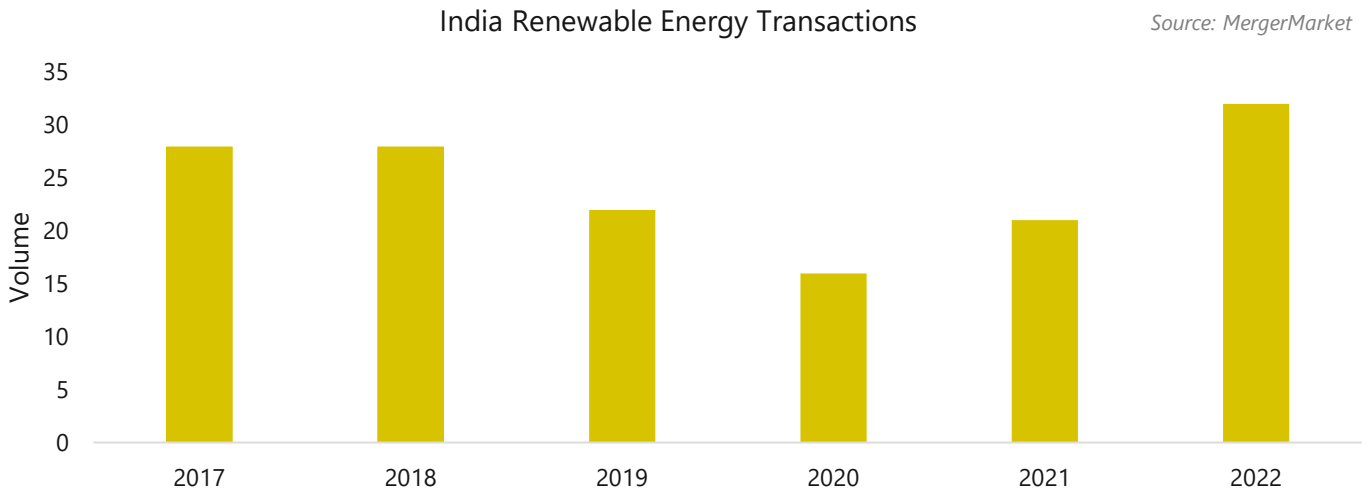
India



India's renewable capacity is expected almost to double, increasing 145 GW between 2022-2027, making India the third-largest renewable energy growth market worldwide – behind China and the US. Capacity expansion is expected to be dominated by solar (75%), onshore wind (15%) and hydropower[105]. Continued pandemic-related restrictions have led to an economic slowdown, with supply chain and logistical issues delaying projects from previously awarded auctions. However, the commissioning of these renewable assets is expected to be accelerated through 2023.

The Indian government continues to support the renewable energy roll-out and transition, setting COP27 targets of 500 GW of non-fossil fuel capacity alongside total electricity generation sourced from a minimum of 50% renewable energy by 2030 and net zero by 2070[106]. Consistent policy support and ambitious long-term targets will enable India to double its renewable capacity by 2027, ensuring long-term revenue visibility for investors and developers.

Government-held auctions remain the central pillar of utility-scale solar and wind growth. However, growing consumer awareness and policy support will increase the speed of distributed solar applications. Recent reform in auction rules has improved competition, with most auctions being oversubscribed. This trend is expected to continue thanks to policy improvements reducing off-taker risks through national auctions and facilitating grid connections and land procurement for the solar parks programme.

Additionally, hybrid auctions that require an amalgamation of multiple renewable technologies to provide a more diversified capacity and boost grid reliability by reducing generation fluctuations are increasing in popularity. These hybrid auctions result in considerably more capacity than what has been contracted alongside energy storage to comply with grid power and balancing requirements; these auctions are expected to be an increasingly important growth driver for expanding development.

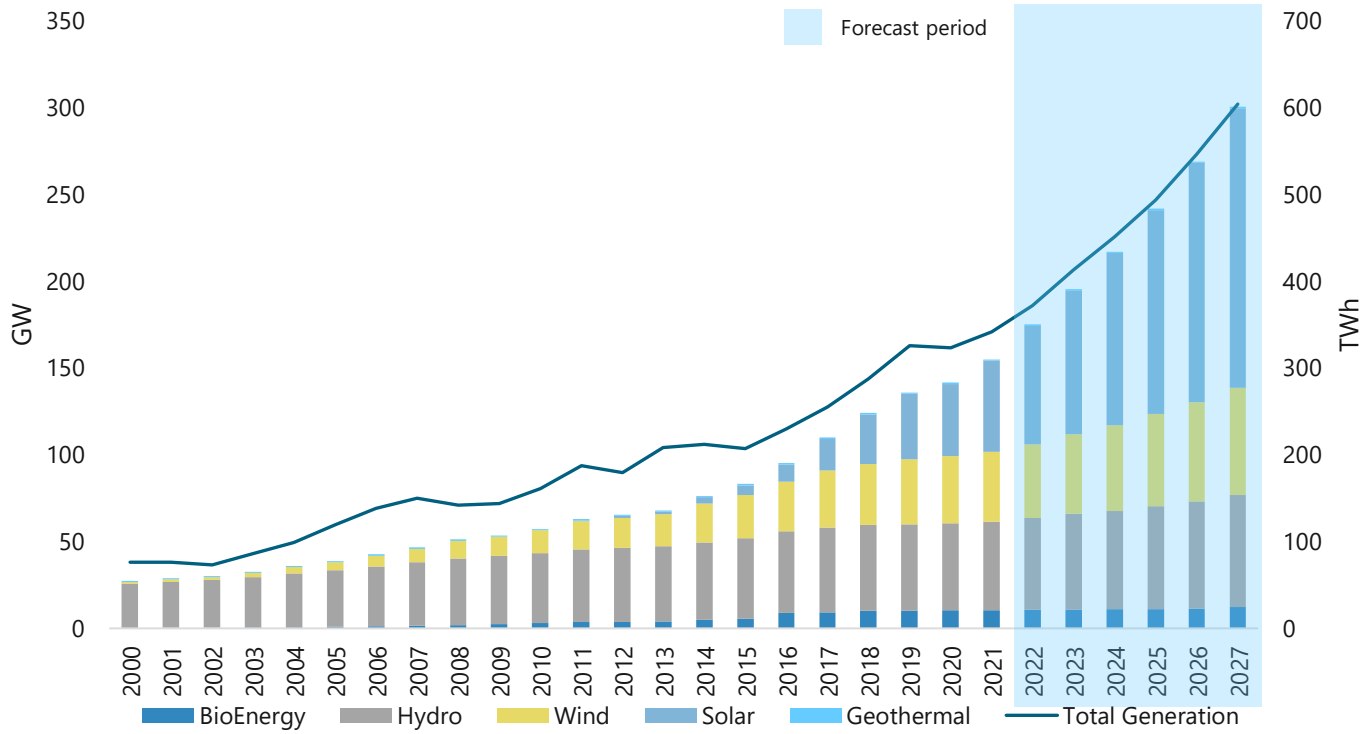
India

India remains a growing market for renewable energy; however, its potential is enormous and comparatively untapped across multiple sub-sectors. The Indian Ministry of New & Renewable Energy (MNRE) estimates a potential renewable energy capacity of around 1,700 GW, with 750 GW from solar, 695 GW from wind, over 210 GW from hydropower and 45 GW from bioenergy[107]. Given the appropriate land, the scale for ultra-mega utility-scale solar projects in India is vast, with over 750 GW of potential capacity[108].

However, the financial viability of India's distressed distribution companies (DISCOMs) remains the weakest link in India's renewable energy expansion. The DISCOMs poor financial health has strained the sector due to its failure to pay power generators timely, and manage losses, amongst other inefficiencies – these all continue to risk project delays and cancellations. This has led to delays in signing PPAs for auction winners, resulting in further project delays and cancellations. Payment delays are also leading to an excessive (and growing) receivables balance from off-takers and increasing net working capital debt for renewable energy companies.

The reformation of DISCOMs remains on the agenda for India and will be critical to its renewable energy expansion, including privatisation which remains an option which policymakers are contemplating. The government has implemented a DISCOM stimulus programme worth $41bn to roll-out smart and pre-paid meters to reduce DISCOM losses and reduce the revenue gap between the cost of power procurement and electricity tariffs[109]. The government has also allowed the nationalised DISCOMs to terminate PPAs with coal-based plants over 25 years old, reducing capacity payments and leading to a further expansion of renewable energy across the distribution network[110].

India Renewable Energy Capacity



Source: IEA

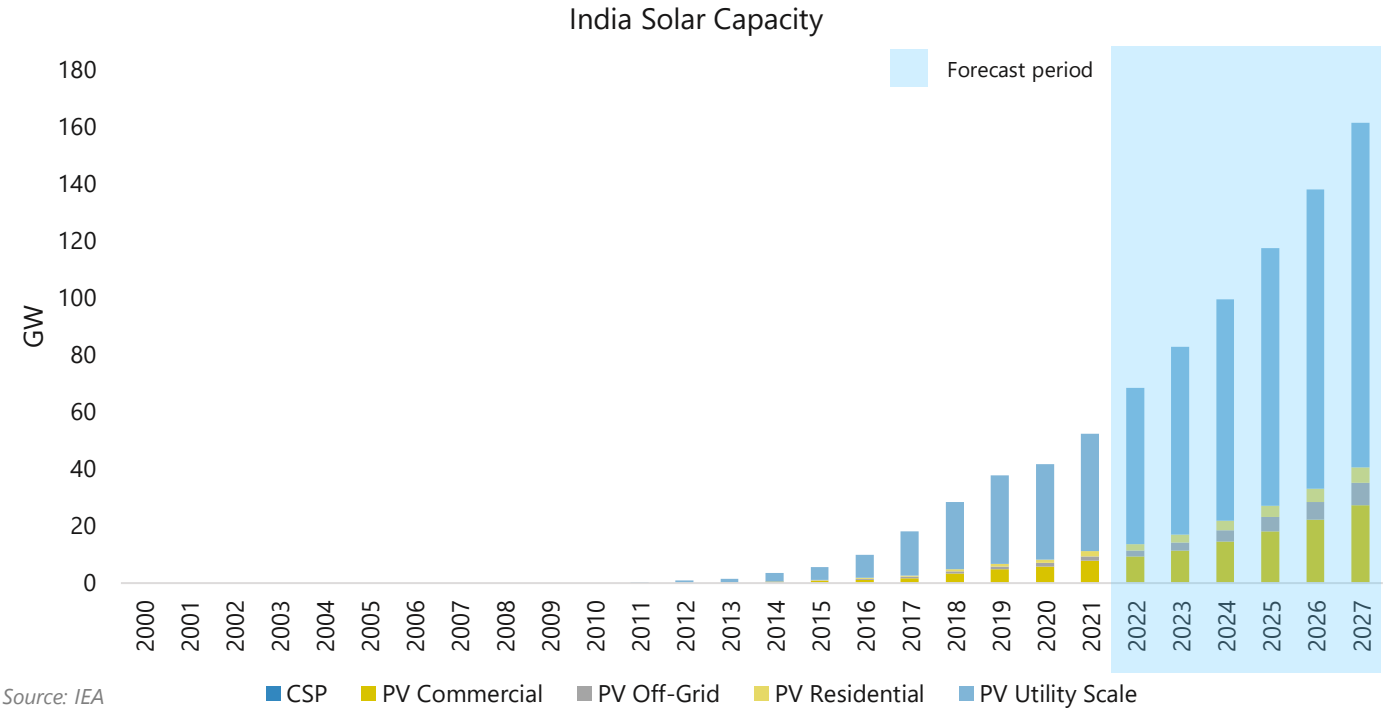
India

However, India has seen rising solar costs with a reversal of historical price reduction trends due to inflation and trade policy changes. This includes increasing the duty on solar PV modules and cells from large manufacturing countries, including China, which increased from 15% to 40% for modules and 25% for cells in 2022[111]. Alongside a requirement for developers winning public auctions from April 2021 to use domestic module manufacturers, which will lead to short-term transitory price increases in solar commissioning in utility-scale projects whilst India levels up its manufacturing quantity and quality to match its trade policies.

This is being supported by the government's production-linked incentive (PLI) scheme, whereby domestic module manufacturers receive incentives over five years post-commissioning of solar projects (PLI has also recently been extended to include energy storage manufacturing) aiming to increase manufacturing to over 70 GW by 2030[112].

Long-term supply-demand synergy should stimulate capacity growth; however, short term, this could increase further cost pressure on developers and may cause project delays or cancellations.

Distributed solar additions are expected to accelerate due to their growing public awareness, economic attractiveness, and continued government support. Policy changes include an increased generation capacity eligibility limit from 10 KW to 500 KW for net metering and further beneficial rules for commercial/industrial installations, increasing commercial growth.



Source: IEA

India

Yet, problems persist, blocking distributed solar from reaching its full potential. DISCOMs who fear revenue losses from self-consumption, incurring higher grid costs from distributed solar, and limited funding options for residential and commercial customers due to relatively expensive transaction costs are some of the issues they are facing. A lack of specialised funding options alongside an unfit credit rating system creates a significant hurdle domestically, with insufficient public education and understanding of solar only further hindering this exploration.

The wind expansion will require government support to aid the procurement of appropriate land, obtaining grid connections, and a reversal of the continued delay in securing PPAs as well as supply chain disruptions and increased raw material costs which have made many projects economically unattractive. The Indian government is altering its wind auctions to a sealed-bid auction, which could raise tariffs and make projects more financially attractive. The new wind renewable purchase obligation should encourage DISCOMs to sign PPAs despite the higher energy prices.

However, the government's Green Energy Corridor has been introduced to install intrastate and interstate dedicated grid connections, transmission lines and substations for renewable energy in remote locations. This includes a submarine HVDC interconnection for 1000 MW of offshore wind off the Gujarat coast[113].

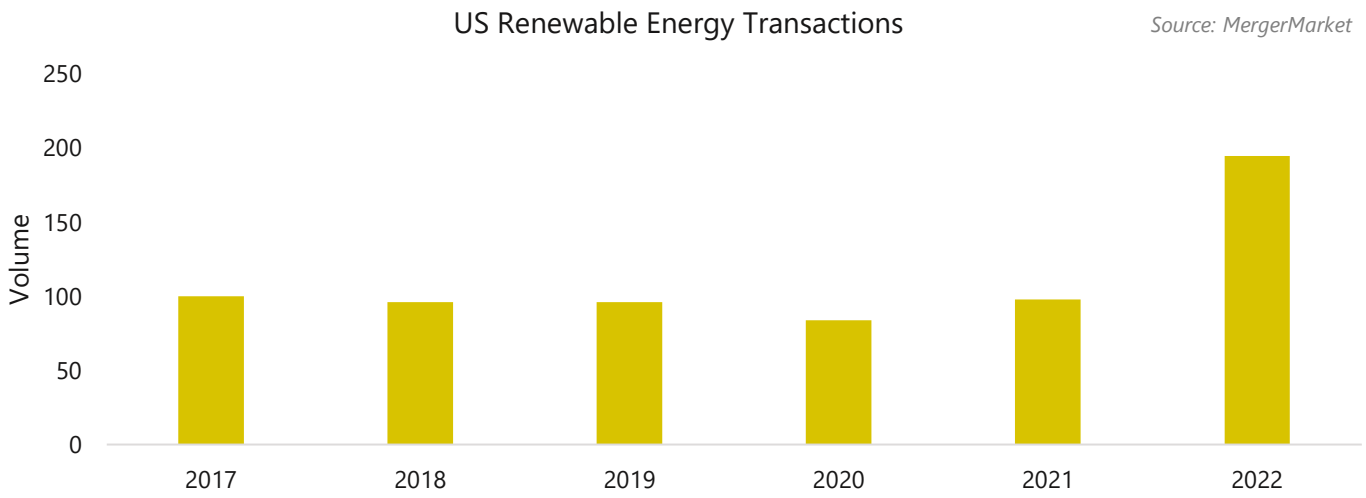
India has implemented numerous favourable environmental policies and a regulatory framework to expand its renewable energy capacity and attractiveness to potential investors. The government have taken a multifaceted policy approach from the MNRE and the Renewable Energy Investment Promotion and Facilitation Board (REIPFB) which facilitates and assists investors in renewable energy projects and further deployment of capital throughout India. Shifting its energy balance towards a renewable focus aligned with its COP27 targets and commitments under the Paris Climate Agreement will fulfil its energy sustainability goal. Resultantly, the renewable sector is crucial to power generation and the overall economy.

A continued positive policy environment from the government is vital for the continued expansion of renewable energy. India fell marginally short of contracting record solar and wind capacity expansion (175 GW) by 2022. This recent historically supportive government policy has encouraged investment from the domestic private sector and overseas investors. The private sector has been at the forefront of investment in India's expansion, in addition to sovereign wealth funds, which have been active investors owing to their low cost of capital. This low-cost, long-term diversified capital from the public and private sectors will be crucial to India meeting its renewable energy goals.

The Americas

- The US is the third largest renewable energy market, marginally behind China and Europe.
- The US has set ambitious environmental targets of a 2050 net zero target, a 100% decarbonised power sector by 2035, and a 50% reduction in greenhouse gas emissions by 2030.
- Latin America has historically seen its renewable generation dominated by large-scale hydropower, but now it is also deploying significant non-hydropower resources through both utility-scale solar and wind expansions.
- Brazil's government policy looks to increase its impetus for renewable energy expansion, with revised COP27 targets, reducing emissions by 50% by 2030 and net zero by 2050 – accelerated from 2060.

The US



The US is the third largest renewable energy market; marginally behind China and Europe, its renewable capacity is expected to increase by 74% (280 GW) between 2022-2027. Almost all growth is attributed to solar, onshore and offshore wind[115].

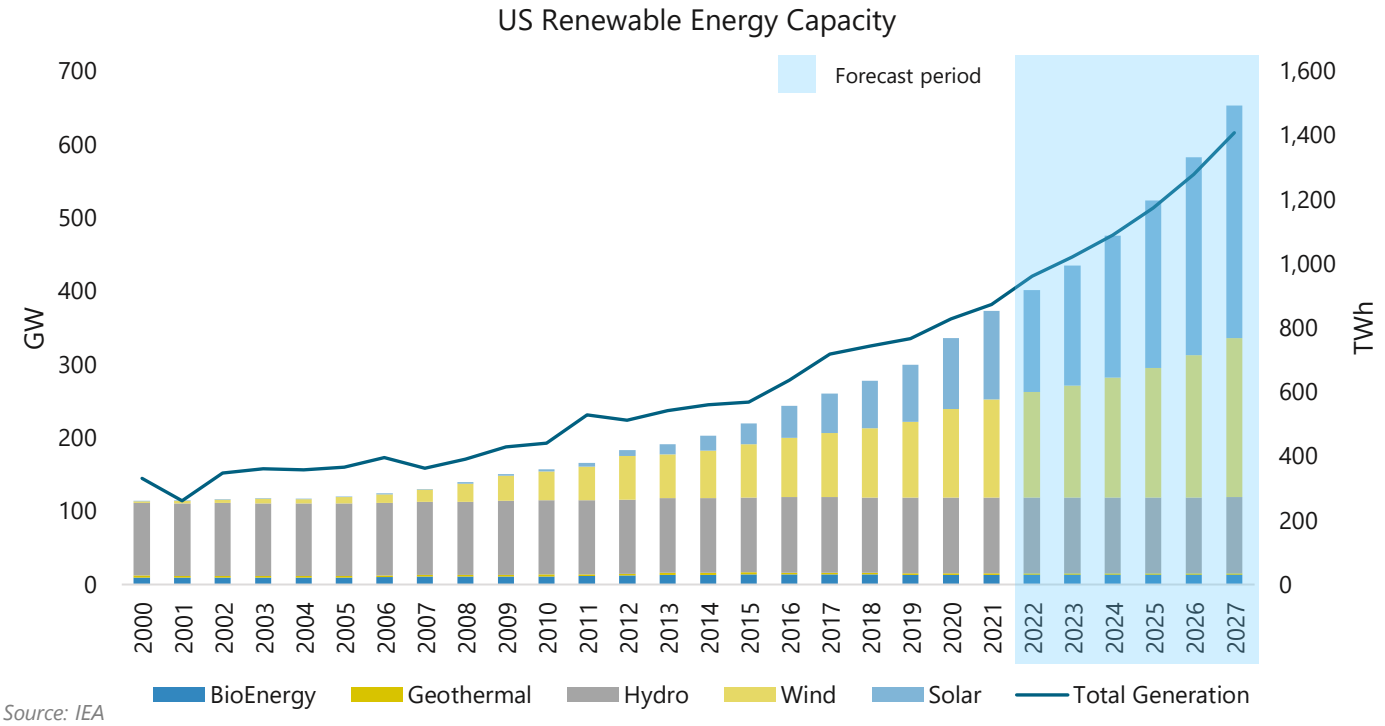
The US government passed the Inflation Reduction Act (IRA) in 2022, which extends Investment Tax Credits (ITC) and Production Tax Credits (PTC) for renewables until 2032, providing unprecedented long-term investment viability for wind and solar projects[116]. These incentives should support the US in meeting its ambitious environmental targets of a 2050 net zero target, a 100% decarbonised power sector by 2035, and a 50% reduction in greenhouse gas emissions by 2030[117].

The US' renewable growth is powered by state-level renewable targets, with 37 states setting Renewable Portfolio Standards (RPS), federal tax incentive schemes and the increasing economic attractiveness of corporate procurement of renewable energy.

The extension of tax credits is driving distributed solar growth, in addition to the favourable economics of the net metering schemes, consumer demand for energy security and self-consumption, and the boom in home renovations that was evidenced during the pandemic.

The US

The US Department of Energy's (DoE) Solar PV Futures Study[117] has found that with cost reductions, a supportive policy environment, and large-scale electrification (including EVs, water heating and building space), the US' solar potential is vast and could account for 40% by 2035 and 45% by 2050 of all electrical generation. However, this requires expanding energy storage capacity alongside increased smart grid technology for transmission expansion and flexibility in both load and generation for improved grid reliability and resilience.



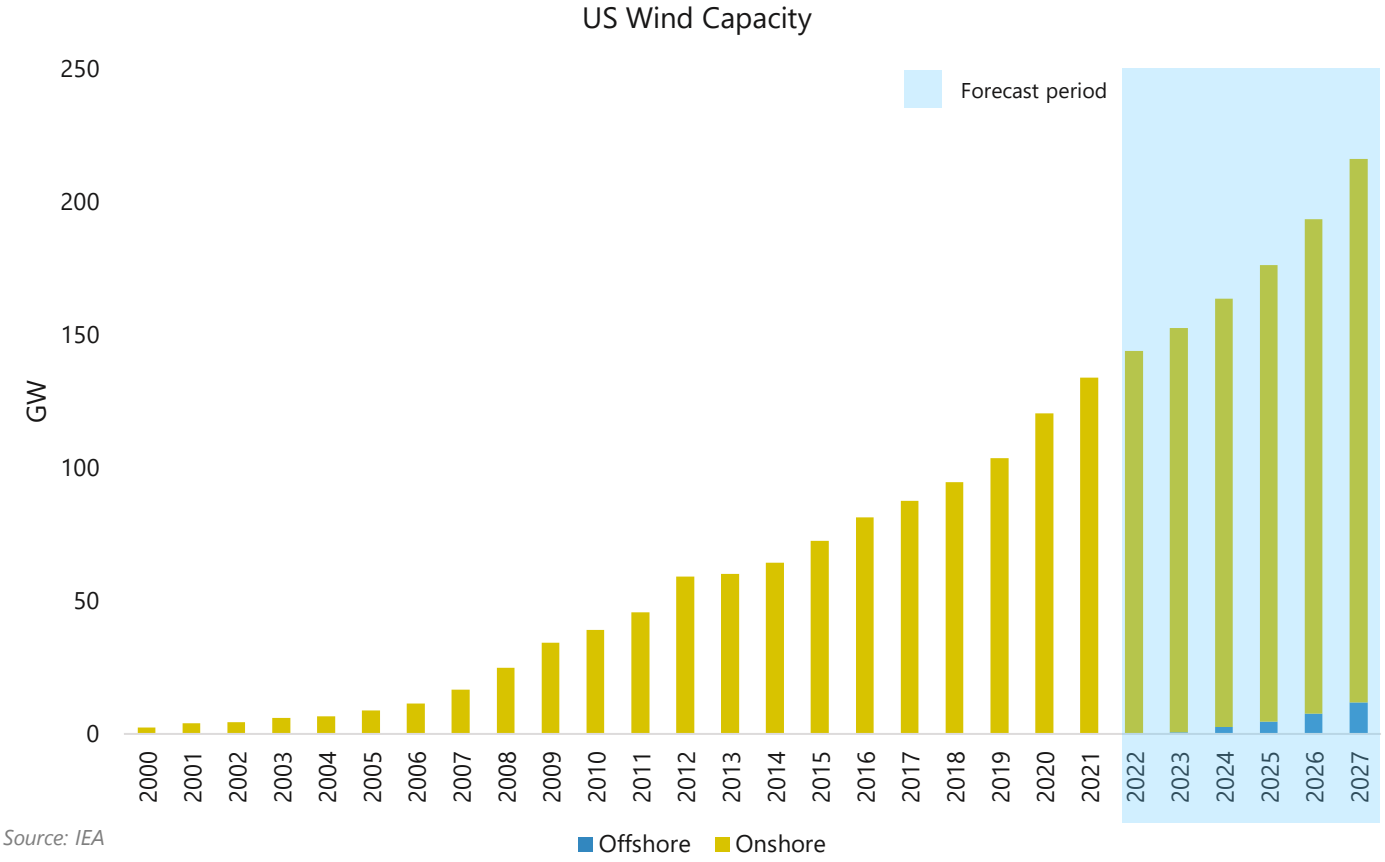
Source: IEA

The US aims to have 30 GW of offshore wind by 2030, expanding to 110 GW by 2050 (increased from 22 GW and 86 GW, respectively, by the Biden administration), with generation across multiple regions, including the East and West Coasts, the Great Lakes and the Gulf of Mexico. However, this will require a more efficient and streamlined permitting process, more turbine installation vessels (WTIVs) and new areas for development. Historically, the offshore wind market has been constrained by permitting, regulatory frameworks, litigation, stakeholder opposition and unfavourable price comparatives in the energy market. Whilst the federal policy is improving the momentum of the offshore wind roll-out, barriers still exist, including stakeholder opposition mainly from commercial fisheries and coastal populations and a need for more sufficient transmission infrastructure, which will require upgrading to new infrastructure and utilising energy storage.

The US

The US government should look towards the well-advanced European offshore wind industry and learn from it to design a large-scale integrated system, an offshore grid, ports and domestic supply chains to scale towards its targets quickly.

The IRA incentive and long-term certainty will lead to the US onshore wind capacity expansion, ending historical boom-bust cycles fuelled by short-term policy extensions.

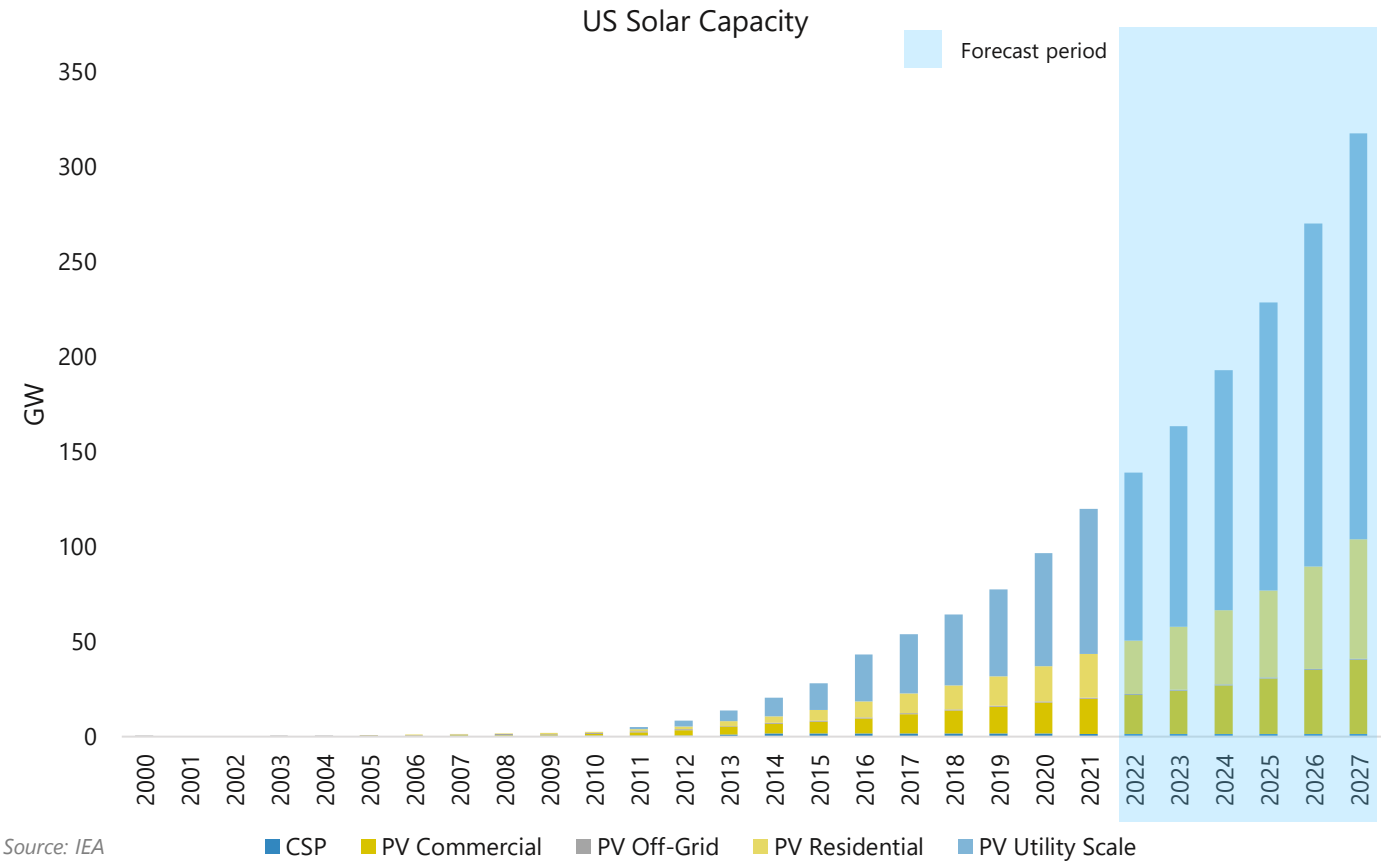


Source: IEA

The US

Critical challenges to the US' roll-out remain, including increasing commodity prices, import duties and anti-dumping levies impacting investment returns and transmission and distribution infrastructure requiring significant upgrading. During 2022, there were delays in rolling out both utility-scale solar and wind projects due to supply chain challenges and rising costs, alongside import tariffs and measures adding further complications. The US anti-dumping and circumvention investigation into SE Asian exporters of solar modules has been suspended for two years; however, the uncertainty surrounding the measures impacted investment decisions and pushed the project pipeline out due to delays. In combination, the Uyghur Forced Labour Act came into force in June 2022, requiring documentation confirming that no forced labour was used in manufacturing imports from China's Xinjiang province, further adding to delays due to extra compliance procedures on the import of solar equipment to developers.

However, with federal tax incentives being expanded with support for labour and domestic-content bonuses, alongside an alignment of federal and state policy to work in harmony, with improvements and upgrading of the transmission and grid infrastructure – utility-scale projects become more economically attractive.



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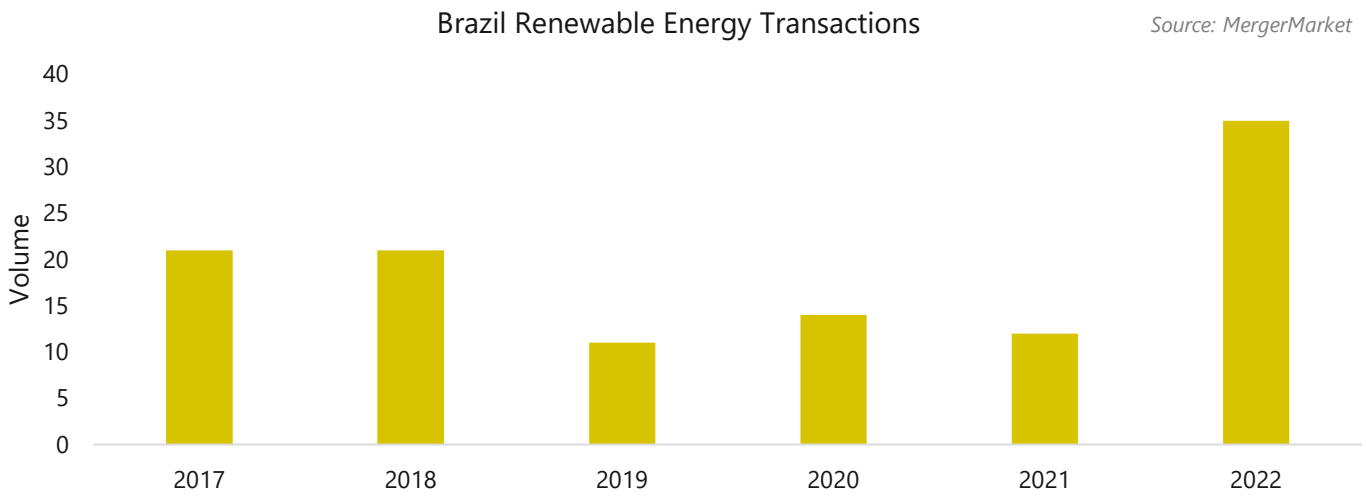
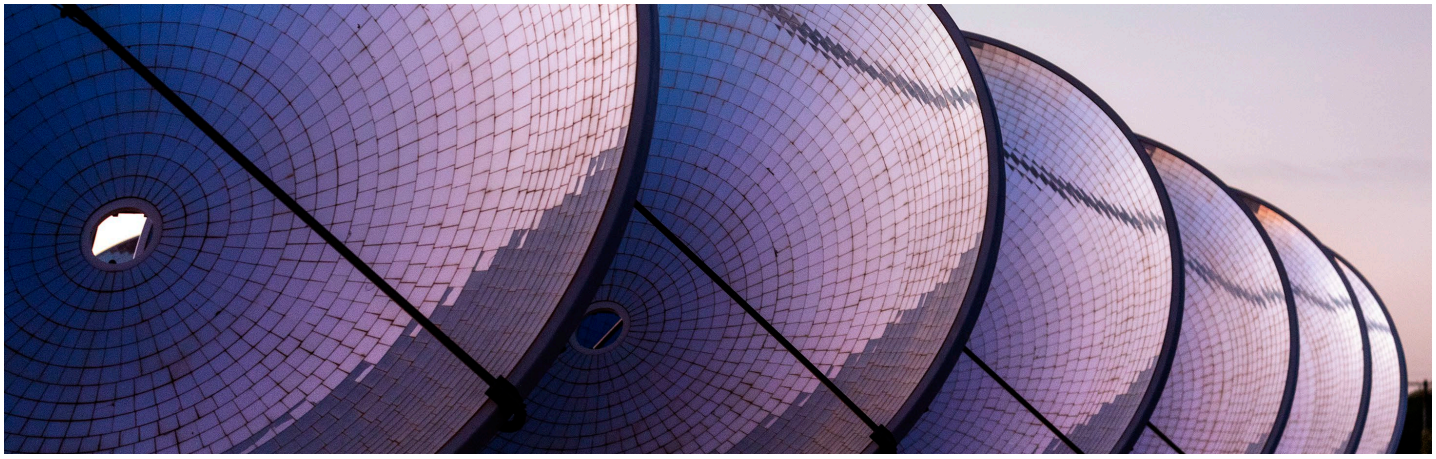
Brazil



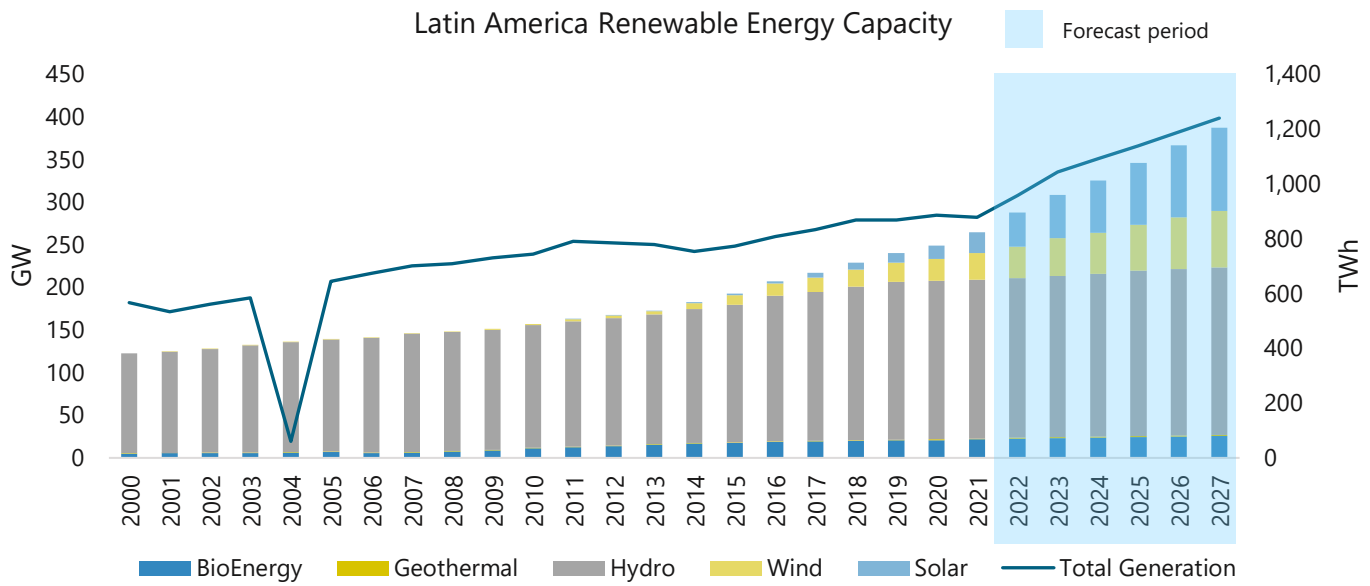
Latin America has continued its roll-out of renewables, mainly owing to its abundance of solar, wind and hydropower potential. Latin America has historically seen its renewable generation dominated by large-scale hydropower, but now it is also deploying significant non-hydropower resources through both booming distributed solar and utility-scale solar and wind expansions. This theme is expected to grow due to lengthy droughts affecting hydropower production.

Brazil continues to be the largest market in Latin America, with an expansion of 70 GW expected between 2022-2027, with the majority of this being expanded solar and wind, supported by the free market and deadlines for onshore wind auctions and distributed solar benefits[118].

Brazil's government policy looks to increase its impetus for renewable energy expansion, with revised COP27 targets, reducing emissions by 50% by 2030 and net zero by 2050 – accelerated from 2060[119].

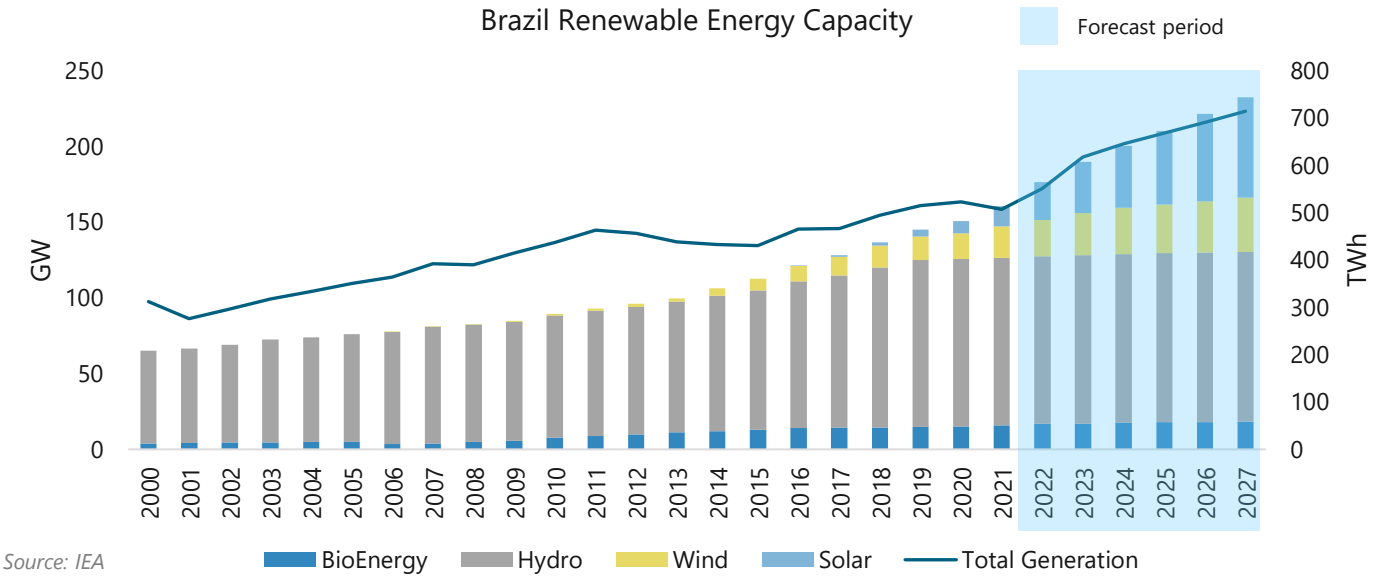


Brazil



Source: IEA

Hydropower remains the largest source of Brazil's electricity production at 61%[120]; however, droughts have caused historical record 92-year lows in water flows. These extreme weather events are expected to continue and become more frequent. Brazil is expected to continue to roll-out further hydropower projects; however, as a percentage of overall generation, this is expected to drop to 49% by 2030[121] as Brazil diversifies its renewable energy capacity through solar and wind.



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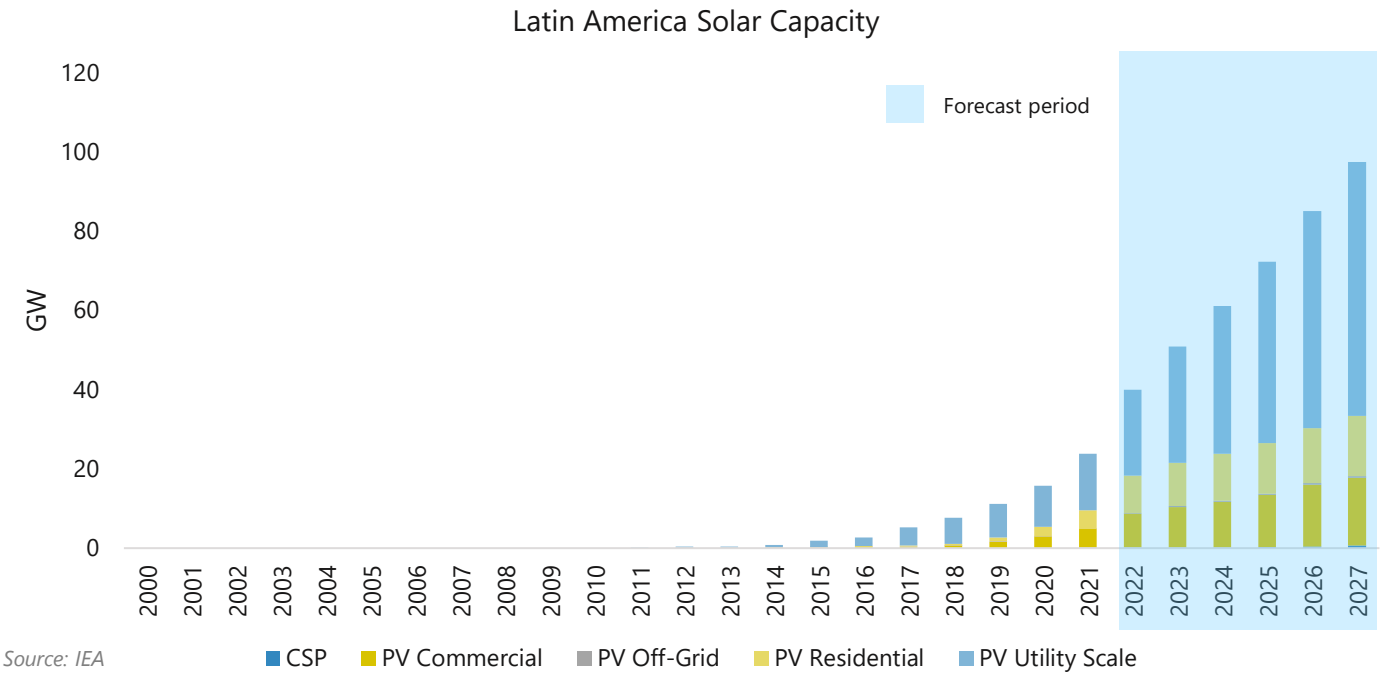
Brazil



Source: IEA

The solar expansion will primarily be through distributed projects. However, power market reform in Brazil's generous net metering compensation scheme, whereby reducing the value of surplus production that can be offset against distribution, is expected to end in 2024, leading to a slowdown in the roll-out as the economic viability of systems becomes squeezed. However, systems installed within 12 months of the new rules will not be affected, and therefore we expect a rush in the roll-out of installations through 2023 before the reform is implemented.

Utility-scale solar and onshore wind expansion is being driven predominantly through the free bilateral market, in addition to previously awarded auction capacity. 85% of the utility-scale solar and onshore wind are developed through this route; as uncertain future demand led to lower government auction capacity, utilities acquired less renewable energy capacity through government-held auctions[122].

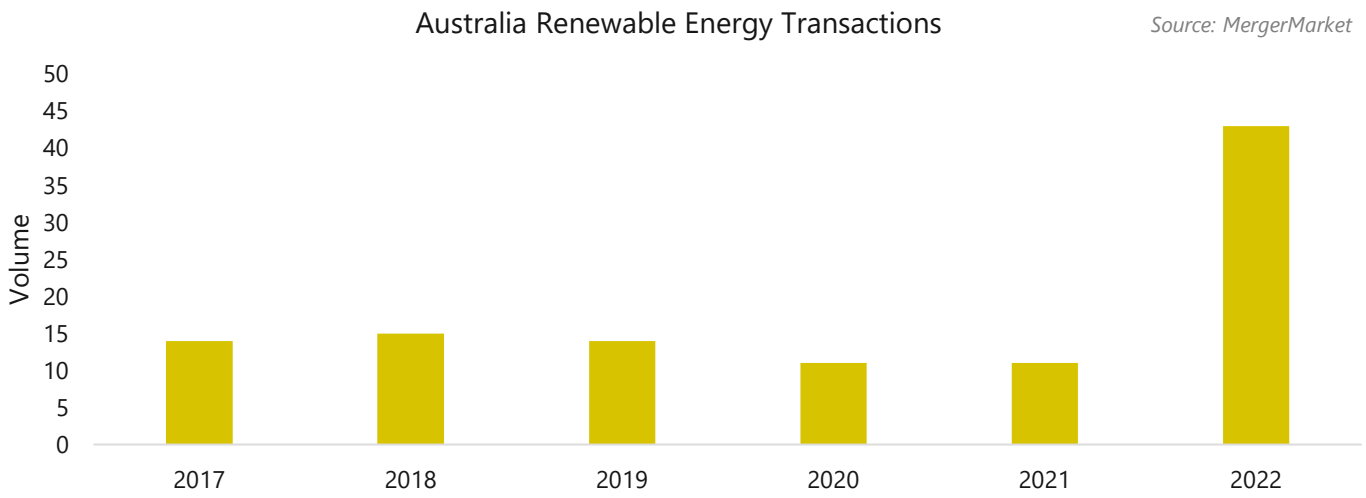
Economic recovery from the pandemic and increasing electricity demand could accelerate further renewable energy deployment via government-held and free-market auctions, increasing utility-scale solar and onshore wind. Renewable investments in Brazil will be desirable during this economic recovery due to the relatively cheap asset value compared with other regions offering an excellent return potential to investors.

Oceania

- Australia’s renewable capacity is projected to increase by 85% between 2022-2027, driven mainly by the nation's federal and state renewable energy targets, targeting net zero by 2050.

- Australia is one of the most ideally placed regions to take advantage of hydrogen, given its natural potential for solar deployment and wind resources around its coasts.

Australia

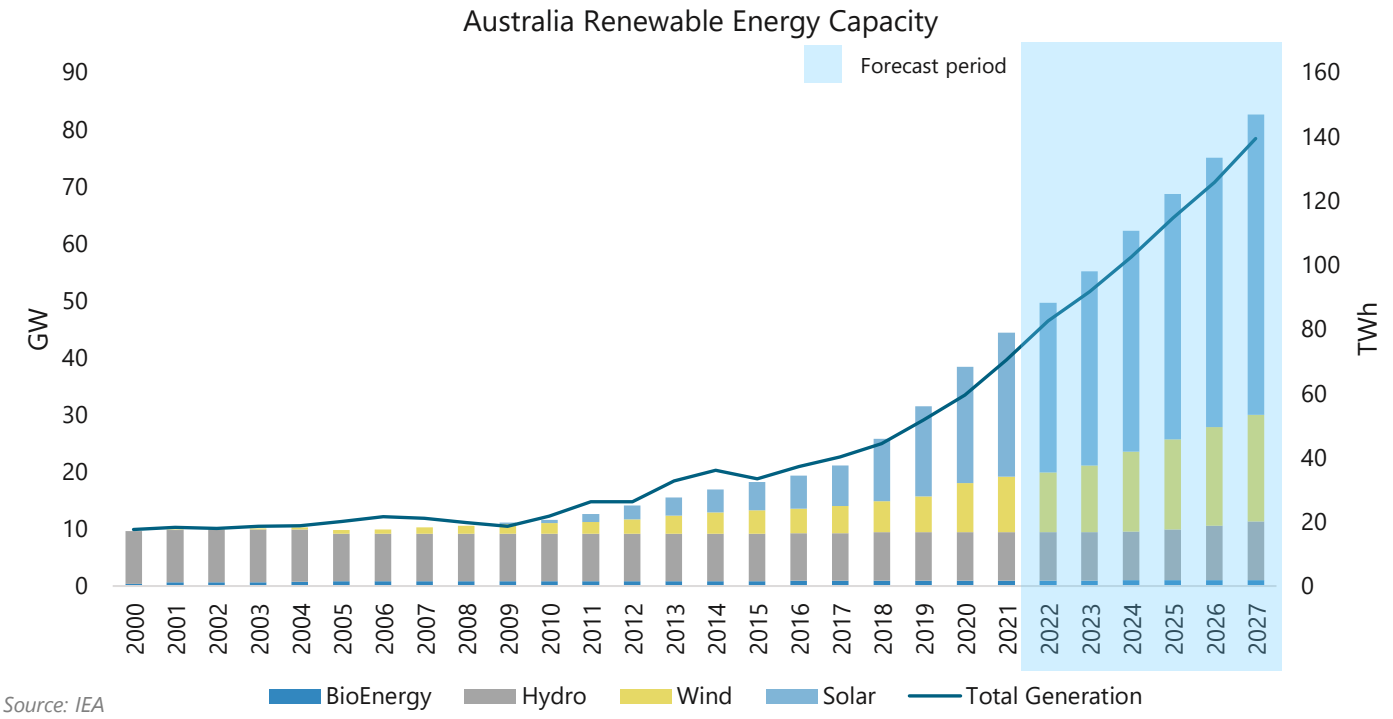


Australia's renewable capacity is projected to increase by 85% (40 GW) between 2022-2027[123]. Driven mainly by the nation's federal and state renewable energy targets, state-level auctions incentives for solar and corporate PPAs, targeting net zero by 2050[124].

Growth is driven mainly by distributed solar, with over 10 GW of new capacity, powered by favourable economics from subsidy support schemes such as the state-level FiTs expansion and the small-scale certificate federal scheme. However, this growth is expected to be tempered by higher system costs and new charges for exported power.

States have set additional targets after federal large-scale renewable energy targets (LRET) were achieved in 2019. Australia's Climate Bill 2022 aims to reduce carbon emissions by 43% by 2030 from 2005 levels and reach net zero by 2050.

Australia



Source: IEA

Utility-scale solar and onshore wind will expand by over 20 GW thanks to projects associated with emerging Renewable Energy Zones (REZs), energy revenue from government-held auctions and PPAs with government, utilities and the private sector acting as a hedge against wholesale energy price volatility, in addition to certificate revenue from the governments oversubscribed LRET programme which is due to end in 2030. However, some challenges still need to be addressed, mainly associated with the transmission infrastructure causing project delays. Although the government have implemented network upgrades and established large-scale renewable deployment in REZs, this should tap into additional grid capacity and enable further deployment.

Australia

Australia is one of the most ideally placed regions to take advantage of hydrogen, given its natural potential for solar deployment and wind resources around its coasts. Given this, Geoscience Australia estimates that around 11% of Australia would be suitable for renewable hydrogen production, with 3% ideal for production given its proximity to water, which is required for hydrogen production[125].

With the global energy sector transitioning towards clean, flexible, storable and safe energy sources, hydrogen has attributes that match those requirements, producing zero carbon emissions and usability across a range of industries and settings.

Australia continues to lead the charge worldwide in terms of progressing its hydrogen technologies and is betting big on its national hydrogen strategy, as is the IEA, which predicts significant growth in hydrogen demand and its growing importance to net zero strategies. Australia is making historical step changes in the efficiency of electrolysers to push the timeline ahead for green hydrogen to seek parity with fossil fuels as an alternative energy source as well as its impact on storage and distribution. This will enable a vast progression towards net zero and decarbonisation, particularly in industries and transport where current technologies make electrification difficult or too expensive.

Australia is ideally positioned to take advantage of hydrogen technologies given its historical reputation for building large-scale power industries and its potential to consume hydrogen domestically across industries and as an exporter to other geographically well-placed nations. These nations, including China, Japan and Korea, are committed to using hydrogen to reach net zero or decarbonise their power systems.

Australia has vast swathes of potential and large ambitions which could power it forward to compete for further investment with some of the larger renewable energy markets worldwide.

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Relevant Deals

Selected Renewable Energy sector credentials completed by DSW:

Absolute Solar & Wind Ltd	**ADEV Environment**	**APEM Group Limited**	**APEM Limited**	**Aquafact International Services Limited**	**Biocensus Ltd**	**Boden + Wasser GmbH**
Sold to	Sold to	Backed by	Backed by	Sold to	Sold to	Sold to
RSK Group Ltd	**RSK Group Ltd**	**CYBG Plc**	**Westbridge Capital**	**APEM Group**	**RSK Group Ltd**	**RSK Group Ltd**
Solar	*Infrastructure*	*Wind*	*Hydroelectric & Wind*	*Wind*	*Infrastructure*	*Infrastructure*
Buy Side	Buy Side	Re-Finance / Debt Advisory	Buy Side	Buy Side & Due Diligence	Buy Side	Buy Side

Carbon Zero	**CBEC Eco Engineering Limited**	**Consents Solutions Ltd**	**Cumbria Access Services Ltd**	**Dr Tillmanns & Partner**	**Drilling Supplies and Hire Services Ltd**	**Marsh Systems**
Sold to	Sold to	Sold to	Sold to	Sold to	Sold to	Sold to
RSK Group Ltd	**RSK Group Ltd**	**RSK Group Ltd**	**RSK Group Ltd**	**RSK Group Ltd**	**RSK Group Ltd**	**BAS**
Infrastructure	*Infrastructure*	*Infrastructure*	*Wind*	*Infrastructure*	*Infrastructure*	*Infrastructure*
Buy Side	Buy Side	Buy Side	Buy Side	Buy Side	Buy Side	Buy Side

GoBe Consultants Limited	**Ground Heat Installations Ltd**	**Inis Environmental Consultants Ltd**	**Nicholas O'Dwyer Ltd (based in the ROI)**	**Optisol**	**RSK Oribital Limited**	**Stephenson Halliday Limited**
Sold to	Sold to	Sold to	Sold to	Sold to	Sold to	Sold to
APEM Group Limited	**RSK Group Ltd**	**RSK Group Ltd**	**RSK Group Ltd**	**RSK Group Ltd**	**RSK Group Ltd**	**RSK Group Ltd**
Wind	*Infrastructure*	*Infrastructure*	*Infrastructure*	*Solar*	*Infrastructure*	*Infrastructure*
Buy Side & Due Diligence	Buy Side	Buy Side	Buy Side	Buy Side	Buy Side	Buy Side

Twig Trading Ltd	**Windtech**	**Woodrow Sustainable Solutions**	**Geocore Site Investigations Ltd**	**Moixa**
Sold to	Sold to	Sold to	Sold to	Sold to
RSK Group Ltd	**RSK Group Ltd**	**APEM Group**	**RSK Group Ltd**	**Tokyo Electric Power Company Holdings, Inc. and Greater Manchester Combined Authority First Imagine! Ventures LLP**
Solar	*Wind*	*Infrastructure*	*Infrastructure*	*Battery Storage*
Buy Side	Buy Side	Buy Side & Due Diligence	Buy Side	Due Diligence

Relevant Deals

Selected Renewable Energy sector credentials completed by the Pandea Global M&A network:

Corrosion Sold to **Nordian Capital Partners** *Wind* Sell Side	**Santon Group** Sold to **discoverIE** *Solar* Sell Side	**Powersonic** Sold to **Blackbird** *Battery Storage* Re-Finance / Debt Advisory	**Filtrexx** Sold to **Mativ** *Solar* Sell Side	**Siemens Gamesa** *Wind* Strategic Advisory	**Aventron** *Wind, Solar & Hydro* Strategic Advisory	**Cox Energy** *Solar* Strategic Advisory
KST Solar Energy Sold to **Teralight Innovative Energy** *Solar* Sell Side	**Brenmiller Energy** *Storage* Strategic Advisory	**Yuzhne Energy / 4 Wind** *Wind* Sell Side	**Sun Investment Group** *Solar* Sell Side	**Orion Alternative Energy Fund** *Wind* Fundraising	**Vėjo Spektras** Sold to **Inter RAO Lietuva** *Wind* Sell Side	**Sale of Company Solar Power Park** *Solar* Sell Side
Ascometal Sold to **BKW** *Hydroelectric* Sell Side	**Envy** Sold to **Assystem** *Solar* Sell Side	**Balestra** *Infrastructure* Sell Side	**Project Aurora** *Solar* Fundraising	**Iberol** *Biofuel* Valuation	**CEMSI** Sold to **Kontrol Energy Corp** *Infrastructure* Buy Side	**Lifepowr** *Storage* Fundraising
CFE *Renewables* Fundraising	**CFE** *Renewables* Fundraising	**Blue Global Energy** Sold to **Iberdrola** *Solar* Sell Side	**Blue Global Energy & Mitsui Tokyo Gas** *Solar* Fundraising	**PSEG** Sold to **Electroanders / SAESA / Frontel** *Hydroelectric* Buy Side		

Glossary

$	US Dollar
€	Euro
£	Great British Pound
AUD	Australian Dollar
bn	Billion
CfD	Contract for difference
COP27	United Nations Climate Change Conference or Conference of the Parties of the UNFCCC, more commonly referred to as COP27.
CSP	Concentrated Solar Power
DISCOMs	Distribution Companies
EaaS	Energy-as-a-Service
EEG	Renewable Energy Sources Act
ESG	Environmental, Social and Governance
EU	European Union
FACTS	Flexible Alternating-Current Transmission Systems
FiT	Feed-in-Tariff
FYP	Five-Year Plan
G20	The G20 or Group of Twenty is an intergovernmental forum comprising 19 countries and the European Union (EU)
GHG	Greenhouse Gas
GW	Gigawatt
HVDC	High Voltage Direct Current
IRA	Inflation Reduction Act
ITC	Investment Tax Credits
KW	Kilowatt
LCOE	Levelised cost of electricity
LRET	Large-Scale Renewable Energy Target
m	Million
M&A	Mergers & Acquisitions
m3	Metre Cubed
MNRE	The Indian Ministry of New & Renewable Energy
MW	Megawatt
NECPs	National Energy and Climate Plans
Net Zero	A target of completely negating the amount of greenhouse gases produced by human activity, to be achieved by reducing emissions and implementing methods of absorbing carbon dioxide from the atmosphere.
PLI	Production Linked Incentives
PPA	Power Purchase Agreement
PPE	Plan de programmation pluriannuelle de l'Energie
PTC	Production Tax Credits
PV	Photovoltaic
R&D	Research & Development
REER	Régimen Económico de Energías Renovables
REIPFB	Renewable Energy Investment Promotion and Facilitation Board
REZ	Renewable Energy Zone

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