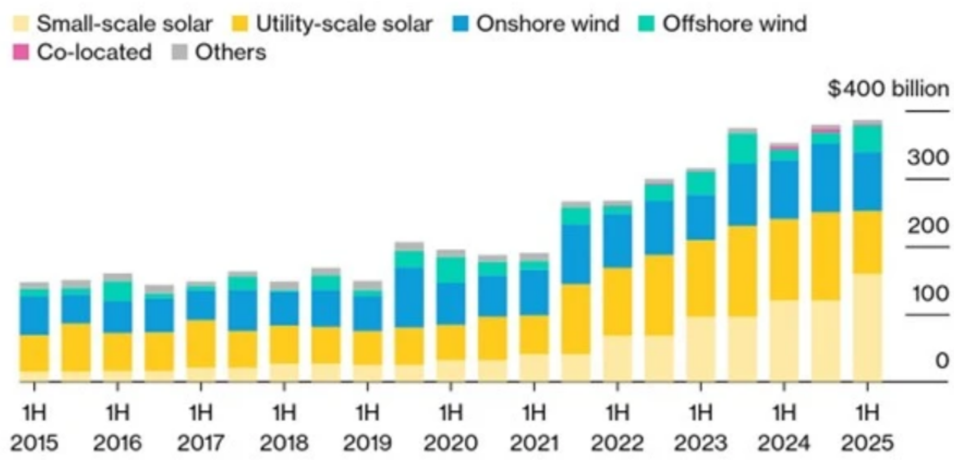
Chart of the Month: Global Renewable Investment

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

Renewable Energy Investment ($bn)



Source: BNEF, August 2025

News

- According to Ember's Global Electricity Mid-Year Insights 2025 report, renewables overtook coal in the global electricity mix for the first time during the first half of 2025. Solar and wind generation rose by a combined 363 TWh(terawatt-hour) (a 7.7 % increase), lifting renewables' share of global electricity to 34.3 %. In contrast, coal generation declined 31 TWh, dropping its share to 33.1%. This milestone signals a turning point in the clean-energy transition as renewable growth managed not just to meet rising demand (which grew by 2.6 %) but to displace coal.
- In October, the US government struck an agreement with Westinghouse to deploy at least $80 billion worth of new reactors across the US, signaling the largest American nuclear investment in decades. In the same month, Google and NextEra Energy unveiled plans to restart the Duane Arnold plant in Iowa under a multi-decade power purchase agreement to power Google's expanding AI and data-center operations. While new generation is unlikely to come online before the mid-2030s, Wood Mackenzie expects U.S. nuclear output to climb around 27 % after 2035, as data-center growth and electrification drive sustained demand for carbon-free baseload power. Together, these developments underscore nuclear energy's resurgence as a pillar of the clean, reliable grid of the future.
- In China, leaders from the wind power industry announced an ambitious roadmap under the Beijing Declaration on Wind Energy 2.0, committing to add at least 120 GW (gigawatts) of new wind capacity annually, including 15 GW offshore, from 2026 to 2030. The declaration sets a target of 1.3 TW of total installed wind capacity by 2030, at least 2 TW (terawatts) by 2035 and up to 5 TW by 2060. Industry leaders say this push would more than double China's present wind base and help the country accelerate its carbon-neutrality goals.
- Global electric vehicle (EV) sales climbed 26% year-on-year in September to a record 2.1 million units, according to research firm Rho Motion. Growth accelerated in China, where consumers rushed to

purchase ahead of subsidy cuts, while U.S. sales spiked (+66%) as buyers sought to lock in expiring tax credits. Europe also saw record sales (+36% YoY), supported by fresh incentives in key markets including the UK and Germany.

- China and the United States have reached a temporary truce over rare earth minerals, a sector critical to EV and advanced manufacturing. After months of escalating tensions marked by Chinese export controls and US tariff threats, Beijing agreed to suspend new restrictions for one year and issue general licenses for rare earth exports, while Washington rolled back planned tariff hikes and extended trade exclusions. This pause offers short-term relief for global supply chains but does not undo earlier curbs, leaving structural vulnerabilities intact. China still dominates the market, controlling roughly 70% of mining and nearly 90% of processing capacity, giving it significant leverage.

Manager's Comments

Data Centers and US Electricity Demand

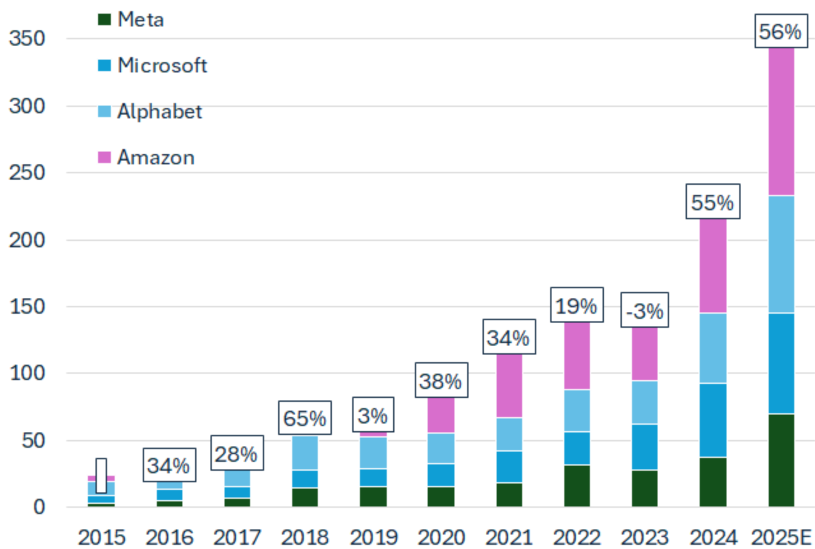
After two decades of stagnation, US electricity demand is rising again. The primary driver of load growth is the rapid build out of AI data centers, underpinned by record capital expenditure from the US hyperscalers. At the same time, the reshoring of manufacturing and broader electrification are causing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

Hyperscaler Capex and US power demand

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

In the short term, Morgan Stanley expect AI data centers to contribute to ~50% of incremental power demand. In 2025 alone, the largest hyperscalers: Meta, Microsoft, Alphabet, and Amazon, are expected to spend ~$350 billion on capex to build out their AI capabilities, with all commenting that they plan to spend more next year.

Capital expenditure of the US hyperscalers (USD$)



Source: Bloomberg; November 2025

The Impact of AI Data Centers on US power demand

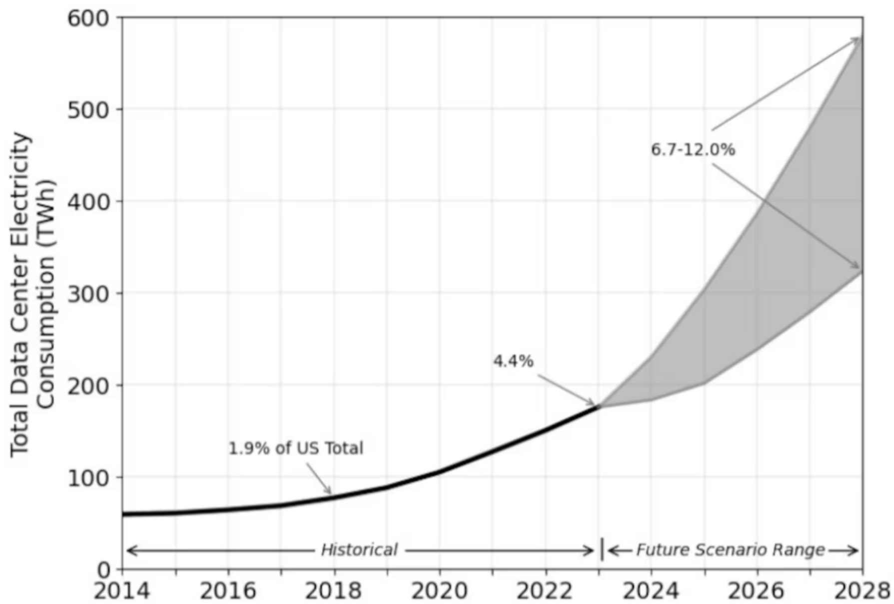
Estimates for the increase in power demand from AI data centers are particularly difficult to forecast, and as such vary considerably. They are difficult to predict because both the efficiency of computing hardware and the scale of AI workloads are changing rapidly: each new generation of chips uses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

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

Given this uncertainty, we see a range of forecasts:

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

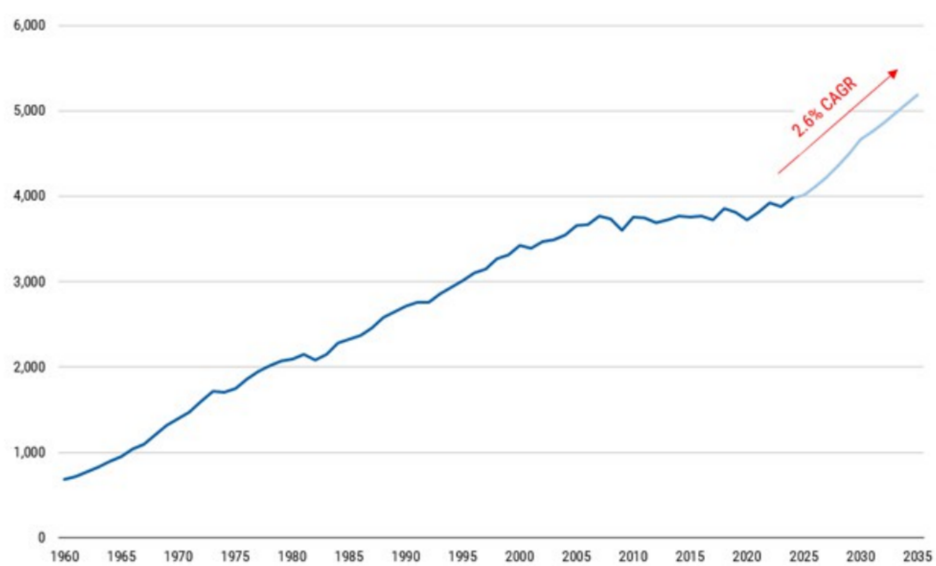
Estimated data center consumption (TWh)



Source: Lawrence Berkeley National Laboratory

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

Total US Retail Sales forecast (TWh)



Source: Morgan Stanley, October 2025

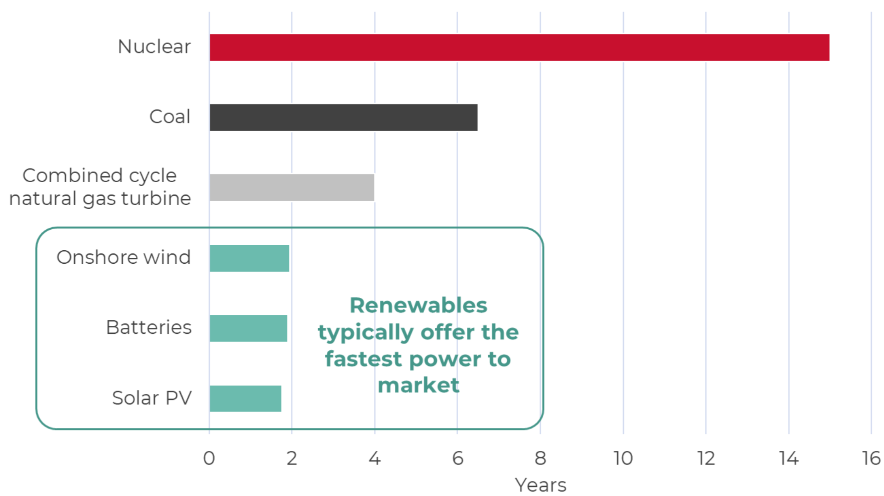
How can the US meet this demand?

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

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

- **Renewables and storage:** existing and well-developed supply chains support rapid development, as does the availability of battery equipment. Storage projects can also be built on existing sites and connected to existing grids, and at the same time, battery costs have fallen sharply as the technology has matured and scaled.
- **Natural Gas:** longer lead times, cost inflation, and underdeveloped supply chains mean that new or unplanned natural gas projects cannot meet all of the near-term demand, and in the long-term, is a more expensive solution. However, given the rise of intermittent renewables, natural gas will play an important role in providing baseload generation.
- **Nuclear:** after decades of underinvestment, supply chains need to be rebuilt, and technology developed before nuclear can contribute meaningfully to the generation mix. Plans to restart retired nuclear reactors are not expected to add generation until closer to 2030. If they come online as planned, they will be able to add ~15TWh of generation per year. However, timelines remain uncertain, with potential risks around regulatory approvals, financing, and construction delays.

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



Source: Lawrence Berkeley National Laboratory, Wood Mackenzie, Bernstein

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

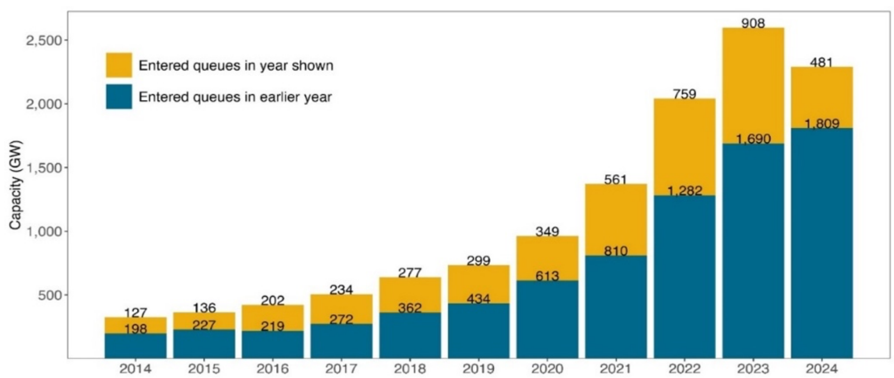
This reality is playing out. As of the end of July 2025, 93% of new capacity has been renewables, with 83% being solar and storage. The economics and scalability mean that renewables, in combination with storage are the cheapest and fastest way to meet incremental demand.

The interconnection queue is a genuine constraint

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

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

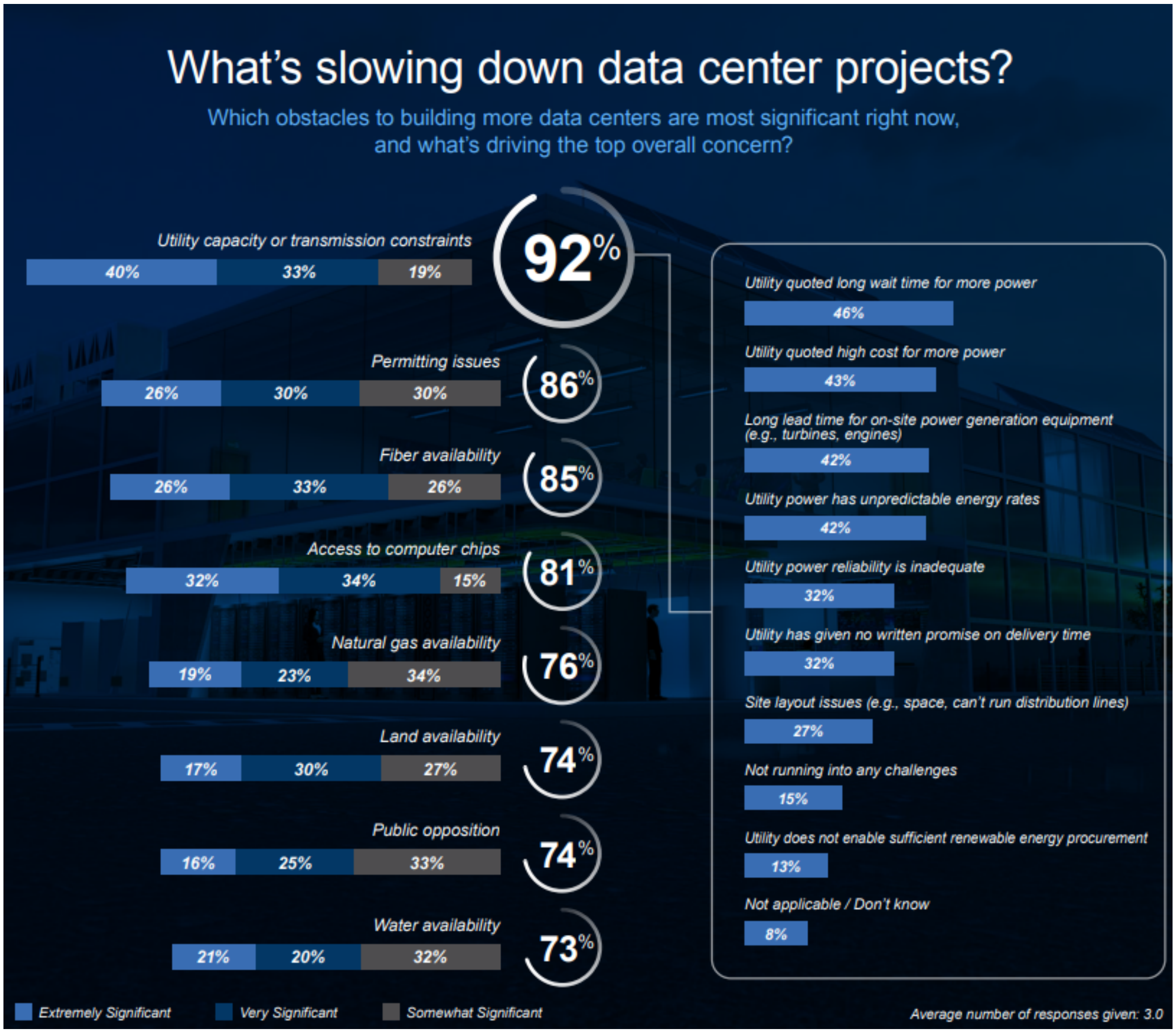
Total cumulative capacity within the interconnect queue (GW)



Source: Lawrence Berkeley National Laboratory

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

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



Source: Alpha Structure, Schneider Electric

To achieve these efficiency gains and integrate battery technologies, significant investment is needed to upgrade an already ageing grid. Morgan Stanley estimate that annual U.S. transmission and distribution spending will need to double by 2030, from roughly $30–35 billion today to $60–70 billion per year, simply to connect planned generation and maintain reliability. This current grid was designed for flat or declining load, and without major expansion, the 2TW of capacity within the interconnection queue is at risk of becoming stranded.

Beyond expansion, the system also needs substantial reinforcement and modernization. William Blair estimates that more than $250 billion of upgrades will be required this decade to strengthen ageing infrastructure, integrate storage, and support rising variability from renewables. In total, $400–500 billion of cumulative grid investment through 2035 may be needed to maintain reliability and enable electrification and data center growth. Encouragingly, policy momentum is building: the DOE's Grid Deployment Office has begun allocating over $20 billion in grants and loan guarantees, FERC (Federal Energy Regulatory Commission) has finalized new long-term transmission-planning rules, and utilities such as NextEra, Exelon, and PPL have already raised their grid-capex guidance in response.

Conclusion

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

Performance

As of 10/31/2025	YTD	1 Year	3 Years	5 Years	10 Years
GAAEX	29.62%	16.93%	5.67%	6.82%	8.07%
MSCI World Index NR	19.78%	22.02%	21.67%	15.57%	11.78%

As of 9/30/2025	YTD	1 Year	3 Years	5 Years	10 Years
GAAEX	24.06%	3.91%	6.01%	7.05%	8.41%
MSCI World Index NR	17.43%	17.25%	23.69%	14.40%	12.42%

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 10/31/25:

1. Legrand SA 5.43%
2. Amphenol Corp 5.15%
3. Prysmian SpA 4.49%
4. Siemens AG 4.48%
5. Eaton Corp PLC 4.46%
6. Hubbell Inc 4.45%

7.	Iberdrola SA	4.43%
8.	Schneider Electric SE	4.36%
9.	Trane Technologies PLC	4.16%
10.	Nextera Energy Inc	4.15%

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.

The MSCI World Index (Net Return) measures the performance of large and mid-sized companies across 23 Developed Markets countries. It reflects both share price movements and dividends, with dividends reinvested after accounting for local withholding taxes.

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

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 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.

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