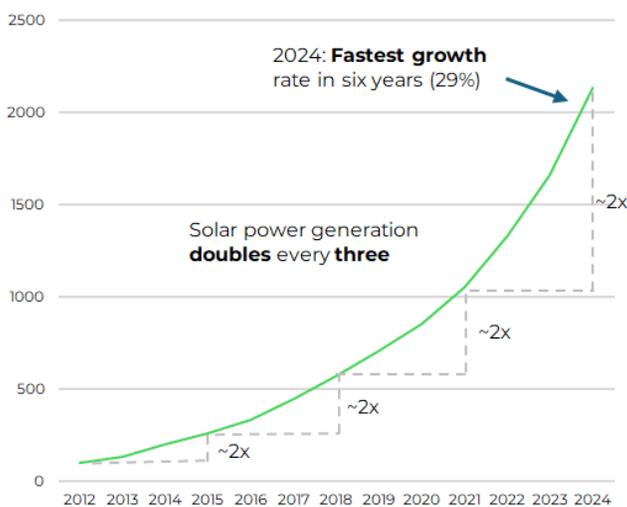


Chart of the Month: Growth of Global Solar

Solar was the largest source of new electricity generation globally for the third year in a row in 2024 and has doubled in the last three years. Global solar power capacity growth has inflected in recent years, having taken decades to reach 1 TW (terawatt) in 2022, it took only two years to reach 2 TW in 2024. Growth in China has been particularly rapid, and the country was able to meet 81% of its incremental power demand last year with solar additions, according to Ember.

Electricity generation from solar power (TWh)



Source: Ember Global Electricity Review 2025

News

- Global electric vehicle (EV) sales rose 29% year-on-year in Q1 2025 to 4.1 million units, according to research house Rho Motion. China led both in volume (2.4 million units) and growth (+36% YoY), with sales almost entirely shielded from the ongoing tariff dispute due to limited imports. Europe saw strong gains in key markets, with battery electric vehicles (BEV) sales up 37% in Germany, 64% in Italy, and 42% in the UK, though sales in France declined due to recent policy changes impacting incentives. North American sales grew 16% year-on-year despite political and economic uncertainty, with future growth likely to be impacted by uncertainty around US tariffs.
- The outlook for the offshore wind sector in the US deteriorated in April as Norwegian energy company Equinor was forced to halt construction of its Empire Wind 1 project following a stop-work order from the Trump Administration. This is an unwelcome development for the sector, as it had been hoped that active projects would be shielded from political forces. In the same month, RWE suspended its US offshore wind activities, citing regulatory uncertainty and the consultant Wood Mackenzie downgraded its 5-year US outlook due to policy instability and project delays.
- Developments in battery charging technologies are helping to overcome concerns about EV driving range, a key barrier to adoption. In April, Chinese battery manufacturer CATL unveiled its newly upgraded battery cells that it claims can offer 520km (kilometers) range on a 5-minute

charge. The announcement followed that of its rival BYD, who set a new industry standard earlier in the year when it unveiled its upgraded charging system that enabled 470km range on a 5-minute charge. According to Bernstein analysts, charging speeds have doubled over the past year, and increased tenfold over the past 3-4 years as intense competition has driven further innovation in the space.

- A Reuters survey conducted in April found that nearly half of the 13 major electric utility companies surveyed had received inquiries from datacenter companies for volumes and power that would exceed their peak demand or existing generation capacity. The survey results point to the sheer scale of incremental demand facing the US and raises questions about where incremental supply will come from and how quickly it can be deployed. One of President Trump's key challenges will be overseeing sweeping grid and energy investments to overcome capacity constraints so that he can achieve his goal of "energy domination" while enabling the US to win the AI race.
- China's energy transition continues to gain momentum, with wind and solar generation capacity surpassing fossil-fuel based thermal power for the first time. The country reached its 2030 wind and solar installation target in 2024, six years ahead of schedule, and has increased its capacity to 1,482 GW (gigawatts). At the same time, China continues to invest in other low-carbon technologies and infrastructure, recently greenlighting the construction of 10 new nuclear power units, adding to the 10 units that have already been approved since 2022. Under current construction forecasts, China is likely to become the global leader in installed nuclear capacity by 2030.

Manager's Comments

The landmark power blackout which occurred in Spain & Portugal at the end of April has prompted debate and inquisition as to the suitability and resilience of the grid and the role of renewables in power generation. In this note we summarize the incident, and outline our thoughts around the implications, including the case for grid resilience, and the sensible scaling of renewables in the mix.

Europe's largest power outage, with causes still unclear

Around midday on April 28th, Spain experienced a blackout which saw nationwide power supply falling by around 60% to 10GW, taking around 18hrs to fully remedy. The resolution required a material draw from power interconnectors that connect the Iberian Peninsula to France and Morocco. Red Eléctrica, Spain's grid operator, stated that two "loss of generation" events occurred within seconds of one another, taking 10GW of solar, and 3GW of nuclear capacity offline. This caused material changes to the frequency of transmission onto the grid causing system wide failure. While the specific cause of the upstream outage remains under investigation, there are three clear implications which we envisage.

Remaking the case for grid T&D spending

Firstly, the case for grid resilience has been remade by this incident. Around ~33% of the European grid is aged 40 years or older, well beyond its envisaged working life. The European grid has been chronically under-invested in; Spain in particular has seen essentially flat transmission and distribution (T&D) capex from 2010-21 at around €2bn per annum, despite a significant modernization in the generation fleet. This change in generation, towards renewables, introduces significant load variation and frequency

adjustments to the grid, which in turn require more modern grid infrastructure to transform, manage and distribute. Investment has only recently begun to increase in the last 2-3 years but is still little higher than 2010-11.

We note that the two previous major European blackouts - Spain in 2001 and Italy in 2003 - unlocked a supportive regulatory cycle for T&D investment. We therefore see this outage as a significant opportunity within the **grid equipment** (e.g. portfolio companies: Schneider, Itron, Eaton, Hubbell), **cable providers** (Prysmian) and **grid contractors** (SPIE), sectors which are exposed to T&D grid capex. The focus of this incident is of course Europe, but we have written for some time about the equivalent need for investment in the similarly aged North American grid, where we see substantial opportunity for the same group investee companies to provide solutions.

Transmission & Distribution investment in Spain, 2010-24 (\$bn)

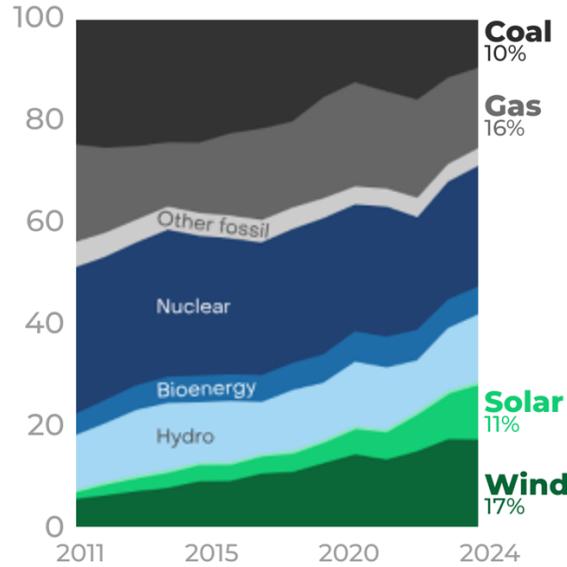


Source: Goldman Sachs, 2024

The role of renewables queried, but the case remains robust

Secondly, this blackout raises the question of the reliability of renewables within the grid. Spain, at the time of the outage relied upon ~80% renewable energy, principally solar. Intermittency, the variation in output from renewable energy, introduces grid instability challenges. These can ordinarily be dealt with through the load management of conventional power plants (nuclear, hydro, gas, coal) which can moderate production to prevent the grid from being overloaded in the case of a surge or fill in with back-up power in the case of an outage. The speculated unavailability of such conventional power capacity in this incident might well explain the scale and length of the blackout. It may also prompt policymakers to question whether the grid can operate, in its current form, with such high renewables penetration. While we see this as an unwelcome headwind for the deployment of solar and wind in Spain, we caution that renewables constitute a significantly smaller share of electricity generation in the EU as a whole (17% wind and 11% Solar in 2024), and the US (10% wind and 4% solar in 2023), making the backdrop to the Spanish outage somewhat unique.

EU power generation by source, 2011-2024

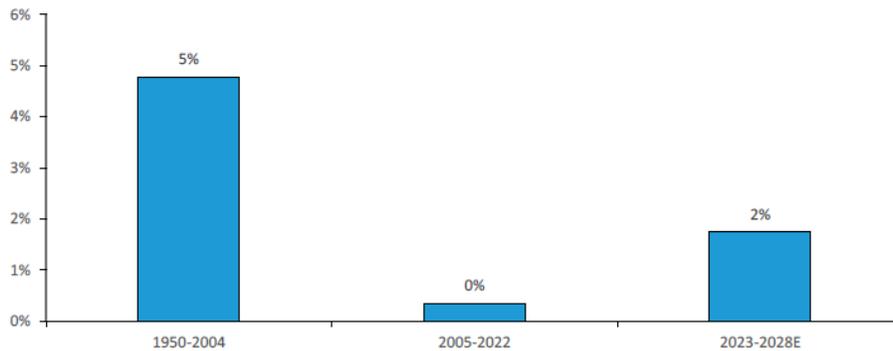


Source: Ember

The recent issues experienced in Spain and Portugal raise questions about power supply and the challenge of producing a flexible and functional grid. But they also highlight a demand issue: the step change in power consumption that is occurring in many parts of the world, including Europe. Spain, for example has seen 4% growth in power demand so far this year. Supporting this has been growing electrification, and demand from data centers, where the pipeline of interconnection requests now equals an incremental 19GW of demand, equivalent to ~60% of Spain’s current power consumption.

We expect global electrification and data center demand growth to lift total load growth from the 0-0.5% of the past decade to 1.5-2.0% for the next 5-10 years. The data presented below demonstrates this inflection for US power demand. We see renewables as the clear solution to this incremental demand, supplying power at the lowest marginal cost, and being deployed with the shortest build times. Consequently, we see a case for renewable **original equipment manufacturers (OEMs)** (Vestas, First Solar), and **Power Utilities/IPPs** (Iberdrola, Next Era) who deploy renewables as potential beneficiaries.

Global electricity demand growth (1950-2028E)



Source: Bernstein

Regulated battery storage, a potential beneficiary.

Finally, battery storage could be a beneficiary of the blackout. Regulated battery storage allows grid operators to manage load effectively and reduce the impact of intermittency that renewables introduce to the grid. Investments into regulated energy storage in Europe have been limited, with Spain currently having deployed ~100MW of capacity against a planned 12.5GW by 2030. This could conceivably be upsized and accelerated, following the blackout, and would likely be funded as part of a greater investment in the grid. We see opportunity here for the aforementioned **grid contractors** as well as **battery OEMs** (LG Chem).

Performance

As of 4/30/2025	YTD	1 Year	3 Years	5 Years	10 Years
GAAEX	-3.38%	-11.09%	-3.84%	10.55%	2.50%
MSCI World Index NR	-0.92%	12.16%	11.06%	13.95%	9.34%

As of 3/31/2025	YTD	1 Year	3 Years	5 Years	10 Years
GAAEX	-4.97%	-15.78%	-7.63%	12.75%	3.08%
MSCI World Index NR	-1.79%	7.04%	7.57%	16.12%	9.49%

All returns after 1 year annualized.

Inception 03.31.2006 Expense ratio* 1.10% (net); 1.76% (gross)

Performance data quoted represents past performance; past performance does not guarantee future results. The investment return and principal value of an investment will fluctuate so that an investor’s shares, when redeemed, may be worth more or less than their original cost. Current performance of the Fund may be lower or higher than the performance quoted. Performance data current to the most recent month end may be obtained by visiting www.gafunds.com or calling 800-915-6566.

* The Advisor has contractually agreed to reduce its fees and/or pay Fund expenses (excluding Acquired Fund Fees and Expenses, interest, taxes, dividends on short positions and extraordinary expenses) in order to limit the Fund’s Total Annual Operating Expenses to 1.10% through June 30, 2028. To the extent that the Advisor absorbs expenses to satisfy this cap, it may recoup a portion or all of such amounts absorbed at any time within three fiscal years after the fiscal year in which such amounts were waived or absorbed, subject to the expense cap in place at the time recoupment is sought, which cannot exceed the expense cap at the time of the waiver. The expense limitation agreement may be terminated by the Board of the Fund at any time without penalty upon 60 days’ notice.

Top 10 Fund Holdings as of 4/30/25:

1. Iberdrola SA	5.63%
2. Trane Technologies PLC	5.40%
3. Legrand SA	5.13%
4. Siemens AG	4.89%
5. Schneider Electric SE	4.88%
6. Nextera Energy Inc	4.68%
7. Hubbell Inc	4.64%
8. Eaton Corp PLC	4.62%
9. Spie SA	4.39%
10. Amphenol Corp	4.22%

MSCI World Index captures large and mid cap representation across 23 Developed Markets countries. With 1,546 constituents, the index covers approximately 85% of the free float-adjusted market capitalization in each country.

COP29, or the 29th Conference of the Parties of the United Nations Climate Change Conference, is an annual United Nations Climate Change Conference that brings together world leaders and negotiators from nearly every country to negotiate global goals for tackling climate change, present their countries' plans for contributing to those goals, report on their progress, and agree on actions to address the climate crisis.

Minimum Capital Ratios is a requirement that an organization must meet to ensure it has enough assets to satisfy creditor claims in the event of financial instability or insolvency. The minimum capital ratio is also known as the capital requirement in banking and financial regulation.

Reshoring is the process of returning the production and manufacturing of goods back to the company's original country.

Capital Expenditure (capex) are funds used by a company to acquire, upgrade, and maintain physical assets such as property, plants, buildings, technology, or equipment.

Tier 1 manufacturers directly provide components, materials, or services to an Original Equipment Manufacturer without a middleman, unlike Tier 2 or Tier 3 suppliers, who supply Tier 1 suppliers.

Fund holdings and/or sector allocations are subject to change at any time and are not recommendations to buy or sell any security.

One cannot invest directly in an index.

Earnings Growth is not a measure of future performance.

Opinions expressed are subject to change, are not guaranteed and should not be considered investment advice.

The Guinness Atkinson Alternative Energy Fund's investment objectives, risks, charges and expenses must be considered carefully before investing. The statutory and summary prospectuses contain this

GAAEX: May 2025 Monthly Update

and other important information and can be obtained by calling 800- 915-6565 or visiting www.gafunds.com. Read and consider it carefully before investing.

The Fund invests in foreign securities which will involve greater volatility and political, economic and currency risks and difference in accounting methods. The risks are greater for investments in emerging markets. The Fund also invests in smaller and mid-cap companies, which will involve additional risks such as limited liquidity and greater volatility than larger companies. The Fund's focus on the energy sector to the exclusion of other sectors exposes the Fund to greater market risk and potential monetary losses than if the Fund's assets were diversified among various sectors.

Distributed by Foreside Fund Services, LLC