

This is a marketing communication. Please refer to the prospectus and KIID for the Fund, which contain detailed information on the Fund's characteristics and objectives, before making any final investment decisions. Past performance does not predict future returns.

June 2022

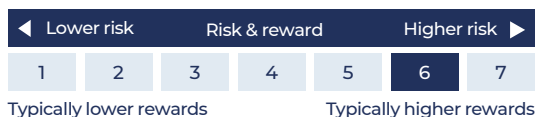
GUINNESS SUSTAINABLE ENERGY FUND

The Guinness Sustainable Energy Fund is 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 Fund is run by co-managers Will Riley and Jonathan Waghorn, supported by Jamie Melrose (analyst). The investment philosophy, methodology and style which characterise the Guinness approach have been applied to the management of various energy equity portfolios at Guinness since 1998.

RISK

The Guinness Sustainable Energy Fund is an equity fund. Investors should be willing and able to assume the risks of equity investing. The value of an investment and the income from it can fall as well as rise as a result of market and currency movement, and you may not get back the amount originally invested. The Fund invests only in companies involved in the energy sector; it is therefore susceptible to the performance of that one sector, and can be volatile. Details on the risk factors are included in the Fund's documentation, available on our website.



The risk and reward indicator shows where the Fund ranks in terms of its potential risk and return. The Fund has been classed as 6 because its volatility has been measured as above average to high. This is based on how investments have performed in the past and you should note that the Fund may perform differently in the future and its rank may change. Historic data may not be a reliable indicator for the future.

EUROPE PUTS ENERGY SECURITY FIRST

This month, we assess the impact of the European Commission's REPowerEU Plan with its dual objectives of ending the EU's dependence on Russian fossil fuels and tackling the climate crisis. The Plan proposes "to enhance long-term energy efficiency measures" alongside "a massive scaling-up and speeding-up of renewable energy". We have exposure to a number of these themes in the Guinness Sustainable Energy Fund.

EQUITIES

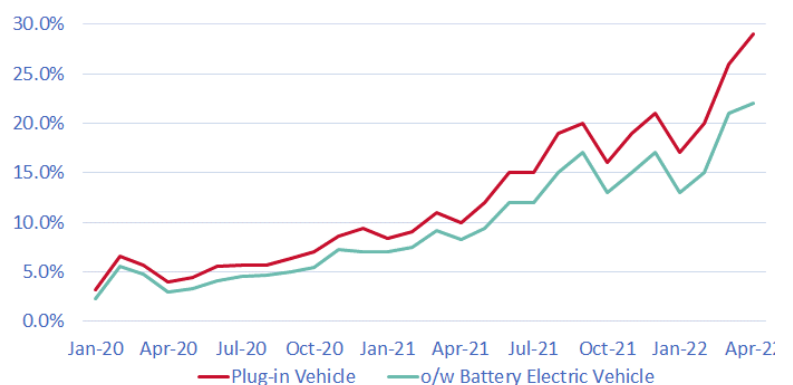
Sustainable energy equities outperformed global stock markets in May. The Guinness Sustainable Energy Fund (Class Y) delivered a return of +3.8% (in USD), ahead of the MSCI World at +0.1%. Year to date, the Guinness Sustainable Energy Fund has delivered -14.2%, versus the MSCI World at -13.0%.

The Fund's performance was led by the Equipment subsector (+8.7%). Siemens Gamesa contributed to this strength (+19.2%) after receiving a takeover bid from Siemens Energy. This represents the third incidence of M&A interest in our portfolio since April, following KKR's bid for Albioma and Standard Industries' purchase of a stake in Johnson Matthey.

CHART OF THE MONTH

Electric vehicles are gaining momentum in China, the world's largest auto market. The monthly market share of Plug-in Electric Vehicles (PEVs) has increased from 3% in January 2020 to 29% in April 2022. PEVs are largely (c80%) dominated by sales of Battery Electric Vehicles, with Plug-in Hybrid Electric Vehicles making up the balance.

China PEV market share (source: Cleantechnica)



Signatory of:








The Guinness Sustainable Energy Report

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1. MAY NEWS AND EVENTS IN REVIEW

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

News	Sub Sector	Impact
As part of its REPowerEU Plan to end Russian fossil fuel imports, the European Commission announced an increase in its energy efficiency target for 2030 from 9% to 13%. Part of achieving this ambition will be to double the roll-out of heat pumps with a view to banning gas boilers by 2029. It is estimated that installing 10m heat pumps over the next five years would save 12bn cubic metres (bcm) of gas per year.	Heat pumps	
Denmark, Germany, Belgium, and the Netherlands announced a joint target to build at least 65 gigawatts (GW) of offshore wind capacity in the North Sea by 2030 and 150GW by 2050. The agreement aims for a tenfold increase in offshore wind energy over the next three decades, representing half of the EU's 2050 offshore wind ambition.	Offshore wind	
Siemens Energy launched a €4.04bn offer to acquire the 33% stake in Siemens Gamesa Renewable Energy it does not currently own. The wind turbine manufacturer's minority shareholders will be offered €18.05 per share in cash – a 28% premium. The transaction will allow management to resolve challenges at Siemens Gamesa whilst realising cost synergies of up to €300m per year within three years.	Wind M&A	
UK Chancellor, Rishi Sunak, has ordered officials to draw up plans for a possible windfall tax on the excess profits reaped by electricity generators. This comes on top of a 25% tax on the “extraordinary profits” made by North Sea oil and gas producers. Whitehall estimates suggest he could seek to raise £3-4bn in order to support households struggling with higher energy bills.	UK energy generation	
US President Joe Biden will allow solar panel parts to be imported free of tariffs for 24 months from four Southeast Asian nations (Cambodia, Malaysia, Thailand and Vietnam) after a Department of Commerce investigation froze imports and stalled solar projects in the United States. The move comes amid concern about the impact of the Commerce Department's months-long investigation into whether imports of solar panels are circumventing tariffs on goods made in China. Biden's action would allay companies' concerns about having to hold billions of dollars in reserves to pay potential tariffs.	US Solar	

2. MANAGER'S COMMENTS

Europe puts energy security first with updated REPowerEU plan

This month, we assess the impact of the European Commission's REPowerEU Plan with its dual objectives of ending the EU's dependence on Russian fossil fuels and tackling the climate crisis. The Plan proposes "to enhance long-term energy efficiency measures" alongside "a massive scaling-up and speeding-up of renewable energy in power generation, industry, buildings and transport". We have exposure to a number of these themes in the Guinness Sustainable Energy Fund.

On May 18, Ursula von der Leyen presented the European Commission's updated REPowerEU Plan. This Plan builds upon the proposals released in March to eliminate dependence on Russian gas before 2030, further building upon the EU's 'Fit for 55' package. The Fit for 55 package was released in two batches in July and December 2021 and encompassed a suite of cross-sector legislative initiatives designed to deliver a 55% reduction in GHG emissions by 2030 versus 1990 levels.

The new Plan recognises that no member state can tackle the challenge of ending fossil fuel imports from Russia on their own, and highlights five sets of actions:

1. Save Energy (efficiency)

The European Commission (EC) recognises that energy efficiency is the cheapest, cleanest, and quickest way to reduce the bloc's reliance on fossil fuel imports and reduce energy bills. Under the Fit for 55 package, the Energy Efficiency Directive legally bound EU countries to collectively reduce their energy consumption by 9% below 2020 levels by 2030. Under the new Plan, this energy efficiency target has been increased from 9% to 13%. Member States are encouraged to use fiscal measures to encourage energy savings, such as "reduced VAT rates on energy efficient heating systems, building insulation and appliances and products".

2. Diversify supplies

The EU has already been working to diversify energy suppliers and will use a newly created EU Energy Platform to pool purchases of gas, LNG and hydrogen. The EC will consider developing a joint purchasing mechanism (similar to that used to purchase COVID-19 vaccines) to negotiate gas purchases on behalf of member states. Alongside this, the EU External Energy Strategy will aim to build long-term partnerships with trusted suppliers, including cooperation on hydrogen. In the Mediterranean and North Sea, major hydrogen corridors will be developed.

3. Substitute fossil fuels and accelerate Europe's clean energy transition

The proposal seeks "a massive scaling-up and speeding-up of renewable energy in power generation, industry, buildings and transport". The headline proposal is to increase the EU-wide renewable energy target to 45% (1,236GW) by 2030, up from the 40% (1,067GW) target in the Fit for 55 package. The 40% target expanded upon the 32% target set by the Renewable Energy Directive before that. This ratcheted ambition will create a framework for other targets and initiatives including:

- Installing >320GW of solar by 2025, and 600GW by 2030.
 - For context, EU members deployed c.25 GW of solar in 2021 and cumulative solar capacity is c.160GW today. Part of this additional push for solar is a phased-in legal obligation to install solar panels on new buildings, along with a scheme to expand the solar supply chain within the EU, particularly in the PV manufacturing sector.
- Installing 10m heat pumps over the next five years.
- Speeding up permitting from up to nine years for wind and 4.5 years for solar projects to as little as one year.
- Producing 10m tonnes of renewable hydrogen and importing another 10m by 2030.
- Producing 35bcm of biomethane by 2030.

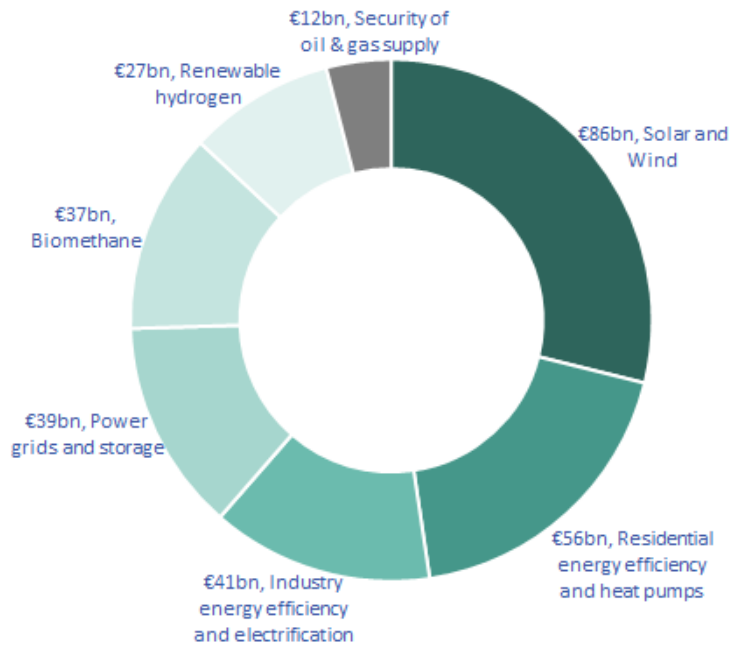
In transport, the EC plans to present a Greening of Freight Package, aiming to significantly increase energy efficiency in the sector, and is considering legislation to increase the share of zero-emission vehicles in public and corporate car fleets above a certain size.

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4. Smartly combine investment and reforms

To deliver the REPowerEU Plan, the EU intends to invest €210bn between 2022-27 and €300bn by 2030. The big winners will be renewable energy (€86bn) and energy efficiency (€97bn), benefiting from c.60% of the funding. The package will be financed by €225bn in loans and €72bn in grants. The €225bn of loans is already available under the Recovery and Resilience Facility (the EU’s pandemic recovery program) and €20bn of grant funding will come from the auctioning of emissions trading system allowances. The EC claims that the spending is justified as cutting Russian fossil fuel imports could save the EU €100bn per year by 2030: €80bn in gas imports, €12bn in oil imports and €2bn in coal imports.

Split of funding for REPowerEU



Source: European Commission

5. Reinforcing preparedness

The EC states that Europe must be ready for severe supply disruption, warning that without further action in coming months, gas storage may not be sufficient for next winter. The Commission calls on Member States to identify essential customers in critical supply chains, ask transmission system operators to accelerate West to East gas flow capacity, and conclude the outstanding bilateral solidarity arrangements between neighbouring countries. Solidarity measures are meant as last resort in the event of an extreme gas shortage to ensure supply to households, district heating systems and basic social facilities.

Summary of changes

We present a summary of the changes between the REPowerEU Plan versus the Fit for 55 package below. In our view, the big winners are efficiency and solar, capturing the majority of the funding and with the most ambitious targets. We already viewed the energy efficiency target of 9% to be challenging, so ratcheting the desired savings by 40-50% is a big step up. Furthermore, the combination of the 25% uplift to 2030 solar capacity targets, the prospect of faster permitting, support for an EU solar supply chain, and the potential for solar to be incorporated into future building standards should be a significant tailwind to companies exposed to European Solar. Within our portfolio, we would expect Canadian Solar, Iberdrola, and SolarEdge to be the key beneficiaries.

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Fit for 55 targets versus REPowerEU targets

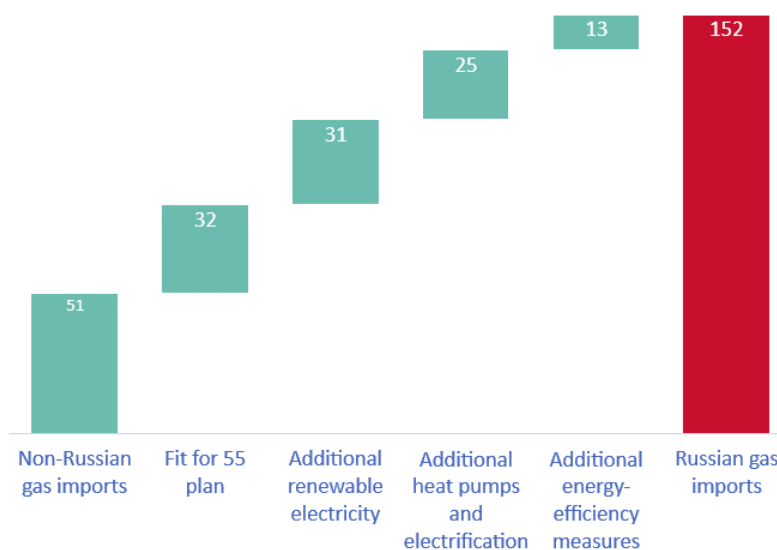
Measure	Fit for 55 Ambition by 2030	REPowerEU
Renewable energy	40%	45%
Capacity targets	1,067GW	1,236GW
o/w Solar	420GW	600GW (>320GW by 2025)
o/w Wind	480GW	Unchanged
Biomethane production	17bcm	35bcm
Renewable hydrogen	5.6m tonnes	10m tonnes (+10m tonnes imported)
Energy efficiency target	9%	13%
Heat pumps	30m units	Unchanged (10m units over next 5 years)

Source: European Commission

Conclusion

This is a serious package of measures which the EU expects will enable the bloc to entirely offset Russian gas imports over the coming years. Below we show the impact of each set of measures on EU gas demand.

Contribution of measures on EU gas demand



Source: Energy Monitor

This Plan underscores the importance of efficiency (insulation and heat pumps), alternative fuels (biomethane and hydrogen), electrification (zero emission vehicles and power storage), and clean energy (wind and solar) in the effort to displace fossil fuel demand and deliver the low carbon transition. By investing in the relevant subsectors, the Guinness Sustainable Energy Fund aims to provide exposure to these solutions.

3. PERFORMANCE

Past performance does not predict future returns.

The Guinness Sustainable Energy Fund (Class Y, 0.67% OCF) delivered a return of +3.8% in the month to 31/05/2022, while the MSCI World Index (net return) delivered +0.1% (all in USD terms).

	Ytd	1 Yr	3 Yrs	5 Yrs*	10 Yrs*
Fund (Class Y)	-14.2%	-7.9%	106.7%	117.9%	186.6
MSCI World NR Index	-13.0%	-4.8%	43.0%	59.0%	185.4
<i>Out/Underperformance</i>	-1.2%	-3.1%	63.8%	58.9%	1.1%

Annual performance	2021	2020	2019	2018*	2017*
Fund (Class Y)	10.4%	84.1%	31.4%	-15.2%	20.2%
MSCI World NR Index	21.8%	15.9%	27.7%	-8.7%	22.4%
<i>Out/Underperformance</i>	-11.4%	68.2%	3.7%	-6.5%	-2.2%

Annual performance	2016*	2015*	2014*	2013*	2012*
Fund (Class Y)	-15.4%	-12.0%	-12.1%	70.8%	-13.2%
MSCI World NR Index	7.5%	-0.9%	4.9%	26.7%	15.8%
<i>Out/Underperformance</i>	-23.0%	-11.2%	-17.0%	44.1%	-29.1%

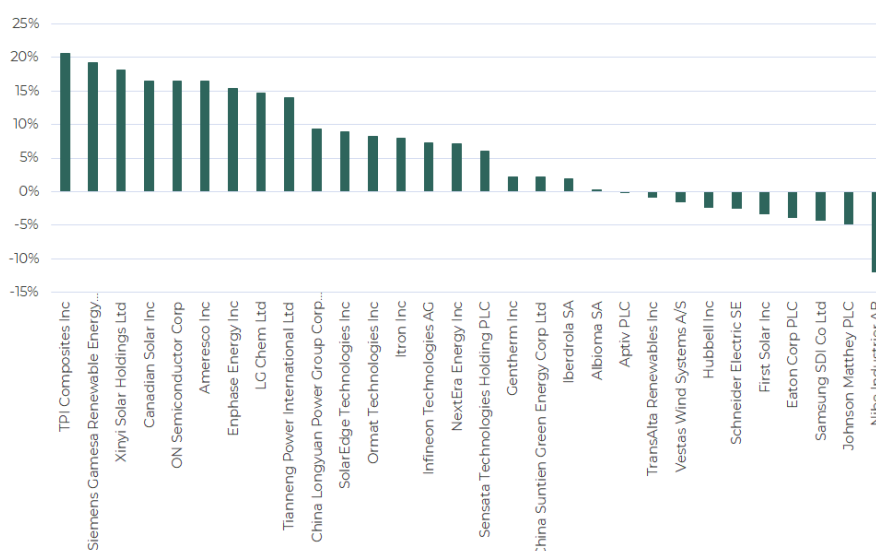
*Simulated Past Performance prior to the launch of the Y class on 16/02/2018. The Performance shown is a composite simulation for Y class performance being based on the actual performance of the Fund's E class, which has an OCF of 1.24%. The Guinness Sustainable Energy Fund was launched on 19/12/2007. Source: Financial Express, bid to bid, total return.

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 0.67% per annum. Returns for share classes with different OCFs will vary accordingly. Performance returns do not reflect any initial charge; any such charge will also reduce the return.

Within the Fund, the strongest performers were TPI Composites, Siemens Gamesa, Xinyi Solar, Canadian Solar, and onsemi while the weakest performers were Nibe, Johnson Matthey, Samsung SDI, Eaton and First Solar.

Stock by Stock performance over the month, in USD

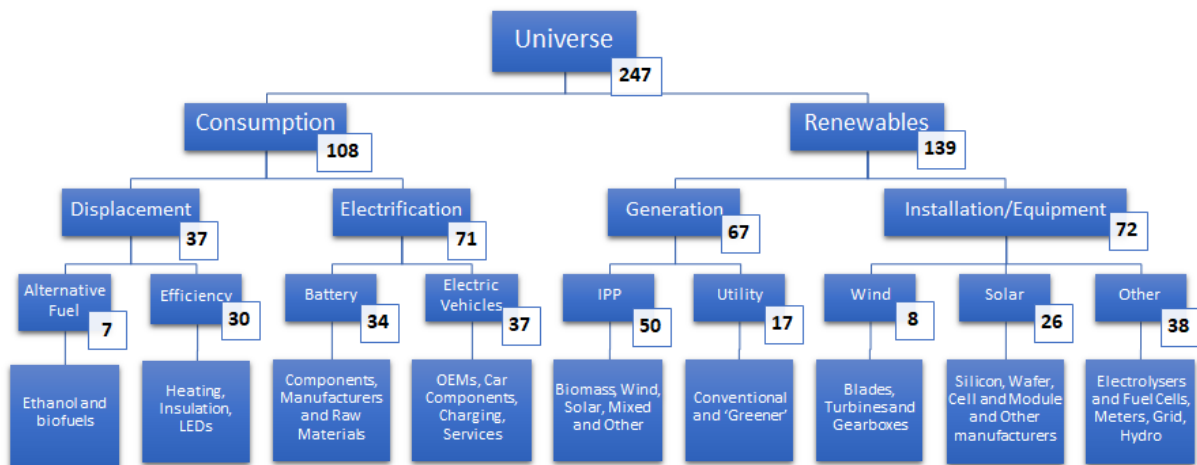
Source: Bloomberg. As of 31 May 2022



4. 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:

Signatory of:

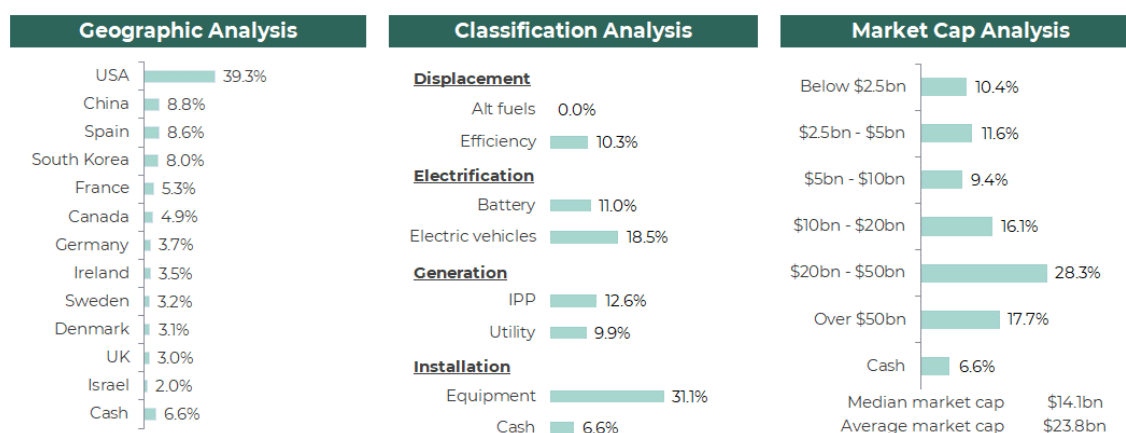


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Buys/Sells

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

Portfolio structure analysis



Source: Guinness Global Investors

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	Year end	Previous year ends	
	May-22		Dec-21	Dec-20	Dec-19	Dec-18
Consumption	39.8%	-3.6%	43.4%	36.7%	41.7%	26.5%
Displacement	10.3%	-1.5%	11.8%	9.9%	13.4%	16.4%
Alternative Fuel	0.0%	0.0%	0.0%	0.0%	0.0%	3.9%
Efficiency	10.3%	-1.5%	11.8%	9.9%	13.4%	12.5%
Electrification	29.5%	-2.1%	31.6%	26.8%	28.2%	10.1%
Batteries	11.0%	2.2%	8.9%	10.8%	12.6%	3.9%
Electric vehicles	18.5%	-4.3%	22.8%	16.0%	15.7%	6.2%
Renewables	53.6%	2.3%	51.3%	60.4%	54.1%	69.7%
Generation	22.5%	-0.6%	23.1%	24.6%	22.2%	27.3%
IPP	12.6%	-1.9%	14.5%	17.0%	18.9%	26.7%
Utility	9.9%	1.3%	8.6%	7.6%	3.2%	0.6%
Installation	31.1%	2.9%	28.2%	35.8%	32.0%	42.5%
Equipment	31.1%	2.9%	28.2%	35.8%	32.0%	42.5%
Cash	6.6%	1.3%	5.3%	3.0%	4.2%	3.8%

Source: Guinness Global Investors

Valuation

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

As at 31 May 2022

	P/E			EV/EBITDA			Dividend Yield		EPS Growth (%pa)		CFROI*	
	2021	2022E	2023E	2021	2022E	2023E	2022E	2023E	2014-21	2021-23	2021E	2022E
Guinness Sustainable Energy Fund	24.4x	22.9x	18.5x	14.1x	13.5x	11.0x	1.3%	1.4%	5.1%	20.5%	6.2%	7.5%
MSCI World Index	18.5x	16.2x	15.1x	12.3x	10.8x	10.4x	2.1%	2.2%	6.7%	10.7%	8.6%	9.1%
Fund Premium/(Discount)	32%	41%	23%	15%	25%	6%						

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

Source: Guinness Global Investors, Bloomberg

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Portfolio holdings, as at end May 2022

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

We hold c.40% 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 10% 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 23% weight to companies involved in the generation of sustainable energy and 31% 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 around a third of our generation exposure. The remaining exposure comes in the form of biomass (Albioma), geothermal (Ormat) and then broad-based wind/solar renewable energy generation through TransAlta Renewables. 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 and Siemens Gamesa are both well placed providers of wind turbines in the world providing 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.

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Portfolio themes, as at end May 2022

Theme	Example holdings	Weighting (%)
1 Electrification of the energy mix		22.6%
2 Rise of the electric vehicle and auto efficiency		21.5%
3 Battery manufacturing		8.1%
4 Expansion of the wind industry		12.4%
5 Expansion of the solar industry		13.7%
6 Heating, lighting and power efficiency		10.3%
7 Geothermal and biomass		4.9%
8 Other (inc cash)		6.6%

Portfolio at end April 2022 (one month in arrears for compliance reasons)

Guinness Sustainable Energy Fund (30 April 2022)			P/E			EV/EBITDA			Price/Book			Dividend Yield		
Stock	% of NAV	Market Cap USD	2021	2022E	2023E	2021	2022E	2023E	2021	2022E	2023E	2021	2022E	2023E
Displacement/Efficiency														
Hubbell Inc	4.6%	10,483	23.2x	21.2x	19.3x	15.8x	14.7x	13.4x	4.8x	4.5x	4.2x	2.0%	2.2%	2.3%
Nibe Industrier AB	3.7%	20,044	56.2x	53.5x	46.5x	32.6x	31.5x	27.9x	8.9x	8.1x	7.2x	0.5%	0.5%	0.6%
Ameresco Inc	2.4%	2,609	35.4x	27.0x	24.3x	22.5x	16.4x	15.0x	3.8x	3.3x	2.9x	n/a	n/a	n/a
	10.7%													
Electrification/Battery														
LG Chem Ltd	3.4%	29,041	9.6x	15.3x	12.5x	5.6x	6.6x	5.4x	1.7x	1.5x	1.4x	2.2%	2.0%	2.2%
Samsung SDI Co Ltd	4.5%	33,304	33.5x	26.7x	21.7x	17.6x	14.7x	12.0x	2.7x	2.6x	2.3x	0.2%	0.2%	0.2%
Johnson Matthey PLC	3.2%	5,149	11.4x	10.7x	10.2x	6.6x	6.8x	6.8x	1.3x	1.6x	1.5x	2.9%	3.4%	3.5%
Tianneng Power International Ltd	0.1%	946	3.5x	2.7x	2.3x	0.6x	0.5x	0.5x	0.5x	0.4x	0.4x	6.1%	7.5%	8.2%
	11.2%													
Electrification/Electric Vehicles														
Aptiv PLC	3.6%	28,825	40.6x	27.3x	17.7x	14.7x	12.2x	9.4x	3.5x	3.2x	2.8x	0.1%	0.1%	0.3%
ON Semiconductor Corp	3.8%	22,634	18.4x	10.6x	10.5x	11.6x	7.0x	6.8x	4.9x	3.6x	2.8x	n/a	n/a	n/a
Infineon Technologies AG	3.5%	37,816	22.3x	16.1x	15.1x	11.3x	9.2x	8.6x	2.9x	2.8x	2.4x	1.0%	1.2%	1.4%
Sensata Technologies Holding PLC	3.7%	7,126	13.0x	11.7x	10.0x	10.4x	9.8x	8.8x	2.3x	2.2x	1.9x	n/a	0.7%	0.9%
Gentherm Inc	3.1%	2,234	25.3x	24.2x	16.3x	13.9x	13.2x	9.3x	3.2x	n/a	n/a	n/a	n/a	n/a
	17.7%													
Generation/IPP														
China Longyuan Power Group Corp Ltd	3.1%	22,387	16.5x	14.1x	12.1x	12.0x	10.8x	9.3x	1.7x	1.5x	1.4x	1.2%	1.4%	1.6%
Ormat Technologies Inc	3.4%	4,358	63.0x	59.7x	40.3x	15.7x	14.3x	12.0x	2.1x	2.1x	2.1x	0.7%	0.6%	0.7%
TransAlta Renewables Inc	3.7%	3,710	29.1x	25.8x	22.0x	12.3x	11.4x	10.8x	2.3x	2.4x	2.4x	5.3%	5.3%	5.3%
Albioma SA	1.7%	1,721	27.2x	27.4x	24.2x	11.8x	12.1x	11.0x	3.1x	3.1x	2.8x	1.8%	1.8%	1.9%
NextEra Energy Inc	4.4%	139,519	28.1x	25.2x	23.5x	20.7x	17.1x	15.4x	3.3x	3.3x	3.1x	2.2%	2.4%	2.6%
China Suntien Green Energy Corp Ltd	2.1%	4,990	6.4x	6.8x	5.9x	10.8x	10.5x	9.4x	0.9x	0.7x	0.7x	5.6%	4.9%	5.4%
	18.5%													
Generation/Utility														
Iberdrola SA	5.4%	74,769	17.5x	16.9x	15.5x	10.3x	10.3x	9.5x	1.7x	1.6x	1.5x	4.3%	4.2%	4.5%
	5.4%													
Installation/Equipment														
Schneider Electric SE	4.3%	82,658	21.7x	20.0x	18.0x	15.1x	14.2x	13.0x	3.3x	3.0x	2.8x	2.2%	2.2%	2.4%
Eaton Corp PLC	4.1%	57,946	21.9x	19.3x	17.3x	18.1x	15.5x	14.1x	3.6x	3.4x	3.2x	2.1%	2.2%	2.3%
Itron Inc	2.5%	2,152	39.5x	33.7x	16.8x	17.8x	18.7x	10.8x	1.8x	1.8x	1.7x	n/a	n/a	n/a
Xinyi Solar Holdings Ltd	2.9%	13,420	19.1x	19.3x	14.9x	14.8x	13.4x	10.3x	3.5x	3.1x	2.7x	2.4%	2.5%	3.2%
SolarEdge Technologies Inc	1.9%	13,869	49.9x	37.8x	26.2x	39.7x	30.7x	20.1x	10.5x	6.5x	5.3x	n/a	n/a	n/a
Enphase Energy Inc	2.0%	21,794	69.9x	46.4x	36.2x	61.9x	38.1x	29.2x	32.5x	29.6x	16.3x	n/a	n/a	n/a
First Solar Inc	3.7%	7,784	17.6x	237.9x	35.7x	12.7x	49.0x	15.9x	1.3x	1.3x	1.3x	n/a	n/a	n/a
Canadian Solar Inc	2.3%	1,751	19.2x	13.0x	8.4x	6.1x	4.3x	3.4x	0.8x	0.8x	0.7x	n/a	n/a	n/a
Vestas Wind Systems A/S	3.2%	26,184	60.4x	n/a	45.4x	16.2x	27.7x	14.0x	4.8x	5.8x	5.3x	0.5%	0.2%	0.6%
Siemens Gamesa Renewable Energy SA	2.8%	11,012	n/a	n/a	90.8x	23.3x	251.0x	14.5x	2.1x	2.8x	2.7x	n/a	n/a	0.1%
TPI Composites Inc	0.5%	426	n/a	n/a	n/a	9.3x	15.9x	3.3x	1.5x	2.3x	2.4x	n/a	n/a	n/a
	30.1%													
		26.11%												
Cash	6.3%													

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.

5. OUTLOOK - sustainable energy & the energy transition

Sustainable energy: the long-term outlook

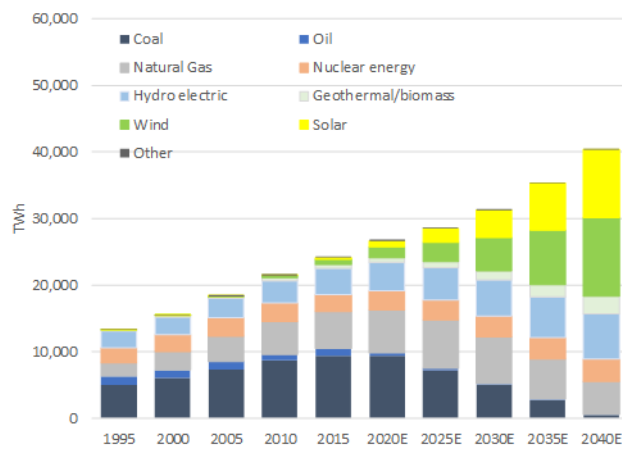
Over the next thirty years, the world will continue its transition to a sustainable energy system. The key factors driving the transition are:

- **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.

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 around 60% by 2050.

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



Sources: BP Statistical Review; IEA: Guinness Global Investors estimates

Policy support for decarbonisation

After very strong policy support in 2020, we witnessed further policy commitment in 2021. The path has not always been smooth, however, with US's return to the Paris Agreement, for example, butting up against resistance to key clean energy spending plans. The most significant policy milestones in 2021 included:

- **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.** Mid-year, the Intergovernmental Panel on Climate Change (IPCC) published their sixth assessment report on the physical science of climate change and the physical impacts of various carbon emission and warming scenarios

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- **COP26 climate conference.** In November, 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 MtCO₂e) while Canada introduced a federal carbon tax that will increase by 2030 to around US\$130/tonne.
- **Post COVID stimulus and infrastructure plans.** While policy towards stimulus plans continues to be positive, the passage of actual investment into the energy transition has been slower than expected. The influential US “Build Back Better” (BBB) infrastructure package is the clearest example of the delay between policy announcement and actual investment. After passing the House of Representatives in November, Democratic Senator Joe Manchin announced on December 19th that he would not be supporting the \$1.75trn bill (as currently written) thus delaying the passage of the BBB bill through the House of Congress. A compromise bill is likely in our opinion.

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 measures were negatively impacted by COVID in 2020, as projects and investments were disrupted, but it appears that governments are turning their attention to efficiency measures as part of post-COVID stimulus measures. There is urgency to do this as current government policies imply that annual energy efficiency improvements need to increase by around 50% from a long-term historic 1.5%pa to a forecast level of 2.3%pa.

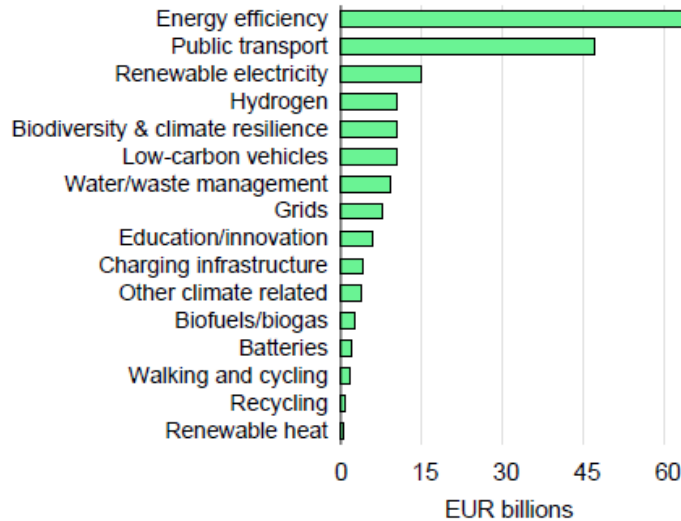
Energy efficiency measures are typically employment-intensive and offer a cheap form of carbon abatement. These factors help explain why the efficiency sector has received around US\$144bn of stimulus spending since the start of COVID, the largest allocation within clean energy spending globally. The renovation of public and private buildings and energy efficiency investment in the industrial sector are the largest beneficiaries of the allocated spending.

Despite the acceleration of energy efficiency spending for buildings, current spending plans will only be enough to keep total building heat consumption flat over the next few years, as per square foot efficiency gains are offset by an expanding stock of buildings.

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EU Recovery and Resilience Facility (RRF) fund allocation

source: IEA



Based on current government policies, the IEA estimates that energy efficiency spending needs to increase this decade from around \$250bn pa to around \$375bn pa, rising to \$550bn in the 2030s. However, current activity, plus recent subsidy announcements, are not sufficient to deliver even the IEA's base case, which is far from net zero.

Alternative fuels

Alternative fuels such as ethanol (which displaces gasoline), biodiesel and renewable diesel (which displace conventional diesel) and Sustainable Aviation Fuels (SAF, which displace conventional jet fuel) serve a role in displacing existing fossil fuel demand, predominantly in transportation. In 2021, the global alternative fuel demand was nearly 160bn litres (over 2.5m b/day), representing nearly 3% of world oil transportation demand. The US has the largest alternative fuel market, at around 60bn litres (40% of the global market) where around 10% of all road fuel consumed is classified as alternative.

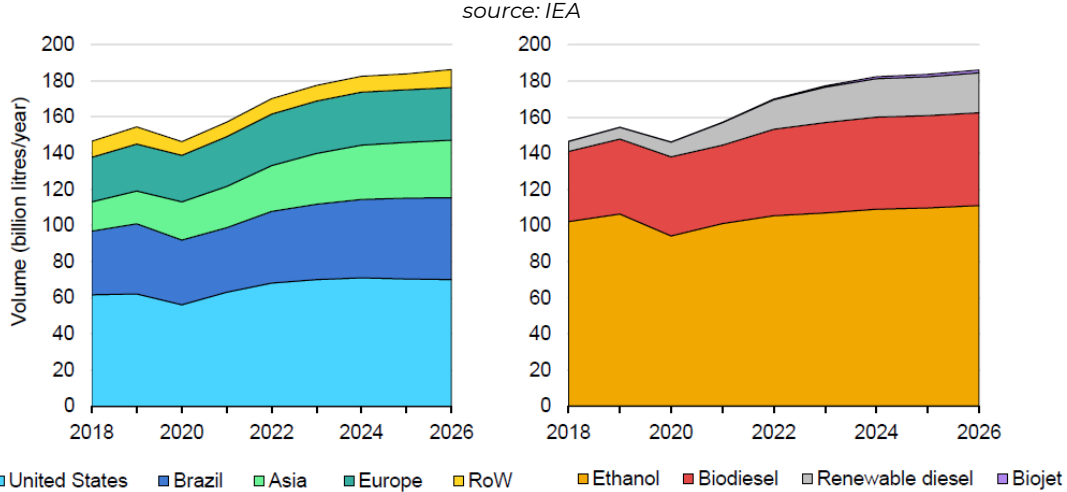
Alternative fuels consumption in 2021 grew by 10% versus 2020 and 3% versus 2019. Demand growth was significantly stronger than the underlying 6% increase in global oil demand, underlining the policy support for increased blending of alternative fuels in the transportation mix. Renewable diesel demand in the US and biodiesel demand in Asia were the biggest growth drivers. Over the next five years, alternative fuel demand is likely to grow at around 4%pa, reaching 186bn litres and continuing to outgrow global oil demand growth.

With regard to product mix, we see ethanol having the largest absolute demand growth but its market share recedes to around 60% as demand for renewable diesel (using feedstocks such as used cooking oil, corn oil or rendered animal fats) accelerates and overtakes the current leading biodiesel technology. Combined, ethanol and renewable diesel satisfy 80% of the demand growth over the next five years.

We expect Asia to be the fastest growing market, driven for example by India's 20% ethanol blending target for 2025. However, North America will remain the largest market (40% market share) followed by Latin America (27% market share, driven by ethanol in markets like Brazil) and Asia (17% market share) and overtaking Europe (<15%).

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Alternative fuel demand by region (left) and fuel (right) (2018-2026)



On an unsubsidised basis, alternative fuels typically look expensive. Reliance on government subsidies increases the risk around the medium-term growth outlook. For example, in the US, there was significant uncertainty in 2021 around the Renewable Volume Obligation (RVO), a volume-driven subsidy. Various price-related subsidies in the US have also been volatile. In October 2021, the aggregate value of the subsidies, including Renewable Identification Numbers (RINs), Low Carbon Fuel Standards credits (LCFS) and the biodiesel Blenders Tax Credit (BTC), was around \$4/gallon. With wholesale conventional diesel prices at around \$2.50/gallon, it is clear how important subsidy is in delivering the growth of the biodiesel and renewable diesel industry in the US.

Electrification

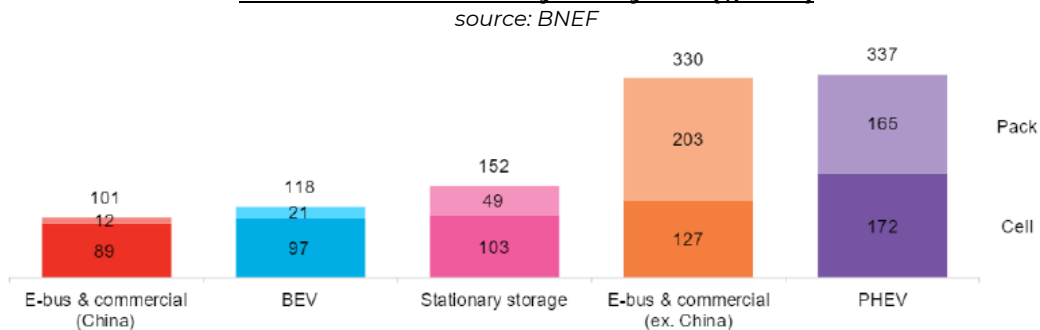
The energy transition is seeing energy demand being 'electrified' as it moves away from predominantly hydrocarbon fuels and gases towards the consumption of electricity. Our 'electrification' sector includes some key enablers of this transition: the lithium-ion battery and the electric vehicle industries. 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 catalyst for greater **lithium-ion battery** use has been sharp falls in the cost of manufacturing. According to BNEF, battery pack costs are down 89% over the period 2010 to 2021 (an implied 'learning rate' of around 18%) with the average cost being \$132/kWh in 2021 (split \$101/kWh for the cell itself and an additional \$31/kWh for the pack).

The \$132/kWh survey outcome for 2021 is an average calculated across a wide range of uses and regions. China was typically the lowest cost manufacturer with some individual passenger EV battery packs at below \$100/kWh (and e-bus and commercial vehicle packs at \$101/kWh on average) while BNEF calculated that Tesla's estimated average pack price in 2021 was around \$112/kWh. The survey also includes stationary storage solutions which saw a fall in cost of around 16% in 2021, to \$152/kWh, as manufacturers turned to simple and cheaper battery chemistries, such as lithium-ion phosphate, to offset raw material inflation.

BNEF lithium-ion battery survey 2021 (\$/kWh)



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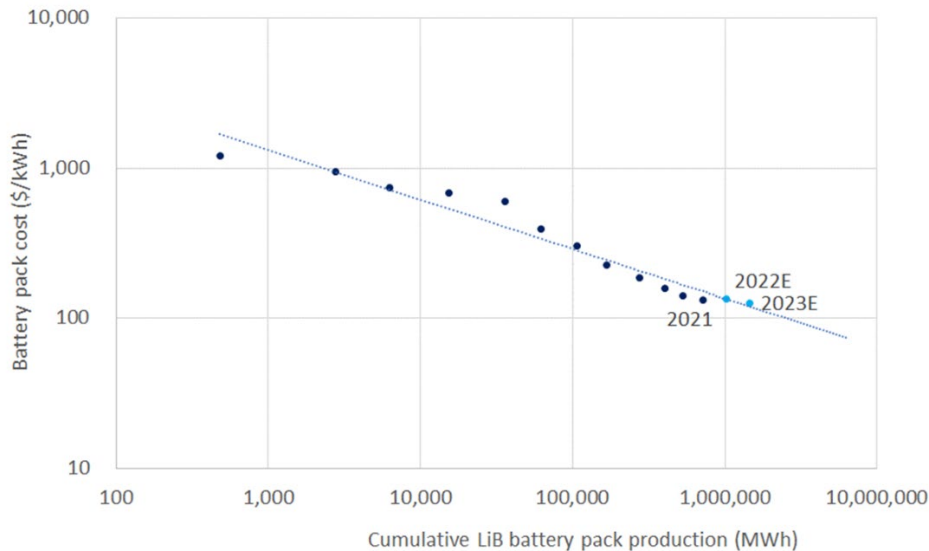
Raw materials make up around 50% of the cost of a lithium-ion battery pack, with cathode materials alone representing around 20% of the total cost. The key catalyst material is lithium carbonate, whose price in China rose by 270% in 2021. While battery manufacturers have long-term contracts and approaches in place to mitigate such inflation, they ultimately have little choice but to pass on the costs to consumers. In Q4 2021, BYD increased its battery prices by 20%.

Raw material cost inflation will continue to have an impact in 2022 and we see the likelihood that the cost of manufacturing may exceed levels seen in 2020. Rapidly increasing manufacturing capacity, (bringing further efficiencies of scale) together with reduced supply chain disruptions should help to alleviate the cost pressures in subsequent years and allow the average cost of producing a lithium-ion battery for an EV is likely to fall towards \$100/kWh in the mid-2020s, maybe a year or so later than we previously expected.

While the \$100/kWh cost level is a key target, we note that in 2021 the battery and EV industry started focusing on manufacturing costs well below \$100/kWh. EV manufacturers started to vertically integrate with battery manufacturers and form battery manufacturing JVs such as BlueOvalSK (Ford/SK) and Ultium Cells (GM/LG Energy Solutions) in efforts to improve manufacturing efficiencies with \$60/kWh targets discussed for the end of the decade. The US Department of Energy also set \$60/kWh as its 'stretch' goal, a level would be achieved by 2030 if the current 18% learning rate is maintained.

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

source: Bloomberg, Guinness Global Investors



Electric Vehicles

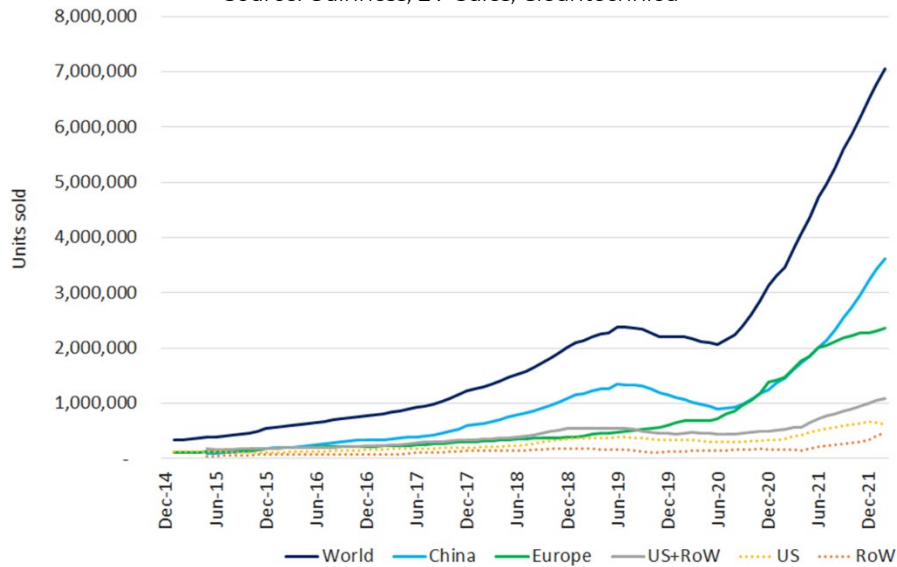
Strong momentum in EV sales growth continued through 2021. On our estimates, nearly 6.5m new EVs were sold in 2021, more than double the sales in the same period twelve months earlier (affected by COVID) and 178% higher than the same period in 2019. This growth compares very favourably to overall global light vehicle sales growth of 6.8% and -9.4% for the same periods in 2021 and 2020 respectively. Accordingly, the market share for EVs has increased to around 8% for 2021 versus 4% and 2.4% in 2020 and 2019 respectively.

Regionally, China has regained its position as the largest EV market with total sales of new EVs of around 3.0m in 2021, up 150% on 2020. Europe, which overtook China to be the largest EV market at the end of 2020, saw total new EV sales of 2.27m units, up 94%. The US still lags Europe and China with new EV sales of 0.6m, up 95% on the same period twelve months earlier.

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Global EV sales (rolling 12-month basis up to December 2021)

Source: Guinness, EV-Sales, Cleantechnica

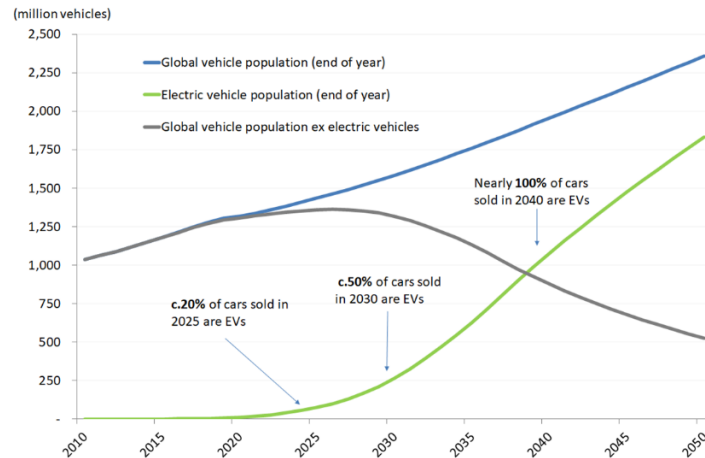


Government support for EVs will reduce in 2022. Europe will continue rolling back its EV “super-credits”, and China plans to reduce EV subsidies further. Despite this, we expect global EV sales to exceed 9 million in 2022, representing around 10% of total passenger vehicle sales, taking the global EV stock from 16m vehicles to 25m vehicles.

On a global basis, we expect EVs will represent around 20% of new vehicle sales in 2025 (concurrent with the cost of EV lithium-ion batteries falling to around \$100/kWh), 50% of new vehicle sales in 2030 and nearly all new vehicle sales by 2040. At that point, it implies an overall EV population of around 1bn vehicles, over sixty-five times greater than current global population of around 15m EVs. With EVs using roughly one third of the energy of a typical internal combustion engine vehicle, this transition alone will have substantial impact on global energy efficiency and global decarbonisation.

Global EV population (to 2050)

Source: IEA; Guinness Global Investors



Despite these rapid 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.

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

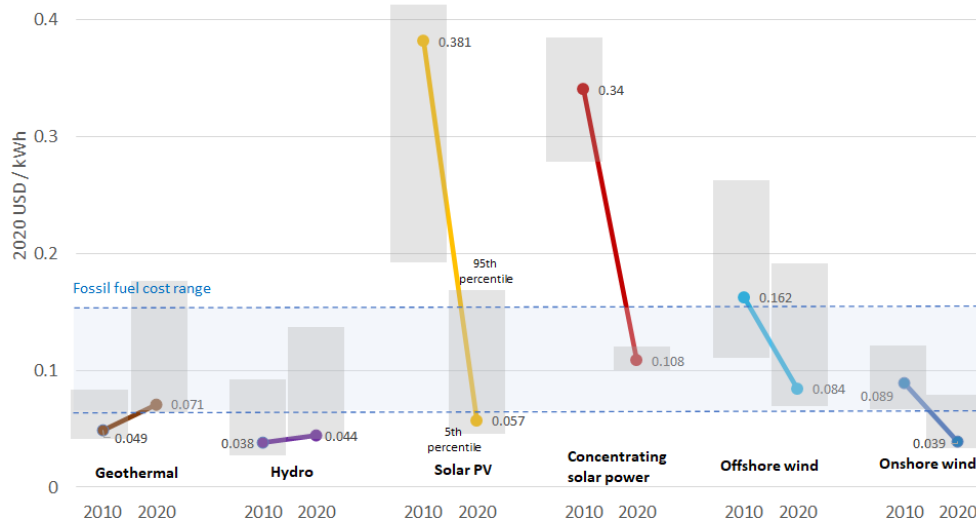
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and geothermal power to sit at the lower end of, or below, the cost range for new fossil fuel power generation.

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 of utility-scale renewable power generation technologies (2010–2020)

source: IRENA, Guinness Global Investors estimates



The solar sector

2021 was a year of record installations, but one that also witnessed a tick up in the cost of solar module manufacturing as a result of raw material, power and logistics inflation. These issues slowed installation growth in the fourth quarter and lead us to forecast 173 GW for 2021. Even so, it is level comfortably above our 155 GW forecast for 2021 that we made at the start of the year. In 2020, the IEA described solar power as “now the cheapest electricity in history” and, despite near term headwinds and cyclical cost inflationary factors, large-scale solar remains at the bottom of the cost curve.

Our initial estimate for 2022 installations is 215 GW (up 42 GW on 2021) and we note that the factors creating uncertainty around 2021 installations will also impact 2022 installations. Most projects being installed today utilise projects with modules purchased some months earlier, so full effect of higher costs in 2021 is still to be witnessed in 2022. On the other hand, our checks generally show that affected projects are being delayed rather than cancelled, so projects falling out of 2021 are likely to be delivered in 2022. Based on current activity at the end of April 2022, it appears that our estimate for 2022 will be exceeded.

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Global solar module installations, 2010-2022E (GW)

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

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021E	2022E
OECD solar installations (annual)													
North America	1	2	4	6	7	8	14	11	10	11	19	30	25
Germany	7	7	8	3	2	1	2	2	4	4	5	5	6
Spain	0	0	0	0	0	0	0	0	0	5	3	4	5
Rest of Europe	3	4	5	5	5	6	4	3	4	6	8	15	19
Australia	0	1	1	1	1	1	1	2	4	4	4	5	6
South Korea	0	0	0	1	1	1	1	1	2	3	4	4	5
Japan	1	1	2	7	10	11	8	8	7	7	9	7	9
Total OECD	17	23	24	24	25	29	29	26	31	40	51	70	75
<i>Change in OECD annual installations</i>	<i>10</i>	<i>7</i>	<i>0</i>	<i>0</i>	<i>2</i>	<i>4</i>	<i>0</i>	<i>-3</i>	<i>5</i>	<i>9</i>	<i>11</i>	<i>19</i>	<i>5</i>
Non-OECD solar installations (annual)													
China	0	3	3	14	13	19	30	53	44	33	52	55	75
India	0	0	1	1	1	2	5	10	11	12	4	12	19
Rest of non-OECD	1	3	3	4	6	6	11	9	22	34	37	36	46
Total Non-OECD	2	5	8	18	21	27	46	72	77	78	93	103	140
<i>Change in non-OECD annual installations</i>	<i>1</i>	<i>3</i>	<i>2</i>	<i>11</i>	<i>2</i>	<i>6</i>	<i>19</i>	<i>26</i>	<i>5</i>	<i>1</i>	<i>15</i>	<i>10</i>	<i>37</i>
Total solar installations (annual)	19	29	31	42	46	56	75	98	108	118	144	173	215
<i>Change in world annual installations</i>	<i>11</i>	<i>10</i>	<i>2</i>	<i>11</i>	<i>4</i>	<i>10</i>	<i>19</i>	<i>23</i>	<i>10</i>	<i>10</i>	<i>26</i>	<i>29</i>	<i>42</i>

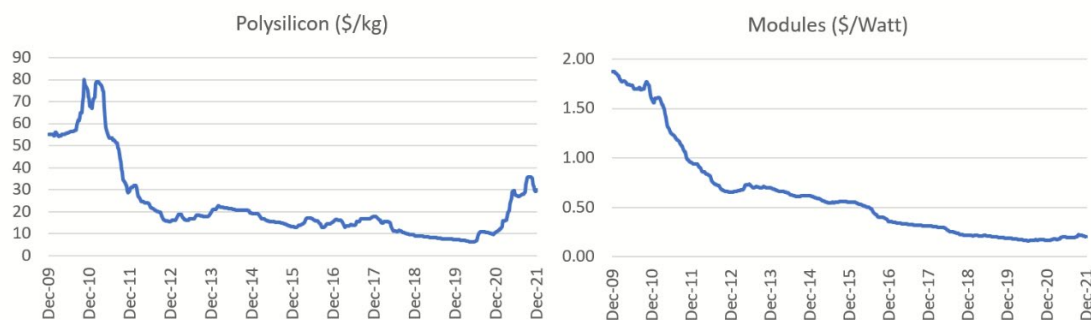
Supply solar supply chain

Most parts of the solar module manufacturing chain were oversupplied in 2021 and will likely remain so in 2022 as new capacity is added across the breadth of the chain, including polysilicon, wafers, cells and modules.

- **Polysilicon** is a key raw material for a solar wafer. This was the tightest part of the solar market in 2021, evidenced by poly-silicon prices nearly trebling over the year to end the year at around US\$30/kg. The price strength allowed polysilicon manufacturers to realise super normal profits and is incentivising a supply response. Capacity averaged around 460 MT in 2021 but around 190 MT of new Chinese supply (representing 40% of 2021 capacity) has either recently started or is about to start production.
- **Wafer and solar cell** manufacturing capacity increased by over 60% in 2021 while mono wafer prices have increased by around 75%. The increase in capacity leaves this part of the value chain as oversupplied in 2022 as it was in 2021 although 78% of 2022 wafer capacity is in the hands of the five largest producers.
- **Solar module** prices have increased around 25% during 2021 (to around US\$0.28/Watt according to BNEF) – back to where they were in mid-2018. Module manufacturing continues to be significantly oversupplied with around 470 GW of available capacity in 2022, of which around 310 GW is newer 'Tier 1' capacity with lower costs resulting from the scale of manufacturing and new technologies.

Polysilicon and solar module pricing

source: Bloomberg



Solar installations by region

Installations by country and region are affected by a wide range of factors:

- **China**, which represents around one third of global solar installation demand, is likely to see lower installations in 2021 than initially expected. Cost inflation could therefore cause actual 2021 installations to be biased lower. Any shortfall is expected to be only a short-term delay and to be delivered in 2022, leading to an upside bias here. Recent comments from President

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Xi at COP15 indicate that annual Chinese solar installations could rise to 130-150GW (versus around 50GW in 2020).

- **India** is still small in terms of global solar installations (4GW in 2020 and potentially 12GW in 2021) but installations could grow by around 50% in 2022. The Indian market has good potential and is being driven by the large conglomerates such as Ambani, Tata Power and Adani Green that publicly stated plans to install 100GW, 30GW and 45GW respectively by 2030, thus forming a large part of India's overall 450GW installation plan for 2030.
- Solar installations in the **United States** continued in 2021 to surprise to the upside. The estimated 30GW of installation in 2021 has been supported by the investment tax credit (ITC) and support for local manufacturing of clean power equipment.
- The new coalition government in **Germany** has a target of installing 200GW of solar by 2030, biased to residential projects.

The wind sector

The long-term outlook for the wind industry remains very positive as wind power will play a critical role in global decarbonisation and the energy transition. Global wind generation capacity today is around 700GW with annual installations in 2022 expected to be around 84GW.

However, the wind industry is suffering short-term pressures as recent sharp peaks in installation demand (a 50% increase to 98GW in 2020, driven by tax incentives and policy changes) have moderated and have been compounded by COVID-related project delays, raw material cost inflation, logistics issues and permitting constraints.

Wind turbine manufacturing is raw material intensive. According to Vestas in December 2021, steel plate prices were up 2x and resin up 2.5x versus the start of 2020. In terms of logistics, the cost of shipping containers was up 4x and the cost of delivery vessels was up 2x in 3Q 2021 vs 2020. While these cost increases are significant, they were compounded by supply chain issues, such as a 4x increase in the average time that equipment spent waiting in Chinese ports and a 50% reduction in the reliability of scheduling.

Below, we consider the key factors for the onshore and offshore wind markets in 2021 and beyond, concluding 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	2021E	2022E
Onshore wind installations (annual)															
North America	9	11	6	8	15	2	7	10	9	8	8	10	17	16	8
Latin America	0	0	0	0	0	0	5	3	3	3	4	4	2	5	5
Europe	6	9	9	10	12	11	11	11	12	13	8	9	12	16	18
China	6	14	17	18	14	15	21	29	22	17	19	26	54	29	31
India	2	1	1	1	2	2	2	3	4	4	2	2	1	3	4
RoW	3	3	3	4	4	3	4	5	5	5	4	4	5	9	5
Total onshore	27	38	35	40	46	33	49	61	55	49	46	55	91	78	71
<i>Change in onshore annual installations</i>		12	-3	5	6	-14	17	11	-6	-6	-3	9	36	-13	-7
<i>World ex China</i>	21	24	18	22	32	18	29	32	33	32	27	29	37	49	40
Offshore wind installations (annual)															
China	0	0	0	0	0	0	0	1	1	1	2	3	4	5	3
UK	0	0	1	0	1	1	0	1	0	1	2	2	1	1	2
Germany	0	0	0	0	0	0	0	2	0	2	0	2	0	1	2
RoW	0	0	0	0	0	1	0	0	0	1	0	1	2	3	6
Total offshore	0	0	1	0	2	2	1	4	1	4	4	8	7	11	13
<i>Change in offshore annual installations</i>		0	1	-1	1	1	-1	4	-4	3	0	3	-1	4	2
<i>World ex China</i>	0	0	1	0	1	2	1	3	0	4	3	5	3	5	10
Total wind installations (annual)	27	38	36	40	48	35	50	65	56	53	50	63	98	89	84
<i>Change in world annual installations</i>		12	-2	4	8	-13	16	15	-9	-3	-2	12	35	-9	-5

Onshore wind

Global onshore wind installations in 2021 were around 78GW, down 13GW from the record level seen in 2020 but still up 23 GW on the pre-pandemic installation level of 55GW in 2019.

Onshore wind installations had been growing very steadily since 2008, averaging an increase of around 3GW pa, with China representing around 70% of the annual growth. Chinese demand peaked

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sharply in 2020 and we expect installations to moderate to the longer-term trend resulting in around 30GW of installations in 2022.

Outside China, onshore installations reached a new high in 2021, averaging 49GW, up 12 GW on 2020 levels. Onshore installations outside China are expected to be lower in 2022, averaging around 40GW, as the surge of policy and tax incentive-led demand falls off and post-COVID supply chain issues and cost inflation start to impact the value chain. A level of 40GW is still higher than any year prior to 2020.

Combined with underlying new project increases, we note that by 2030 around one third of the world's total installed capacity will be more than 13 years old and will be strong candidates for refurbishing.

Offshore wind

Offshore wind remains a nascent industry, at only 14% of the size of onshore (by annual installations in 2021), but one where the growth trajectory is becoming increasingly visible.

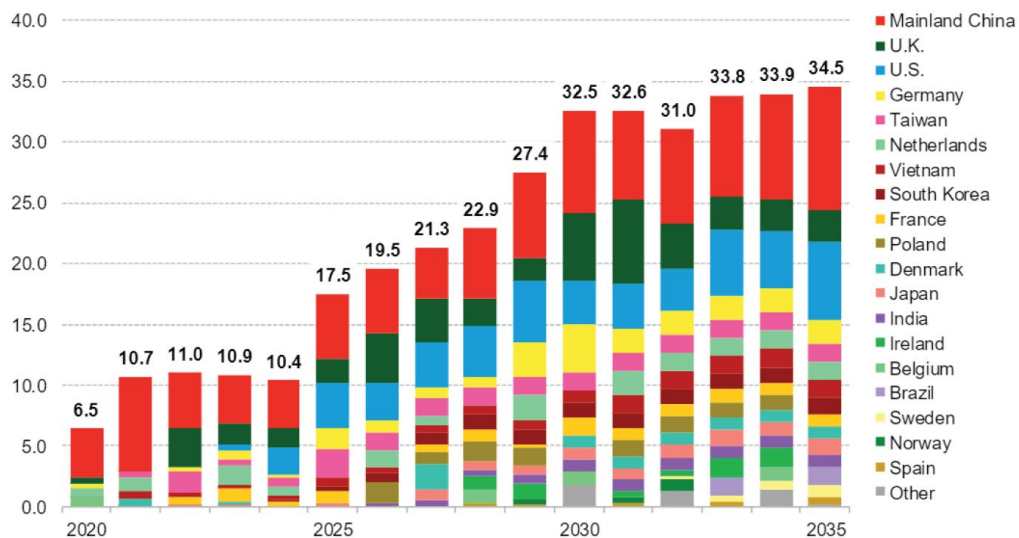
Annual installations of offshore wind capacity have increased from 0.9GW in 2010 to a new high of 11GW in 2021. Chinese offshore installations reached 5GW in 2021 while ex-China installations are likely to grow from 5GW in 2021 to a new high of 10GW in 2022.

The economics of offshore wind continue to improve and there was further constructive cost data in 2021 suggesting that the LCOE for the median offshore wind project halved between 2010 and 2020, and now sits at the bottom end of the competing fossil fuel generation cost range. The growing interest underlines the significant potential of the offshore industry which benefits from better operational (higher and more reliable wind speed) and visual characteristics as well as being close to key demand areas which are often coastal.

In the later part of this decade, we expect annual offshore wind installations to represent around 20% of the total wind market with cumulative installations in offshore between 2020 and 2030 likely to be around 140GW. A broader spread of countries including the United States, Chinese Taipei, Korea, Vietnam and Japan means that cumulative installations will be split around 30GW in the Americas, 90GW in Europe, Middle East and North Africa and around 20GW in Asia Pacific. The current European market will continue to grow, as excess offshore wind generation will be utilised for the generation of green hydrogen via electrolyzers, and while the Chinese market will also grow it will not be as dominant globally as it is in the onshore market.

The outlook for offshore wind installations

source: BNEF



The Guinness Sustainable Energy Report

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- the Manager: Link Fund Manager Solutions (Ireland) Ltd (LFMSI), 2 Grand Canal Square, Grand Canal Harbour, Dublin 2, Ireland; or,
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