Guinness Sustainable Energy

Investment Commentary – November 2025

RISK

This is a marketing communication. Please refer to the Prospectus, Supplement and KID/KIID for the Funds (available on our website), which contain detailed information on their characteristics and objectives and full information on the risks, before making any final investment decisions. The Funds are equity funds. Investors should be willing and able to assume the risks of equity investing. The value of an investment and the income from it can fall as well as rise as a result of market and currency movement, and you may not get back the amount originally invested. The Funds invest at least 80% in companies in the sustainable energy sector and can be volatile. Past performance does not predict future returns.

ABOUT THE STRATEGY

Launch	19.12.2007
Index	MSCI World
Sector	IA Commodity/Natural Resources
Managers	Will Riley Jonathan Waghorn
EU Domiciled	Guinness Sustainable Energy Fund Guinness Sustainable Energy UCITS ETF
UK Domiciled	WS Guinness Sustainable Energy Fund

INVESTMENT POLICY

The Guinness Sustainable Energy Funds are managed for capital growth and invest in companies involved in the generation, storage, efficiency and consumption of sustainable energy sources (such as solar, wind, hydro, geothermal, biofuels and biomass). We believe that over the next twenty years the sustainable energy sector will benefit from demand growth, improving economics and both public and private support, offering attractive investment opportunities. The Funds are actively managed and use the MSCI World Index as a comparator benchmark only.

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PRI Principles for Responsible Investment

COMMENTARY

AI Data Centres and US Power Demand

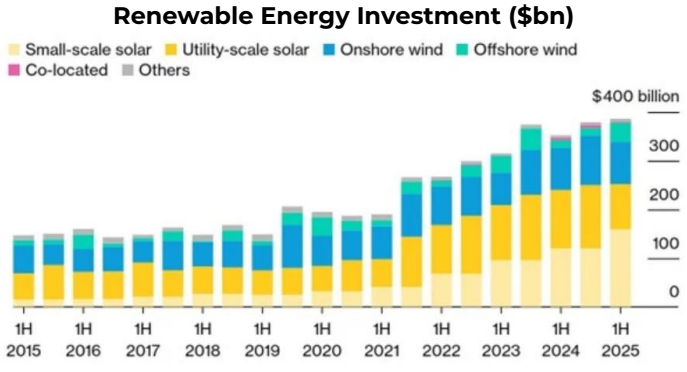
The build-out of AI data centres in the United States is helping to drive an inflection in power demand for the first time in two decades. To meet this demand, the US must build generation capacity rapidly and at scale, and at the same time overcome emerging supply constraints such as long-interconnection queues, ageing grids, and increasing complexity as intermittent renewables displace baseload capacity.

EQUITIES

The Guinness Sustainable Energy Fund (Class Y) delivered a return of 4.3% (in USD) in October, outperforming the MSCI World Index, which returned 2.0%. Among the fund's top performers were Solar equipment manufacturers such as Canadian Solar and First Solar, which benefited from strong domestic US demand and an improving outlook for China's solar sector amid anti-involution efforts. The fund's weakest performer was Itron, which after a strong run this year, reported weak third quarter results

CHART OF THE MONTH: GLOBAL RENEWABLE INVESTMENT

Global investment in new renewable-energy projects hit a record $386 billion in the first half of 2025, rising about 10% year-on-year, driven primarily by strong growth in offshore wind and small-scale solar. The European Union saw the largest increase, with roughly 63% growth over the previous half.



Source: BNEF, August 2025

OCTOBER NEWS AND EVENTS IN REVIEW

In this section, we review the key news items and their impact on our various portfolio sub-sectors over the last month.

News	Sub-Sector	Impact
According to Ember's Global Electricity Mid-Year Insights 2025 report, renewables overtook coal in the global electricity mix for the first time during the first half of 2025. Solar and wind generation rose by a combined 363 TWh (a 7.7% increase), lifting renewables' share of global electricity to 34.3%. In contrast, coal generation declined 31 TWh, dropping its share to 33.1%. This signals a turning point in the clean energy transition as renewable growth managed not just to meet rising demand (which grew by 2.6%) but to displace coal.	Global Renewables	
In October, the US government struck an agreement with Westinghouse to deploy at least $80 billion-worth of new reactors across the US, signalling the largest American nuclear investment in decades. In the same month, Google and NextEra Energy unveiled plans to restart the Duane Arnold plant in Iowa under a multi-decade power purchase agreement to power Google's expanding AI and data centre operations. While new generation is unlikely to come online before the mid-2030s, Wood Mackenzie expects US nuclear output to climb around 27% after 2035, as data centre growth and electrification drive sustained demand for carbon-free baseload power. Together, these developments highlight nuclear energy's resurgence as a pillar of the clean, reliable grid of the future.	Nuclear Generation	
In China, leaders from the wind power industry announced an ambitious roadmap under the Beijing Declaration on Wind Energy 2.0, committing to add at least 120 GW of new wind capacity annually, including 15 GW offshore, from 2026 to 2030. The declaration sets a target of 1.3 TW of total installed wind capacity by 2030, at least 2 TW by 2035 and up to 5 TW by 2060. Industry leaders say this push would more than double China's present wind base and help the country accelerate its carbon-neutrality goals.	China Wind Industry	
Global electric vehicle (EV) sales climbed 26% year-on-year in September to a record 2.1 million units, according to research firm Rho Motion. Growth accelerated in China, where consumers rushed to purchase ahead of subsidy cuts, while US sales spiked (+66%) as buyers sought to lock in expiring tax credits. Europe also saw record sales (+36% year-on-year), supported by fresh incentives in key markets including the United Kingdom and Germany.	Electric Vehicle Sales	
China and the United States have reached a temporary truce over rare earth minerals, a sector critical to EV and advanced manufacturing. After months of escalating tensions marked by Chinese export controls and US tariff threats, Beijing agreed to suspend new restrictions for one year and issue general licences for rare earth exports, while Washington rolled back planned tariff hikes and extended trade exclusions. This pause offers short-term relief for global supply chains but does not undo earlier curbs, leaving structural vulnerabilities intact. China still dominates the market, controlling roughly 70% of mining and nearly 90% of processing capacity, giving it significant leverage.	Global Trade	

MANAGERS' COMMENTS

Data Centres and US Electricity Demand

After two decades of stagnation, US electricity demand is rising again. The primary driver of load growth is the rapid build-out of AI data centres, underpinned by record capital expenditure from the US hyperscalers. At the same time, the reshoring of manufacturing and broader electrification are causing power demand to grow at its fastest rate since the 1990s. To meet this demand, the US must build generation capacity rapidly and at scale, and at the same time overcome emerging supply constraints such as long-interconnection queues, ageing grids, and increasing complexity as intermittent renewables displace baseload capacity. In this note, we examine the impact of the AI build-out on US power demand and comment on the likely constraints on growth.

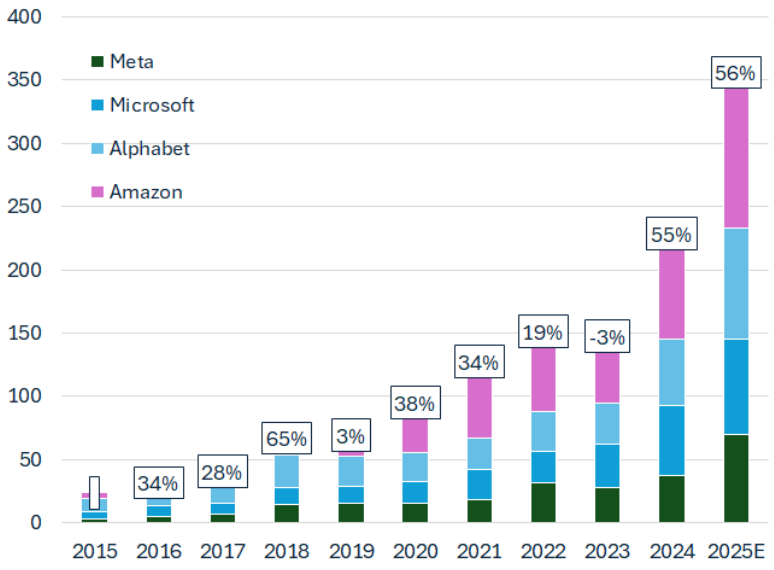
Hyperscaler capex and US power demand

Power demand in the US is reaching an inflection. Over the previous two decades, energy consumption has remained broadly flat, with growth of around 0.4% per year, as energy-intensive industries have been offshored, and efficiency gains have tempered growth. Over the same period, the energy intensity of GDP has fallen by more than a third. This dynamic is set to change, driven primarily by the build-out of AI data centres, but also by the reshoring of manufacturing and broad electrification of the economy:

- **AI data centres:** AI data centres operate continuously and consume power at far higher densities than conventional facilities. The IEA estimates that AI queries can use 10-40 times more electricity per than traditional search functions. Data centres are also getting larger and more complex as hyperscalers consolidate workloads to capture scale efficiencies.
- **Reshoring:** according to Wood Mackenzie, investment in new US manufacturing facilities has risen 184% since 2020, led by sectors such as semiconductors, batteries, and advanced materials. The CHIPS Act and the Inflation Reduction Act have catalysed hundreds of billions of dollars in private investment, with over $500 billion in announced projects since 2021.
- **Broad electrification:** the electrification of transport, buildings and industry as the economy moves away from fossil fuels.

In the short term, Morgan Stanley expect AI data centres to contribute to around 60% of incremental power demand. In 2025 alone, the largest hyperscalers, Meta, Microsoft, Alphabet, and Amazon, are expected to make c.$350 billion in capital expenditure to build out their AI capabilities, and all have said that they plan to spend more next year.

Capital expenditure of the US hyperscalers (USD)



Source: Bloomberg, November 2025

The impact of AI data centres on US power demand

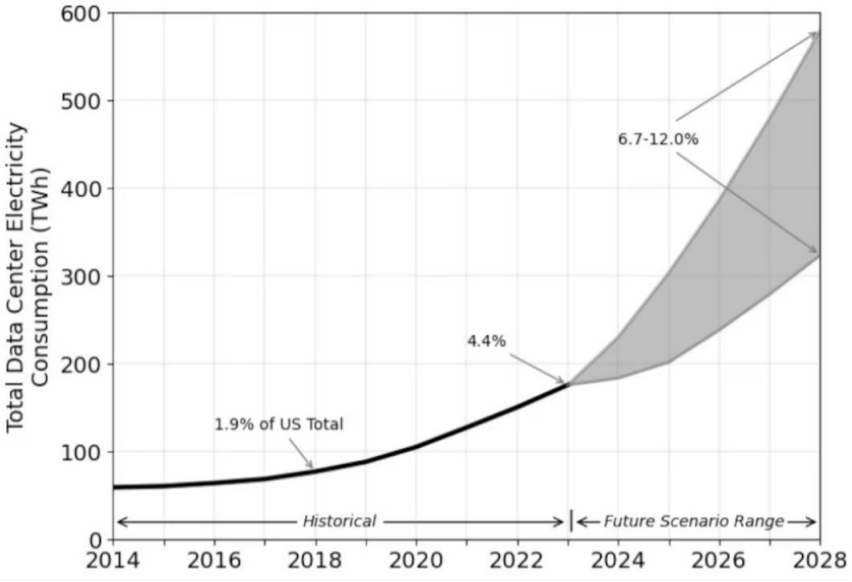
Estimates for the increase in power demand from AI data centres are particularly difficult to forecast and, as such, vary considerably. They are difficult to predict because both the efficiency of computing hardware and the scale of AI workloads are changing rapidly: each new generation of chips uses less energy per operation, but model sizes and usage are growing much faster, making future electricity needs highly uncertain.

Estimating existing data centre demand is similarly difficult, though the IEA puts its electricity consumption at around 180-200TWh in 2024, accounting for roughly 4% of total US demand.

Given this uncertainty, we see a range of forecasts:

- **The IEA** projects that data centre electricity consumption will grow by c.12-15% per year, increasing by approximately 240 TWh to reach c.420 TWh in total by 2030.
- **The Lawrence Berkeley National Laboratory** (LBNL) forecasts demand growing by 8-12% per year to reach between 325–580 TWh annually and account for 7–12% of total electricity demand by 2028.
- More bullish still, **consultancies and sell-side analysts** expect US data centre consumption to at least double by 2030, adding an additional 325–600 TWh of demand to the grid.

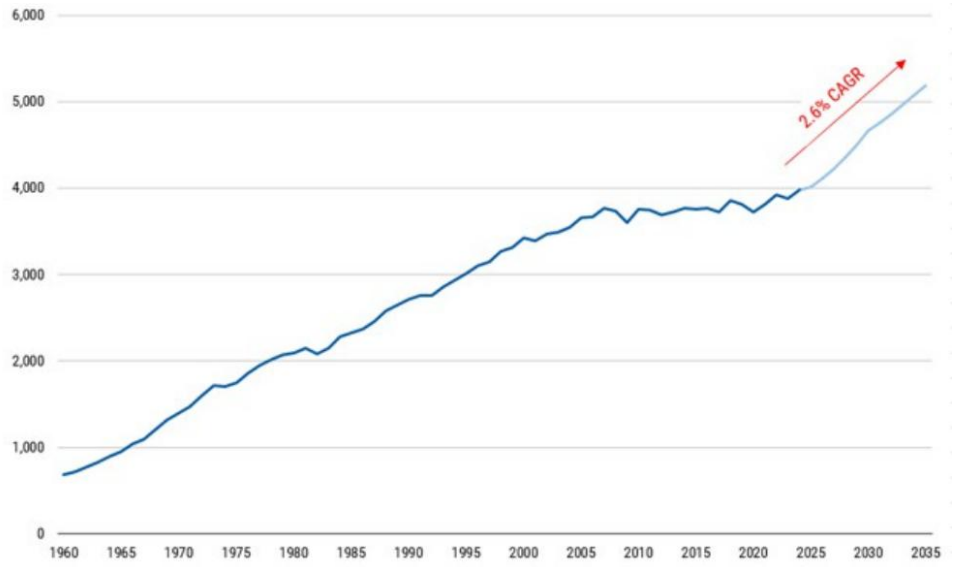
Estimated data centre consumption (TWh)



Source: Lawrence Berkeley National Laboratory, 2025

While forecasting exact demand figures is challenging, the direction of travel is clear. Assuming data centre demand grows by around 12% per annum, rising from c.180 TWh in 2024 to about 400 TWh by 2030, the US would need to add c.40 TWh of incremental generation capacity each year. That equates to about a 1% annual increase in total electricity output before factoring in additional demand from reshoring and broader electrification. Morgan Stanley estimate that in combination, AI, reshoring and electrification are likely to add c.900TWh of incremental demand by 2035, taking total US consumption above 5,000TWh. This would imply load growth of 2.6% per annum, requiring c.90TWh of incremental generation a year.

Total US Retail Sales forecast (TWh)



Source: Morgan Stanley, October 2025

How can the US meet this demand?

Meeting this surge in demand will require new generation capacity after years of under-investment. The US grid currently supplies c.4,300 TWh of electricity each year, meaning that supply will have to grow at c.2% pa., to add 90TWh of incremental demand to 2030.

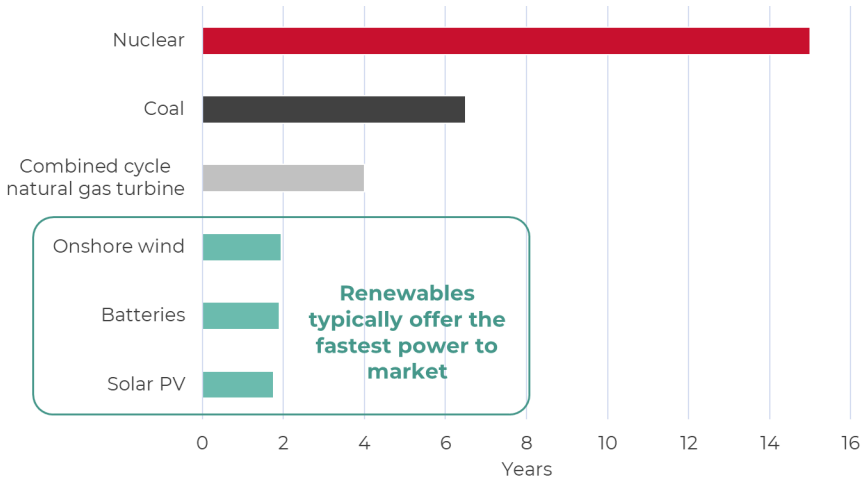
NextEra, a portfolio holding and an operator of both fossil-fuel and low-carbon assets, outlines a scenario of rapid renewable build-out, supported by long-term capacity additions from natural gas and eventually, nuclear. Underpinning this roadmap is the scale and speed of projected demand growth and the need for cost-efficient technologies that can be deployed rapidly at scale. NextEra argues that the advantage of renewable technologies lies in their speed to market, flexibility, and cost advantages:

- **Renewables and storage**: existing and well-developed supply chains support rapid development, as does the availability of battery equipment. Storage projects can also be built on existing sites and connected to existing grids, and at the same time, battery costs have fallen sharply as the technology has matured and scaled.

- **Natural gas**: longer lead times, cost inflation, and underdeveloped supply chains mean that new or unplanned natural gas projects cannot meet all of the near-term demand, and in the long term, natural gas is a more expensive solution. However, given the rise of intermittent renewables, natural gas will play an important role in providing baseload generation.

- **Nuclear:** after decades of underinvestment, supply chains need to be rebuilt, and technology developed before nuclear can contribute meaningfully to the generation mix. Plans to restart retired nuclear reactors are not expected to add generation until closer to 2030. If they come online as planned, they will be able to add c.15TWh of generation per year. However, timelines remain uncertain, with potential risks around regulatory approvals, financing, and construction delays.

Average US power plant development timeline (from concept to operation)



Source: Lawrence Berkeley National Laboratory, Wood Mackenzie, Bernstein, 2025

Given these characteristics, NextEra see "firmed" generation (intermittent renewables backed by storage) as having the lowest levelized cost of generation in 2030. The company reports an estimated cost of $25-$50/MWh for new onshore wind (including storage) and $35-$75/MWh for new solar (including storage). This is considerably cheaper than new combined cycle natural gas at $85-$115/MWh and a small modular reactor (in 2035) at $130-$150/MWh.

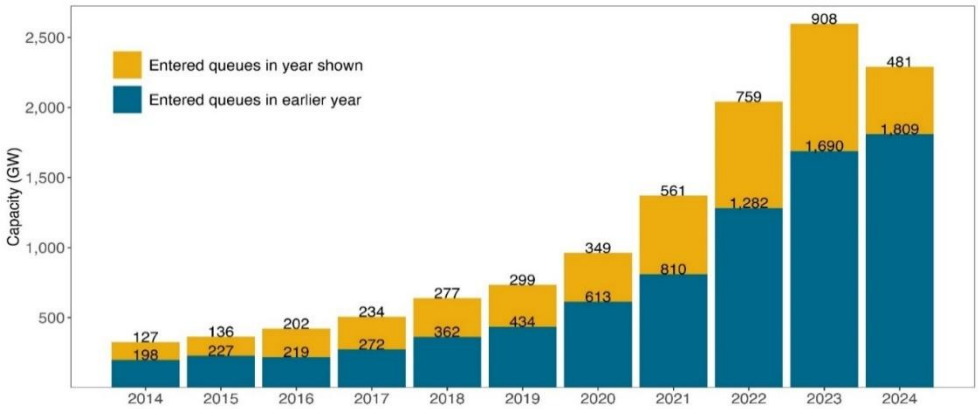
This reality is playing out. As of the end of July 2025, 93% of new capacity has been renewables, with 83% being solar and storage. The economics and scalability mean that renewables, in combination with storage, are the cheapest and fastest way to meet incremental demand.

The interconnection queue is a genuine constraint

Although utility-scale renewables are the best placed to meet electricity demand, the US is finding it increasingly difficult bring new generation online. Supply has become constrained by an outdated interconnect process, permitting delays, and supply chain constraints.

Official interconnection queues suggest that the US can meet incremental demand effectively, and quickly. As of 2024, some 2.2 TW of projects await connection. Around 42% of this pipeline is solar, 39% battery storage, 9% wind, and only 6% natural gas. If realised in full, it would represent a profound reshaping of the generation mix towards renewables and storage. However, in reality, much of this interconnection won't translate into real projects as developers have flooded the queue to try and reserve place on the grid. At the same time, it doesn't take into account actual grid constraints like the availability of power equipment and turbines.

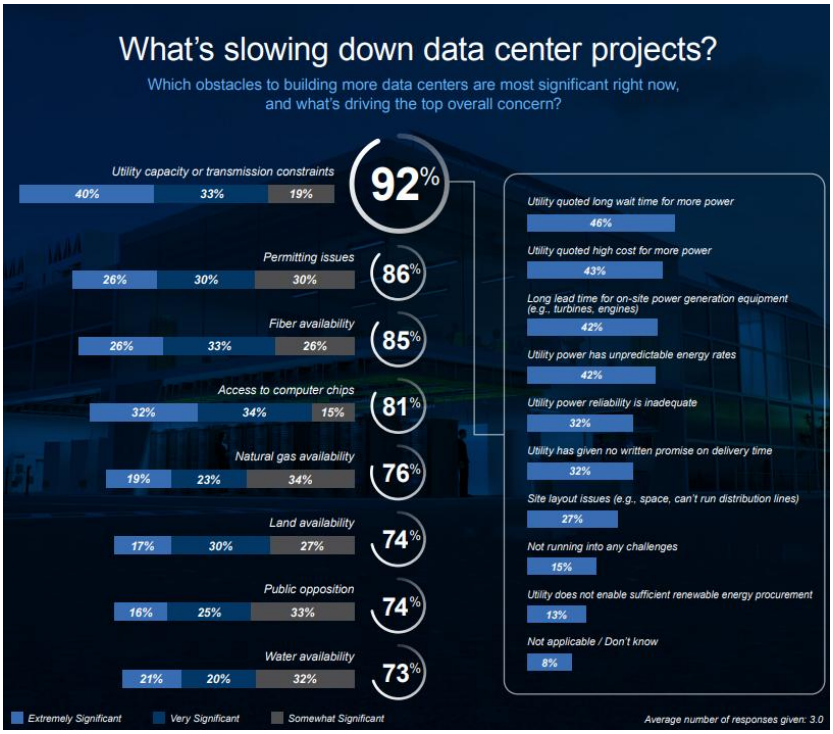
Total cumulative capacity within the interconnect queue (GW)



Source: Lawrence Berkeley National Laboratory, 2025

In practice, however, the queue has become the central bottleneck. Developers report interconnection waits of four to ten years, with some markets, such as Northern Virginia, facing a minimum seven-year delay.

Given these factors, 'time-to-power' is likely the single largest constraint to the data centre build out in the US, as reflected in a recent survey conducted by Schneider Electric. In the survey, respondents ranked utility interconnection delays and power availability well ahead of factors such as financing or equipment supply. Nearly half reported wait times of four years or longer to secure grid connections, and many cited a lack of available high-voltage capacity in prime data-centre regions like Northern Virginia, Dallas and Silicon Valley.



Source: Alpha Structure, Schneider Electric, 2025

To achieve these efficiency gains and integrate battery technologies, significant investment is needed to upgrade an already ageing grid. "In its Net Zero scenario, BNEF estimates that approximately $500 billion of transmission and distribution investment will be required over the coming decade, with cumulative spending reaching around $1 trillion by 2035. As roughly half of current grid capex is needed merely to sustain existing infrastructure, this indicates that an incremental $500 billion of investment will be necessary to maintain reliability while simultaneously expanding the grid to accommodate electrification and surging data-centre demand. Long-term forecasts from William Blair and Morgan Stanley suggest a similar level of capex in order to integrate intermittent renewables into the existing system. Encouragingly, policy momentum is building: the DOE's Grid Deployment Office has begun allocating over $20 billion in grants and loan guarantees, FERC has finalised new long-term transmission-planning rules, and utilities such as NextEra, Exelon, and PPL have already raised their grid-capex guidance in response.

Conclusion

The build-out of US data centres is advancing rapidly and is backed by substantial, long-term investment from the country's leading hyperscalers. In combination with the reshoring of manufacturing and broader electrification, the US will see its electricity demand grow at around 2.6% over the next decade. To enable growth on this scale, the US must accelerate investment into transmission and distribution infrastructure, address persistent interconnection bottlenecks, and take a pragmatic view of which generation sources can meet near-term needs.

PERFORMANCE

Past performance does not predict future returns.

The **Guinness Sustainable Energy Fund** (Class Y, 0.68% OCF) delivered a return of 4.3% in the month, while the MSCI World Index (net return) delivered 2.0% (all in USD terms).

Total return in USD	Ytd	1 Yr	3 Yrs	5 Yrs	10 Yrs*
Fund (Class Y)	29.3%	16.7%	19.6%	45.2%	131.6%
MSCI World NR Index	19.8%	22.0%	80.2%	106.3%	204.9%
Out/Underperformance	*9.5%*	*-5.3%*	*-60.6%*	*-61.1%*	*-73.2%*

	2024	2023	2022	2021	2020
Fund (Class Y)	-11.8%	-0.4%	-12.5%	10.4%	84.1%
MSCI World NR Index	18.7%	23.8%	-18.1%	21.8%	15.9%
Out/Underperformance	*-30.4%*	*-24.2%*	*5.6%*	*-11.4%*	*68.2%*

	2019	2018*	2017*	2016*	2015*
Fund (Class Y)	31.4%	-15.2%	20.2%	-15.4%	-12.0%
MSCI World NR Index	27.7%	-8.7%	22.4%	7.5%	-0.9%
Out/Underperformance	*3.7%*	*-6.5%*	*-2.2%*	*-23.0%*	*-11.2%*

*The Fund was launched on 19.12.2007. *Simulated past performance prior to the launch of the Y class on 16.02.2018. The Performance shown is a composite simulation for Y class performance being based on the actual performance of the Fund's E class, which has an OCF of 1.24%. On 31.12.2018, the benchmark became the MSCI World NR. Prior to this, the benchmark was the Wilderhill Clean Energy Index (ECO Index).*

The **WS Guinness Sustainable Energy Fund** (Class Y, 0.67% OCF) delivered a return of 6.9% in the month in GBP, while the MSCI World Index (net return) delivered 4.5%.

Total return in GBP	Ytd	1 Yr
Fund (Class Y, 0.67% OCF)	23.0%	14.1%
MSCI World NR Index	14.2%	19.4%
Out/Underperformance	*8.8%*	*-5.2%*

	2024	2023
Fund (Class Y, 0.67% OCF)	-10.4%	-5.8%
MSCI World NR Index	20.8%	16.8%
Out/Underperformance	*-31.2%*	*-22.6%*

The Fund was launched on 30.12.2022.

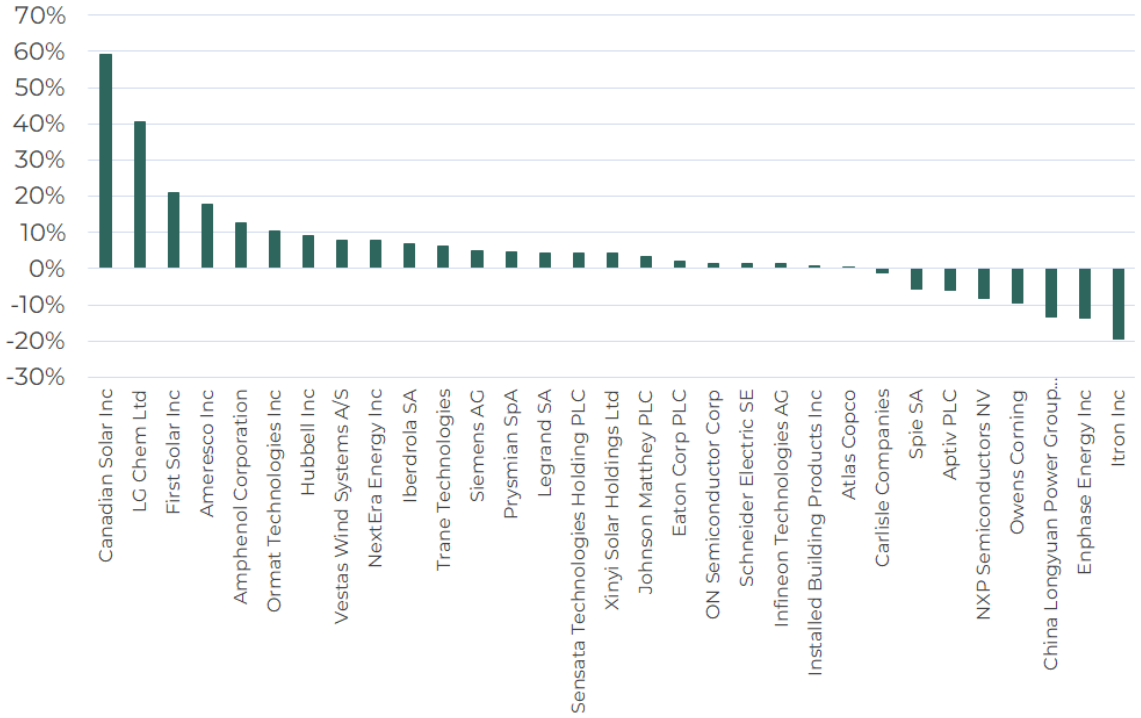
The **Guinness Sustainable Energy Fund UCITS ETF**, under our management since 25 July 2024, delivered a return of 4.4% in the month in USD, while the MSCI World Index (net return) delivered 2.0% (all in USD terms).

Total return in USD	Ytd	1 Yr
Fund (Class A Acc, 0.65% OCF)	29.2%	17.0%
MSCI World NR Index	19.8%	22.0%
Out/Underperformance	*9.4%*	*-5.1%*

Data as of 31.10.2025. Source: FE fundinfo, bid to bid, total return net of fees. Investors should note that fees and expenses are charged to the capital of the Funds. This reduces the return on your investment by an amount equivalent to the Ongoing Charges Figure (OCF). The performance shown has been reduced by the current OCF shown. Returns for share classes with different OCFs will vary accordingly. Transaction costs also apply and are incurred when a Fund buys or sells holdings.

Within the Fund, the strongest performers were Canadian Solar Inc, LG Chem Ltd, First Solar Inc, Ameresco Inc and Amphenol Corporation while the weakest performers were Itron Inc, Enphase Energy Inc, China Longyuan Power Group Corp Ltd, Owens Corning and NXP Semiconductors NV.

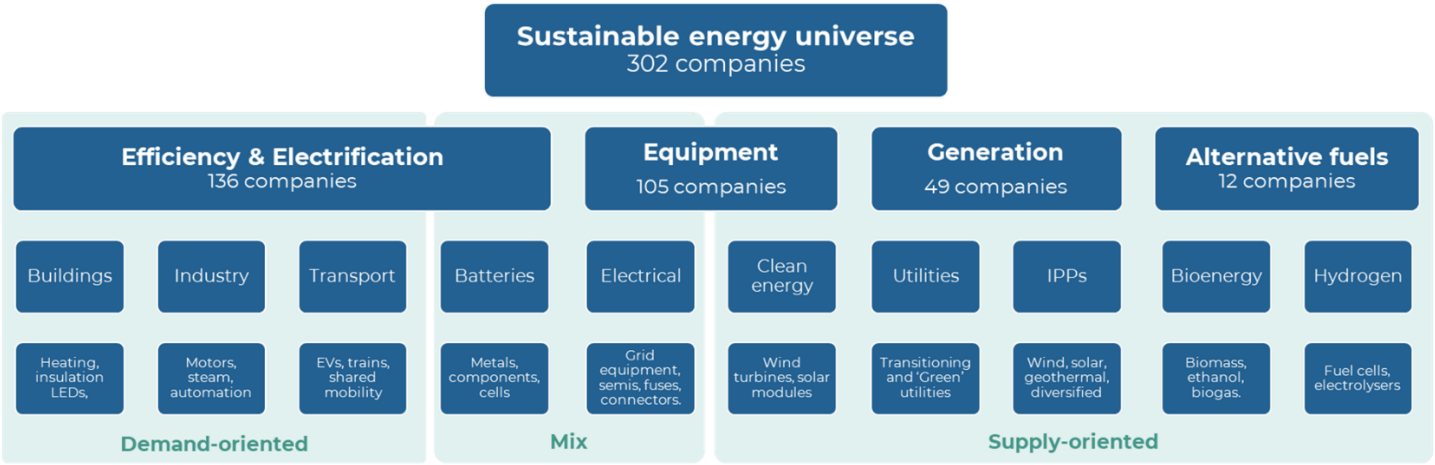
Stock by Stock performance over the month, in USD



Source: Bloomberg. As of 31st October 2025

PORTFOLIO

The Guinness Sustainable Energy Fund is positioned to benefit from many of the long-term themes associated with the transition towards a lower-carbon economy and of sustainable energy generation via investment in companies with activities that are economic with limited or zero government subsidy and which are profitable. We do not limit ourselves to 'pure plays', opening our universe to some companies with existing hydrocarbon-based fuel exposure, but this must be accompanied by a commitment to transitioning their business models towards sustainable energy sources. Our investment universe comprises around 300 companies which are classified as follows:



Source: Guinness Global Investors; data as of 30 September 2025

We monitor each of the industry areas very closely and hope that detailed top-down (macro) analysis of each (complemented with disciplined equity screening and stock valuation work) will allow us to deliver attractive fund performance via a broadly equally weighted portfolio of 30 stocks. The portfolio is designed to create a balance between maintaining fund concentration and managing stock-specific risk.

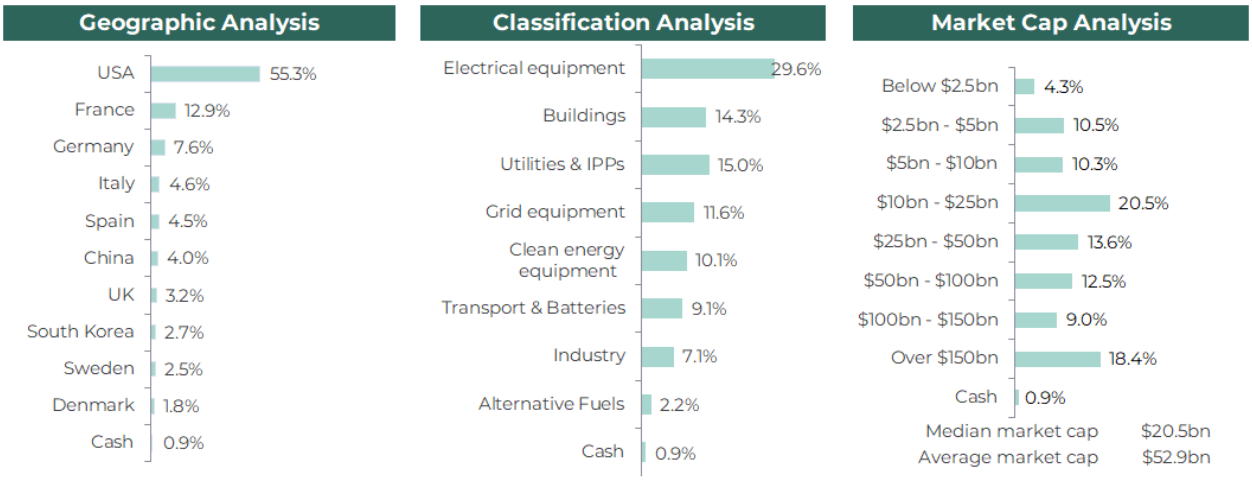
Guinness Global Investors is a signatory of the United Nations Principles for Responsible Investment. The Guinness Sustainable Energy Fund prioritises returns whilst delivering concentrated exposure to companies playing a key role in global decarbonisation. The Fund's holdings align most closely with four of the UN's sustainable development goals:

Signatory of:
PRI Principles for Responsible Investment

Buys/Sells

There were no buys/sells in the month, but the portfolio was actively rebalanced.

Portfolio structure analysis



Data as of 31.10.2025. Source: Guinness Global Investors. Portfolio holdings are subject to change.

Portfolio sector breakdown

The following table shows the asset allocation of the Fund at 30th September and at previous year ends.

Asset allocation as %NAV	Current	*Change*	Year end	Previous year ends				
	Oct-25		*Dec-24*	Dec-23	Dec-22	Dec-21	Dec-20	Dec-19
Electrical equipment	29.6%	*2.8%*	26.8%	25.1%	20.3%	19.0%	10.0%	9.6%
Buildings	14.3%	*-0.5%*	14.8%	*9.6%*	*7.7%*	*4.2%*	*3.7%*	*10.2%*
Utilities & IPPs	15.0%	*-5.5%*	20.5%	*19.5%*	*17.7%*	*23.1%*	*24.6%*	*22.2%*
Grid equipment	11.6%	*2.6%*	9.0%	7.6%	7.3%	6.6%	6.1%	5.5%
Clean energy equipment	10.1%	*-0.2%*	10.3%	15.8%	19.7%	18.7%	28.8%	23.5%
Transport & Batteries	9.1%	*-2.2%*	11.3%	16.4%	18.5%	19.5%	20.4%	21.7%
Industry	7.1%	*2.3%*	4.8%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*
Alternative Fuels	2.2%	*0.4%*	1.8%	*1.8%*	*3.0%*	*3.7%*	*3.6%*	*3.2%*
Cash	0.9%	*0.2%*	0.7%	4.2%	5.8%	5.3%	3.0%	4.2%
Total	100.0%		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Guinness Global Investors

Valuation

At the month's end, the Guinness Sustainable Energy portfolio traded on the following multiples:

As at 31 October 2025	PE			EV/EBITDA			Dividend Yield		EPS Growth (%pa)		Cash return	
	2024	2025E	2026E	2024	2025E	2026E	2025E	2026E	2019-24	2024-27	2025E	2026E
Guinness Sustainable Energy Fund	22.9x	21.0x	18.1x	13.7x	12.8x	11.5x	1.4%	1.7%	7.7%	13.3%	10.6%	11.2%
MSCI World Index	24.5x	22.6x	20.1x	15.1x	14.2x	12.7x	1.6%	1.7%	6.8%	10.6%	9.9%	10.4%
Fund Premium/(Discount)	*-7%*	*-7%*	*-10%*	-9%	*-10%*	-9%						

*2024 P/E = Latest month-end price / 2024 earnings; Portfolio = median CFROI; Index data = HOLT MSCI World ETF median CFROI, EPS derived from consensus, adjusted for Canadian Solar

Source: Guinness Global Investors, Bloomberg

Portfolio holdings as at the end of October 2025

Our portfolio is typically allocated across 30 broadly equally weighted equities, providing exposure across the value chain of sustainable energy.

A key theme in the portfolio (at around 39% weight) is that of **electrical equipment**, where we own a number of companies that facilitate the electrification of energy demand and the build-out of the electrical grid. Holdings such as Eaton, Schneider Electric, Amphenol and Legrand participate in various niches in the design, manufacturing and servicing of electrical products across low, medium and high voltage applications, for a wide range of end markets. Hubbell holds a particular specialism in high voltage grid equipment, especially in the United States, while Prysmian manufactures the cable used in high voltage interconnectors and connections to new supply sources. Lastly, Itron has a heritage in manufacturing smart meters and is increasingly providing services and consulting to utilities around this installed base to enable more efficient utilisation of the grid.

The electrification and efficiency of buildings, industrial activities, and transportation represent a total weight of 33% and are split as follows:

- In terms of **transportation** exposure, the portfolio holds six names in the electric vehicle sub-category, giving it exposure to companies that provide semiconductors, electronics, components and software/services to the growing EV and autonomous vehicle industry. Onsemi, Infineon and NXP Semi are providers of power semiconductors and microcontrollers that are a necessity for higher-voltage electric vehicles to become competitive with ICE (internal combustion engine) vehicles, while Aptiv and Sensata are component manufacturers and service providers that should benefit from the ever-increasing amount of electronics present in electric vehicles. We hold one lithium-ion battery manufacturer, LG Chem, which is a Korean chemicals company and one of the largest lithium-ion battery manufacturers in the world.

- Our **buildings** exposure comes via pure-play quality exposure to heating and cooling industries (via commercial HVAC manufacturer Trane Technologies) as well as high-quality roofing manufacturer Carlisle Companies. We have two names focused on insulation: Owens Corning, as a manufacturer of insulation (and associated products), while Installed Building Products is an installer of insulation. Our final holding here in SPIE, a French electrical engineering company that provides services for building maintenance, predominantly in France and Germany.

- Our **industrial** efficiency and electrification exposure comes from two positions, in Siemens and Atlas Copco. Siemens provides us with exposure to efficiency and electrification across a wide range of end markets, while Atlas Copco offers exposure to the efficient use of air (often referred to as the fourth utility) in manufacturing processes, via compressors and vacuum technology.

In terms of the **generation** of sustainable energy, we hold a c.17% weight to utilities and independent power producers. China Longyuan is a pure-play Chinese wind power producer and represents one of our two IPP holdings. The remaining exposure comes in the form of geothermal via Ormat, the world's only integrated producer and equipment manufacturer for geothermal projects. We also have broad-based wind/solar renewable energy generation through NextEra Energy (the largest producer of renewable energy in the world), while Iberdrola is our one utility, with particular exposure to electricity networks.

We hold exposure to the **solar and wind equipment** and manufacturing value chains. Xinyi Solar is the world's largest supplier of the glass used in solar cell modules, and Enphase manufactures the inverters required to convert DC solar power into consumable AC electricity. Canadian Solar and First Solar give integrated exposure to the solar cell and module manufacturing process, covering both the standard polysilicon manufacturing process (via Canadian Solar) as well as the specialist cadmium telluride process used by First Solar. Wind turbine manufacturer Vestas provides broad exposure to the strong growth that we expect in the onshore and offshore wind markets. Lastly, we have some exposure to bioenergy (and a broader range of energy efficiency projects) via Ameresco, a US-listed clean energy project developer.

Portfolio themes as at end October 2025

	Theme	Example holdings	Weighting (%)
1	Electrification of energy demand		27.2%
2	Modernising the power grid		11.6%
3	Rise of the electric vehicle and auto efficiency		11.5%
4	Power semiconductors		7.8%
5	Wind & solar equipment manufacturing		10.1%
6	Low carbon power generation: regulated producers		8.7%
7	Low carbon power generation: independent producers		8.5%
8	Building and industrial efficiency		13.6%
9	Other (inc cash)		0.9%

Portfolio at end September 2025 (one month in arrears for compliance reasons)

Guinness Sustainable Energy Fund (30 September 2025)			P/E			EV/EBITDA			Price/Book			Dividend Yield		
Stock	**ISIN**	**% of NAV**	**2024**	**2025E**	**2026E**	**2024**	**2025E**	**2026E**	**2024**	**2025E**	**2026E**	**2024**	**2025E**	**2026E**
ALTERNATIVE FUELS														
Ameresco Inc	US02361E1082	2.0%	47.3x	41.4x	30.8x	19.4x	15.5x	13.2x	1.7x	1.6x	1.6x	0.0%	n.m.	n.m.
		2.0%												
EFFICIENCY & ELECTRIFICATION														
Carlisle Cos Inc	US1423391002	2.2%	18.0x	16.4x	14.5x	11.7x	12.6x	11.8x	5.9x	6.3x	5.8x	1.1%	1.2%	1.3%
Installed Building Products In	US45780R1014	3.1%	26.7x	24.5x	23.5x	13.9x	15.5x	15.2x	9.7x	8.5x	6.8x	1.2%	1.1%	1.1%
Owens Corning	US6907421019	2.1%	8.1x	10.4x	9.9x	6.4x	7.2x	7.1x	2.4x	2.2x	2.0x	1.8%	2.0%	2.0%
Spie SA	FR0012757854	3.7%	21.2x	16.4x	14.6x	10.7x	9.4x	8.8x	4.2x	3.5x	3.1x	2.0%	2.5%	2.8%
Trane Technologies PLC	IE00BK9ZQ967	4.2%	37.2x	32.4x	28.6x	23.9x	22.6x	20.5x	12.7x	11.3x	9.8x	0.8%	0.9%	0.9%
Siemens AG	DE0007236101	4.6%	25.1x	19.7x	20.2x	14.0x	12.1x	10.9x	3.7x	3.1x	2.9x	2.1%	2.3%	2.5%
Atlas Copco AB	SE0017486889	2.7%	29.1x	28.1x	26.0x	43.9x	41.6x	38.6x	8.0x	6.4x	5.8x	1.7%	1.9%	2.0%
Aptiv PLC	JE00BTDN8H13	3.5%	10.3x	11.4x	10.5x	8.4x	8.1x	7.7x	2.3x	1.9x	1.7x	0.0%	0.1%	0.1%
Johnson Matthey PLC	GB00BZ4BQC70	3.3%	131.5x	24.9x	12.4x	13.4x	7.3x	7.9x	1.7x	1.4x	1.4x	3.6%	3.9%	9.9%
LG Chem Ltd	KR7051910008	2.0%	n.m.	251.4x	15.5x	10.0x	7.9x	5.8x	0.6x	0.6x	0.6x	0.4%	0.4%	1.1%
		31.3%												
GENERATION														
Iberdrola SA	ES0144580Y14	4.4%	19.8x	17.3x	16.8x	12.3x	11.4x	11.0x	2.4x	1.9x	1.9x	3.0%	4.2%	4.3%
China Longyuan Power Group Cor	CNE100000HD4	2.8%	9.9x	10.0x	9.1x	11.0x	11.1x	10.4x	0.9x	0.8x	0.8x	3.0%	3.0%	3.4%
NextEra Energy Inc	US65339F1012	4.1%	23.4x	20.6x	19.0x	19.9x	15.2x	13.4x	3.1x	2.8x	2.5x	2.7%	3.0%	3.3%
Ormat Technologies Inc	US6866881021	3.8%	43.8x	43.0x	38.2x	19.1x	14.9x	13.2x	2.4x	2.2x	2.1x	0.5%	0.5%	0.5%
		15.1%												
EQUIPMENT														
Amphenol Corp	US0320951017	4.9%	62.2x	40.7x	35.8x	36.2x	24.7x	22.2x	15.3x	11.9x	9.5x	0.4%	0.5%	0.6%
Eaton Corp PLC	IE00B8KQN827	4.7%	37.6x	31.0x	27.2x	26.0x	23.9x	21.2x	8.0x	7.4x	6.8x	1.0%	1.1%	1.1%
Hubbell Inc	US4435106079	4.4%	28.8x	24.1x	22.2x	17.7x	17.4x	16.1x	7.1x	6.2x	5.4x	1.2%	1.2%	1.3%
Itron Inc	US4657411066	3.3%	23.7x	20.6x	19.8x	17.3x	16.7x	15.2x	4.0x	3.4x	3.0x	0.0%	n.m.	n.m.
Legrand SA	FR0010307819	5.6%	32.9x	26.7x	24.1x	20.4x	17.4x	16.1x	5.6x	4.5x	4.2x	1.4%	1.7%	1.9%
Prysmian SpA	IT0004176001	4.6%	29.9x	22.6x	18.8x	17.8x	12.7x	11.3x	5.4x	3.9x	3.4x	0.9%	1.1%	1.2%
Schneider Electric SE	FR0000121972	4.6%	32.9x	27.0x	23.9x	19.9x	17.8x	16.2x	5.1x	4.4x	4.1x	1.5%	1.8%	1.9%
Infineon Technologies AG	DE0006231004	3.2%	20.4x	23.2x	18.1x	10.8x	10.9x	9.6x	2.8x	2.4x	2.2x	1.0%	1.1%	1.1%
ON Semiconductor Corp	US6821891057	2.2%	12.5x	21.5x	16.8x	7.9x	13.2x	11.4x	2.4x	2.6x	2.4x	0.0%	0.0%	0.0%
NXP Semiconductors NV	NL0009538784	3.0%	19.9x	19.3x	16.1x	13.6x	14.2x	12.4x	6.3x	5.9x	5.3x	1.8%	1.8%	2.0%
Sensata Technologies Holding P	GB00BFMBMT84	2.4%	7.6x	9.1x	8.5x	5.8x	8.3x	8.0x	1.6x	1.5x	1.3x	1.6%	1.6%	1.6%
Canadian Solar Inc	CA1366351098	1.4%	5.1x	n.m.	16.0x	11.0x	10.5x	8.2x	0.3x	0.3x	0.3x	0.0%	0.0%	0.0%
Enphase Energy Inc	US29355A1079	0.7%	35.6x	13.2x	13.9x	21.6x	10.9x	11.4x	5.6x	4.9x	3.9x	0.0%	0.0%	0.0%
First Solar Inc	US3364331070	3.4%	17.4x	14.4x	9.6x	12.1x	10.3x	7.1x	3.0x	2.5x	2.0x	0.0%	0.0%	0.0%
Xinyi Solar Holdings Ltd	KYG9829N1025	1.7%	23.5x	34.0x	16.4x	9.9x	12.1x	9.0x	1.1x	1.0x	1.0x	2.9%	1.6%	2.7%
Vestas Wind Systems A/S	DK0061539921	1.7%	38.8x	22.1x	15.3x	11.2x	8.1x	6.6x	5.2x	4.0x	3.3x	3.2%	1.2%	1.9%
		51.8%												
Cash	Cash	**-0.1%**												

The Fund's portfolio may change significantly over a short period of time; no recommendation is made for the purchase or sale of any particular stock.

OUTLOOK - sustainable energy & the energy transition

Over the next thirty years, the world will continue its transition to a sustainable energy system. The key factors driving the transition are:

- **Population and GDP growth** putting a significant strain on today's energy supply
- **Economics** as sustainable sources of energy will be cheaper than the incumbents
- **Climate change** leading the world to reduce carbon emissions via cleaner energy
- **Pollution** forcing governments to drive air pollution out of cities via cleaner energy
- **Energy security** as sustainable energy sources, which are more evenly spread across all countries, facilitate lower reliance on energy imports.

The outcomes of the energy transition will, of course, be wide-ranging. On the **supply** side, we see a sustained shift towards renewable power generation, fulfilling global power generation needs, which are set to double by 2050. On the **demand** side, we believe that improved energy efficiency will be key to limiting energy consumption growth to a manageable level so that it can be increasingly satisfied by renewable sources.

The long-term direction is clear and is driven by economics, in our opinion, while geopolitical issues (such as the invasion of Ukraine in February 2022) could potentially have an effect on the speed of the transition and the relative importance of the factors stated above.

Policy support for decarbonisation

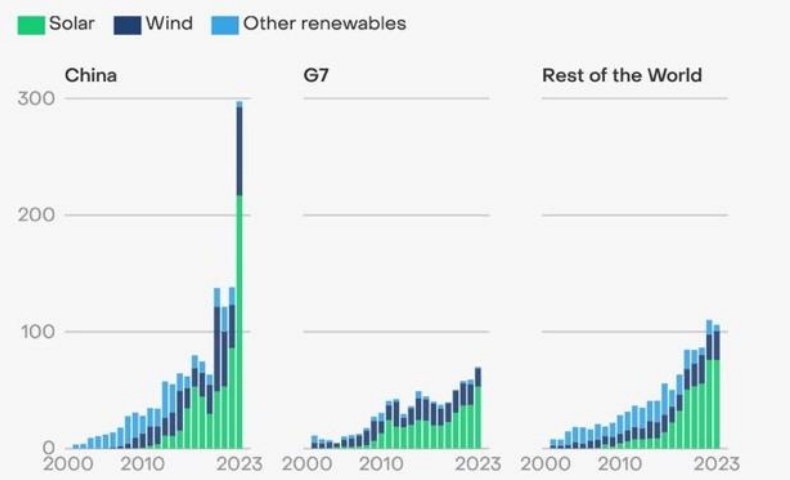
The re-election of Donald Trump has dominated sustainable energy policy in the United States. His term will be a backward step for the energy transition. It will bring a shift in US energy policy, as he targets reduced energy costs, "energy dominance," and improved competitiveness for US industry through the removal of environmental regulations. The Inflation Reduction Act (IRA) – the key Democrat-led legislation providing $369bn of tax credits for clean energy investment – has been partially unwound as part of the President's plans to raise funds to support tax cuts elsewhere.

Trump's One Big Beautiful Bill eliminates electric vehicle and residential solar tax credits and accelerates the phasing out of utility solar and wind ITC and PTC tax credits, relative to the initial IRA timelines. On the positive side, manufacturing tax credits for battery and solar equipment will remain in effect until 2032 (beyond previous expectations), with wind credits set to expire in 2027. While the new bill is less favourable for clean energy, its passing will provide project developers with the certainty needed to plan and proceed. Our dialogue with OEMs and developers indicates that the planning scenario for many following the Trump election was for a full repeal of the IRA and that little activity would occur while the bill was under consideration. With this hurdle now cleared, we expect to see a resumption of activity in the US, from what we see as an encouraging base level of activity, unabated by recent policy headwinds.

Other areas of focus for Trump have included a broader reach of the Foreign Entity of Concern (FEOC) designation (beyond the electric vehicle industry), a slow down in the awards of new offshore wind permits (since there is federal involvement in offshore wind), a departure from the Paris Agreement, a removal of the liquefied natural gas (LNG) export pause and a roll back of environmental restrictions.

China continued to reap benefits from decades of investment in sustainable energy technologies, building nearly twice as much wind and solar capacity as the rest of the world combined in 2024, delivering the lowest clean energy costs globally (with onshore wind being the cheapest) and supplying over 60% of the world's demand for electric vehicles. We will likely look back and see that China achieved its target of 1,200 GW in wind and solar installations in mid-2024, around six years ahead of schedule. We view China's ability to offer comprehensive, long-term demand-side and supply-side policy support as a key differentiator, allowing it to increasingly dominate the global clean tech environment. We expect this rapid growth to continue as renewable energy (alongside grid modernisation) was again listed among the "strategic industries" whose development is expected to be supported by policymakers.

Annual renewable capacity additions by region 2000-23 (GW)



Source: Ember, 2024

In contrast, there seemed to be little real progress from **Europe** around commitment and investment as part of the Net Zero Industrial Act. Amendments to the European Climate Law (which targets net zero greenhouse emissions by 2050) were made to reduce the EU's net greenhouse gas emissions by 90% by 2040 (relative to 1990). This new interim target was designed to accelerate the transition and put the EU on a path towards a healthier and safer future, thereby avoiding wasted investments in fossil fuels, boosting the competitiveness of Europe's businesses, and making Europe more resilient.

As has often been the case in Europe, we found the bloc to be 'long' on targets but 'short' on actual support to help establish the supply chains and domestic manufacturing to allow the targets to be achieved. The Green Deal Industrial Plan, the Net Zero Industry Act and Critical Raw Materials Act (all passed in 2023) do not yet appear to be catalysing investment in the EU as little new central funding was announced to support these ambitions. However, we're optimistic that 2025 marks a shift in tone and substance, with the Clean Industrial Deal and Germany's debt brake reform offering substantial funding to enable Europe's green ambitions, unlocking up to €1 trn for broader defence, infrastructure and energy transition projects over the coming decade.

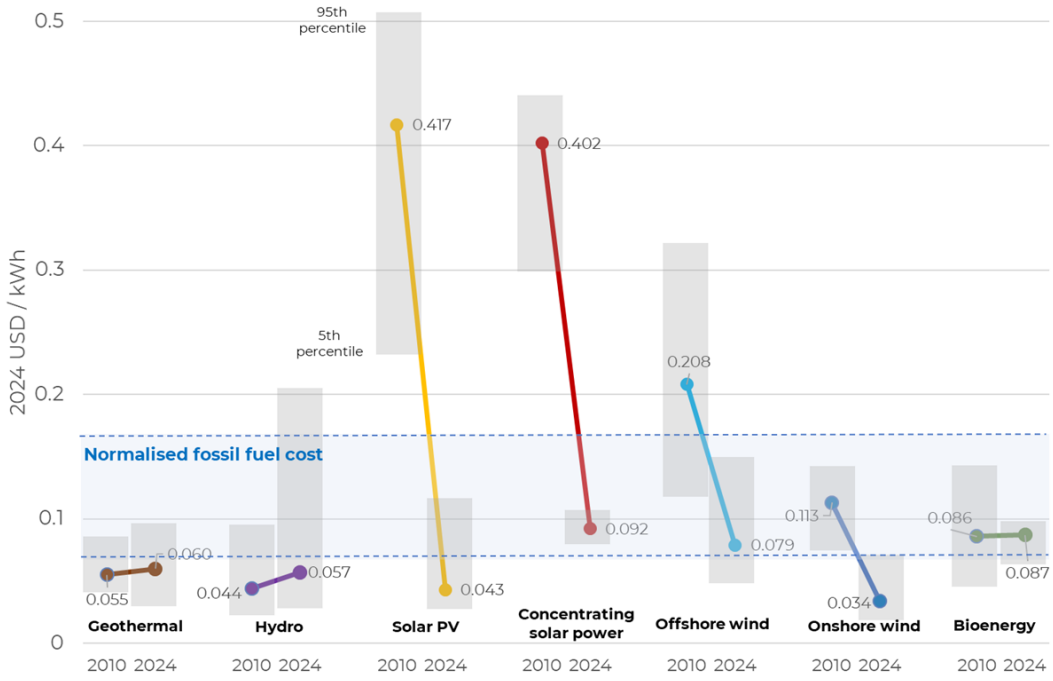
Compared to previous events, **COP 29** in November in Azerbaijan was lightly attended and appeared to make little progress toward broader decarbonization goals. Notable wins included Mexico setting a 2050 net zero target, Indonesia (operator of the fifth largest coal fleet in the world) announcing a 2040 coal phase-out target (16 years earlier than the prior target) and progress was also made towards a global carbon credit platform. The COP was billed in advance as having a particular focus on climate finance, but the ultimate agreement, which stipulated that developed nations pay $300 bn per year to developing nations, was seen by many as being insufficient.

On a positive note, **global investment in clean technologies** grew, reaching $2 trn in 2024 according to the IEA – almost twice the spend on coal, oil and gas in the year, and up from $1.7 trn in 2023. Higher-than-anticipated borrowing costs have been offset by easing supply chain pressures and falling prices, especially for solar PV and battery technologies. The greater investment means that clean energy is becoming a greater share of global GDP growth (having averaged 10% in 2023), with the number of clean energy jobs growing and accounting for more than half of employment in the global energy sector.

Renewable electricity is often the most cost-effective form of new electricity supply. According to Levelized Cost of Electricity (LCOE) estimates from the International Renewable Energy Agency (IRENA), the cost of wind and solar projects commissioned in 2023 ranged from $0.03-0.11/kWh, well below the fossil fuel cost range of $0.08-0.17/kWh. Despite increases in project financing costs and inflation across the broader economy, the LCOE of solar and onshore wind projects fell by 12% and 3% respectively, vs 2022. This illustrates that renewables remain cost-competitive, and this keeps the long-term driver of renewables adoption intact.

Global LCOE of newly commissioned utility-scale renewable power generation technologies (2010–2024)

LCOE = levelized cost of electricity



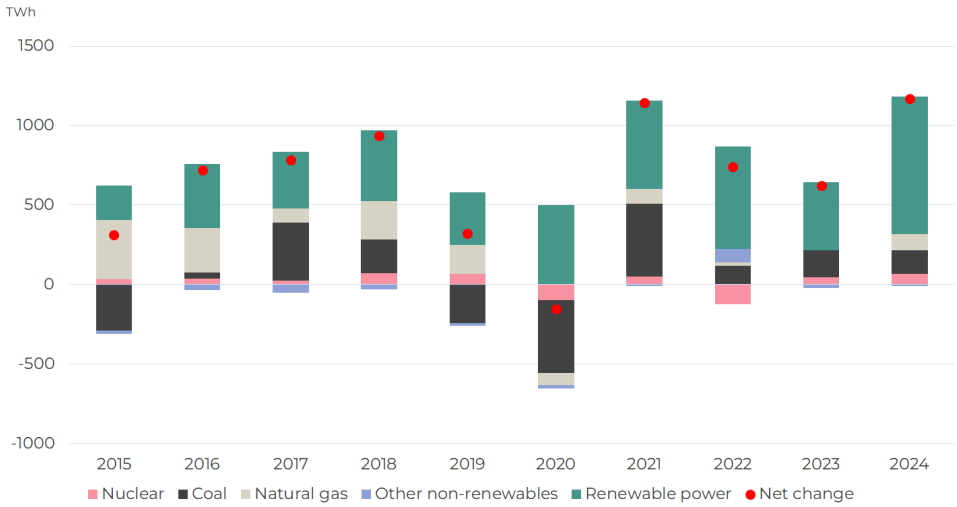
Source: IRENA; Guinness Global Investors, December 2024

Installations and power generation

Around 580 GW of **new renewable generation capacity** was installed in 2024, 100 GW higher than the record installations in 2023 and more than triple the 185 GW installed pre-COVID in 2019. At over 400 GW, solar represented around three-quarters of the new capacity additions. Wind came next, at just over 100 GW, followed by hydropower, then bioenergy.

Renewable electricity generation in 2024 increased by 858 TWh (around 10%), reaching over 9,800 TWh and outpacing global electricity demand (1,170 TWh or 4% growth in 2024). Most of the rise in renewable power generation can be attributed to the increase in installed solar and wind capacity, although it was also boosted by a strong recovery in hydro output after drought conditions in various regions the year before.

Change in electricity generation (TWh) 2015-2024E



Sources: IEA; Ember; Guinness Global Investors, 2025

More than half of the electricity demand growth in 2024 came from five technologies: electric vehicles (EVs), heat pumps, electrolysers, air conditioning and datacentres. The spread of these technologies is accelerating the growth in electricity demand, but overall energy demand is not growing as fast, since electrification is more efficient than fossil fuels.

Energy displacement: efficiency and alternative fuels

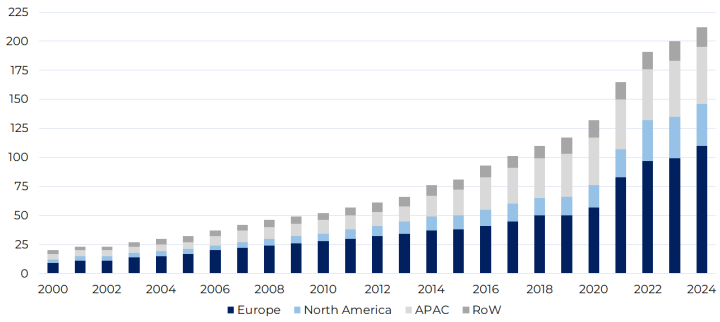
It is a common misconception that achieving rapid growth in renewable power generation will be enough to deliver government targets for pollution, energy security and decarbonisation. Renewable power generation is a key part of the solution, but we see the displacement and more efficient use of existing energy sources as just as critical, and arguably more urgent, in achieving these goals. The IEA refers to the theme of energy efficiency as being the 'first fuel' that should be considered in delivering the energy transition. It is the one energy source that every country can access in abundance today.

In our base case, we assume global energy demand growth over the next 30 years of around 1% pa. This assumes significant efficiency improvements relative to a historical energy demand growth rate of around 2% pa. Within the energy displacement sector, the key areas of focus are **efficiency** and **alternative fuels**.

Energy efficiency

It is hard to understate the importance of **energy efficiency**. Energy efficiency and energy security rose to the top of the political agenda following the surge in energy prices after the Russian invasion of Ukraine in 2022.

National policies in force targeting building efficiency



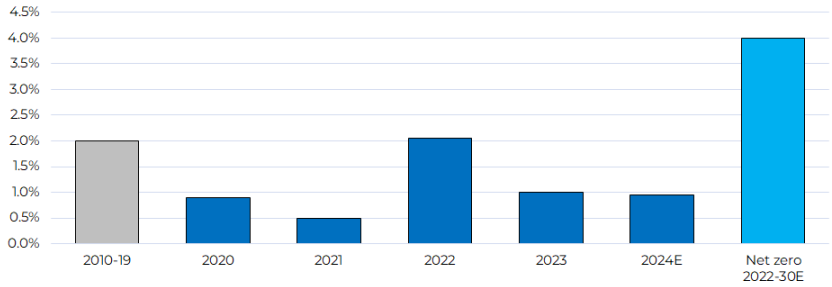
Source: IEA, Guinness Global Investors, December 2024

The increase was most pronounced in Europe, where the REPower EU plan aimed to rapidly reduce dependence on Russian natural gas imports and fast-track the green transition. In 2024, the EU set new goals to achieve 100% zero-emission buildings by 2050, adding to existing targets to install 10 million heat pumps by 2027 and reduce final energy consumption by 13% by 2030.

Elevated energy prices drove three years of double-digit growth in global efficiency spending from 2020 to 2022. Investment then retreated 7% in 2023 as higher interest rates weighed on housebuilders and renovation activity, and a 16% decline in Chinese construction significantly impacted the delivery of green buildings globally. In 2024, despite continued headwinds, spending remained resilient, falling just 3% to $270bn, 35-40% higher than 2019 levels.

We believe that Europe's decision to end its reliance on Russian gas is likely to lead to structurally higher natural gas (and therefore electricity) prices in Europe and Asia. Higher energy prices should support efficiency project economics, ultimately providing a tailwind to the COP28 goal to double the global average annual rate of energy efficiency improvements from around 2% to over 4% every year until 2030.

Global annual improvement in primary energy intensity



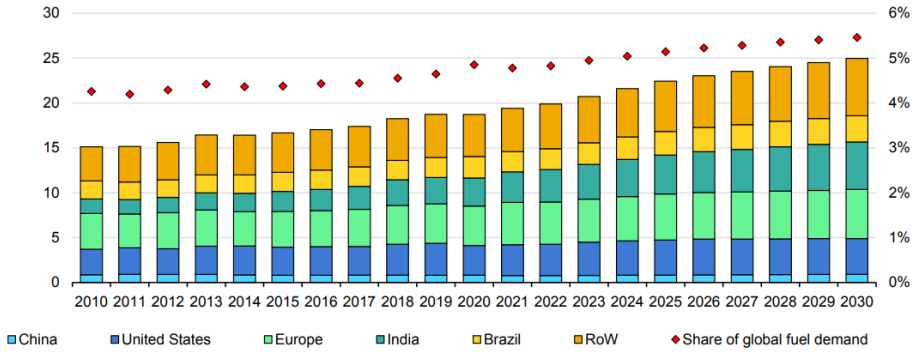
Source: IEA, Guinness Global Investors, December 2024

Alternative Fuels

Alternative (or renewable) fuels are set to play an important role in tackling emissions in carbon-intensive, hard-to-abate sectors. Global demand for these fuels in 2024 was around 21.5 exajoules (EJ) across industry, buildings and transportation, satisfying around 5% of their energy needs. Solid biofuels were the most prominent, making up 75% of alternative fuel consumption globally, followed by liquid biofuels at 20%, and biogas trailing at 5%. Four countries – the United States, India, Brazil, and China – represented over 50% of global demand.

Alternative fuel consumption is expected to grow steadily at around 2.5% per year out to 2030, reaching 25EJ, with over 65% of demand growth coming from India, China, Brazil, the US and Europe. Solid bioenergy contributes over 60% of the total demand growth, with liquid biofuels, used predominantly in transportation, representing around 25% of the total growth.

Global renewable fuel demand (EJ)



Source: IEA (incl. estimates), December 2024

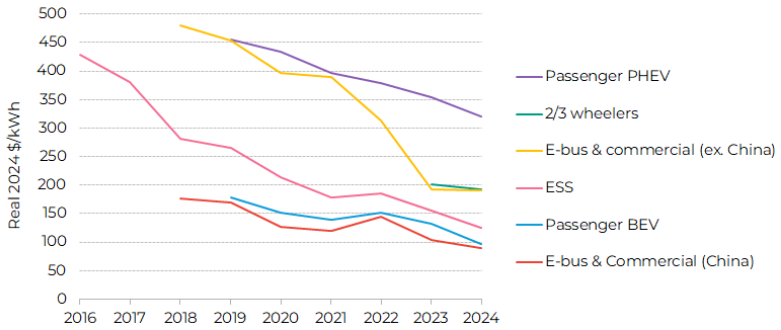
It is important to remember that alternative fuels broadly remain more expensive than their fossil fuel counterparts, meaning that policy support is key to underpinning future growth. For example, the $2/litre cost of producing biojet (often known as Sustainable Aviation Fuel, SAF) is nearly three times as much as the $0.75/litre cost of producing traditional jet fuel. Blending targets will still be needed to encourage the uptake of liquid biofuels while limiting the financial impact to consumers.

Electrification: batteries and electric vehicles

Global **battery demand** reached 1.2TWh in 2024, up 25% year-on-year and up nearly 500% since 2020. Battery prices (across all applications) fell a further 20% to $115/kWh in 2024, due to rapid growth of lower-cost Chinese manufacturing. Assuming a continuation of the 18% historic learning rate, Bloomberg New Energy Finance forecasts battery prices could fall to around $70/kWh by 2030.

The battery market is primarily driven by passenger electric vehicles (EVs), representing 70% of demand, with energy stationary storage (ESS) a distant second at 14%. Looking ahead, we expect passenger vehicles to remain the dominant driver, with emergent demand from commercial vehicles acting as a tailwind, resulting in an average annual growth in battery demand of around 20% per year out to 2030. The price of batteries for EVs fell below $100/kWh for the first time in 2024, driven by economies of scale and an increase in the adoption of lithium iron phosphate (LFP) chemistries. Thanks to its greater stability and lower cost, LFP's share of the global cathode mix has grown from 17% in 2020 to 44% in 2024. China now boasts the lowest battery pack prices globally at $94/kWh, 20-30% lower than the US and Europe, and is the only region to see average prices below $100/kWh.

Historical volume-weighted average pack prices by sector

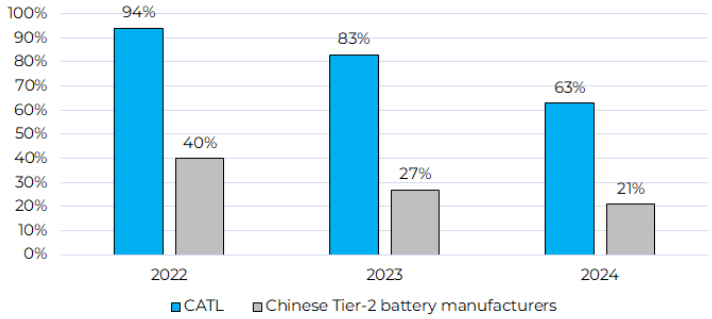


Source: BNEF, Guinness Global Investors, December 2024

Weaker-than-expected EV demand in 2024 led to falling battery manufacturing utilisation rates across the industry, falling as low as 21% for tier 2 manufacturers in China compared to 63% for industry leader CATL. Smaller players facing persistently low utilization and weak profitability are starting to respond by curtailing investment or exiting the industry entirely.

Benchmark Minerals noted that at least 25 gigafactory projects across China and Europe were cancelled or postponed in 2024, leading to downward revisions to long-term supply estimates. With EV penetration expected to accelerate across the West in 2025 and 2026, we expect utilisation rates at tier 1 manufacturers to inflect positively, helping to boost margins and profitability.

Chinese battery capacity utilisation

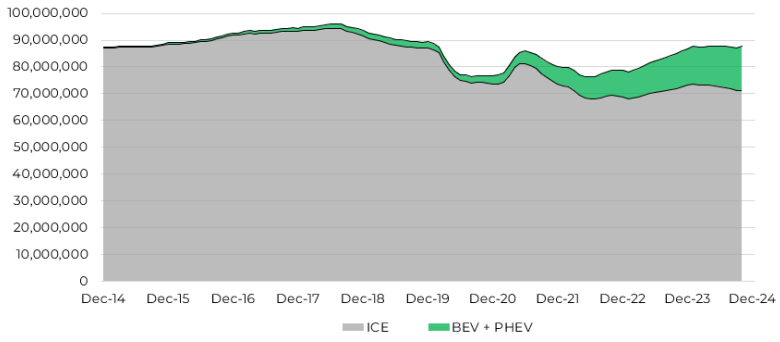


Source: Bernstein, Guinness Global Investors, December 2024

2024 saw rising trade tensions after the Biden administration more than tripled tariffs on Chinese imports of lithium-ion batteries (7.5% to 25%) and quadrupled tariffs on Chinese EVs (25% to 100%) in an attempt to shield domestic manufacturers from China's "unfair economic practices". Since taking office, President Trump has signed a flurry of executive orders, including the revocation of President Biden's 2021 EV targets, and implemented tariffs with key trade partners. Although uncertainty around auto tariffs persists, the announcement of a temporary pause provided markets with some near-term clarity. Subsequently, attention shifted towards the Republican's first budget (the One Big Beautiful Bill) and its implications for the scaling back of the Inflation Reduction Act. As had been widely expected, the revised bill eliminated electric vehicle tax credits post 2025, but crucially, support for battery manufacturing in the US is set to last until 2032, a positive development that was beyond previous expectations.

Electric vehicles continued to gain popularity in 2024, growing 20% year-over-year to 17 million units (a 20% penetration rate). Meanwhile, internal combustion engines (ICEs) continue to lose share, with sales having fallen by around 25% since their peak in 2017.

Rolling 12-month light vehicle sales by drivetrain

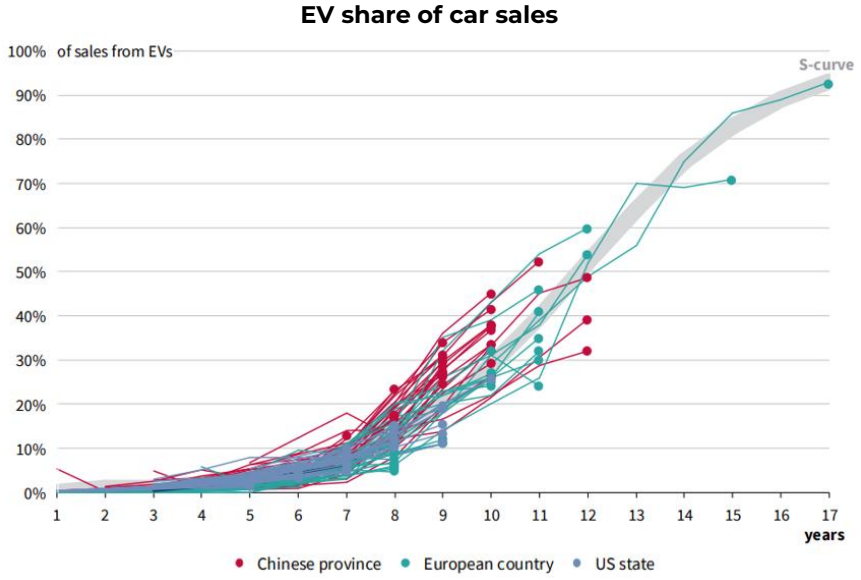


Source: LMC, Cleantechnica, Guinness Global Investors, December 2024

Slowing EV sales growth was largely attributable to higher financing costs, a post-COVID inflationary spike in vehicle prices and a weakening macroeconomic environment. Lower interest rates and cheaper batteries will improve EV affordability and should act as further positive catalysts for the sector.

We take confidence from Norway, which has banned ICE vehicle sales this year after seeing EV penetration rise from just 10% in 2013 to over 90% in 2024. While Norway is a small high-income country, it is interesting that its EV adoption curve is being tracked very closely by China, which achieved EV penetration rates of over 50% in the second half of 2024. Indeed, RMI

analysis covering over 110 countries, states, and provinces across Europe, the US, and China found a universal S-curve pattern in EV deployment, with EV sales taking six years to get to 5%, and only another six years to get to 50%. If growth continues along these S-curves, RMI estimates that electric vehicles will make up over 80% of new vehicle sales in China and Europe by 2030 with the United States reaching that level by 2035.



Source: RMI, December 2024

Ultimately, we believe EVs will be cheaper to buy, cheaper to run and cheaper to maintain, driving the journey towards 50% global EV sales penetration in 2030 and over 90% sales penetration in 2040. Whilst regulatory and policy-based initiatives have been necessary to grow the EV industry to critical size, EVs can ultimately offer better technology (Chinese battery manufacturers CATL and BYD have both developed batteries capable of offering ~500km range on just a 5-minute charge), better efficiency (EVs convert over 85% of energy stored into motion, compared to less than 40% for ICE vehicles) and better economics (60% of all EVs sold in China in 2023 were cheaper than the ICE equivalent) that will allow them to dominate.

Renewable installations: solar, wind, power grids and nuclear

Solar

Solar deployments grew significantly again in 2024, with global installations of around 600 GW, up around four times (40% per year) since 2020 and nearly double the 22% annual growth achieved between 2014 and 2019. The rapid uptake is undoubtedly due to the vast improvements in both solar technology and solar economics, with module prices continuing to tumble, falling by 90% over the past 10 years to a record low of just 9 cents per watt in 2024. The profitability of module manufacturers suffered as oversupply caused module prices to fall below the cash cost of manufacturing at times.

Solar continues to become more efficient. Around 20 years ago, solar modules were 5% efficient, 10 years ago they were 15% efficient, current modules are around 25% efficient and current research suggests that we may achieve 50% efficiency over the longer term. This could open the door to solar power costs falling 50-75% to as little as 1-3 cents per kilowatt hour (c/kWh), thereby cementing its position at the bottom of the electricity cost curve.

In 2025, we anticipate growth across all major geographies, resulting in full-year global installations of approximately 670 GW. China will continue to dominate, making up approximately 50% of the global market as it attempts to decarbonise its power grid and achieve peak emissions before 2030. Growth should remain robust in North America, driven by hyperscalers looking to lock in solar power purchase agreements, which offer zero-carbon electricity with long-term price visibility and one of the fastest times to power. Datacentres also provide a tailwind in Europe, which is expected to grow at a more restrained pace after more than doubling over the previous three years.

Global solar module installations, 2010-2025E (GW)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025E
OECD solar installations (annual)																
North America	1	2	4	6	7	8	15	12	12	15	22	26	26	40	48	53
Germany	7	7	8	3	2	1	1	2	4	4	5	6	7	15	15	16
Spain	0	0	0	0	0	0	0	0	0	5	4	6	9	9	8	9
Rest of Europe	3	4	5	5	5	8	5	7	9	14	15	21	28	46	55	56
Australia	0	1	1	1	1	1	1	1	4	3	4	6	4	6	4	5
South Korea	0	0	0	1	1	1	1	1	2	4	6	4	3	3	3	4
Japan	1	1	2	7	10	11	8	7	7	7	9	6	6	5	4	5
Total OECD	**17**	**23**	**24**	**24**	**25**	**31**	**32**	**31**	**39**	**53**	**65**	**75**	**86**	**128**	**141**	**152**
Change	*10*	*7*	*0*	*0*	*2*	*5*	*1*	*0*	*7*	*14*	*12*	*10*	*18*	*42*	*55*	*25*
Non-OECD solar installations (annual)																
China	0	3	3	14	13	19	30	53	44	33	52	69	107	260	309	330
India	0	0	1	1	1	2	5	10	11	11	4	13	19	14	27	29
Rest of non-OECD	1	3	3	4	6	4	8	7	12	21	29	26	40	42	123	156
Total Non-OECD	**2**	**5**	**8**	**18**	**21**	**27**	**46**	**72**	**67**	**65**	**85**	**107**	**172**	**316**	**458**	**515**
Change	*1*	*3*	*2*	*11*	*2*	*6*	*19*	*26*	*-5*	*-2*	*20*	*22*	*58*	*144*	*286*	*198*
Total solar installations (annual)	**19**	**29**	**31**	**42**	**46**	**56**	**75**	**101**	**106**	**118**	**150**	**182**	**252**	**444**	**599**	**667**
Change	*11*	*10*	*2*	*11*	*4*	*10*	*19*	*26*	*5*	*12*	*32*	*32*	*76*	*192*	*347*	*223*

Source: BP, BloombergNEF, PV InfoLink, IEA and Guinness Global Investors estimates, December 2024

Thinking longer-term, solar power sits at the bottom end of the power generation cost curve, and significant increases in solar power generation are inevitable and necessary in a low-carbon energy system. Record-low module prices will only improve the volume outlook and the down cycle in pricing will end, providing opportunities for manufacturers to regain normalised profitability levels. To offset the intermittency, we will need to see solar & storage projects being more broadly economic in order to displace new build fossil fuel power generation. Storage project costs have dropped by around 90% since 2010 meaning that, over the last couple of years, the cheapest solar & storage projects (LCOEs in the range of 4.6-6.0 c/kWh) are already competitive with the cheapest new gas/coal-fired power projects (LCOEs in the range of 3.9-4.5 c/kWh and 6.8-6.9 c/kWh respectively). Higher-cost projects still require subsidies and incentives, but costs are likely to fall.

Wind

Turning to the **wind industry**, manufacturing capacity grew by 21 GW in 2024, vs 12 GW in 2023. Total installations grew to a record 122 GW as manufacturers continued to recover from supply chain bottlenecks, raw material and labour market cost inflation and onerous non-profitable contracts that were priced before inflationary conditions hit in 2021. Wind operators also saw greater stabilisation in 2024 with no new significant project cancellations as the interest rate easing cycle started to improve project economics. In addition, power purchase agreements (PPAs) for wind reached record highs in the US ($68/MWh in Q4 2024 according to Levelten) and remain near all-time highs in Europe (€90/MWh). This sustained pricing, as interest rates started to decline, shored up new project economics and provided much-needed certainty to operators who have sat on the sidelines for the last two or three years.

Looking into 2025, we estimate a record level around 145 GW of new installations, an increase of around 21 GW versus 2024. Encouragingly, well over half of that increase is ex-China, suggesting a material ramp in growth in the sector in the key North American and European regions.

Global wind installations, 2010-2025E (GW)

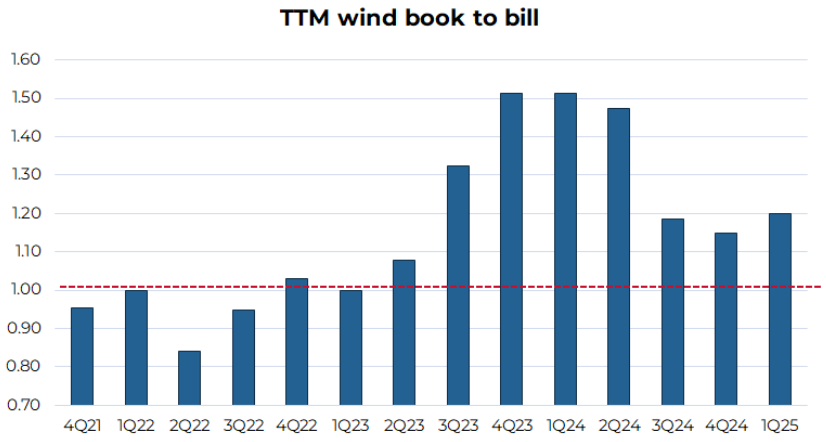
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025E
Onshore wind installations (annual)																
North America	6	8	15	2	7	10	9	8	8	10	17	14	10	8	8	10
Latin America	0	0	0	0	5	3	3	3	4	3	3	6	4	6	6	4
Europe	9	10	12	11	11	11	12	13	8	9	14	14	15	16	11	18
China	17	18	14	15	21	29	22	17	19	26	54	42	44	54	77	81
India	1	1	2	2	2	3	4	4	2	2	1	2	2	3	3	5
RoW	3	4	4	3	4	5	5	5	4	4	4	8	5	4	5	8
Total onshore	**35**	**40**	**46**	**33**	**49**	**61**	**55**	**49**	**46**	**55**	**93**	**84**	**79**	**91**	**110**	**126**
Change	*-3*	*5*	*6*	*-14*	*17*	*11*	*-6*	*-6*	*-3*	*9*	*38*	*-9*	*-5*	*12*	*19*	*16*
World ex China	*18*	*22*	*32*	*18*	*29*	*32*	*33*	*32*	*27*	*29*	*40*	*43*	*36*	*38*	*33*	*45*
Offshore wind installations (annual)																
China	0	0	0	0	0	1	1	1	2	3	4	14	5	8	7	12
UK	1	0	1	1	0	1	0	1	2	2	1	1	3	1	0	3
Germany	0	0	0	0	0	2	0	2	0	2	0	1	0	1	1	1
RoW	0	0	0	1	0	0	0	1	0	1	2	1	1	2	6	3
Total offshore	**1**	**0**	**2**	**2**	**1**	**4**	**1**	**4**	**4**	**8**	**7**	**17**	**9**	**12**	**14**	**19**
Change	*1*	*-1*	*1*	*1*	*-1*	*4*	*-4*	*3*	*0*	*3*	*-1*	*10*	*-8*	*3*	*2*	*5*
World ex China	1	0	1	2	1	3	0	4	3	5	3	3	4	4	7	6
Total wind installations	**36**	**40**	**48**	**35**	**50**	**65**	**56**	**53**	**50**	**63**	**100**	**101**	**88**	**103**	**124**	**145**
Change	*-2*	*4*	*8*	*-13*	*16*	*15*	*-9*	*-3*	*-2*	*12*	*38*	*1*	*-13*	*15*	*21*	*21*

Source: BP, IEA, BNEF, Guinness Global Investors estimates, December 2024

We see a near 60% increase in installations to around 200 GW by the end of the decade, with onshore growing at 6% pa and offshore growing at 20% pa. The starting point for the industry is healthy, with industry-level book-to-bill (the ratio of new orders to existing sales) having been comfortably above 1.0x on a trailing 12-month basis for the last eight quarters. This suggests that the industry has a strong pipeline of work.

We remain encouraged by the potential of the Offshore sector to drive growth in the wind industry as we enter the second half of the decade. Within Europe alone, there is c.26 GW of awarded and approved capacity set to come on-stream by 2030, the equivalent of 2-3 years of onshore growth globally. We would expect this to grow and note that there are 9.2 GW of projects tendered offshore France in November 2024 that will soon join this backlog.

Trailing 12-month European wind book to bill



Source: company data, Guinness Global Investors estimates, June 2025

Global power grids

Global power grids will have to be substantially upgraded and extended to cope with higher wind and solar generation as electricity demand inflects upwards. This includes high-voltage transmission (covering large distances), medium-voltage distribution (covering shorter distances) and low-voltage equipment (used within buildings). Within high and medium-voltage applications, we continue to see strong growth in transmission and distribution (T&D) spending. The Edison Electric Institute calculated US T&D investment at $95bn in 2024, up 9% versus 2023. We expect a healthy outlook for US grid investment, averaging 8-10% growth per year to 2030, as network owners and operators look to replace and upgrade ageing infrastructure (typically 30-50 years old or over), harden the grid against extreme weather and build out new capacity.

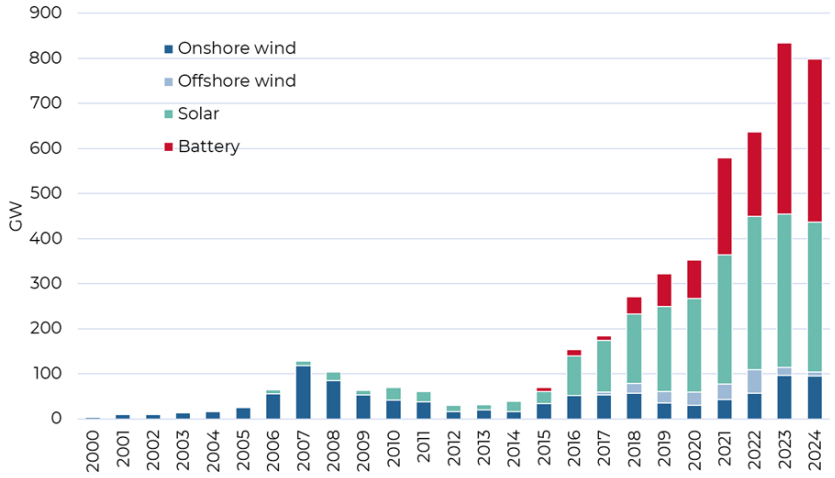
After 20 years of flat electricity consumption, we see demand growth of around 2-3% per year due to datacentres, AI querying, reindustrialisation and electrification. Political support will be required to make this happen and we stress that the outlook here is very robust despite President Trump's cuts to the IRA. The inflection started in 2024 in the US, but we expect pressure in Europe as well, where – despite the region being 12-24 months behind the US – data centre capacity is still forecast to grow at 20% per year to reach 35 GW in 2030. Three meaningful bottlenecks to this growth exist, relevant both in a US and a global context, and provide opportunities for companies to make superior margins:

- **Labour:** Bernstein estimates that the US will need 50% more linemen by 2035, forecasting a 12,000-worker shortage if the industry continues to grow at its historic rate. Experienced engineers are in short supply.

- **Transformers:** The average US transformer is 35-40 years old, and the US imports around 80% of its large transformers. Supply chains are stretched with prices up 60-80% since early 2020 and lead times tripling to c.150 weeks since 2021. Electrical equipment manufacturers, especially US domestic manufacturers, are well placed.

- **Permitting:** The Lawrence Berkley National Laboratory sees the US interconnection queue at its highest level on record, while WoodMac expects that permit applications from as far back as 2020 will not be approved until later this decade. The opportunity for superior margins could last for a few years.

US cumulative interconnection queue



Source: Generation, Lawrence Berkeley National Laboratory, December 2024

These are long-term trends that will require multi-year investment programmes and it is therefore not surprising that **nuclear power** came back into consideration in the US as concerns grew about grid stability. While not necessarily considered to be a 'renewable' power source, and despite its chequered past, nuclear power will play a role in the global energy transition and there is no credible net zero scenario which doesn't forecast growth in 'carbon-free' nuclear. The 2024 nuclear renaissance saw hyperscalers sign deals to restart old reactors, support small modular reactors (SMRs) and invest in start-up companies developing nuclear fusion technologies.

A key focus remains SMRs, which are frequently touted as a solution to provide baseload low-carbon power generation. However, as far as we are aware, only two SMRs are currently in operation globally: one in Russia (in a maritime setup) and the other in China. With limited information about either, the development schedule and the underlying economics of both are unclear. Based on our current understanding, we believe SMRs in the US will not be cheaper than gas or renewable-based power generation. In late 2023, NuScale cancelled its planned SMR Carbon Free Power Project (CFPP) in Utah as its costs escalated (requiring 9 c/kWh to be economic, after a 3 c/kWh IRA subsidy) and its start date slipped (back to 2029, from an original plan of 2026). While carbon-free baseload power at $9 c/kWh could certainly be considered 'economic', we would expect project delays and cost overruns to take this substantially higher.

So, beyond restarting idled nuclear plants, nuclear power does not appear to be set for meaningful growth. We expect the first power from new SMR facilities to come after 2032, but even then, it is unlikely that SMRs have any meaningful impact until the late 2030s, in our opinion. This leads to a situation where global power grids will need to be extended and strengthened in order to cope with higher levels of variable renewable power.

IMPLICATIONS OF A NET ZERO SCENARIO

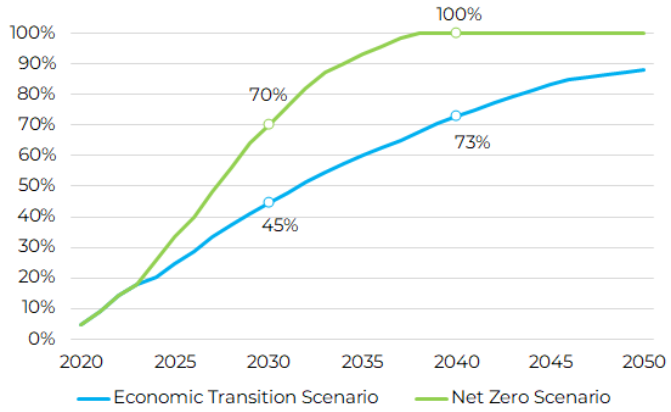
Throughout this document, we refer to our base-case energy transition scenario that reflects our understanding of the industry's current capacity and plans to provide decarbonisation solutions. This scenario is not consistent with net zero, and we highlight the following changes across our subsectors that would be required to deliver a net zero transition:

- Within **efficiency**, annual improvements in energy intensity would need to quadruple from 1% in 2024 to average 4% per year out to 2030 globally. For buildings, this translates into efficiency, electrification and end-use investment increasing to around $850bn per year this decade (from $340bn today). For the industry, investment must step up from $50bn in 2024 to $125bn per year out to 2030. It is worth noting that our base case scenario already assumes significant energy efficiency gains, with world energy demand forecast to grow at 1% per year, half the historic rate of 2% per year.

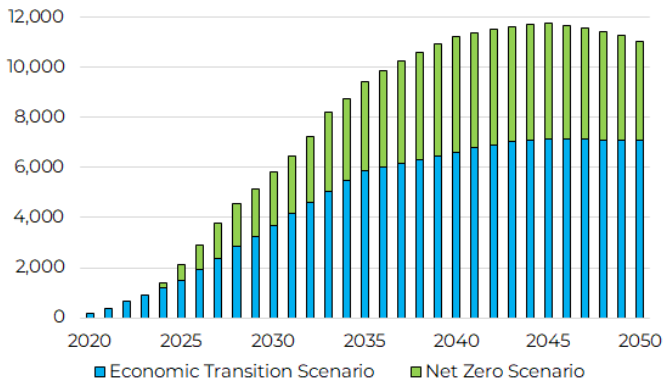
- **Alternative fuel** production growth would need to more than double by 2030 from 2023 levels (implying 11% per year growth) and then double again by 2050. SAF would have to grow from 0.3% of global jet fuel in 2024 to around 10% in 2030 (substantially higher than our base case 2030 estimate of around 2%).

- For **electric vehicles** and **batteries**, BNEF estimates that in a net zero scenario, global EV penetration rates must hit 70% by 2030 with 100% of vehicles sold being electric by 2040 (versus their current 'base case' economic transition estimates of 45% and 73% respectively). This translates into global battery demand of 5.8 TWh in 2030 compared to 1.2 TWh today, almost 60% higher than their base case assumptions, which themselves imply an annual growth rate of 20% per year from current levels.

EV sales penetration forecasts (%)



Lithium-ion battery demand forecasts (GWh)



Source: BNEF, Guinness Global Investors, December 2024

- **Solar** and **wind** generation by 2050 would need to be more than double the levels anticipated under our base case scenario, which already assumes a 4x increase in the wind generation base and a 10x increase in the solar base.

- For **power grids**, net zero would require global grid investment to grow at around 14% per year to the end of the decade, more than doubling from around $370bn today to over $800bn by 2030, 50% higher than our base case estimate.

- Under a net zero scenario, **nuclear** power capacity needs to expand by around 15 GW every year to the end of the decade, reaching 545 GW by 2030. Despite this only constituting 30% growth from current levels, new installations must outpace a wall of retirements from power plants installed in the 1970s and 1980s, which are now coming to the end of their useful lives.

- According to McKinsey, annual **investment** in low-emissions technologies would need to increase from about $1.5trn to around $7trn over the next three decades, while annual investment in renewable capacity in 2025-2030 would need to be triple the 2023 levels in order to achieve 16%pa renewable growth required near term to achieve a NZE trajectory.

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GUINNESS SUSTAINABLE ENERGY UCITS ETF

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