

## RISK

This is a marketing communication. Please refer to the prospectuses, KIDs and KIIDs 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

|                        |                                     |
|------------------------|-------------------------------------|
| <b>Launch</b>          | 19.12.2007                          |
| <b>Index</b>           | MSCI World                          |
| <b>Sector</b>          | IA Commodity/Natural Resources      |
| <b>Managers</b>        | Will Riley<br>Jonathan Waghorn      |
| <b>Irish Domiciled</b> | Guinness Sustainable Energy Fund    |
| <b>UK Domiciled</b>    | TB Guinness Sustainable Energy Fund |

## INVESTMENT POLICY

The Guinness Sustainable Energy Funds are managed for capital growth and invests 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 the combined effects of strong demand growth, improving economics and both public and private support and that this will provide attractive equity investment opportunities. The Funds are actively managed and use the MSCI World Index as a comparator benchmark only.

## CONTENTS

|                       |    |
|-----------------------|----|
| August in review      | 2  |
| Managers' comments    | 3  |
| Performance           | 8  |
| Portfolio             | 10 |
| Outlook               | 14 |
| Important information | 26 |

## COMMENTARY

### 'BACK TO SCHOOL' FOR SUSTAINABLE ENERGY EQUITIES

Sustainable energy equities have experienced a sharp pullback in recent months despite policy momentum, leaving our portfolio trading at the lowest valuation since mid-2020 and at a small discount to the broader market. In this commentary, we conclude that fundamentals are robust and that policy support (in the form of the IRA and the EU Industrial Act) will accelerate investment. This leaves our portfolio well positioned, with earnings growth significantly in excess of the broader market.

### EQUITIES

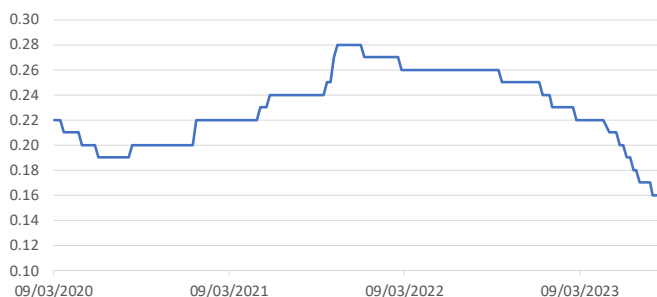
Sustainable energy equities underperformed global stock markets in August. The Guinness Sustainable Energy Fund (Class Y) delivered a return of -9.5% (in USD), behind the MSCI World at -2.4%. Year to date, the Fund has delivered +0.1%, versus the MSCI World at +16.1%.

Within the Fund, the strongest stocks included grid & electrical equipment companies Eaton, Hubbell, Legrand and Schneider, which all reported improved margins and guidance upgrades driven by positive price/cost dynamics. The weakest areas were linked to solar and wind. Residential solar names (SolarEdge, Sunnova, Enphase) sold off having reported poor second quarter results and weak guidance while utility solar (First Solar and Canadian Solar) and supply chain names (Xinyi Solar) reported project delays and weaker pricing throughout the value chain driven by aggressive capacity additions. At the end of the month, Orsted announced a potential DKK16bn of impairments on its US offshore wind projects driven by supplier cost overruns, lower than expected tax credits and higher interest rates.

### CHART OF THE MONTH

Standard monocrystalline module prices reached \$0.16/W in August, down from the post-COVID peak of \$0.28/W and below the most recent trough of \$0.19/W in mid-2020.






#### Solar module prices (USD\$/watt) fall to record lows



Source: Bloomberg, August 2023

**AUGUST 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  |
|---|-------------------------|---|
| <p>Chinese battery manufacturer CATL has announced a new version of lithium iron phosphate (LFP) battery that is capable of a 400km range from a 10-minute charge. The new battery is called Shenxing and EVs equipped with it will be available for sale in the first quarter of 2024. This is potentially a big improvement for LFP batteries that have typically suffered slower charging times and lower energy densities than their more expensive NMC counterparts.</p>                                     | EV uptake               |    |
| <p>The Chinese National Development and Reform Commission (NDRC) is preparing to publish new industrial standards and rules that will detail acceptable ways to decommission, dismantle and recycle wind and solar facilities. The agency expects to have a "basically mature" full-process recycling system for both technologies by the end of the decade. Globally, we believe that policy, regulation and technology for recycling sustainable energy equipment is still nascent.</p>                         | Solar and wind          |    |
| <p>Solar module prices hit all-time lows during the month, according to Bloomberg data. The standard monocrystalline module price registered \$0.16/W, down from the post COVID peak of \$0.28/W in late 2021. Associated with increasing affordability, BNEF upgraded its global solar installation estimates in its latest outlook, raising its FY23 estimate for solar installations by +14% to 392GW (+56% yoy).</p>  | Solar industry          |    |
| <p>Orsted announced a potential DKK16bn of impairments on its US offshore wind projects driven by supplier cost overruns, lower than expected tax credits and higher interest rates. The market reaction on the day (-25%) implied a negative that is at least 3x large as the announced impairment, reflecting questions about credibility and confidence in the equity story as well as the underlying economics of offshore wind</p>   | Offshore wind           |  |
| <p>The UK announced plans to have a number of small modular reactors operating in the UK in 2030s. Subsequently, US company Terra Power, which is backed by Bill Gates, announced that it will be able to build "dozens of reactors in the UK in the 2030s". Meanwhile, in nuclear fusion, scientists at the Lawrence Livermore National Laboratory in California have repeated a net energy gain from a fusion reaction for a second time, increasing confidence that nuclear fusion could yet be developed.</p> | Nuclear SMRs and fusion |  |

MANAGERS' COMMENTS

**'Back to school' for sustainable energy equities**

Sustainable energy equities have experienced a sharp pullback in the last couple of months, despite continued policy momentum, leaving our portfolio trading at the lowest valuation since mid-2020 and at a small discount to the broader market. In this month's "back to school" piece, we conclude that fundamentals are robust, that policy support (in the form of the IRA and the EU Industrial Act) will accelerate investment. This leaves our sustainable energy portfolio well positioned with earnings growth significantly in excess of the broader market.

**Earnings and cash returns progression remains attractive**

Since the end of June, the Guinness Sustainable Energy Fund has fallen 8.6% (to 31 August in USD), underperforming the MSCI World (up 0.9%). On a year-to-date basis, the fund is up by 0.1% versus the MSCI World up 16.1%. It is somewhat surprising that the underperformance has occurred during a period of continued policy support for the energy transition. The weakness has been across most of the sector: by comparison we note the 12.6%/15.3% decline in the iShares Clean Energy ETF and MSCI Alternative Energy Index since the end of June, leaving them down 18.5% and 25.9% year to date.

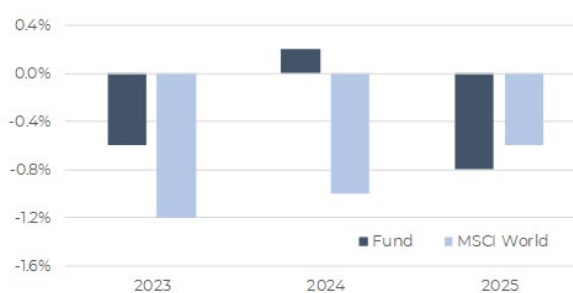
Below, we explore some subsector and company specific issues, but we start by reviewing the earning and cashflow return progression of our portfolio, which continues to evolve satisfactorily.

- In terms of **earnings**, we are now nearly through the Q2 2023 earnings season and our average holding has beaten consensus EPS estimates by 14.0% (vs 7.7% for the MSCI World). Earnings revisions and company guidance have also delivered fine, with year-to-date and quarter-to-date earnings revisions for the portfolio generally being better than the MSCI World.

Revisions to EPS (YTD)



Revisions to EPS (QTD)



Source: Bloomberg, as of 31.08.2023

- Our preferred metric of **cash returns** (cash flow return on investment (CFROI)) shows a similar picture. Over the last three months, the portfolio's 2023/24 cash return expectations are unchanged, as are those for the broad market. Over the last six months, the portfolio's 2023/24 cash return expectations are +0.3%, whereas the broad market is -0.2%. Within the portfolio, nearly 60% of the holdings saw positive cash returns progression while the universe was much more balanced (51% of companies saw positive cash returns progression while 49% saw negative progression).

Percentage point change in cash return expectations (3months to end August 2023)



Source: Bloomberg, CS HOLT, Guinness Global Investors estimates 31.08.2023

In simple terms, then, the performance of the fund versus MSCI World so far this year has not been driven by a weaker earnings outlook, but instead can be explained by:

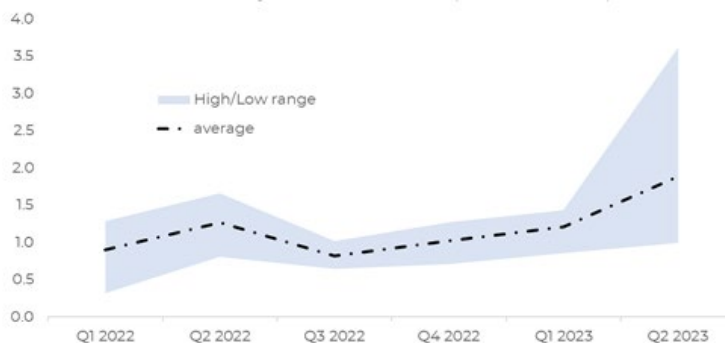
- The fund’s 12 month forward P/E ratio compressing from 19.1x to 16.6x (-13.0%)
- MSCI World’s 12 month forward P/E ratio inflating from 14.1x to 16.7x (+18.4%)

**Wind, solar and renewable generation seeing the greatest pressures**

Drilling deeper into the share price performance of our sustainable energy universe shows that the consumption (demand) side of our universe has been largely unscathed, with most of the weakness coming from three areas on the supply side: wind equipment, solar equipment and renewable generation.

1. In the **wind equipment** subsector, market confidence in a recovery has been badly dented by the surprise profit warning from Siemens Energy (not owned) in late June. At that time, the company identified a design flaw in their installed base of turbines which they estimated would cost more than EUR1bn to fix (tipping the company into losses). In their actual results, they increased this estimate to EUR2.7bn, sending further shockwaves through the industry. Despite these issues appearing to be very company specific, it has not prevented other wind equipment companies from selling off in sympathy. In contrast, the 2Q23 results provided a much improved orders to sales ratio (book to bill ratio) indicating inflecting growth alongside deflating input costs.

**Wind industry new turbine orders (book to bill ratio)**

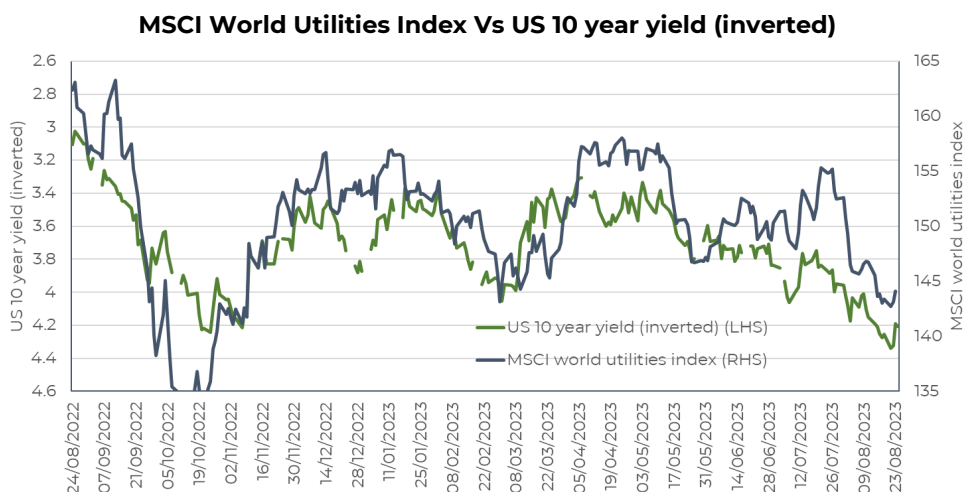


Source: Company data to 30.06.2023

- The **solar equipment** sector also suffered with the US residential solar space showing clearer signs of a short-term industry slowdown. This led to our two solar inverter holdings (Solaredge and Enphase) downgrading earnings guidance for the full year.

The issues here are twofold: first, there has been a moderate slowdown in underlying industry growth driven by rising interest rates and NEM 3.0 legislation in California. Secondly, we have moved from a position of stretched to more normalised supply chains. The combination of the two means that solar distributors who had built inventories in anticipation of higher growth rates are now finding that they can run with lower levels of inventory. As such, despite the industry continuing to grow nicely in aggregate, current distributors are running down inventories before ordering new inverters and this is having a short term knock-on effect on the demand that our companies are seeing. While frustrating, both Solaredge and Enphase expect the destock to be over by the end of the year and for growth to resume thereafter.

- In the **renewable generation** sector there is little stock specific news to report. All of our holdings reported good quarterly results and continue to experience revisions in line with or exceeding the broader market. However, this subsector continues to be highly correlated with interest rates and thus has sold off over the last couple of months with the rising US 10 year yield.



Source: Bloomberg, 31.08.2023

**Investment outlook continues to improve: the IRA one year on...**

We first wrote about the Inflation Reduction Act just over a year ago and described it as a seminal piece of legislation set to turbo charge clean tech investment in the US. One year on, it's clear that its impact, if anything, was understated; the \$369bn of tax breaks initially talked about have morphed, on some estimates, into \$1.6 trillion of capital being mobilised towards achieving net zero aims.

The American Clean Power Association - who have been tracking investment announcements, count over \$270bn of incremental investments announced over the last 12 months alone – equal to the prior seven years of green energy investment combined. In generation terms, it has led to 185GW of incremental clean power announced - approximately 80pct of the existing clean power generation. The transformational impact this has having on the US economy is difficult to overstate. Newly coined terms such as the “battery belt” are springing up to describe the vast rollout of production facilities spreading from Michigan in the North, down through the Carolinas in the South.

Accompanying this, of course, is a large quantity of new jobs - over 170k announced to date, according to the World Economic Forum, and expected to rise to 9 million over the next decade. Importantly, while there have been some grumblings about this happening under Biden’s watch from various pockets of the Republican party, 80-90pct of job additions are happening within red states, meaning each passing day serves to further entrench the legislation, leading some to argue that it is likely to be rolled beyond the initial 10-year term.

**... and Europe’s response is just gathering momentum**

None of this has gone unnoticed in Europe. Robert Habeck, the German economy minister has publicly warned about green investment being “sucked away” from Europe. Yet you can’t argue with the economics. In our day-to-day interactions we have seen countless examples of company’s pivoting growth plans away from other geographies to take advantage of the tangible benefits on offer in the US. To take just one example: Norwegian battery producer Freyr have talked about tax credits making battery plants in the US three times as profitable as in Norway!

Perhaps in acknowledgement of this, last week we had the first tangible policy *with funding* passed by German parliament. The so-called “Climate and Transformation” package commits EUR 212bn of funding towards building efficiency and renewables (2024-2027) as well as offering some non-financial incentives such as ensuring the right of renewables within law to avoid permitting delays. Goldman Sachs estimate that the capital mobilised by this legislation is likely to exceed EUR1trn over the next decade, in Germany alone, with the legislation likely seen as a blueprint for the country-by-country roll out required to enact the broad brush REPowerEU/Green Industrial plan announced at various stages over the last year.

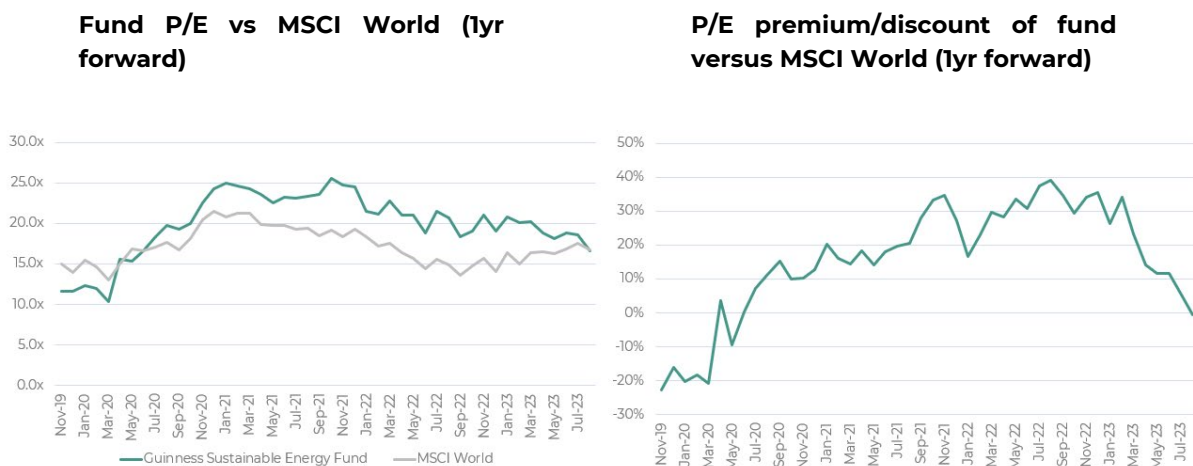
**Attractive growth outlook trading at market average multiples**

Putting this all together, it’s hard to draw out a single strand or stock specific issue that fully explains the scale of recent weakness across the sustainable energy sector, especially considering the supportive macro and policy outlook.

One aspect of market behaviour that does appear to weighing on the sector is withdrawals from sustainable energy ETFs. The iShares Clean Energy ETF (ICLN), for example, which is the largest ETF in the sector, has seen sustained outflows over the last 6 months at a faster pace than at any time in the previous five years.

Overall, portfolio-level earnings upgrades in excess of the market leads us to believe that the ultimate driver of prices has instead been a confluence of peripheral noise, short term wrinkles and broader factor rotation rather than an end to the attractive growth outlook for sustainable energy equities.

All this leaves the Guinness Sustainable Energy fund trading on a 12 month forward P/E of 16.6x, which is slightly below the MSCI World forward P/E ratio of 16.7x. This represents the first time that the portfolio is trading at a discount to the MSCI World since June 2020.



Source: Bloomberg; Guinness Global Investors, to 31.08.2023

The fall in P/E premium comes at a time when the outlook for the portfolio remains strong; consensus earnings for our fund forecast 22.2% p.a. consensus earnings per share growth in 2022-2025. This is more than three times that of the MSCI World, at around 6.4% p.a.

## Guinness Sustainable Energy

As at 31 August 2023

|                                  | P/E   |       |       | EV/EBITDA |       |       | Dividend Yield |       | EPS Growth (%pa) |         | CFROI* |       |
|----------------------------------|-------|-------|-------|-----------|-------|-------|----------------|-------|------------------|---------|--------|-------|
|                                  | 2022  | 2023E | 2024E | 2022      | 2023E | 2024E | 2023E          | 2024E | 2014-21          | 2022-25 | 2022   | 2023E |
| Guinness Sustainable Energy Fund | 21.9x | 18.6x | 15.6x | 14.2x     | 11.8x | 9.9x  | 1.4%           | 1.5%  | 6.8%             | 22.2%   | 5.4%   | 7.5%  |
| MSCI World Index                 | 15.9x | 17.5x | 16.3x | 10.4x     | 11.8x | 10.7x | 2.0%           | 2.2%  | 5.3%             | 6.4%    | 8.1%   | 7.8%  |
| <i>Fund Premium/(Discount)</i>   | 38%   | 6%    | -4%   | 37%       | 0%    | -7%   |                |       |                  |         |        |       |

\*Portfolio = median CFROI; Index data = Credit Suisse MSCI World ETF median CFROI

With fossil fuels still accounting for 83% of the global energy mix, company fundamentals remaining robust and more policy support and accelerating investment to come, we remain confident in the ability of our portfolio companies to grow earnings in excess of the broader equity market. The energy transition is just getting started and the fund's holdings are very well positioned to benefit from the opportunities.

PERFORMANCE

Past performance does not predict future returns.

The Guinness Sustainable Energy Fund (Class Y, 0.66% OCF) delivered a return of -9.5% in the month, while the MSCI World Index (net return) delivered -2.4% (all in USD terms).

|                      | Ytd    | 1 Yr   | 3 Yrs | 5 Yrs* | 10 Yrs* |
|----------------------|--------|--------|-------|--------|---------|
| Fund (Class Y)       | 0.1%   | 0.7%   | 33.9% | 106.7% | 79.0%   |
| MSCI World NR Index  | 16.1%  | 15.6%  | 27.4% | 49.2%  | 142.8%  |
| Out/Underperformance | -16.0% | -14.9% | 6.5%  | 57.5%  | -63.8%  |

| Annual performance   | 2022   | 2021   | 2020  | 2019  | 2018*  |
|----------------------|--------|--------|-------|-------|--------|
| Fund (Class Y)       | -12.5% | 10.4%  | 84.1% | 31.4% | -15.2% |
| MSCI World NR Index  | -18.1% | 21.8%  | 15.9% | 27.7% | -8.7%  |
| Out/Underperformance | 5.6%   | -11.4% | 68.2% | 3.7%  | -6.5%  |

| Annual performance   | 2017* | 2016*  | 2015*  | 2014*  | 2013* |
|----------------------|-------|--------|--------|--------|-------|
| Fund (Class Y)       | 20.2% | -15.4% | -12.0% | -12.1% | 70.8% |
| MSCI World NR Index  | 22.4% | 7.5%   | -0.9%  | 4.9%   | 26.7% |
| Out/Underperformance | -2.2% | -23.0% | -11.2% | -17.0% | 44.1% |

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%. Source: Financial Express, bid to bid, total return. On 31/12/2018, the benchmark became the MSCI World NR. Prior to this, the benchmark was the Wilderhill Clean Energy Index (ECO Index).

Investors should note that fees and expenses are charged to the capital of the fund. This reduces the return on your investment by an amount equivalent to the Ongoing Charges Figure (OCF). The fund performance shown has been reduced by the current OCF of 0.66% per annum. Returns for share classes with different OCFs will vary accordingly. Transaction costs also apply and are incurred when a fund buys or sells holdings. Performance returns do not reflect any initial charge; any such charge will also reduce the return.

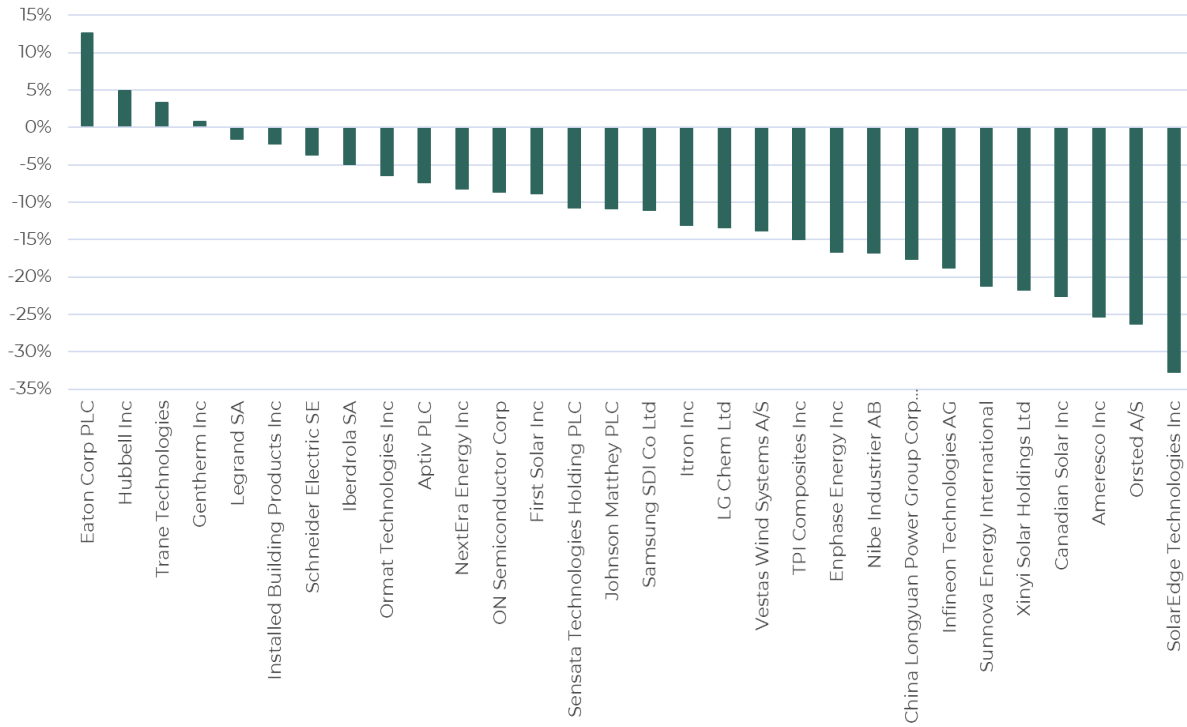
Within the Fund, the strongest stocks/subsectors included grid & electrical equipment (Eaton, Hubbell, Legrand and Schneider) which defended well with all names delivering improved margins and guidance upgrades driven by positive price/cost dynamics. The Building products subsector also performed well (HVAC provider Trane Technologies and insulation installer Installed Building Products), delivering better growth and margins than expected thanks to strength in commercial end markets. Both companies raised guidance off the back of solid demand and positive pricing action.

The weakest subsectors/stocks were linked to solar and wind. Solar names saw a broad based sell off across residential (SolarEdge, Sunnova, Enphase), utility scale (Canadian Solar, First Solar) and supply chain (Xinyi Solar) names. Residential solar names sold off as they digested poor second quarter results and weaker than expected third quarter guidance on weak demand, oversupply and increased competition in the US. Utility scale and supply chain names didn't fare much better, facing project delays and weaker pricing throughout the value chain driven by aggressive capacity additions. In addition, Orsted announced DKK16bn of (potential) impairments on its US projects driven by supplier cost overruns, lower than expected tax credits, and higher interest rates. The market reaction (-DKK 133/sh, -25%) implies a negative that is at least 3x large as the announced impairment, reflecting questions about credibility and confidence in the equity story, so recently after 2Q results.



# Guinness Sustainable Energy

## Stock by Stock performance over the month, in USD

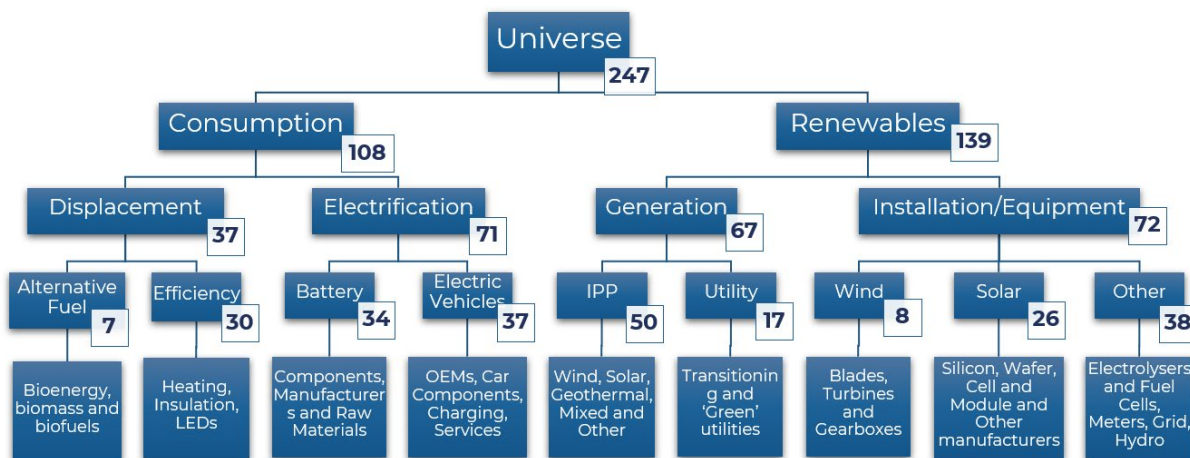


Source: Bloomberg. As of 31.08.2023

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. 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 pureplay 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 an 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:**

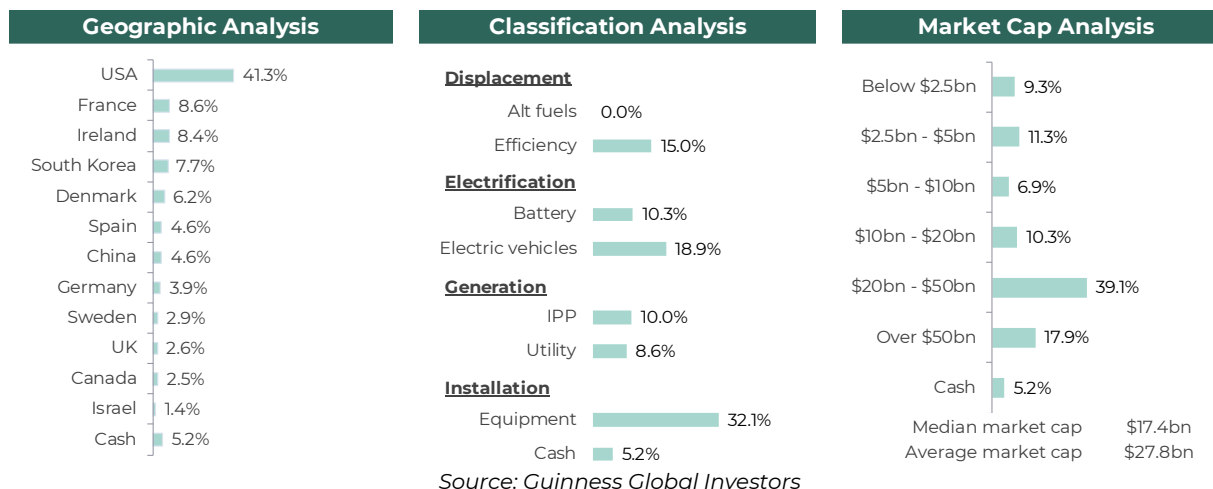


## Guinness Sustainable Energy

### Buys/Sells

There were no stock switches during the month but the portfolio was actively rebalanced.

### Portfolio structure analysis



### 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 |              |              |
|--------------------------|--------------|--------------|--------------|--------------|--------------------|--------------|--------------|
|                          | Aug-23       |              | Dec-22       | Dec-21       | Dec-20             | Dec-19       | Dec-18       |
| <b>Consumption</b>       | <b>44.1%</b> | <b>-0.8%</b> | <b>44.9%</b> | <b>43.4%</b> | <b>36.7%</b>       | <b>41.7%</b> | <b>26.5%</b> |
| Displacement             | 15.0%        | 0.0%         | 15.0%        | 11.8%        | 9.9%               | 13.4%        | 16.4%        |
| Alternative Fuel         | 0.0%         | 0.0%         | 0.0%         | 0.0%         | 0.0%               | 0.0%         | 3.9%         |
| Efficiency               | 15.0%        | 0.0%         | 15.0%        | 11.8%        | 9.9%               | 13.4%        | 12.5%        |
| Electrification          | 29.1%        | -0.8%        | 29.9%        | 31.6%        | 26.8%              | 28.2%        | 10.1%        |
| Batteries                | 10.3%        | -1.4%        | 11.6%        | 8.9%         | 10.8%              | 12.6%        | 3.9%         |
| Electric vehicles        | 18.9%        | 0.6%         | 18.2%        | 22.8%        | 16.0%              | 15.7%        | 6.2%         |
| <b>Renewables</b>        | <b>50.7%</b> | <b>1.4%</b>  | <b>49.3%</b> | <b>51.3%</b> | <b>60.4%</b>       | <b>54.1%</b> | <b>69.7%</b> |
| Generation               | 18.6%        | 0.9%         | 17.7%        | 23.1%        | 24.6%              | 22.2%        | 27.3%        |
| IPP                      | 10.0%        | 1.3%         | 8.7%         | 14.5%        | 17.0%              | 18.9%        | 26.7%        |
| Utility                  | 8.6%         | -0.4%        | 9.0%         | 8.6%         | 7.6%               | 3.2%         | 0.6%         |
| Installation             | 32.1%        | 0.5%         | 31.6%        | 28.2%        | 35.8%              | 32.0%        | 42.5%        |
| Equipment                | 32.1%        | 0.5%         | 31.6%        | 28.2%        | 35.8%              | 32.0%        | 42.5%        |
| Cash                     | 5.2%         | -0.6%        | 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 August 2023             | P/E   |       |       | EV/EBITDA |       |       | Dividend Yield |       | EPS Growth (%pa) |         | CFROI* |       |
|----------------------------------|-------|-------|-------|-----------|-------|-------|----------------|-------|------------------|---------|--------|-------|
|                                  | 2022  | 2023E | 2024E | 2022      | 2023E | 2024E | 2023E          | 2024E | 2014-21          | 2022-25 | 2022   | 2023E |
| Guinness Sustainable Energy Fund | 21.9x | 18.6x | 15.6x | 14.2x     | 11.8x | 9.9x  | 1.4%           | 1.5%  | 6.8%             | 22.2%   | 5.4%   | 7.5%  |
| MSCI World Index                 | 15.9x | 17.5x | 16.3x | 10.4x     | 11.8x | 10.7x | 2.0%           | 2.2%  | 5.3%             | 6.4%    | 8.1%   | 7.8%  |
| Fund Premium/(Discount)          | 38%   | 6%    | -4%   | 37%       | 0%    | -7%   |                |       |                  |         |        |       |

\*Portfolio = median CFROI; Index data = Credit Suisse MSCI World ETF median CFROI

Source: Guinness Global Investors, Bloomberg

### Portfolio holdings as at end August 2023

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

We hold c.44% 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 (11%) or the electrification of transportation (19% weight) while we have 15% weight to those companies involved in either displacing existing energy sources or improving overall energy efficiency.

We hold two lithium-ion battery manufacturers. LG Chem is a large Korean chemicals company that is the largest lithium-ion battery manufacturer in the world, while Samsung SDI is a pure play lithium-ion battery manufacturer, currently in the top 10 in the world.

The portfolio holds five 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 and Infineon are providers of power semiconductors that are a necessity for higher-voltage electric vehicles to become competitive with ICE (internal combustion engine) vehicles, while Gentherm, Aptiv and Sensata are component manufacturers and service providers that should benefit from the ever-increasing amount of electronics present in electric vehicles.

Our displacement holdings provide pure play quality exposure to heating industries (Nibe Industrier), energy efficient electrical equipment and services (Hubbell) 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 19% weight to companies involved in the generation of sustainable energy and 32% weight to those exposed to the installation of or equipment used in the process of sustainable energy generation.

China Suntien and China Longyuan are our two pure play Chinese wind power producers and they represent 2 of our 6 generation holdings. The remaining exposure comes in the form of geothermal (Ormat), US residential solar (Sunnova) and then offshore wind and broad-based wind/solar renewable energy generation through Orsted and 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 both EnPhase and SolarEdge manufacture 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, while TPI Composites offers niche exposure to the high-skilled business of manufacturing wind turbine blades.

Our remaining exposure to Installation (Itron, Eaton and Schneider Electric) gives exposure to companies that provide equipment and services to improve the efficiency and metering of electricity transmission and consumption.

Portfolio themes as at end August 2023

| Theme  | Example holdings   | Weighting (%) |
|--|--|---------------|
| 1 Electrification of the energy mix                |   | 25.7%         |
| 2 Rise of the electric vehicle and auto efficiency |  | 21.4%         |
| 3 Battery manufacturing                            |   | 7.7%          |
| 4 Expansion of the wind industry                   |   | 8.9%          |
| 5 Expansion of the solar industry                  |   | 12.9%         |
| 6 Heating, lighting and power efficiency           |   | 15.0%         |
| 7 Geothermal                                       |   | 3.2%          |
| 8 Other (inc cash)                                 |  | 5.2%          |

Portfolio at end July 2023 (one month in arrears for compliance reasons)

| Guinness Sustainable Energy Fund (31 July 2023) |              |              | P/E    |        |       |       | EV/EBITDA |       |       | Price/Book |       |       | Dividend Yield |       |       |
|---|--------------|--------------|--------|--------|-------|-------|-----------|-------|-------|------------|-------|-------|----------------|-------|-------|
| Stock   | ISIN         | % of NAV     | 2022   | 2023E  | 2024E | 2025E | 2022      | 2023E | 2024E | 2022       | 2023E | 2024E | 2022           | 2023E | 2024E |
| <b>Displacement/Efficiency</b>                  |              |              |        |        |       |       |           |       |       |            |       |       |                |       |       |
| Hubbell Inc                                     | US4435106079 | 3.8%         | 30.0x  | 20.6x  | 19.4x | 18.2x | 20.4x     | 14.4x | 13.7x | 7.1x       | 5.9x  | 5.2x  | 1.4%           | 1.5%  | 1.6%  |
| Nibe Industrier AB                              | SE0015988019 | 3.1%         | 46.3x  | 33.9x  | 29.5x | 25.2x | 28.0x     | 21.2x | 18.6x | 7.3x       | 6.0x  | 5.2x  | 0.6%           | 0.8%  | 1.0%  |
| Trane Technologies PLC                          | IE00BK9ZQ967 | 4.1%         | 27.8x  | 23.6x  | 21.6x | 19.6x | 18.3x     | 16.2x | 15.3x | 8.0x       | 7.2x  | 6.6x  | 1.3%           | 1.5%  | 1.5%  |
| Installed Building Products Inc                 | US45780R1014 | 0.8%         | 17.1x  | 17.6x  | 17.0x | 14.1x | 11.0x     | 11.2x | 10.9x | 8.9x       | 7.0x  | 5.5x  | 1.3%           | 1.1%  | 0.9%  |
| Ameresco Inc                                    | US02361E1082 | 2.8%         | 31.1x  | 32.1x  | 23.1x | 16.4x | 18.3x     | 17.9x | 13.5x | 3.7x       | 3.3x  | 2.8x  | n/a            | n/a   | n/a   |
|   |              | <b>14.6%</b> |        |        |       |       |           |       |       |            |       |       |                |       |       |
| <b>Electrification/Battery</b>                  |              |              |        |        |       |       |           |       |       |            |       |       |                |       |       |
| LG Chem Ltd                                     | KR7051910008 | 3.9%         | 19.7x  | 23.7x  | 12.3x | 8.0x  | 8.4x      | 7.9x  | 5.2x  | 1.5x       | 1.5x  | 1.4x  | 1.6%           | 1.5%  | 1.9%  |
| Samsung SDI Co Ltd                              | KR7006400006 | 4.0%         | 23.6x  | 23.3x  | 18.4x | 14.8x | 14.1x     | 13.0x | 10.3x | 2.7x       | 2.4x  | 2.1x  | 0.2%           | 0.2%  | 0.2%  |
| Johnson Matthey PLC                             | GB00BZ4BQC70 | 2.7%         | 8.8x   | 10.2x  | 10.6x | 9.2x  | 5.9x      | 6.9x  | 6.6x  | 1.3x       | 1.4x  | 1.3x  | 4.1%           | 4.2%  | 4.3%  |
|   |              | <b>10.5%</b> |        |        |       |       |           |       |       |            |       |       |                |       |       |
| <b>Electrification/Electric Vehicles</b>        |              |              |        |        |       |       |           |       |       |            |       |       |                |       |       |
| Aptiv PLC                                       | JE00B783TY65 | 3.8%         | 32.7x  | 24.9x  | 18.3x | 14.4x | 15.3x     | 12.5x | 10.4x | 3.6x       | 3.1x  | 2.8x  | 0.0%           | 0.2%  | 0.3%  |
| ON Semiconductor Corp                           | US6821891057 | 4.9%         | 20.4x  | 20.9x  | 19.1x | 16.8x | 14.0x     | 14.3x | 13.0x | 7.5x       | 5.7x  | 4.4x  | n/a            | n/a   | n/a   |
| Infineon Technologies AG                        | DE0006231004 | 4.4%         | 22.6x  | 15.6x  | 15.2x | 13.7x | 12.9x     | 9.2x  | 8.6x  | 4.1x       | 3.1x  | 2.7x  | 0.8%           | 0.9%  | 1.1%  |
| Sensata Technologies Holding PLC                | GB00BFMBMT84 | 3.4%         | 12.7x  | 11.2x  | 10.0x | 9.2x  | 10.1x     | 9.9x  | 9.0x  | 2.1x       | 1.9x  | 1.6x  | 0.8%           | 1.1%  | 1.1%  |
| Gentherm Inc                                    | US37253A1034 | 2.6%         | 30.1x  | 24.2x  | 17.3x | 11.2x | 15.7x     | 11.3x | 8.9x  | n/a        | n/a   | n/a   | n/a            | n/a   | n/a   |
|   |              | <b>19.0%</b> |        |        |       |       |           |       |       |            |       |       |                |       |       |
| <b>Generation/IPP</b>                           |              |              |        |        |       |       |           |       |       |            |       |       |                |       |       |
| China Longyuan Power Group Corp Ltd             | CNE100000HD4 | 1.6%         | 9.2x   | 7.3x   | 6.1x  | 5.3x  | 11.2x     | 9.5x  | 8.3x  | 0.8x       | 0.8x  | 0.7x  | 2.1%           | 2.7%  | 3.3%  |
| Ormat Technologies Inc                          | US6866881021 | 3.1%         | 60.3x  | 42.2x  | 31.9x | 26.1x | 15.3x     | 13.7x | 12.1x | 2.4x       | 2.0x  | 1.9x  | 0.6%           | 0.6%  | 0.6%  |
| NextEra Energy Inc                              | US65339F1012 | 3.9%         | 25.4x  | 23.5x  | 21.5x | 19.8x | 20.1x     | 15.9x | 14.6x | 3.3x       | 3.2x  | 3.1x  | 2.3%           | 2.6%  | 2.8%  |
| Sunnova Energy International I                  | US86745K1043 | 1.6%         | n/a    | n/a    | n/a   | n/a   | 75.1x     | 44.0x | 29.4x | 1.3x       | 1.0x  | 0.9x  | n/a            | n/a   | n/a   |
| Orsted A/S                                      | DK0060094928 | 2.8%         | 14.6x  | 34.4x  | 24.3x | 21.0x | 10.9x     | 14.4x | 11.8x | 3.5x       | 2.8x  | 2.7x  | 2.2%           | 2.5%  | 2.6%  |
| China Suntien Green Energy Corp Ltd             | CNE100000TW9 | 1.1%         | 4.7x   | 4.8x   | 4.0x  | 3.3x  | 9.1x      | 10.9x | 9.1x  | 0.5x       | 0.5x  | 0.5x  | 7.4%           | 7.4%  | 8.5%  |
|   |              | <b>14.1%</b> |        |        |       |       |           |       |       |            |       |       |                |       |       |
| <b>Generation/Utility</b>                       |              |              |        |        |       |       |           |       |       |            |       |       |                |       |       |
| Iberdrola SA                                    | ES0144580Y14 | 4.6%         | 17.9x  | 15.5x  | 15.0x | 14.0x | 10.9x     | 9.5x  | 9.0x  | 1.8x       | 1.6x  | 1.5x  | 4.0%           | 4.6%  | 4.7%  |
|   |              | <b>4.6%</b>  |        |        |       |       |           |       |       |            |       |       |                |       |       |
| <b>Installation/Equipment</b>                   |              |              |        |        |       |       |           |       |       |            |       |       |                |       |       |
| Schneider Electric SE                           | FR0000121972 | 4.0%         | 23.2x  | 20.3x  | 19.1x | 17.6x | 15.8x     | 14.0x | 13.2x | 3.6x       | 3.4x  | 3.1x  | 1.8%           | 2.2%  | 2.3%  |
| Legrand SA                                      | FR0010307819 | 3.9%         | 22.4x  | 19.8x  | 19.4x | 18.0x | 14.4x     | 12.9x | 12.5x | 3.9x       | 3.4x  | 3.2x  | 1.9%           | 2.2%  | 2.3%  |
| Eaton Corp PLC                                  | IE00B8KQN827 | 4.1%         | 27.2x  | 24.2x  | 21.9x | 20.0x | 21.4x     | 19.1x | 17.3x | 4.9x       | 4.5x  | 4.2x  | 1.6%           | 1.7%  | 1.8%  |
| Itron Inc                                       | US4657411066 | 3.7%         | 156.1x | 53.3x  | 32.6x | 20.4x | 48.7x     | 28.6x | 19.2x | 3.2x       | 2.9x  | 2.7x  | n/a            | n/a   | n/a   |
| Xinyi Solar Holdings Ltd                        | KYG9829NI025 | 2.4%         | 16.6x  | 15.8x  | 11.5x | 9.4x  | 12.2x     | 10.9x | 8.2x  | 2.3x       | 2.3x  | 2.0x  | 2.8%           | 2.9%  | 4.0%  |
| SolarEdge Technologies Inc                      | US83417M1045 | 1.9%         | 50.9x  | 22.1x  | 18.7x | 15.3x | 29.2x     | 15.1x | 12.2x | 6.5x       | 5.0x  | 4.0x  | n/a            | n/a   | n/a   |
| Enphase Energy Inc                              | US29355A1079 | 1.7%         | 34.7x  | 29.9x  | 22.9x | 17.6x | 27.4x     | 22.2x | 17.2x | 37.8x      | 15.7x | 9.5x  | n/a            | n/a   | n/a   |
| First Solar Inc                                 | US3364331070 | 3.8%         | n/a    | 28.3x  | 16.2x | 10.5x | 113.4x    | 18.8x | 11.3x | 3.8x       | 3.4x  | 2.8x  | n/a            | n/a   | n/a   |
| Canadian Solar Inc                              | CA1366351098 | 3.0%         | 11.7x  | 6.2x   | 5.8x  | 6.3x  | 7.0x      | 3.6x  | 3.2x  | 1.0x       | 1.0x  | 0.7x  | n/a            | n/a   | n/a   |
| Vestas Wind Systems A/S                         | DK0061539921 | 3.5%         | n/a    | 487.8x | 31.2x | 19.2x | n/a       | 23.7x | 12.7x | 7.3x       | 7.7x  | 6.3x  | 0.1%           | 0.1%  | 0.9%  |
| TPI Composites Inc                              | US87266J1043 | 0.2%         | n/a    | n/a    | n/a   | 7.5x  | 15.7x     | 36.5x | 7.9x  | 2.8x       | 1.9x  | 1.7x  | n/a            | n/a   | n/a   |
|   |              | <b>32.2%</b> |        |        |       |       |           |       |       |            |       |       |                |       |       |

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

### Sustainable energy: the long-term outlook

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

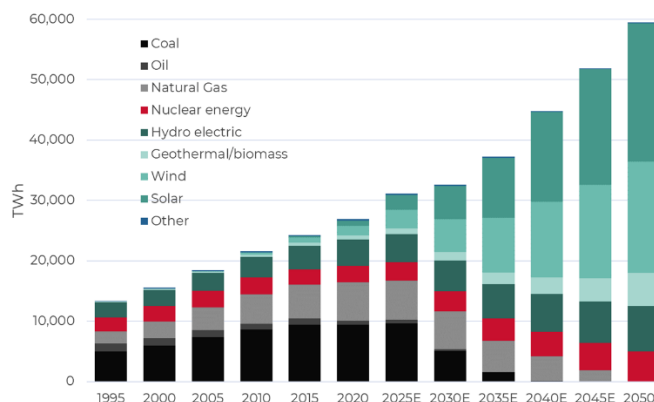
- **Population and GDP growth** putting a significant strain on today's energy supply
- **Economics** as sustainable sources of energy will be cheaper than the incumbents
- **Climate change** leading the world to reduce carbon emissions via cleaner energy
- **Pollution** forcing governments to drive 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.

Within the power generation industry, we expect a radical change in energy mix. Today, the global power mix is predominantly driven by coal and natural gas (35% and 24% respectively), whilst variable renewable generation (wind and solar) have less than a 10% share. By 2035, we expect wind and solar to have grown to around 40% of the generation mix, increasing to over 60% by 2050.

**Global power generation by type (TWh, 1995-2040E)**



Sources: BP Statistical Review; IEA; Guinness Global Investors estimates; as of 31.12.2022

### Policy support for decarbonisation

Policy commitment in recent years has been particularly supportive. However, the path has not always been smooth and it is unlikely to be a smooth ride from here. The most significant policy milestones in the recent period include:

- **President Biden returning the US to the Paris Agreement** and announcing significantly increased 2030 GHG reduction targets. The new target - a 52% reduction in emissions by 2030 (vs 2005 levels) - was substantially ahead of the old target of a 28% reduction by 2025.

- **The 2021 IPCC climate report.** The Intergovernmental Panel on Climate Change (IPCC) published its sixth assessment report on the physical science of climate change and the physical impacts of various carbon emission and warming scenarios.
- **COP26 climate conference.** In November 2021, the COP26 climate conference was held in Glasgow. The conference produced results which we considered to be better than feared, but not as good as hoped. Key headlines included new net zero targets, additional country pledges and some 'alliances of the willing' to reduce coal usage and methane emissions.
- **Carbon pricing.** Developments in carbon pricing remain hopeful with momentum towards the introduction of emissions trading schemes (ETS) as a tool for decarbonisation. At the start of 2021, China commenced a new national ETS scheme which immediately became the world's largest carbon market (covering around 2,225 entities in the power generation industry with annual emissions of around 4,000 MtCO<sub>2</sub>e) while Canada introduced a federal carbon tax that will increase by 2030 to around US\$130/tonne.
- **The RePowerEU deal.** In response to the invasion of Ukraine, the REPowerEU deal was passed. It is designed to increase the resilience of the EU energy system in the short term to deal with the loss of Russian gas imports and it provides a greater emphasis on energy efficiency and increasing domestic renewable energy capacity. It builds on the EU's 'Fit for 55' proposals which are designed to deliver a 55% reduction in GHG emissions by 2030 (vs 1990).
- **The US Inflation Reduction Act.** In response to the invasion of the Ukraine and increased need for energy security, the Inflation Reduction Act was passed. It brings a potential \$369bn in support for energy security and climate change, specifically targeting financial support for clean sources of electricity and energy storage as well as tax credits for clean fuels and clean commercial vehicles.

We are already starting to see new investment driven by the Inflation Reduction Act (IRA) in 2023. We believe the IRA, greater clarity on funding from the EU's Net Zero Industrial Act, and an expected upgrade to Chinese renewables targets, will continue to drive investment in 2024/2025 and well into the second half of the decade.

### Energy displacement

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 de-carbonisation. 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 thirty years of around 1%pa. This assumes significant efficiency improvements relative to an historical energy demand growth rate of around 2%pa. For our base case scenario to be achieved, per capita energy demand over the next thirty years needs to stay broadly flat, whilst the energy intensity of global GDP needs to fall by around 40%.

Within the energy displacement sector, key areas of focus are **efficiency** and **alternative fuels**.

### Energy efficiency

Energy efficiency is a key pillar of new policy. For example, the EU had previously set itself a challenging target to consume 9% less energy in 2030 than in 2020 and the new RePowerEU deal saw this ratcheted up to 13%, supported by €100bn of funding for residential and industrial efficiency. A few months later the US Inflation Reduction Act included \$53bn in support for building efficiency.

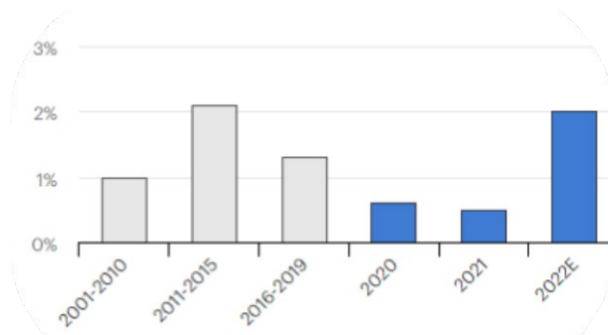
The focus on building efficiency is important, since buildings are responsible for 30% of primary energy consumption and nearly 40% of global carbon emissions. Electrifying heating (heat pumps) and improving the efficiency of heating (insulation), cooling (efficient HVAC), and lighting (LEDs) offers some of the quickest ways to decarbonise whilst lowering energy bills and improving energy security.

Despite the importance of energy efficiency, investment in energy efficiency from 2015-2020 remained flat at around \$400bn per annum. More recently, rising energy costs have increased the incentive to invest, driving a 27% increase in 2021. This rose a further 16% in 2022, bringing total efficiency spending to \$560bn. Building efficiency comprising heating, cooling, lighting, and appliances, made up over half of this spend at \$300bn.

This higher level of efficiency spending alongside behavioural change is expected to have resulted in a 2.0% improvement in global energy intensity in 2022. This represents a meaningful increase from the 0.5-0.6% levels seen in the pandemic years but still not enough to hit net zero by 2050, according to the IEA.

### **Annual global primary energy intensity improvement**

Source: IEA



While a number of energy efficiency investments are already economic today (typical payback periods would be 1-3 years for LEDs and 3-5 years for loft / cavity wall insulation) others are still too expensive for most consumers. We expect global governments to continue to incentivise the roll out of these technologies through subsidies and minimum efficiency standards to improve energy security and deliver the transition to a low-carbon future.

To achieve a net zero scenario, annual energy efficiency improvements would need to jump from 2%pa currently to 4%pa by 2030 globally. This translates to building efficiency spending increasing to over \$750bn per annum between 2026-2030 (from just over \$400bn in a base case scenario and \$300bn in 2022). Worldwide heat pump capacity would need to triple by 2030 and then double again by 2050, implying that heat pumps meet 24% of heating demand in 2030 and 52% in 2050, up from just 8% today. Lighting sales would need to be 100% LED globally by 2030 (vs 50% in 2022).

### **Alternative fuels**

Alternative fuels are materials or substances which can be used as fuel to displace coal, oil, and natural gas. They encompass solid biofuels (also known as biomass e.g. wood, bagasse, animal waste), biogas (e.g. renewable natural gas, biomethane), and liquid biofuels. Below we will predominantly focus on the outlook for liquid biofuels, including bioethanol (derived from corn/sugar) which displaces gasoline, bio-based diesels (derived from plant and animal fats) which displace conventional diesel, and Sustainable Aviation Fuel (SAF, derived from multiple organic/inorganic feedstocks) which displaces jet fuel or kerosene.

Liquid biofuel demand is expected to have reached 168bn litres in 2022, representing around 4.3% of transportation fuel consumption. The US and Brazil continue to dominate the market, making up around 40% and 25% of global demand respectively, supported by strong domestic industries for corn and sugar cane.

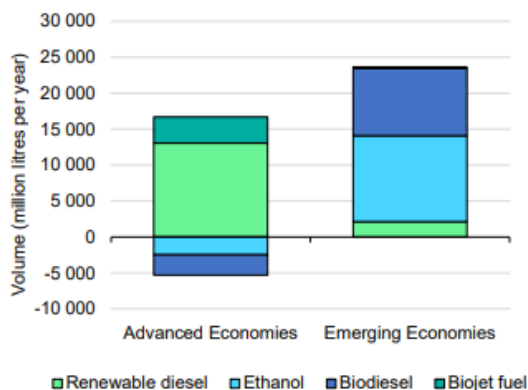
Biofuel consumption grew 6% in 2022 versus 2021, outpacing the underlying 2% increase in world oil demand. Growth continued to benefit from government support, especially from India and Indonesia. However, high prices for retail diesel and gasoline led to a watering down of blending and environmental targets in Brazil, Finland and Sweden, lowering this year's growth by around 2ppts.

Currently, demand for biofuels is met by a roughly even split of bioethanol and bio-based diesel (biodiesel & renewable diesel) with SAF/biojet kerosene making up less than 1% of the market. By 2027, we expect global consumption of alternative fuels to increase by 20%, making up 5.4% of transport fuel. Just five countries (USA, Canada, Brazil, Indonesia, India) will be responsible for 80% of this growth.



**Biofuel growth for advanced and emerging economies out to 2027**

Source: IEA



In developed economies, demand will be driven by renewable diesel (which can directly replace conventional diesel) and biojet fuel. New policies introduced in the last year, namely the Inflation Reduction Act in the USA and Clean Fuel Regulations in Canada, will see the biofuel share in transport energy demand climb from 6% and 4% in 2022 to 8% and 7% respectively in 2027.

In contrast, emerging economies will see biodiesel (which is blended with conventional diesel) and ethanol make up over 90% of their increase, thanks to rising blending requirements over this period. At 30%, Indonesia currently has one of the highest blending requirements in the world and the government has ambitions to raise this over time to 40%.

However, the alternative fuel industry will continue to rely on government regulation, subsidies and tax credits for its existence. We estimate for one of the most profitable US alternative fuel manufacturers, the average level of support in 2022 amounted to around \$4.50 per gallon. When compared to the relatively high average retail gasoline prices observed year to date of \$4 per gallon, it is clear just how reliant government support is in decarbonising liquid fuels.

To achieve a net zero scenario, demand growth for alternative fuels would need to increase from 4%pa to over 15%pa, taking industry production capacity from 168bn litres in 2022 to around 600bn litres by 2030. This would mean that the contribution of biofuels to transport energy demand would need to more than triple to 15% by 2030, up from 4.3% today.

**Electrification**

The energy transition is seeing energy demand being ‘electrified’ as it moves away from predominantly hydrocarbon fuels and gases towards the consumption of electricity. Our ‘electrification’ sector includes some key enablers of this transition: the lithium-ion battery and the electric vehicle industries. The battery industry is critical here in that it will serve electric vehicles and also provide a stationary energy storage solution in electricity grids, allowing variable renewable energy (i.e. solar & wind) to play an expanding role in the global power stack.

**Batteries**

The speedy adoption of lithium-ion batteries in recent years has been spurred on by a vast improvement in economics. According to BNEF, the volume weighted average price of a lithium-ion battery fell 88% from 2010 to 2020. Prices fell a further 6% in 2021 but this was offset by a 7% increase in 2022 due to higher prices for the key battery metals, lithium and nickel. This represented the first observed increase since 2010, taking the average price to \$151/kWh.

At the end of 2022, lithium and nickel prices were trading 800% and 60% higher than levels seen in December 2020 as supply has struggled to keep pace with strong demand for electric vehicles. Lithium carbonate prices in China reached new peaks in 2022, exceeding \$78,000 per tonne, as the market suffered from COVID-19 disruptions and long lead times (5-8 years) for new projects. Nickel prices peaked at \$100,000 per tonne in April following Russia’s invasion of Ukraine and a short squeeze on the London Metal exchange. This has since moderated to \$29,000 per tonne, but future concerns over Russia’s ability to supply its 17% share of the world’s class 1 nickel could keep prices elevated.

These metals are used in the cathode, which typically represents around 60% of the cost of a cell and just under half of the cost of a battery pack. Electric vehicle batteries are dominated by three main cathode chemistries: Nickel Manganese Cobalt

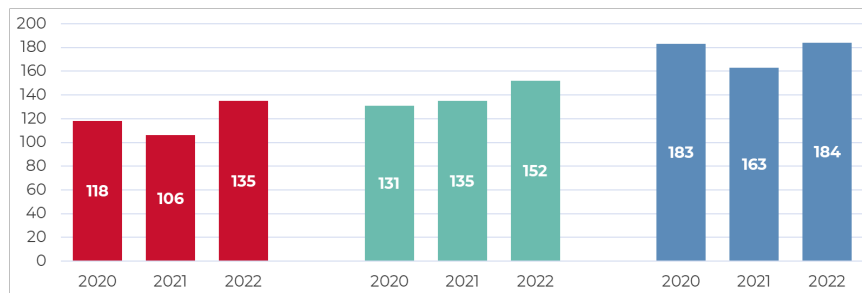
## Guinness Sustainable Energy

(NMC), Nickel Cobalt Aluminium (NCA), and Lithium Iron Phosphate (LFP) and each has specific performance and cost attributes.

Making up over half of the global cathode mix, NMC and NCA enjoy high energy densities, but require more complex and expensive thermal management to keep them stable. In contrast, LFP is much more stable and costs 10-35% less than NMC and NCA, but suffers 30% lower energy density.

### **Historical LFP (red), NCA (green), NMC (blue) pack prices, US\$/kWh**

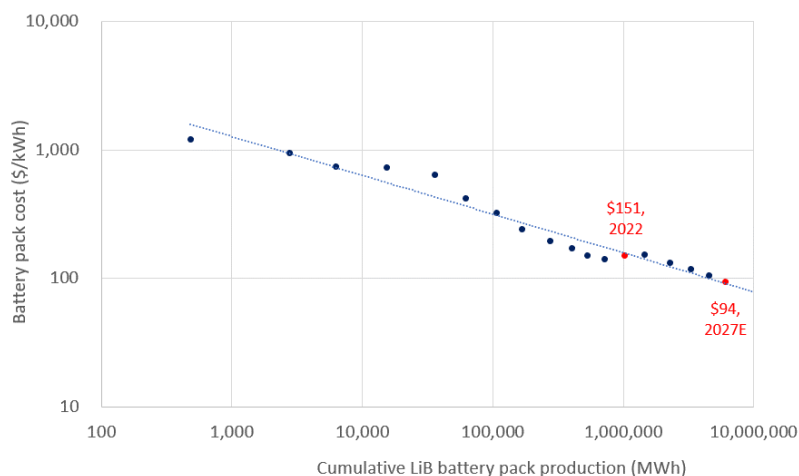
source: BNEF



Despite seeing the biggest increase in prices in 2022 (+27% for LFP vs +13% for NMC and NCA), LFP battery pack prices remain the cheapest option. Its enhanced safety and simpler supply chain (no cobalt or nickel required in the manufacturing) have made it increasingly popular among electric vehicle manufacturers, reaching a 40% share of the global cathode mix in 2022, up from just 15% in 2018. This shift towards cheaper LFP cathodes was key to limiting the increase in battery prices in 2022 to only 7%.

### **Cumulative demand for LiB packs (MWh) vs Battery pack price (\$/kWh)**

source: Bloomberg, Guinness Global Investors



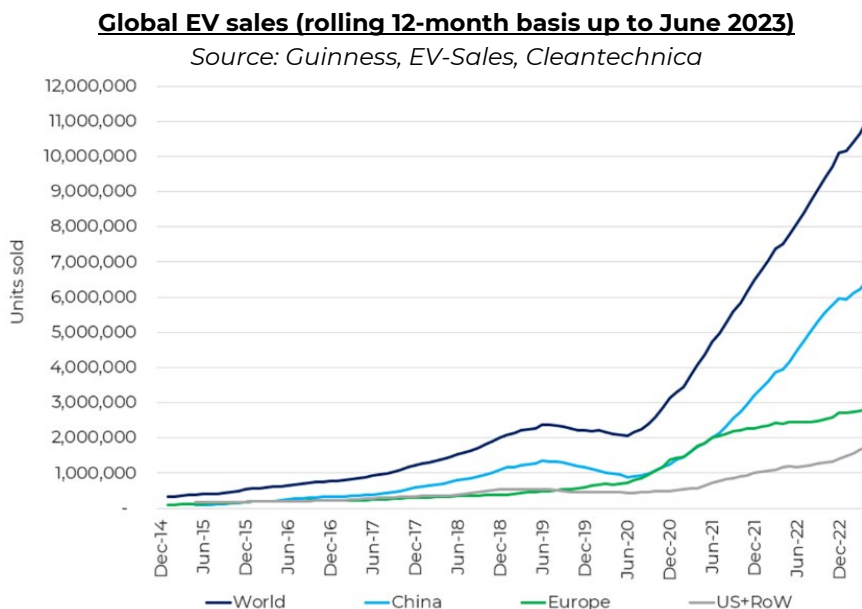
In 2020, the expectation was that the industry battery pack cost target of \$100/kWh (the price at which EVs reach price parity with ICE vehicles) would be hit by 2024. On our estimates, higher lithium and nickel prices are now likely to delay this until 2027. The \$50/kWh cost reduction over the next five years is likely to come equally from i) moderation of commodity prices, ii) improvements to cell chemistry (moving to higher nickel cathodes and increasing silicon content in anodes) and iii) improvements in pack design and manufacturing (moving towards cell-to-vehicle architectures, with lower scrap rates). If the current learning rate of 17% is maintained, battery pack prices could fall as low as \$77/kWh by 2030 and \$62/kWh by 2035.

## Electric Vehicles

Electric vehicle (EV) adoption continued apace in 2022 with over 10 million plug-in vehicles sold throughout the year, more than in 2019 and 2020 combined. Battery electric vehicles (BEVs) made up just under 10% of new car sales with total plug-in penetration (BEV + Plug-in Hybrids) reaching 13%. Global sales are currently growing 60% year-over-year driven largely by

## Guinness Sustainable Energy

China, which now accounts for 60% of sales. Europe is a distant second, with around one quarter of overall EV sales, while the US trails at under 10%.



Much of this growth has been driven by policy, with governments now subsidising 10-30% of the price of an electric vehicle, while bringing forward the timeline on banning internal combustion (ICE) sales. Governments cannot maintain subsidies long-term and it will be interesting to see how the Chinese market continues to develop in 2023 now that the long-existing NEV subsidy program has completely ended, meaning that no NEVs purchased after 1 January 2023 will be subsidised. Nonetheless, looking ahead, we believe that we are now at a tipping point where improving economics, driving range, and charging times begin to drive mass adoption.

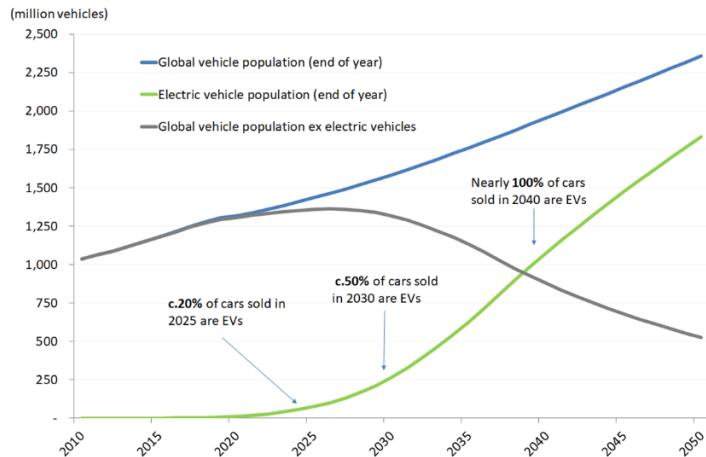
- **Economics:** Electric vehicles cost more to buy but have lower overall running costs. Excluding China, the IEA suggest that BEVs are typically \$15,000 more expensive to purchase. Assuming normalised fuel and electricity prices, we estimate that lifecycle running costs for an electric vehicle in Europe and the US are \$23,000 and \$13,000 lower respectively than the ICE equivalent, broadly justifying the upfront price premium.
- **Range:** The average range of a battery electric vehicle sold in 2021 was around 215 miles, just under half of an ICE equivalent. This is clearly inferior, yet average daily driving distances are only 25-55 miles, meaning that most EVs are easily capable of handling everyday distances, and the market is rapidly waking up to this reality.
- **Charge time:** Level one and two chargers (available in residential and commercial environments) are cheap and can replenish 5-30 miles of range per hour. Level three fast chargers, however, offer fast charging on longer trips, delivering at a significantly higher rate of 200-600 miles of range per hour. Once again, China is leading the regional charging infrastructure roll out with seven electric vehicles per charger whereas the EU and US lag behind at 15-20 EVs per charger.

The recent rapid growth in electric vehicle sales has caught many forecasters by surprise, leading to swift revisions to long-term adoption rates. For example, BNEF revised its 2025 forecast for EV sales penetration up to 23% in its 2022 outlook report, up from 16% in 2021. Our long-held forecast is that electric vehicles will make up 20% of new global vehicle sales by 2025, 50% by 2030 and predominantly all new vehicle sales by 2040. At that point, it implies an overall population of one billion EVs, over 60 times greater than the global stock in 2021 of 16.5 million.

Despite our rapid base case EV growth assumptions, we calculate that oil demand from passenger vehicles will not peak until around 2024/25 and that, even by 2030, passenger vehicle oil demand will be similar to 2021 levels. With transportation generating just over 7bn tonnes of carbon emissions in 2020, accelerating the transition and reducing associated oil demand is critical to achieving a net zero 2050 scenario.

**Global EV population (to 2050)**

Source: IEA; Guinness Global Investors estimates



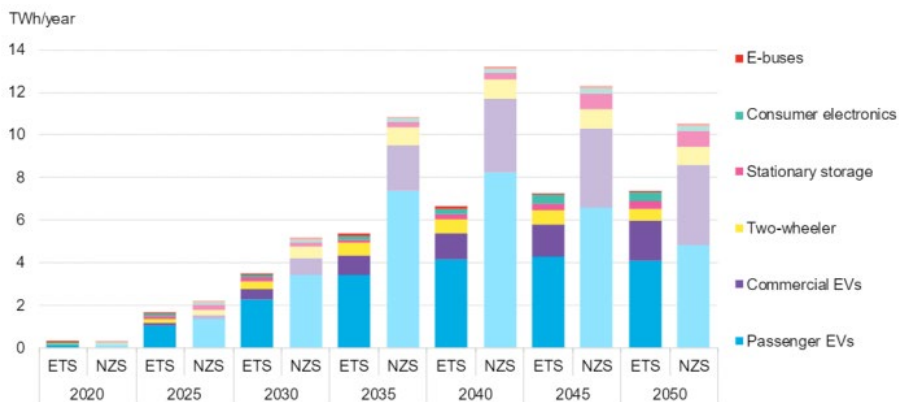
Our base case for electrification implies that there will be over one billion electric vehicles on the road by 2040, that electricity is 57% of total energy demand and that variable renewables such as wind and solar will represent 61% of global power grids. Achieving this would require annual EV sales of around 135m vehicles and annual lithium-ion battery demand of around 6,400 GWh per year in 2040.

A net zero scenario will require an even faster uptake of passenger electric vehicles (reaching 100% penetration by 2035 than 2040) and would require other transportation, such as ICE heavy trucks, to be 100% electric by 2045. To support the rollout of EVs, investment in public charging infrastructure would need to increase from \$6bn in 2022 to around \$40bn pa in 2030 and around \$120bn pa in 2040, significantly ahead of our base case estimates.

The implication would be that electricity demand would likely grow around 3.3%pa to 2040 (faster than our base case of 2.5%pa) with variable renewables reaching 60% grid penetration in 2030 (rather than our base case of 2040) and thus rapidly displacing fossil fuels from the grid. To support the rapid electrification, according to BNEF annual battery demand would grow from 340 GWh in 2021 to 5,600 GWh by 2030 and potentially as much as 13,000 GWh by 2040 (more than double the base case estimate).

**Lithium-ion battery demand under base case and net zero scenarios**

source: BNEF



**Generation & installation (equipment)**

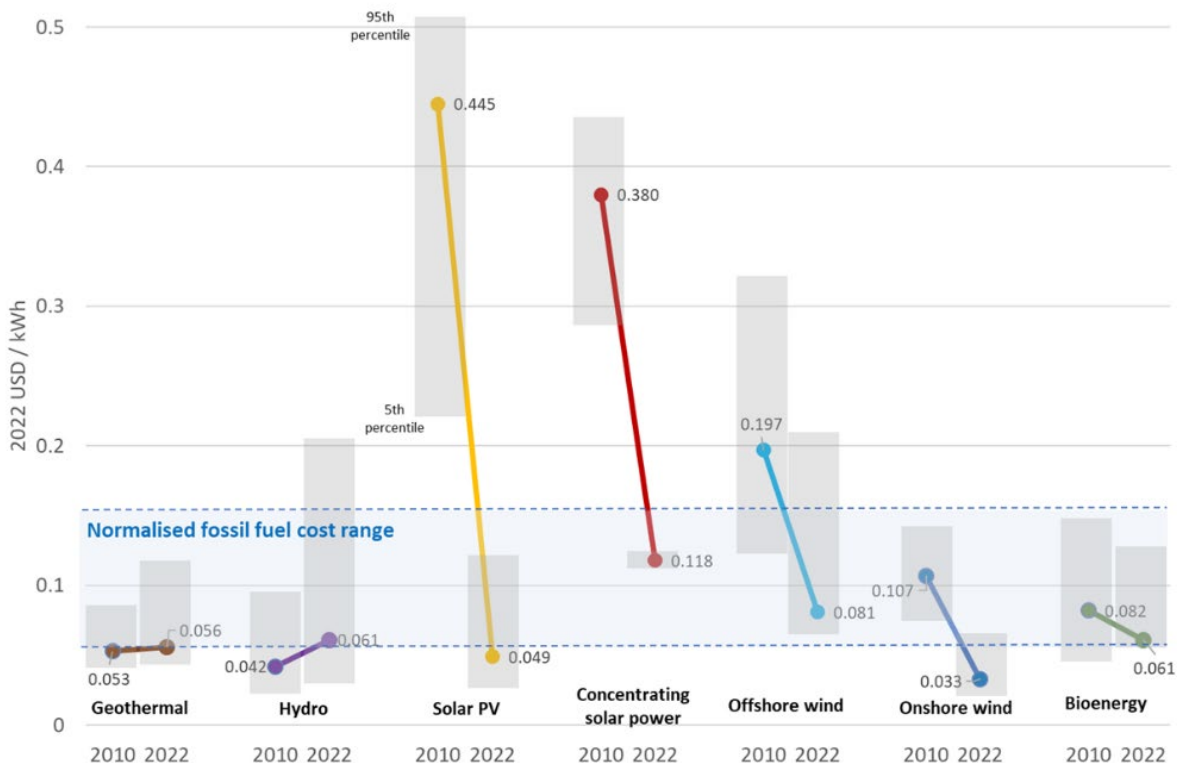
Before considering the detailed dynamics of key renewable power generation markets of wind and solar, it is worth considering the significant changes that have occurred to the economics of various renewable power generation technologies since 2010. Onshore wind and solar PV have joined hydro and geothermal power to sit at the lower end of, or below, the cost range for new fossil fuel power generation.

## Guinness Sustainable Energy

The structural story of cost reduction that we have witnessed for a number of years has recently been complicated by cyclical raw material, energy and logistics cost inflation. However, while the cost of renewable power generation is likely biased upwards short-term, the **relative economics of renewables versus hydrocarbons** continue to improve thanks to fossil fuel generation inflation.

### Global LCOE (Levelised Cost of Electricity) of utility-scale renewable power generation technologies (2010–2022)

source: IRENA, Guinness Global Investors estimates



### The solar sector

The relative economic attractiveness of solar power generation continued to improve in 2022. On one hand, the structural story of cost deflation that we have witnessed for a number of years has stalled as a result of cyclical raw material, energy and logistics cost inflation. But, on the other hand, industry growth has brought improved economies of scale, plus the relative economics of solar versus hydrocarbons continues to improve thanks to inflation in competing fossil fuel generation. According to the IEA, the cost of solar in 2022 (as implied by auction prices in the chart below) sits comfortably below competing fossil fuel-based options and current wholesale electricity prices, meaning that solar (or sometimes wind) is typically the most economic option for new supply that can also help to alleviate energy security concerns.

Solar's improved relative economics and the increased need for security of supply mean that installations in 2022 are likely to be around 260 GW, substantially higher than the 200 GW estimate that we made at the start of the year. With momentum strong, especially following the US IRA and RePowerEU deals, our initial estimate for 2023 module demand of 310 GW has now increased to 345 GW, another record year for global installations, with growth of nearly 100 GW versus 2022.

Regionally, the key moving parts are as follows:

- In the **United States** we initially expected installations in 2022 (20 GW) to be lower than 2021 (30 GW) as a result of i) the Withhold Release Order (WRO) placed on various solar product imports from China, ii) concerns around the level of residential solar support coming from a clean energy infrastructure bill and iii) the impact of new net metering rules (NEM3.0) in California which reduce the attractiveness of solar economics for residential consumers. Actual installations in 2023 are now likely to be around 33 GW as demand is less likely to be impacted by NEM3.0 and the WRO.

- Demand in **Europe** was around 45 GW in 2022, up sharply from 24 GW in 2021, as the region reacted to higher electricity prices and the need for energy security. It is here that the relative economics of solar have improved the most, and the RePowerEU deal has already started to incentivise new demand for solar installations. Looking to 2023, we see further installation increases, with Europe reaching a new record of 62 GW spread well across an increasing number of countries, leading to substantially more growth in future years.
- In **China** module demand was around 107 GW in 2022 (up nearly 40 GW on 2021). Growth has come across utility, residential and commercial and we note plans for the development of significant offshore utility scale plants in 2023. As with Europe, higher power prices have been a key factor in driving stronger demand. In mid-2022, China published its 14th five year plan for renewables which suggested that solar (and wind) installations in 2021-2025 should be double the levels seen in 2015-2020.
- The rest of the **non-OECD** has also seen greater than expected growth in demand, reaching around 60 GW in 2022 (up 23 GW on 2021 levels) with demand increases well spread across Latin America (especially Brazil), African and Middle Eastern countries.

### Global solar module installations, 2010-2023E (GW)

Source: BP, BNEF, PV InfoLink, IEA and Guinness Global Investors estimates

|  | 2010      | 2011      | 2012      | 2013      | 2014      | 2015      | 2016      | 2017      | 2018       | 2019       | 2020       | 2021       | 2022       | 2023E      |
|--|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|------------|------------|------------|------------|------------|
| <b>OECD solar installations (annual)</b>     |           |           |           |           |           |           |           |           |            |            |            |            |            |            |
| North America                                | 1         | 2         | 4         | 6         | 7         | 8         | 14        | 11        | 10         | 11         | 19         | 25         | 24         | 33         |
| Germany                                      | 7         | 7         | 8         | 3         | 2         | 1         | 2         | 2         | 4          | 4          | 5          | 6          | 7          | 10         |
| Spain  | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0          | 5          | 3          | 5          | 7          | 8          |
| Rest of Europe                               | 3         | 4         | 5         | 5         | 5         | 6         | 4         | 3         | 4          | 6          | 12         | 19         | 21         | 29         |
| Australia                                    | 0         | 1         | 1         | 1         | 1         | 1         | 1         | 2         | 4          | 4          | 4          | 5          | 4          | 5          |
| South Korea                                  | 0         | 0         | 0         | 1         | 1         | 1         | 1         | 1         | 2          | 3          | 6          | 4          | 3          | 3          |
| Japan  | 1         | 1         | 2         | 7         | 10        | 11        | 8         | 8         | 7          | 7          | 9          | 6          | 6          | 6          |
| <b>Total OECD</b>                            | <b>17</b> | <b>23</b> | <b>24</b> | <b>24</b> | <b>25</b> | <b>29</b> | <b>29</b> | <b>26</b> | <b>31</b>  | <b>40</b>  | <b>58</b>  | <b>71</b>  | <b>76</b>  | <b>98</b>  |
| <i>Change</i>                                | 10        | 7         | 0         | 0         | 2         | 4         | 0         | -3        | 5          | 9          | 18         | 13         | 18         | 22         |
| <b>Non-OECD solar installations (annual)</b> |           |           |           |           |           |           |           |           |            |            |            |            |            |            |
| China  | 0         | 3         | 3         | 14        | 13        | 19        | 30        | 53        | 44         | 33         | 52         | 69         | 107        | 154        |
| India  | 0         | 0         | 1         | 1         | 1         | 2         | 5         | 10        | 11         | 12         | 4          | 12         | 18         | 16         |
| Rest of non-OECD                             | 1         | 3         | 3         | 4         | 6         | 6         | 11        | 9         | 22         | 34         | 32         | 30         | 47         | 78         |
| <b>Total Non-OECD</b>                        | <b>2</b>  | <b>5</b>  | <b>8</b>  | <b>18</b> | <b>21</b> | <b>27</b> | <b>46</b> | <b>72</b> | <b>77</b>  | <b>78</b>  | <b>88</b>  | <b>111</b> | <b>172</b> | <b>247</b> |
| <i>Change</i>                                | 1         | 3         | 2         | 11        | 2         | 6         | 19        | 26        | 5          | 1          | 10         | 23         | 58         | 75         |
| <b>Total solar installations (annual)</b>    | <b>19</b> | <b>29</b> | <b>31</b> | <b>42</b> | <b>46</b> | <b>56</b> | <b>75</b> | <b>98</b> | <b>108</b> | <b>118</b> | <b>146</b> | <b>182</b> | <b>250</b> | <b>345</b> |
| <i>Change</i>                                | 11        | 10        | 2         | 11        | 4         | 10        | 19        | 23        | 10         | 10         | 28         | 36         | 76         | 95         |

### Solar supply chain in 2022 and 2023

All parts of the solar module manufacturing chain, except polysilicon, appear to have been in oversupply again in 2022 and are likely remain so in 2023. We treat nameplate capacity estimates here with some caution because technological advances and cost improvements can bring rapid capacity obsolescence, meaning that actual supply may well be lower than nameplate capacity. Nonetheless, significant new manufacturing capacity is planned across the entire value chain which will likely bring lower module prices and will likely help to support global solar module demand.

- **Polysilicon** is a key raw material for a solar wafer. The poly market continued to be the tightest part of the solar market in 2022, evidenced by prices rising through the year to reach nearly \$40/kg in August. Poly prices have been high enough over the past two years to incentivise new supply and we can now see signs that the new supply is on the cusp of arrival. BNEF estimates that the capacity of the polysilicon industry rose to 900 mtpa in 2022 (sufficient to support over 300 GW of solar module manufacturing) but that new capacity additions of nearly 2,500 mtpa are being planned by either existing players or new entrants. While many plants will not be built and many will take longer than expected to reach full production capacity, the scale of capacity growth leads us to believe that poly prices will fall in 2023 and beyond, allowing margin expansion elsewhere in the value chain as well as lower solar module prices.
- **Wafer and solar cell** manufacturing capacity, according to PV InfoLink, will reach 583 GW in Q4 2022 and will grow a further 15% in 2023. In 2022, wafer and cell companies have generally been able to pass through cost inflation and to

defend reasonable margins but, similar to polysilicon, this may come under pressure in 2023 as new capacity is added. Unlike polysilicon however, the wafer business is highly concentrated, with nearly 80% of 2022 wafer capacity in the hands of the five largest producers. This may be a factor to help support prices in 2023. Technological changes in wafer manufacturing could lead to existing capacity becoming obsolete, leaving this part of the market tighter than it appears.

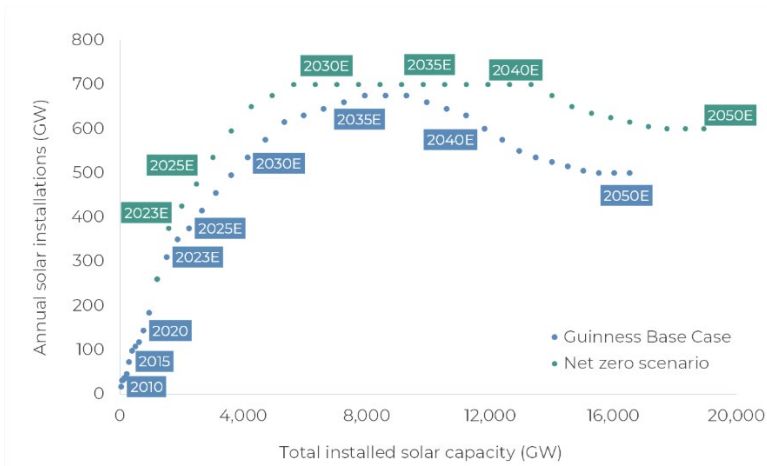
- Solar module** prices moderated in the second half of 2022 with prices likely to average the same level as 2021. With elevated polysilicon and power prices, it is the module manufacturers that suffered the greatest margin compression in 2022. Module manufacturing nameplate capacity in 2022 is estimated to have been around 470 GW, of which around 310 GW is newer 'Tier 1' capacity with lower costs resulting from the scale of manufacturing and new technologies. In 2023, this likely expands to 660 GW and potentially to as high as 820 GW by the end of the year.

The long-term outlook for solar has improved through 2022. In August, BNEF updated its long-term projections, increasing its 2030 module installation forecast to 460 GW from the prior year's forecast of 334 GW, an increase of 37%. The impact of the increase is that a total of 3.4 TW of solar is forecast to be installed globally this decade (up 0.8 TW, or 30%, on the previous forecast) with total capacity in 2030 being 4.2 TW (versus prior estimate of 3.4 TW). This, however, is not consistent with a net zero scenario.

In BNEF's net zero scenario, total installed solar capacity would need to be around 5.3 TW by 2030 (25% higher than their base case). For comparison, the Guinness net zero scenario indicates that total installed capacity would need to be 5.6 TW in 2030 (a compound growth rate of 22%pa from 2021) and that reaching this level of installed capacity would require annual installations to reach as much as 700 GW pa. While solar is a key and well-placed component of any net zero energy transition scenario, the industry still has to deliver more growth in order to be fully aligned.

**Global solar annual installations, base case and NZE scenario**

source: IEA, IPCC, Guinness Global Investors



**The wind sector**

Despite recent headwinds, the long-term outlook for the wind industry remains very positive as the sector plays a critical role in global decarbonisation and the energy transition. Global wind generation capacity today is around 918 GW, but installations have temporarily paused as the industry has wrestled with COVID-related disruptions and various “regulatory airpockets”. Looking forward, we expect these issues to inflect positively over the next few years, leading to a sustained ramp in global wind installations out to 2030.

Below, we discuss some of this new legislation and consider the key factors for the onshore and offshore wind markets in 2023 and beyond. We conclude that the near-term issues are likely a bump in the road on the journey to delivering wind as the second most significant renewable power generation source.

**Annual onshore and offshore wind installations (GW)**

source: BP, IEA, BNEF, Guinness Global Investors estimates

|   | 2008      | 2009      | 2010      | 2011      | 2012      | 2013      | 2014      | 2015      | 2016      | 2017      | 2018      | 2019      | 2020      | 2021       | 2022E     | 2023E      |
|---|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|-----------|------------|
| <b>Onshore wind installations (annual)</b>  |           |           |           |           |           |           |           |           |           |           |           |           |           |            |           |            |
| North America                               | 9         | 11        | 6         | 8         | 15        | 2         | 7         | 10        | 9         | 8         | 8         | 10        | 17        | 16         | 12        | 12         |
| Latin America                               | 0         | 0         | 0         | 0         | 0         | 0         | 5         | 3         | 3         | 3         | 4         | 4         | 2         | 5          | 4         | 6          |
| Europe                                      | 6         | 9         | 9         | 10        | 12        | 11        | 11        | 11        | 12        | 13        | 8         | 9         | 12        | 15         | 18        | 19         |
| China                                       | 6         | 14        | 17        | 18        | 14        | 15        | 21        | 29        | 22        | 17        | 19        | 26        | 54        | 41         | 49        | 51         |
| India                                       | 2         | 1         | 1         | 1         | 2         | 2         | 2         | 3         | 4         | 4         | 2         | 2         | 1         | 3          | 2         | 3          |
| RoW   | 3         | 3         | 3         | 4         | 4         | 3         | 4         | 5         | 5         | 5         | 4         | 4         | 5         | 3          | 3         | 4          |
| <b>Total onshore</b>                        | <b>27</b> | <b>38</b> | <b>35</b> | <b>40</b> | <b>46</b> | <b>33</b> | <b>49</b> | <b>61</b> | <b>55</b> | <b>49</b> | <b>46</b> | <b>55</b> | <b>91</b> | <b>83</b>  | <b>88</b> | <b>95</b>  |
| Change                                      |           | 12        | -3        | 5         | 6         | -14       | 17        | 11        | -6        | -6        | -3        | 9         | 36        | -8         | 5         | 7          |
| World ex China                              | 21        | 24        | 18        | 22        | 32        | 18        | 29        | 32        | 33        | 32        | 27        | 29        | 37        | 42         | 39        | 44         |
| <b>Offshore wind installations (annual)</b> |           |           |           |           |           |           |           |           |           |           |           |           |           |            |           |            |
| China                                       | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1         | 1         | 1         | 2         | 3         | 4         | 14         | 6         | 10         |
| UK  | 0         | 0         | 1         | 0         | 1         | 1         | 0         | 1         | 0         | 1         | 2         | 2         | 1         | 1          | 3         | 2          |
| Germany                                     | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 2         | 0         | 2         | 0         | 2         | 0         | 1          | 0         | 1          |
| RoW   | 0         | 0         | 0         | 0         | 0         | 1         | 0         | 0         | 0         | 1         | 0         | 1         | 2         | 1          | 1         | 6          |
| <b>Total offshore</b>                       | <b>0</b>  | <b>0</b>  | <b>1</b>  | <b>0</b>  | <b>2</b>  | <b>2</b>  | <b>1</b>  | <b>4</b>  | <b>1</b>  | <b>4</b>  | <b>4</b>  | <b>8</b>  | <b>7</b>  | <b>17</b>  | <b>10</b> | <b>18</b>  |
| Change                                      |           | 0         | 1         | -1        | 1         | 1         | -1        | 4         | -4        | 3         | 0         | 3         | -1        | 11         | -7        | 8          |
| World ex China                              | 0         | 0         | 1         | 0         | 1         | 2         | 1         | 3         | 0         | 4         | 3         | 5         | 3         | 3          | 4         | 8          |
| <b>Total wind installations</b>             | <b>27</b> | <b>38</b> | <b>36</b> | <b>40</b> | <b>48</b> | <b>35</b> | <b>50</b> | <b>65</b> | <b>56</b> | <b>53</b> | <b>50</b> | <b>63</b> | <b>98</b> | <b>100</b> | <b>98</b> | <b>113</b> |
| Change                                      |           | 12        | -2        | 4         | 8         | -13       | 16        | 15        | -9        | -3        | -2        | 12        | 35        | 3          | -2        | 15         |

**Onshore wind**

The global onshore wind market currently sits at an installed capacity of 853 GW, with China and the US accounting for around 60% of capacity and Europe making up most of the remainder. Installations have been volatile but were reasonably consistently between 40-60GW from 2011 until 2020. Since 2020 there has been an uptick in installation activity driven, in large part, by both Chinese and US developers rushing to complete projects before subsidies expired. Following this period, it was widely thought that we would subsequently revert to a lower absolute level of installations, with a subdued 5-6% growth rate thereafter. Instead, we have witnessed unprecedented global policy support, which serves not only to keep installations at the current high levels, but also to triple the subsequent growth rate out to 2030, should current government policies be followed through. The three key policy announcements were as follows:

- **Europe’s REPowerEU plan** committed a further EUR 86bn in incremental renewables investment out to 2030 and also sought to remove Europe’s permitting bottlenecks by setting set out plans to streamline the arduous permitting process from 6 years on average to 2 years. Streamlining this process is critical, in our opinion, since the backlog of projects awaiting permitting is around five times the level of annual installations. Overall, the plan represents a dramatic shift, with a target to increase European capacity from 190 GW at present to 510 GW by 2030.
- The **Chinese 14<sup>th</sup> 5 year renewable energy plan** aims to double the installed capacity of both wind and solar by 2030. This has led to China’s major state-owned power companies setting goals to increase total wind and solar capacity by 600 GW by 2025 (5 years ahead of schedule).
- The **US Inflation Reduction Act** outlined a \$369bn package that targets climate and energy security focusing on reducing emissions from (amongst other things) electricity generation and transport. This not only provides very material tax credits, it also guarantees them out to 2033 (providing much needed policy visibility). According to Princeton University, the combined incentives may help increase US wind installations by 2x over the next 3 years compared to 2020 levels.

The result of these policy initiatives is that we no longer expect a dip in installations in the next few years, but instead think that installations stay higher and grow faster, with global capacity nearly tripling by 2030.

**Offshore wind**

Offshore wind remains a nascent industry, at only 7% of global wind capacity, but it has doubled over the last 2 years and should grow nearly five times by the end of the decade driven by improving economics, further geographical adoption and the support of many of the packages outlined above.



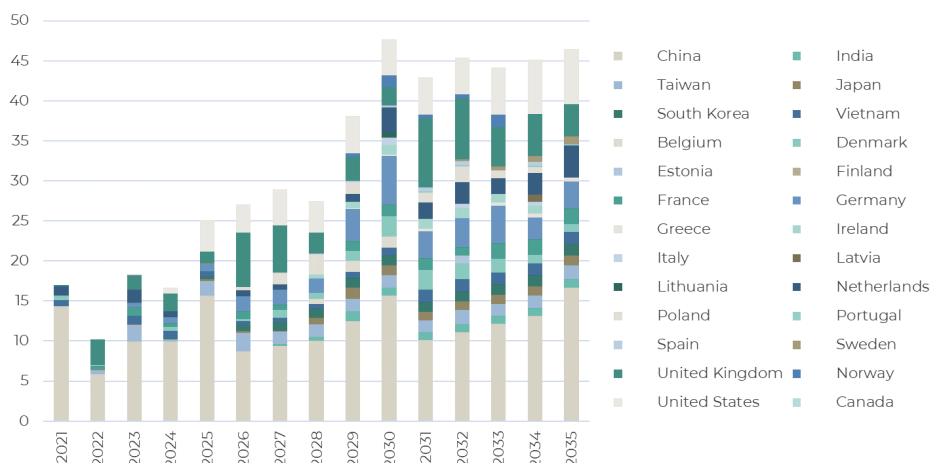
## Guinness Sustainable Energy

In 2022 the LCOE for the median offshore wind project continued to improve relative to the bottom end of competing fossil fuel generation, with key attractions being better operational and visual characteristics as well as being close to key demand areas which are often coastal. 2022 also marked the completion of the first *floating* offshore wind project by Equinor, which while uneconomic today, when industrialised, offers the hope of multiplying the number of potential installation sites.

Positive dynamics for offshore wind in 2022 lead us to increase our 2030 capacity outlook to close to 300 GW, implying 20%pa growth versus 2021. By then, we expect the industry to be primarily made up of Europe and China, with the US still accounting for less than 10% (if President Biden's target 30GW plan is enacted). The first half of 2023 brought a number of problems for offshore wind companies including significant impairments and profit warnings from turbine manufacturers (example Siemens Gamesa) as well as developers (example Orsted) reflecting a number of shorter term supply chain-related issues as well as more structural longer term issues around the economic viability of the resource.

### Outlook for offshore wind installations (GW per annum, to 2035)

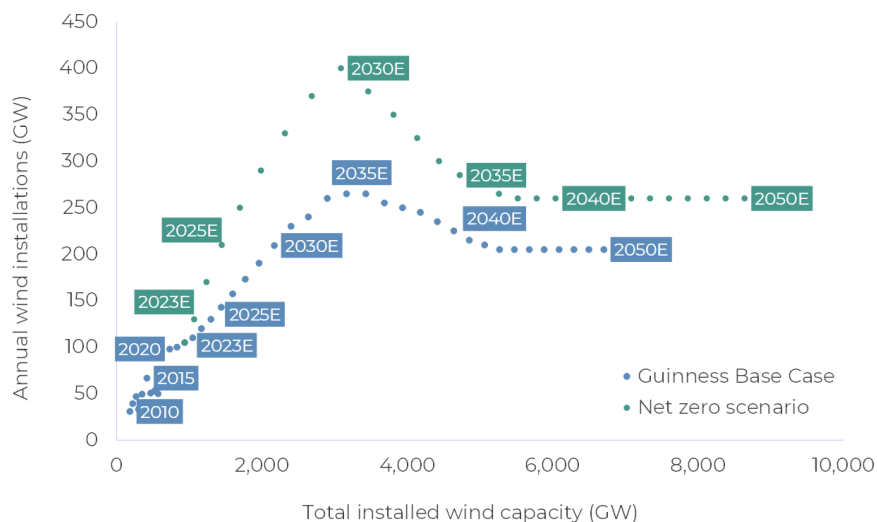
*source: BNEF*



Our base case assumes that total wind installed capacity will be around 2.2 TW in 2030. The Guinness net zero scenario indicates that total installed capacity would need to be 3.1 TW in 2030 (a compound growth rate of 16%pa from 2021) and that reaching this level of installed capacity would require annual installations to reach as much as 400 GW pa. While there appears to be significant policy support to grow the wind industry, we note that it has a very significant way to go in order to be fully aligned and recent announcements in 2023 are slowing the momentum.

### Global wind annual installations, base case and NZE scenario

*source: IEA, IPCC, Guinness Global Investors*



## IMPORTANT INFORMATION

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This report is primarily designed to inform you about the Guinness Sustainable Energy Fund and the TB Guinness Sustainable Energy Fund. It may provide information about the Funds' portfolios, including recent activity and performance. It contains facts relating to the equity markets and our own interpretation. Any investment decision should take account of the subjectivity of the comments contained in the report.

This document is provided for information only and all the information contained in it is believed to be reliable but may be inaccurate or incomplete; any opinions stated are honestly held at the time of writing but are not guaranteed. The contents of the document should not therefore be relied upon. It should not be taken as a recommendation to make an investment in the Funds or to buy or sell individual securities, nor does it constitute an offer for sale.

### GUINNESS SUSTAINABLE ENERGY FUND

#### Documentation

The documentation needed to make an investment, including the Prospectus, the Key Investor Information Document (KIID), Key Information Document (KID) and the Application Form, is available in English from [www.guinnessgi.com](http://www.guinnessgi.com) or free of charge from the Manager: Link Fund Manager Solutions (Ireland) Ltd (LFMSI), 2 Grand Canal Square, Grand Canal Harbour, Dublin 2, Ireland; or the Promoter and Investment Manager: Guinness Asset Management Ltd, 18 Smith Square, London SW1P 3HZ.

LFMSI, as UCITS Man Co, has the right to terminate the arrangements made for the marketing of funds in accordance with the UCITS Directive.

#### Investor Rights

A summary of investor rights in English is available here: <https://www.linkgroup.eu/policy-statements/irish-management-company>

#### Residency

In countries where the Fund is not registered for sale or in any other circumstances where its distribution is not authorised or is unlawful, the Fund should not be distributed to resident Retail Clients. **NOTE: THIS INVESTMENT IS NOT FOR SALE TO U.S. PERSONS.**

#### Structure & regulation

The Fund is a sub-fund of Guinness Asset Management Funds PLC (the "Company"), an open-ended umbrella-type investment company, incorporated in Ireland and

authorised and supervised by the Central Bank of Ireland, which operates under EU legislation. If you are in any doubt about the suitability of investing in this Fund, please consult your investment or other professional adviser.

#### Switzerland

This is an advertising document. The prospectus and KID for Switzerland, the articles of association, and the annual and semi-annual reports can be obtained free of charge from the representative in Switzerland, Carnegie Fund Services S.A., 11, rue du Général-Dufour, 1204 Geneva, Switzerland, Tel. +41 22 705 11 77, [www.carnegie-fund-services.ch](http://www.carnegie-fund-services.ch). The paying agent is Banque Cantonale de Genève, 17 Quai de l'Île, 1204 Geneva, Switzerland.

#### Singapore

The Fund is not authorised or recognised by the Monetary Authority of Singapore ("MAS") and shares are not allowed to be offered to the retail public. The Fund is registered with the MAS as a Restricted Foreign Scheme. Shares of the Fund may only be offered to institutional and accredited investors (as defined in the Securities and Futures Act (Cap.289)) ('SFA') and this material is limited to the investors in those categories.

### TB GUINNESS SUSTAINABLE ENERGY FUND

#### Documentation

The documentation needed to make an investment, including the Prospectus, the Key Investor Information Document (KIID) and the Application Form, is available in English from [www.tbaileyfs.co.uk](http://www.tbaileyfs.co.uk) or free of charge from T. Bailey Fund Services Limited ("TBFS"), 64 St James's Street, Nottingham, NG1 6FJ.

General enquiries: 0115 988 8200.

Dealing Line: 0115 988 8285.

E-Mail: [clientservices@tbailey.co.uk](mailto:clientservices@tbailey.co.uk)

T. Bailey Fund Services Limited is authorised and regulated by the Financial Conduct Authority.

#### Residency

In countries where the Fund is not registered for sale or in any other circumstances where its distribution is not authorised or is unlawful, the Fund should not be distributed to resident Retail Clients.

#### Structure & regulation

The Fund is a sub-fund of TB Guinness Investment Funds, an investment company with variable capital incorporated with limited liability and registered by the Financial Conduct Authority.

Telephone calls will be recorded and monitored.