Guinness Sustainable Energy

Investment Commentary – June 2025

RISK

This is a marketing communication. Please refer to the Prospectus, Supplement and KID/KIID for the Funds, which contain detailed information on their characteristics and objectives, 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. Further details on the risk factors are included in the Funds' documentation, available on our website.

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 at least 80% 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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COMMENTARY

US POWER DEMAND

Addressing surging electricity demand remains a critical issue for President Trump and his goal of achieving energy dominance. It is also at odds with his administration's efforts to reduce federal support for renewable energy projects. This month, we summarise proposed adjustments to the Inflation Reduction Act (IRA) in the latest tax bill and explore the case made by NextEra for renewables and storage as the only realistic option to meet short-term demand growth.

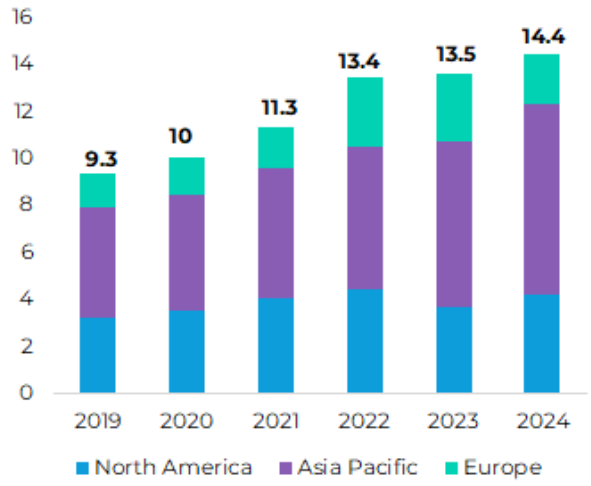
EQUITIES

The Guinness Sustainable Energy Fund (Class Y) delivered a return of 8.1% (in USD) in May, outperforming the MSCI World which returned 5.9%. Markets continued to be impacted by political developments in the US and tariff uncertainty. Among the fund's top performers were auto-related names such as Infineon and Sensata who benefited from the temporary de-escalation in global tariffs. On the other hand, the fund's weaker performers were impacted by ongoing efforts to revise the IRA as part of current US budget discussions.

CHART OF THE MONTH: HEAT PUMP SALES REBOUND

Global heat pump sales rebounded in 2024, growing 6% with strong growth in Asia and North America. Sales in Europe materially declined due to faltering policy support and high electricity costs. Canada and the UK were the fastest growing regions, according to BNEF, with shipments up 53% and 64% respectively. Continued growth remains dependent on consistent and supportive policy as well as further affordability improvements.

Heat pump sales (millions)



Source: BNEF, 2025

MAY 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
Global electric vehicle (EV) sales have demonstrated considerable resilience in the face of ongoing trade disruptions, recording 29% year-on-year growth according to research house Rho Motion. China has seen 35% sales growth this year as domestic manufacturers have met surging domestic demand with little impact from increasing trade barriers. Europe has also enjoyed 25% year-to-date sales growth as tightening emission targets continue to drive adoption in key markets such as Germany (+42%), Italy (+56%), Spain (+57%), and the UK (+32%). In contrast, growth in North America continues to be constrained by tariff volatility and policy uncertainty, resulting in just 5% sales growth year-to-date.	Electric Vehicle Sales	
In May, President Trump signed a series of executive orders aimed at revitalizing the US nuclear industry. The measures include fast-tracking licences for new reactors, streamlining regulatory processes, and initiating a broader overhaul of the Nuclear Regulatory Commission to reduce bureaucratic delays. These moves signal a significant policy pivot designed to re-establish nuclear power as a cornerstone of US energy strategy, potentially unlocking new investment in small modular reactors (SMRs) and next-generation nuclear technologies.	Nuclear Energy	
Developments in the sustainable aviation fuel (SAF) sector point to growing international momentum. The International Air Transport Association (IATA) recently projected that global SAF production will double in 2025 to reach 2 million tons – equivalent to 0.7% of the industry's fuel consumption. However, the agency also cautioned that without substantial investment in production capacity and consistent policy support, the sector may struggle to scale efficiently. Elevated costs could persist, limiting the aviation industry's ability to decarbonise.	Sustainable Aviation Fuel	
Rising forecasts for US power demand continue to fuel M&A activity in the sector. In May, Blackstone Infrastructure announced the acquisition of utility TXNM Energy for $11.5 billion, representing a 15% premium to the undisturbed market price. The firm cited surging electricity demand and TXNM's transition-oriented generation portfolio as key drivers of the investment. In the same month, NRG Energy disclosed plans to acquire a portion of LS Power's generation assets for $12 billion, with management noting that the US is in the early stages of a power demand "supercycle". These transactions mark the latest in a flurry of high-value deals in the space, following Constellation Energy's $16.4 billion acquisition of Calpine in January.	Sustainable Energy M&A	
Danish energy company Orsted has cancelled its £8bn Hornsea 4 offshore wind project in the UK, citing deteriorating economic conditions including inflationary pressures and supply chain constraints. The decision underscores the mounting challenges facing large-scale renewable energy developments, particularly amid rising capital costs and uncertain policy support. Whilst the decision is clearly detrimental to the UK's net zero ambitions, the opportunity remains for the projected to be restarted when conditions improve.	UK Offshore Wind	

MANAGERS' COMMENTS

Accelerating electricity demand remains a critical issue facing US President Trump and his goal of achieving "energy dominance". To narrow the growing short-term supply/demand imbalance, the administration must oversee a rapid built-out of affordable and scalable power generation capacity. At the same time, Trump is seeking to reduce federal support for wind and solar projects to extend corporate tax cuts enacted in his first term. However, according to NextEra, the country's largest electricity provider, renewables and storage technologies are best placed to meet incremental short-term demand, with new natural gas and nuclear unlikely to play a meaningful role before 2030.

The future of the Inflation Reduction Act is now in the hands of the Senate

On May 22nd, the US House of Representatives passed a Budget Bill with implications for the Inflation Reduction Act (IRA). In its current form, the Bill does not attempt to repeal the IRA but raises around $570bn from the reduction of IRA credits. The proposals can be summarised across the different clean technologies as:

- **Electric vehicle purchasing tax credits:** to be eliminated (consistent with market expectations at the start of the year)
- **Utility solar and utility wind development** credits (ITC and PTC): to be wound down within 60 days of the Bill being passed (negative versus expectations)
- **Solar equipment manufacturing** tax credits: phased down in 2032 (positive versus expectations)
- **Battery equipment manufacturing** tax credits: phased down in 2032 (positive versus expectations)
- **Wind equipment manufacturing** tax credits: phased down by the end of 2027 (consistent with expectations)
- **Residential solar** tax credits: negative vs expectations, with tax credits being removed.

If the bill is passed in its current form, this would be incrementally negative for US clean energy production in the short term, albeit a smaller negative for clean energy equities which were already pricing in a highly pessimistic scenario. Our portfolio has limited direct exposure to IRA subsidies. We have one position (Enphase at 1.0%) exposed to US residential solar, where the proposals are negative, and a couple of positions (First Solar at 3.2%; Canadian Solar at 1.2%) exposed to US utility solar, where the news is partly negative (removal of the development tax credit) and partly positive (maintenance of the solar equipment tax credits).

We must now wait for the passage of the Bill through the Senate, where the outcome is hard to predict. On the one hand, the Senate is clearly under pressure to pass the Bill and find savings. On the other, these proposals would result in significant job losses in the residential solar industry which some Senators have lobbied to protect. They would also slow the deployment of utility-scale solar and wind at a time when the US is facing a potential power deficit. Regardless of the outcome, we remain confident in the future of US renewables thanks to their competitive offering on an unsubsidised basis; and we look forward to the clearing of a policy overhang that has suppressed sector sentiment for the last 18-24 months.

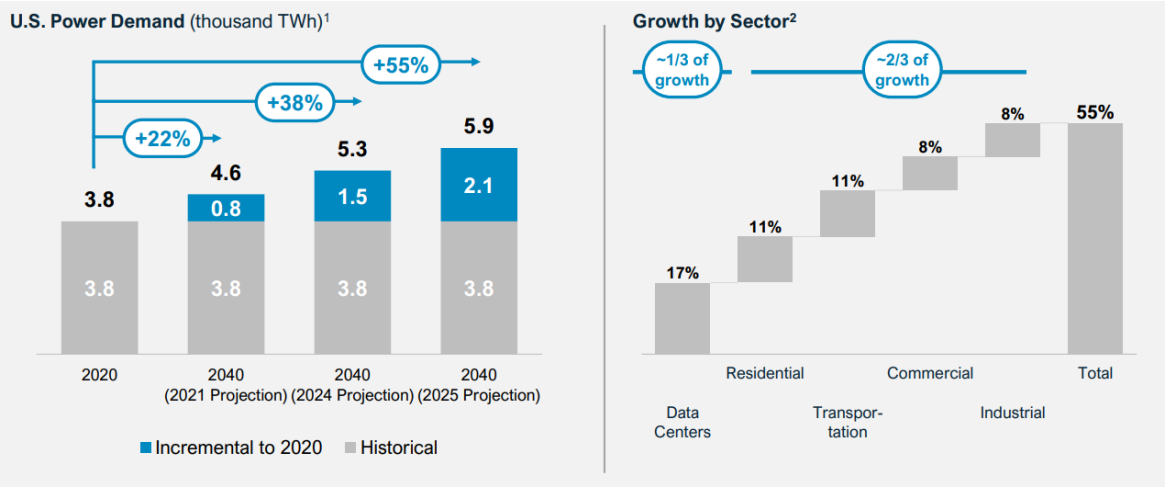
US electricity demand is accelerating – are renewables needed to fulfil this?

Policy uncertainty aside, one of our portfolio holdings, NextEra Energy, one of the largest utilities in the US, operating a diverse portfolio of fossil fuel and low-carbon assets, offers a realistic commentary regarding the future of the US power market. At its recent capital markets event, the company communicated a credible roadmap for how the power sector can balance surging demand growth with decarbonisation targets and reliability needs over the coming decades, outlining a scenario of rapid renewable build-out, supported by longer-term capacity additions from natural gas and nuclear.

NextEra see electricity demand in the United States rising at a pace not seen in decades, reaching c.5,900TWh by 2040. The company now expects total consumption to grow by 55% between 2020 and 2040, a marked increase from the 38% forecast it offered just a year ago and the 22% estimate it offered in 2021.

Over the long term, the trend will be driven by the broad electrification of households, transport and industry as well as the rapid expansion of artificial intelligence, and the proliferation of power-hungry datacentres needed to support it. NextEra expects datacentres to account for nearly a third of incremental demand through 2040, with the remaining two-thirds evenly divided between buildings, transport, and Industry.

US power demand forecasts 2020-2040E



Source: NextEra, 2025

A substantial expansion of the country's generation capacity is required to meet this surging demand. NextEra estimates that 460GW of new capacity will be needed by 2030, with solar accounting for around half, complemented by wind, battery storage and gas-fired plants that are already in construction. Given the scale and speed of projected demand growth, short-term supply/demand imbalances will need to be met by cost-efficient technologies that can be deployed at pace and scaled rapidly.

Renewables plus storage are best placed to bridge the growing supply/demand imbalance

In the short term, a combination of renewables and storage is the only source of generation that can be deployed to meet incremental power demand. The advantage of these technologies lies in their speed to market, flexibility and cost advantages.

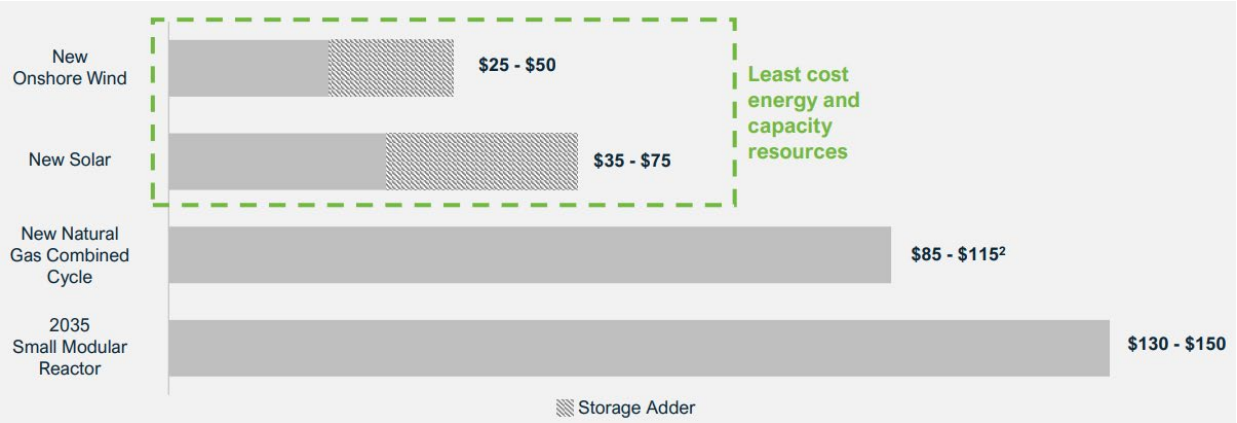
- **Speed to market:** NextEra estimates that it can add between 36.5GW and 46.5GW of incremental renewable-plus-storage capacity by 2027, leveraging existing technologies and well-developed supply chains to support rapid deployment. This is possible, in part, due to the availability of battery equipment which the company estimates it can source within around 12 months. This is in stark contrast to natural gas or new nuclear, which due to sub-scale supply chains, bottlenecks, regulatory delays and longer lead times, have deployment timelines that stretch from 5-10+ years.

- **Flexibility:** Storage projects can be built on existing sites and connected to existing grids, whereas new gas generation requires new gas supply and new pipelines to connect facilities to existing gas networks.

- **Cost Advantages:** As battery technologies have matured and scaled, costs have fallen sharply. The opposite is true for natural gas projects, which are experiencing cost inflation and extended build times.

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 natural gas combined cycle at $85-$115/MWh and a small modular reactor (in 2035) at $130-$150/MWh.

Estimated Costs of Firmed Generation Resources, 2030 ($/MWh)



Source: NextEra, 2025

Renewables and storage are the cheapest and most readily available form of incremental supply and are likely to be so for the next several years.

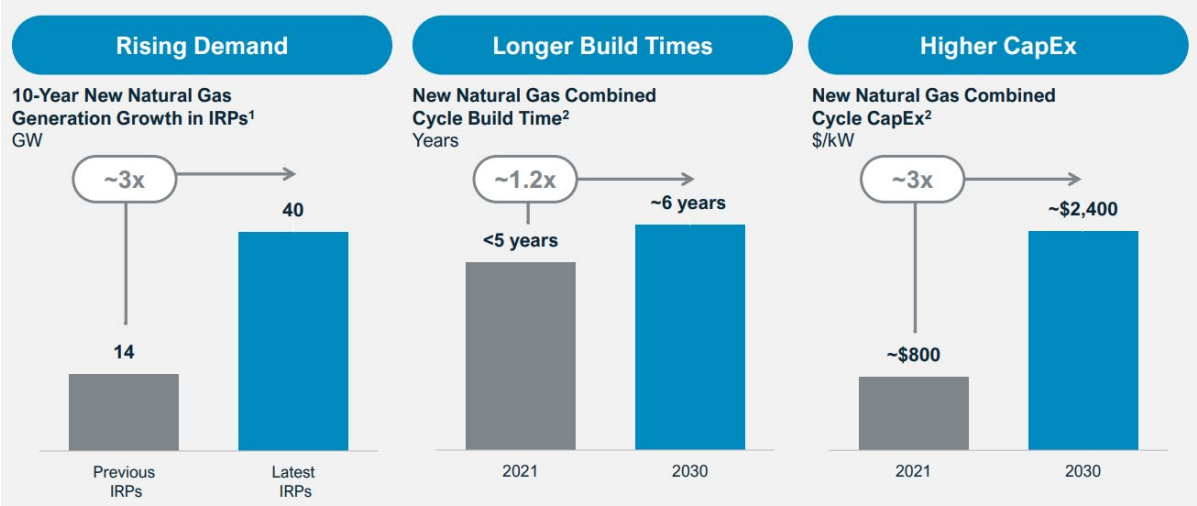
Natural gas will complement renewables in the longer term

New gas plants are needed to meet current demand projections and NextEra has outlined plans to triple its gas generation capacity from 14GW to 40GW. However, longer build times, cost inflation, and underdeveloped supply chains mean that gas cannot meet short-term demand growth and will ultimately be a more expensive source of incremental supply than renewables.

- **Longer build times:** NextEra estimate that build times for new natural gas combined cycle plants are likely to have lengthen by c.20% by 2030 (vs. 2021) due to turbine availability constraints and competition for skilled labour.

- **Increasingly expensive:** NextEra expects the cost of building new combined-cycle gas plants to triple by 2030, rising from around $800 per kilowatt of capacity in 2021 to roughly $2,400 per kilowatt, even as deployment timelines continue to lengthen.

Rising cost of natural gas power generation



Source: NextEra, 2025

Natural gas has an important role to play in the US's long-term generation mix. However, as the company stated in its Development Day, "Natural gas-fired generation cannot meet demand in the near term, and is a longer-term, more expensive solution."

New nuclear unlikely to play a part until 2035 or later

After decades of underinvestment, supply chains need to be rebuilt, and technology developed before new nuclear can contribute meaningfully to the generation mix. NextEra estimates that it will be 10 years or more before new nuclear can be deployed and even then, it is likely to be the most expensive source of generation available. However, the company believes that all forms of energy are needed to meet their electricity demand projections and therefore new nuclear will have an important role to play as a low-carbon baseload source of generation.

Conclusion

Utility-scale renewables now offer the most economic option, even without subsidy, to meet incremental power demand in most geographies. That said, the energy transition has never been about a single technology becoming dominant. NextEra's roadmap for meeting long-term electricity demand growth demonstrates that a number of technologies are relevant and substantial investment in generation capacity additions is required.

In the US over the next five years or so, renewables in combination with storage are the cheapest and fastest way to meet the country's power crunch, and the only realistic source of short-term supply. So, whilst nuclear and natural gas will have an important role to play in the long term, renewables remain the key technology to meet incremental demand today.

PERFORMANCE

Past performance does not predict future returns.

The **Guinness Sustainable Energy Fund** (Class Y, 0.68% OCF) delivered a return of 8.1% in the month, while the MSCI World Index (net return) delivered 5.9% (all in USD terms).

Guinness Sustainable Energy Fund	Ytd	1 Yr	3 Yrs	5 Yrs	10 Yrs*
Fund (Class Y)	4.3%	-12.5%	-6.6%	69.9%	51.7%
MSCI World NR Index	5.0%	13.7%	45.0%	94.1%	157.8%
Out/Underperformance	*-0.6%*	*-26.2%*	*-51.6%*	*-24.2%*	*-106.1%*

	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 7.1% in the month in GBP, while the MSCI World Index (net return) delivered 4.9%.

WS Guinness Sustainable Energy Fund	Ytd	1 Yr
Fund (Class Y, 0.67% OCF)	-2.8%	-16.2%
MSCI World NR Index	-2.5%	7.4%
Out/Underperformance	*-0.2%*	*-23.6%*

	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%*

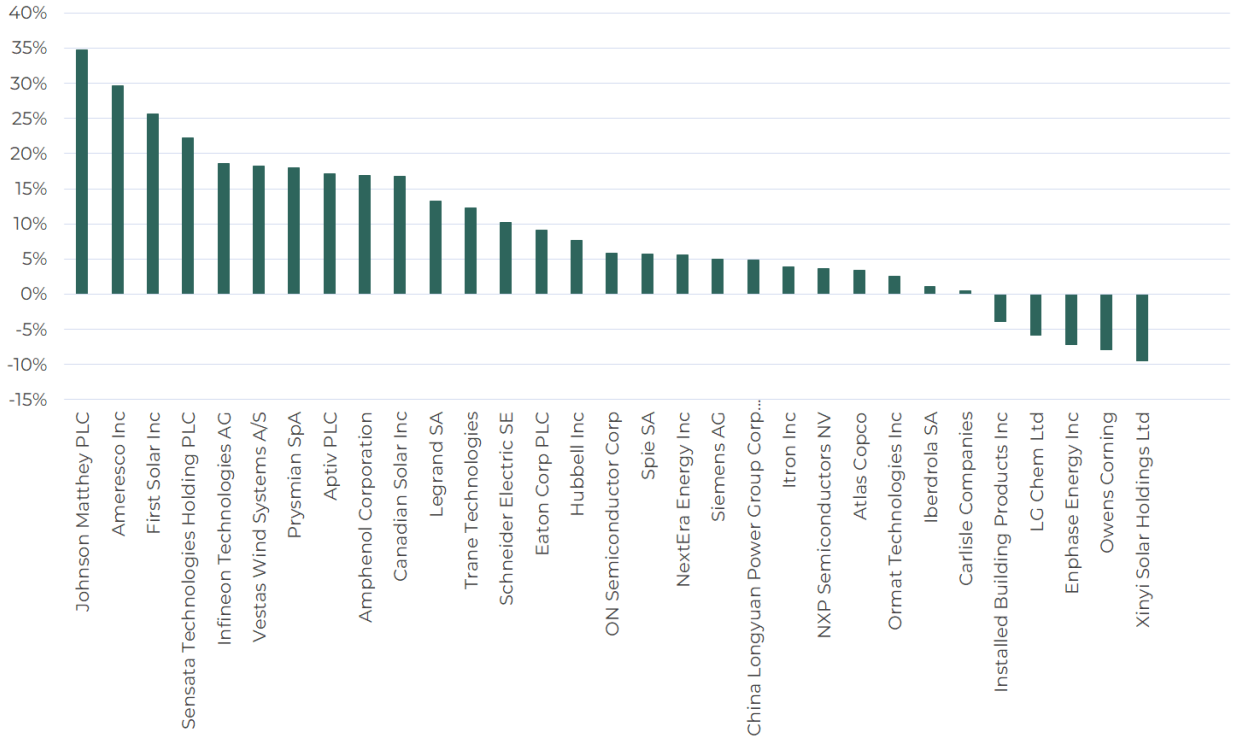
The Fund was launched on 30.12.2022.

Data as of 31.05.2025. 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.

Guinness Global Investors has been the investment manager of the **Guinness Sustainable Energy Fund UCITS ETF** since July 2024. We will include performance data for this vehicle in due course.

Within the Fund, the strongest performers were Johnson Matthey PLC, Ameresco Inc, First Solar Inc, Sensata Technologies Holding PLC and Infineon Technologies AG, while the weakest performers were Xinyi Solar Holdings Ltd, Owens Corning, Enphase Energy Inc, LG Chem Ltd and Installed Building Products Inc.

Stock by Stock performance over the month, in USD

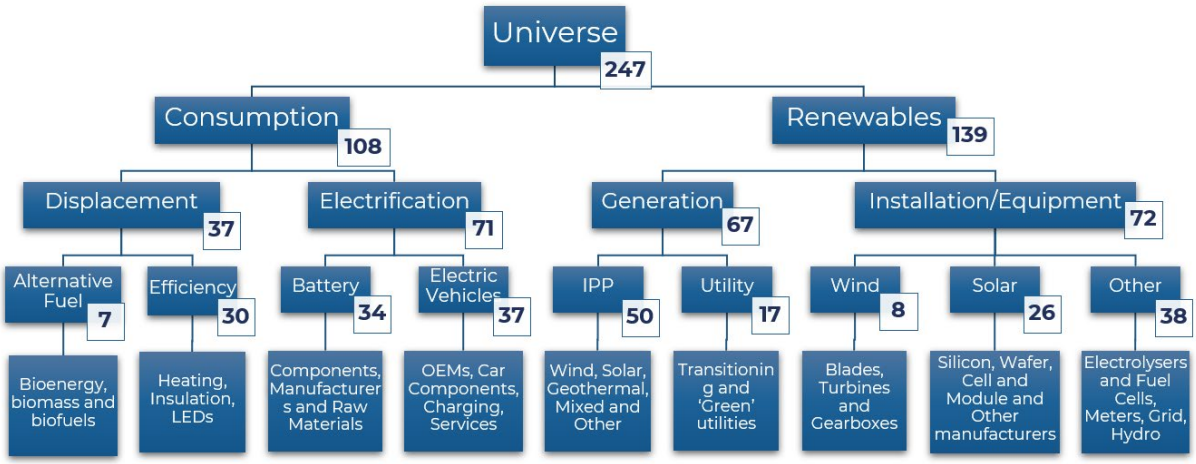


Source: Bloomberg. As of 31st May 2025

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 up to some companies with existing hydrocarbon-based fuel exposure, but this must be allied with a commitment to transitioning their business models towards sustainable energy sources. Our investment universe comprises around 250 companies which are classified into four key areas:

- **Generation** includes companies involved in the generation of sustainable energy, either pure-play companies or those transitioning from hydrocarbon-based fuels
- **Installation** includes companies involved in the manufacturing of equipment for the generation and consumption of sustainable energy
- **Displacement** includes companies involved in the displacement or improved efficient usage of existing hydrocarbon-based energy
- **Electrification** includes companies involved specifically in the switching of hydrocarbon-based fuel demand towards electricity, especially for electric vehicles



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

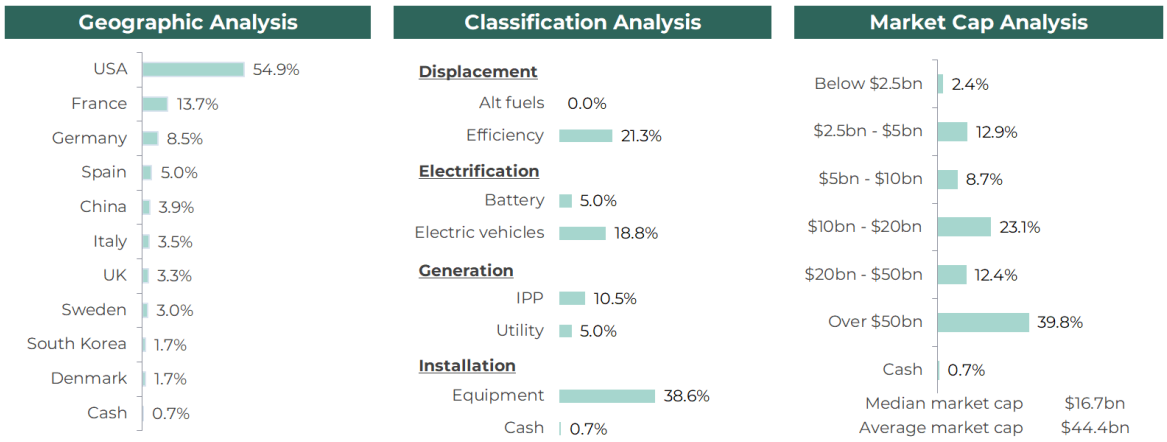
Buys/Sells

Buys

- **Prysmian** is the global leader in electrical and data cable manufacturing and a key enabler of the offshore wind industry. The business operates in an attractive niche and provides a unique exposure to the long-term structural growth opportunity of electrification. The company has a fully booked backlog through 2029, providing clear earnings visibility and as such, we believe that at current valuations the company offers compelling upside with decent defensive characteristics.

- **Atlas Copco** is a high quality Swedish industrial selling energy efficiency products that are critical for many existing and emerging low-carbon technologies. Having somewhat sold off in recent months, we believe it's a compelling opportunity to purchase a high-quality compounder in a depressed cyclical sector at a reasonable valuation.

Portfolio structure analysis



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

Portfolio sector breakdown

The following table shows the asset allocation of the Fund at month end and at previous year ends.

Asset allocation as %NAV	Current	*Change*	Year end	Previous year ends					
	May-25		*Dec-24*	Dec-23	Dec-22	Dec-21	Dec-20	Dec-19	Dec-18
Consumption	**45.1%**	***3.6%***	***41.6%***	**43.9%**	**44.9%**	**43.4%**	**36.7%**	**41.7%**	**26.5%**
Displacement	21.3%	*3.4%*	*17.9%*	15.3%	15.0%	11.8%	9.9%	13.4%	16.4%
Alternative Fuel	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*3.9%*
Efficiency	*21.3%*	*3.4%*	*17.9%*	*15.3%*	*15.0%*	*11.8%*	*9.9%*	*13.4%*	*12.5%*
Electrification	23.8%	*0.2%*	*23.6%*	28.5%	29.9%	31.6%	26.8%	28.2%	10.1%
Batteries	*5.0%*	*-1.6%*	*6.6%*	*10.2%*	*11.6%*	*8.9%*	*10.8%*	*12.6%*	*3.9%*
Electric vehicles	*18.8%*	*1.7%*	*17.0%*	*18.4%*	*18.2%*	*22.8%*	*16.0%*	*15.7%*	*6.2%*
Renewables	**54.2%**	***-3.5%***	***57.7%***	**51.9%**	**49.3%**	**51.3%**	**60.4%**	**54.1%**	**69.7%**
Generation	15.6%	*-5.0%*	*20.5%*	19.5%	17.7%	23.1%	24.6%	22.2%	27.3%
IPP	*10.5%*	*-4.8%*	*15.4%*	*10.9%*	*8.7%*	*14.5%*	*17.0%*	*18.9%*	*26.7%*
Utility	*5.0%*	*-0.1%*	*5.2%*	*8.6%*	*9.0%*	*8.6%*	*7.6%*	*3.2%*	*0.6%*
Installation	38.6%	*1.4%*	*37.2%*	32.4%	31.6%	28.2%	35.8%	32.0%	42.5%
Equipment	*38.6%*	*1.4%*	*37.2%*	*32.4%*	*31.6%*	*28.2%*	*35.8%*	*32.0%*	*42.5%*
Cash	0.7%	*-0.1%*	*0.7%*	4.2%	5.8%	5.3%	3.0%	4.2%	3.8%

Source: Guinness Global Investors

Valuation

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

As at 31 May 2025	PE			EV/EBITDA			Dividend Yield		EPS Growth (%pa)		CFROI	
	2024	2025E	2026E	2024	2025E	2026E	2025E	2026E	2019-24	2024-27	2025E	2026E
Guinness Sustainable Energy Fund	18.5x	17.1x	14.3x	11.4x	10.6x	9.2x	1.7%	2.1%	7.7%	13.6%	11.6%	12.1%
MSCI World Index	21.6x	20.2x	18.1x	13.7x	12.7x	11.5x	1.9%	2.0%	6.7%	9.2%	9.7%	10.2%
Fund Premium/(Discount)	*-14%*	*-16%*	*-21%*	*-17%*	*-16%*	*-21%*						

*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 end May 2025

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

We hold a c.45% weight to companies associated with the consumption (or demand) of sustainable energy. Our largest exposure here is to companies involved in the electrification of demand, either via the creation of new batteries (c.5%) or the electrification of transportation (c.19% weight), while we have c.21% weight to those companies involved in either displacing existing energy sources or improving overall energy efficiency.

We hold one lithium-ion battery manufacturer, LG Chem, which is a Korean chemicals company and the largest lithium-ion battery manufacturer in the world.

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. Amphenol supplies connectors, sensors and high voltage interconnect solutions that are vital for EVs and EV charging infrastructure.

Our displacement holdings provide pure-play quality exposure to heating industries (Trane Technologies), insulation (Installed Building Products, Owens Corning, Carlisle Companies), energy efficient electrical equipment and services (Hubbell, Atlas Copco) and energy efficiency projects (Ameresco), and the group as whole will benefit from the increasing industry focus on energy efficiency that is expected to be a very long-term trend.

In terms of the supply of sustainable energy, we hold a c.16% weight to companies involved in the generation of sustainable energy and 39% weight to those exposed to the installation of or equipment used in the process of sustainable energy generation.

China Longyuan is a pure-play Chinese wind power producer and represents one of our six generation holdings. The remaining exposure comes in the form of geothermal (Ormat), plus offshore wind and broad-based wind/solar renewable energy generation through NextEra Energy (the largest producer of renewable energy in the world). Iberdrola is our one utility.

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. Vestas provides broad exposure to the strong growth that we expect in the onshore and offshore wind markets

Our remaining exposure to installation (Itron, Eaton, Legrand, Siemens, SPIE, Prysmian and Schneider Electric) consists of companies that provide equipment and services to improve the efficiency and metering of electricity transmission and consumption.

Portfolio themes as at end May 2025

	Theme	Example holdings	Weighting (%)
1	Electrification of the energy mix		27.4%
2	Modernising the power grid		11.8%
3	Rise of the electric vehicle and auto efficiency		10.7%
4	Power semiconductors		8.9%
5	Wind & solar: equipment manufacturing		8.3%
6	Low carbon power generation: regulated producers		9.5%
7	Low carbon power generation: independent producers		7.1%
8	Building and Industrial efficiency		15.6%
9	Other (inc cash)		0.7%

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

Guinness Sustainable Energy Fund (30 April 2025)			P/E			EV/EBITDA			Price/Book		
Stock	**ISIN**	**% of NAV**	**2024**	**2025E**	**2026E**	**2024**	**2025E**	**2026E**	**2024**	**2025E**	**2026E**
Displacement/Efficiency											
Hubbell Inc	US4435106079	4.7%	24.3x	20.7x	19.2x	15.1x	14.9x	14.0x	6.0x	5.2x	4.6x
Trane Technologies	IE00BK9ZQ967	5.5%	33.8x	29.9x	26.7x	21.9x	20.9x	19.1x	11.5x	10.3x	8.9x
Installed Building Products Inc	US45780R1014	2.7%	18.0x	16.0x	14.8x	9.8x	10.6x	9.9x	6.5x	5.1x	0.8x
Carlisle Companies	US1423391002	3.2%	20.7x	17.2x	15.2x	13.3x	13.0x	12.1x	6.8x	7.2x	6.0x
Owens Corning	US6907421019	2.8%	8.4x	10.0x	9.2x	6.4x	7.0x	6.7x	2.4x	2.2x	1.9x
Ameresco Inc	US02361E1082	0.9%	15.0x	14.5x	8.6x	11.8x	9.7x	8.0x	0.6x	0.5x	0.5x
		19.8%									
Electrification/Battery											
LG Chem Ltd	KR7051910008	2.0%	n.m.	25.0x	8.1x	8.2x	6.3x	4.6x	0.5x	0.5x	0.5x
Johnson Matthey PLC	GB00BZ4BQC70	2.9%	83.4x	8.9x	7.6x	9.3x	5.0x	4.7x	1.1x	1.0x	0.9x
		4.9%									
Electrification/Electric Vehicles											
Aptiv PLC	JE00BTDN8H13	3.0%	6.8x	8.3x	7.0x	6.7x	6.7x	6.4x	1.5x	1.3x	1.2x
Amphenol Corporation	US0320951017	4.3%	38.7x	29.4x	26.8x	22.9x	17.6x	16.3x	9.5x	7.8x	6.6x
ON Semiconductor Corp	US6821891057	2.3%	10.1x	16.4x	11.2x	6.6x	9.7x	7.9x	1.9x	1.8x	1.7x
Infineon Technologies AG	DE0006231004	3.8%	17.2x	18.5x	13.0x	9.1x	9.4x	7.5x	2.4x	2.0x	1.8x
NXP Semiconductors NV	NL0009538784	3.1%	16.1x	16.0x	13.5x	11.3x	12.0x	10.6x	5.1x	4.8x	4.3x
Sensata Technologies Holding PLC	GB00BFMBMT84	2.2%	5.4x	6.9x	6.3x	4.8x	7.1x	6.7x	1.1x	1.0x	0.9x
		18.6%									
Generation/IPP											
China Longyuan Power Group Corp Ltd	CNE100000HD4	2.7%	7.3x	7.1x	6.5x	10.1x	9.8x	9.0x	0.7x	0.6x	0.6x
Ormat Technologies Inc	US6866881021	3.9%	33.1x	35.3x	30.6x	15.2x	12.0x	10.7x	1.8x	1.7x	1.6x
NextEra Energy Inc	US65339F1012	4.7%	20.7x	18.2x	17.0x	18.3x	14.2x	12.6x	2.7x	2.4x	2.2x
Orsted A/S	DK0060094928	1.0%	24.9x	11.0x	9.3x	7.3x	6.7x	6.0x	1.9x	1.3x	1.1x
		12.3%									
Generation/Utility											
Iberdrola SA	ES0144580Y14	5.6%	18.9x	17.1x	16.3x	11.2x	10.7x	10.1x	2.3x	1.9x	1.9x
		5.6%									
Installation/Equipment											
Schneider Electric SE	FR0000121972	4.9%	27.4x	22.2x	19.7x	16.0x	14.2x	12.9x	4.2x	3.5x	3.2x
Legrand SA	FR0010307819	5.1%	21.8x	19.1x	17.6x	14.0x	12.9x	12.0x	3.7x	3.1x	2.9x
Eaton Corp PLC	IE00B8KQN827	4.7%	29.5x	24.5x	21.8x	20.5x	19.3x	17.5x	6.3x	5.8x	5.4x
Siemens AG	DE0007236101	5.0%	21.4x	17.2x	17.2x	14.0x	12.2x	10.9x	3.2x	2.8x	2.6x
Itron Inc	US4657411066	4.2%	21.2x	20.7x	18.4x	16.2x	16.6x	14.6x	3.6x	3.1x	2.7x
Spie SA	FR0012757854	4.5%	19.3x	15.4x	13.9x	9.4x	8.6x	8.1x	3.8x	3.1x	2.8x
Prysmian SpA	IT0004176001	0.9%	16.5x	12.8x	11.4x	10.6x	8.0x	7.4x	3.0x	2.4x	2.1x
Xinyi Solar Holdings Ltd	KYG9829N1025	1.7%	16.4x	12.4x	8.6x	7.8x	8.4x	6.7x	0.8x	0.8x	0.7x
Enphase Energy Inc	US29355A1079	1.2%	44.9x	17.4x	13.4x	28.0x	14.4x	11.3x	7.1x	6.3x	4.3x
First Solar Inc	US3364331070	2.5%	9.9x	8.0x	5.4x	6.9x	5.8x	4.1x	1.7x	1.4x	1.1x
Canadian Solar Inc	CA1366351098	1.2%	n.m.	n.m.	4.3x	9.4x	8.1x	4.7x	0.2x	0.2x	0.2x
Vestas Wind Systems A/S	DK0061539921	2.1%	27.4x	15.5x	10.9x	7.2x	5.1x	4.2x	3.7x	2.9x	2.4x
		38.0%									
Cash	Cash	**0.8%**									

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 near-term 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.

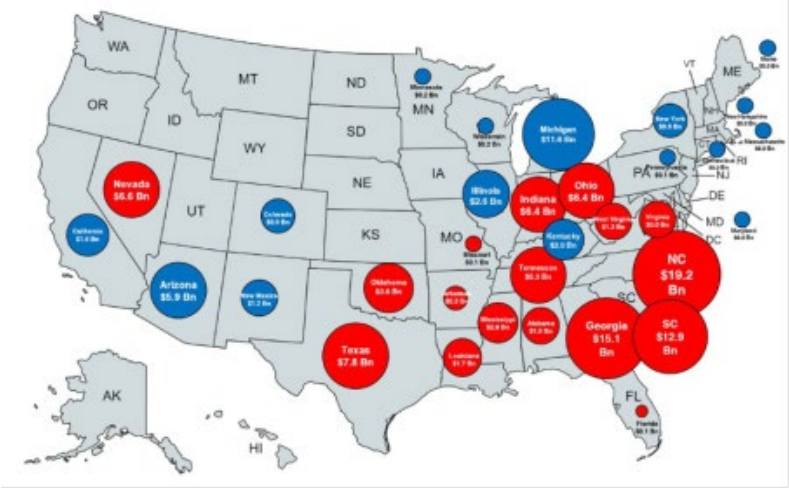
Policy support for decarbonisation

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

With respect to the Inflation Reduction Act, we think that President Trump will struggle to make substantial reforms and that he will have more success using his executive powers to promote fossil fuels instead. We expect him to put greater domestic content requirements on the various IRA tax credits, to broaden the reach of Foreign Entity of Concern (FEOC) designation beyond the electric vehicle industry and to slow down the awards of new offshore wind permits (since there is federal involvement in offshore wind). In addition, he will likely leave the Paris Agreement, lift the liquefied natural gas (LNG) export pause, roll back environmental restrictions and impose new tariffs (in excess of those placed by Biden in mid-2024) on imports related to renewable energy, particularly from China.

Investments announced under the IRA ($bn)

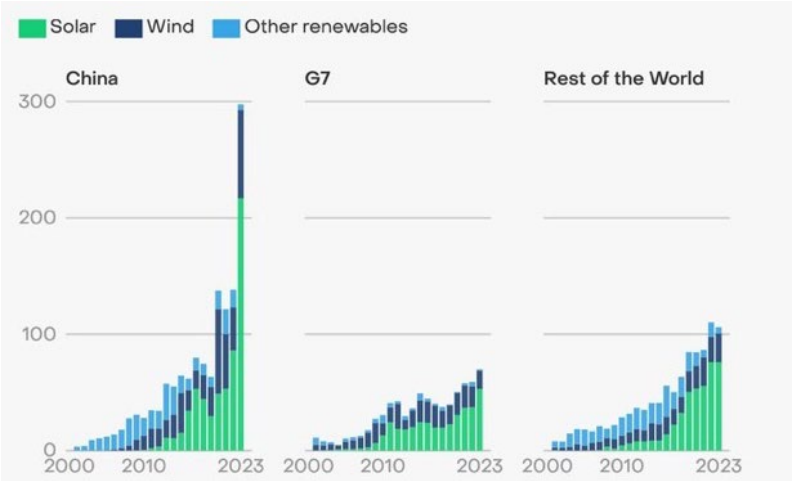
bubble colour = party of Governor (Red = Republican, Blue = Democrat), Prior to 2024 elections



Source: Clean Economy Works, JP Morgan, October 2024

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, to avoid wasted investments in fossil fuels, boost the competitiveness of Europe's businesses and to make 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.

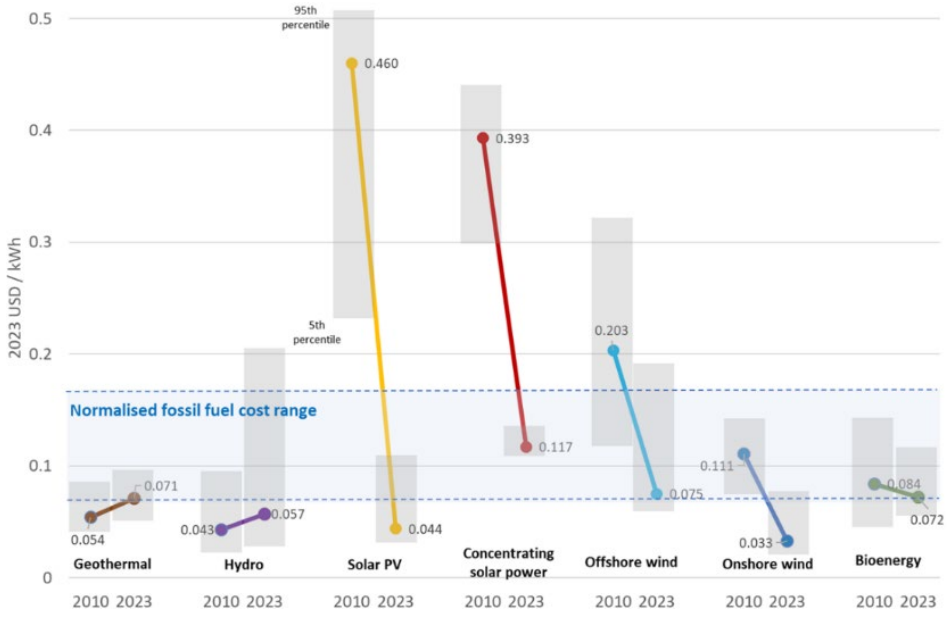
Compared with previous events, **COP 29** in November in Azerbaijan was lightly attended and appeared to do little to progress broader decarbonisation goals. Notable wins included Mexico setting a 2050 net zero target, Indonesia (operator of the fifth largest coal fleet in the world) announcing a 2040 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 that developed nations pay $300bn per year to developing nations was seen by many as being insufficient.

On a positive note, **global investment in clean technologies** grew and is likely to have hit nearly $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 the cheapest form of new electricity supply in most situations. 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 (2010–2023)

LCOE = levelized cost of electricity



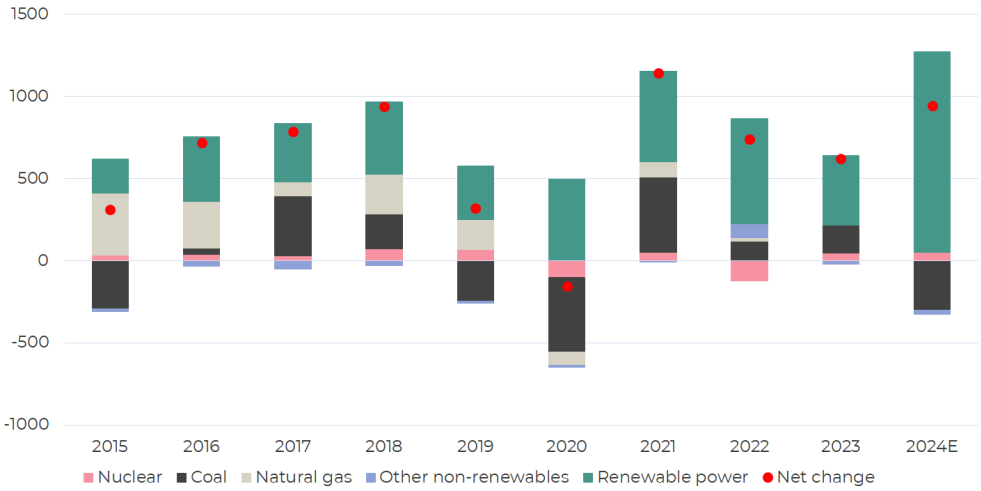
Source: IRENA; Guinness Global Investors, December 2024

Installations and power generation

Around 690 GW of **new renewable generation capacity** was installed in 2024, 170 GW higher than the record installations in 2023 and more than triple the 194 GW installed pre-COVID in 2019. At around 460 GW, solar represented around three quarters of the new capacity additions. Wind came next, at around 110 GW, followed by hydropower, then bioenergy.

Renewable electricity generation in 2024 is likely to have increased by 1,300 TWh (around 13%), reaching over 10,600 TWh and outpacing global electricity demand (estimated 970 TWh or 3% 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. The growth in renewable power generation implies a 2% fall in global fossil fuel generation (-330 TWh).

Change in electricity generation (TWh) 2015-2024E



Sources: IEA; EMBER; Guinness Global Investors

More than half of the electricity demand growth in 2024 came from five technologies: electric vehicles (EVs), heat pumps, electrolysers, air conditioning and data centres. 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

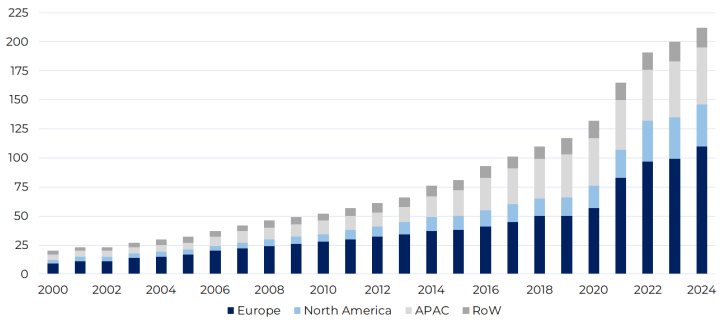
It is a common misconception that achieving rapid growth in renewable power generation will be enough to deliver government targets for pollution, energy security and decarbonisation. Renewable power generation is a key part of the solution, but we see the displacement and more efficient use of existing 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 an 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 raced up the political agenda following the spike in energy prices following the Russian invasion of Ukraine in 2022.

National policies in force targeting building efficiency



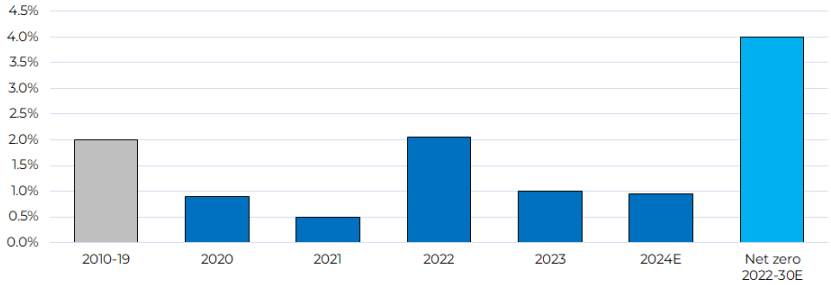
Source: IEA, Guinness Global Investors, December 2024

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 impacting the delivery of green buildings globally. In 2024, despite continued headwinds, spending is expected to have 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



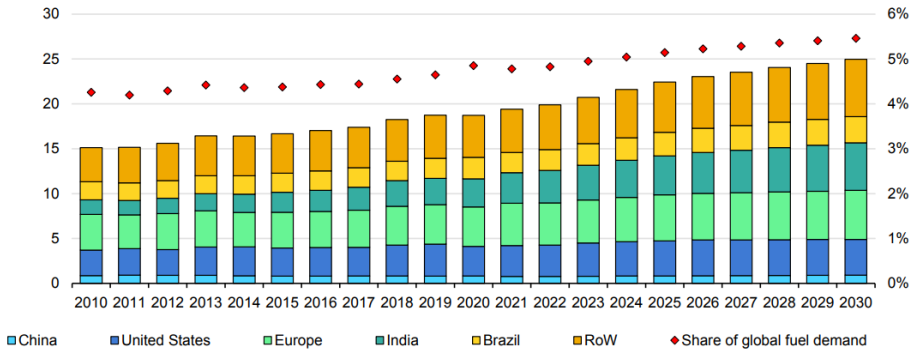
Source: IEA, Guinness Global Investors, December 2024

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

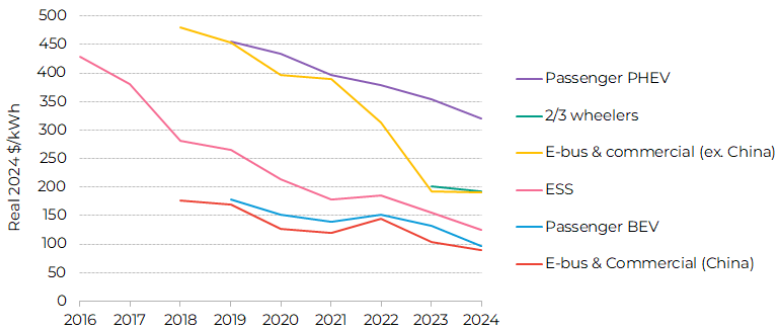
It is important to remember that alternative fuels broadly remain more expensive than their fossil fuel counterparts, meaning that policy support is key to underpinning future growth. For example, the $2/litre cost of producing biojet (often known as Sustainable Aviation Fuel, SAF) is nearly three times 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** is expected to have reached 1.2TWh in 2024, up 29% 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

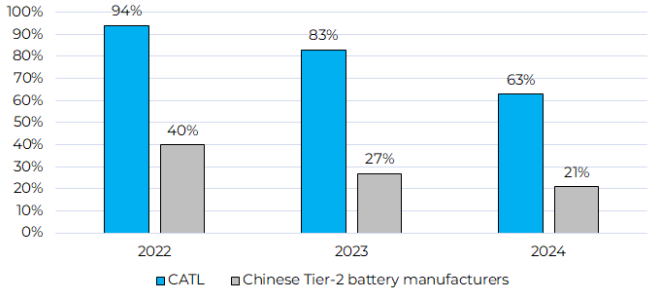


Source: BNEF, Guinness Global Investors, December 2024

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 due to accelerate across the West in 2025 and 2026, we expect utilization rates at tier 1 manufacturers to inflect positively, helping to boost margins and profitability.

Chinese battery capacity utilization

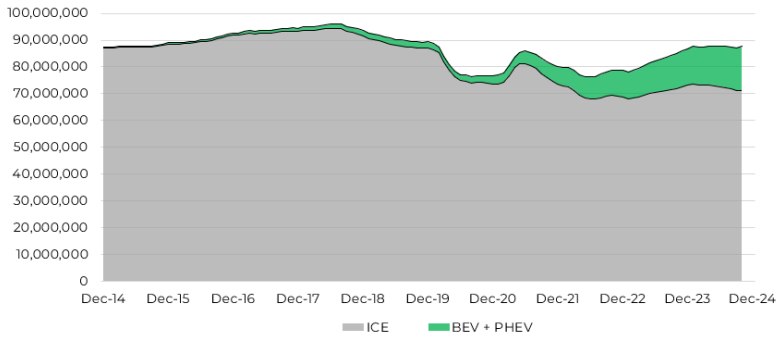


Source: Bernstein, Guinness Global Investors, December 2024

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". With the election of Donald Trump, trade barriers look set to rise further in 2025 and beyond. Given Trump's hostile stance towards China, we see it as highly likely that the US will incentivise 'friendly' countries to bring their technology and build battery manufacturing capacity in the US, presenting an opportunity for Japanese and South Korean manufacturers.

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

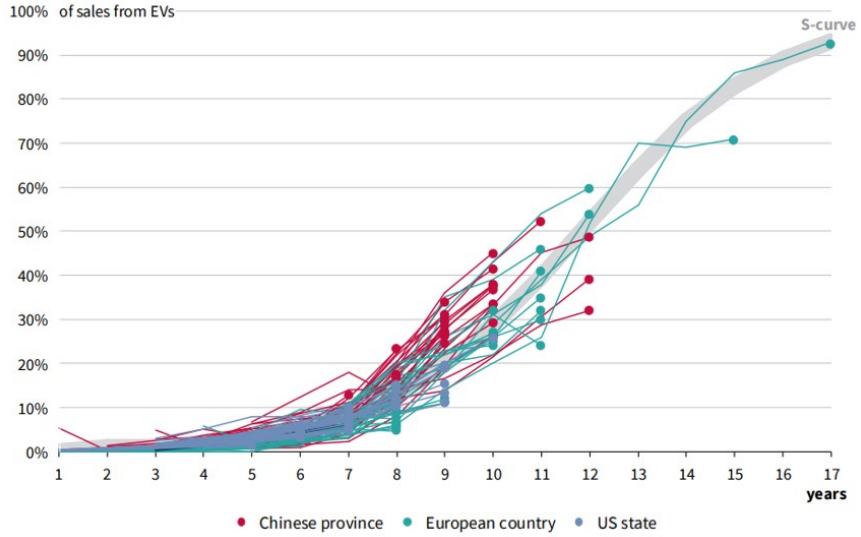


Source: LMC, Cleantechnica, Guinness Global Investors, December 2024

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.**

EV share of car sales



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 manufacturer CATL has developed a lithium iron phosphate battery with a 1,000km range), 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 modules 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.

Looking to 2025, we expect growth across all major geographies to result in full-year global installations of around 670 GW. China will continue to dominate, making up approximately 50% of the global market as it attempts to decarbonize 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. Data centres 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, BNEF, 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 89% between 2010 and 2023 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 subsidy 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 124 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 ($65/MWh in Q3 2024 according to Levelten) and remain near all-time highs in Europe (€89/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)

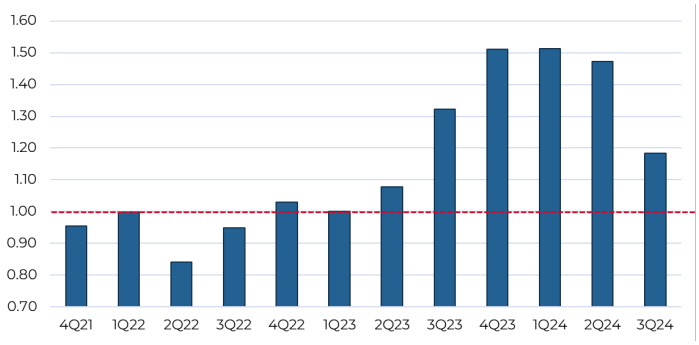
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025E
Onshore wind installations (annual)																
North America	6	8	15	2	7	10	9	8	8	10	17	14	10	8	8	10
Latin America	0	0	0	0	5	3	3	3	4	3	3	6	4	6	6	4
Europe	9	10	12	11	11	11	12	13	8	9	14	14	15	16	11	18
China	17	18	14	15	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) at c.1.2x on a trailing 12-month basis as of Q3'24, comfortably above 1.0x. This suggests that the industry has a strong pipeline of work.

We finally 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, December 2024

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.

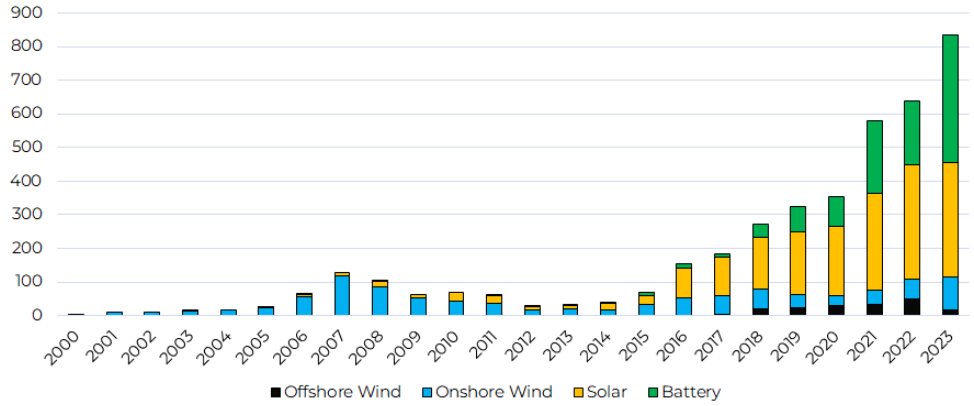
After 20 years of flat electricity consumption, we see demand growth of around 2-3% per year due to data centres, AI querying, reindustrialization and electrification. Political support will be required to make this happen and we stress that the outlook here is very robust regardless of what President Trump achieves with 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. From what we know, we think SMRs in the US will not be cheaper than gas or renewables-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

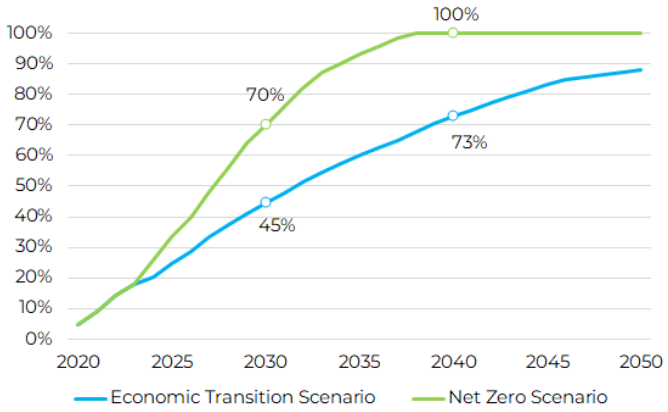
Throughout this document, we refer to our base-case energy transition scenario that reflects our understanding of the industry's current capacity and plans to provide decarbonisation solutions. This scenario is not consistent with net zero and we highlight the following changes across our subsectors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

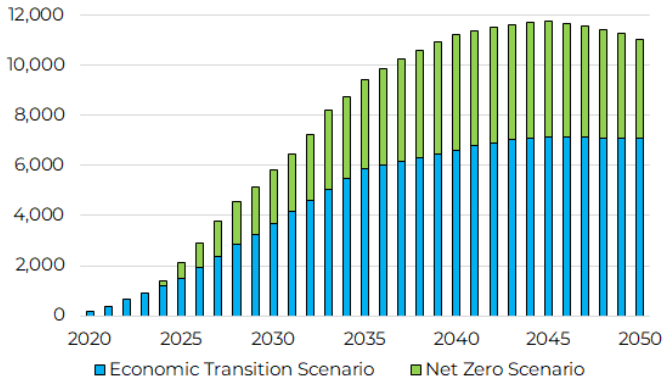
- **Alternative fuel** production growth would need to more than double by 2030 from 2023 levels (implying 11% per year growth) and then double again by 2050. SAF would have to grow from 0.3% of global jet fuel in 2024 to around 10% in 2030 (substantially higher than our base case 2030 estimate of around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

- For **electric vehicles** and **batteries**, BNEF estimate 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** on 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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The documentation needed to make an investment, including the Prospectus, Supplement, the Key Investor Information Document (KIID), Key Information Document (KID) and the Application Form, is available in English from www.guinnessgi.com or free of charge from the Manager: Waystone Management Company (IE) Limited 2nd Floor 35 Shelbourne Road, Ballsbridge, Dublin DO4 A4E0, Ireland; or the Promoter and Investment Manager: Guinness Asset Management Ltd, 18 Smith Square, London SW1P 3HZ.

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General Enquiries: 0345 922 0044
E-Mail: wtas-investorservices@waystone.com.

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GUINNESS SUSTAINABLE ENERGY UCITS ETF

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