Clean Energy & Smart Grid Infrastructure

Industry Report & Investment Case

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A Convergence of Renewables, Energy Storage, Electric Vehicles, and Digitization is Reshaping the Energy Landscape

DEFINING CLEAN ENERGY

Over the past decade, clean energy has gone from niche to mainstream. Clean energy covers a range of products and services enabling the transition from fossil fuels to low- and zero-carbon sources, including:

- **Renewable Energy** including solar, wind, geothermal, hydroelectric power, and renewably produced hydrogen
- **Energy Intelligence** products and services such as smart meters, energy management systems, and light-emitting diodes (LEDs) for lighting
- **Energy Storage & Conversion** including advanced lithium-ion batteries, inverters, and fuel cells
- **Advanced Transportation** such as electric vehicles (EVs) and fleet management

DEFINING SMART GRID INFRASTRUCTURE

Smart grid infrastructure is the enabler of a 21st century electric grid. Among other attributes, this modern grid is more resilient to natural and human-caused disasters and provides for the two-way flow of electrons (enabling customers to not only consume energy, but also produce and share it). Products and services include:

- **Grid Infrastructure (Transmission & Distribution Systems, etc.)**
- **Electric Meters, Internet of Things (IoT), and other Smart Devices**
- **Energy Storage, Electric Vehicle Charging Infrastructure, and Electric Vehicle Network Management**
- **Enabling Software**

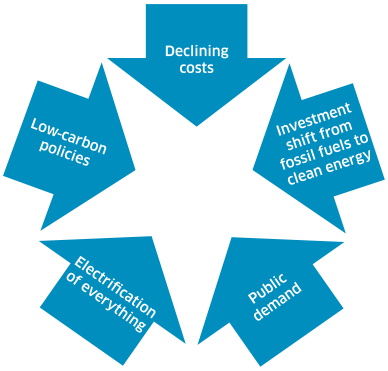
The past two decades have seen a significant change in how the U.S. and the world powers its homes, businesses, factories, and vehicles. At the forefront of this dramatic shift has been the growth of renewable energy (primarily solar and wind), the recent rise of energy storage and EVs, and the advent of smart and connected electric grids.

Technology, capital, and policy-related developments driving this significant change include:

- **Declining Costs:** Utility-scale wind and solar power are now the most cost-effective forms of new electricity generation, beating out new nuclear, coal, and even natural gas plants. Technological innovation has enabled entirely new economies of scale for renewable sources that were unthinkable by most market players just a decade earlier.
- **Investment Shift from Fossil Fuels to Clean Energy and Smart Grid:** Global investments in renewable energy capacity expanded from $32 billion in 2004 to $282.2 billion in 2019, according to Bloomberg New Energy Finance[1]. By comparison, just $100 billion was invested in new coal and natural gas globally last year[2].

- **Electrification of Everything:** With energy storage and electric vehicles continuing to experience cost declines similar to renewables, the concept of the "electrification of everything" is emerging. The cost of EV batteries – the largest component of overall vehicle cost – is expected to decline by 8.3% annually through 2030, according to Guidehouse Insights[3]. And it's not just transportation that's ripe for disruption. Fossil fuels have historically provided 90% of the energy for residential space heating and 80% for water heating in the U.S., according to the Energy Information Administration (EIA)[4]. The move to electric heat (powered by renewable sources) alone represents perhaps the single largest potential for expanding residential electrification. Also underlying these trends is the digitization of energy, from smart meters to connected IoT devices, and the smart grid backbone that supports it.

Clean Tech Major Drivers



- **Low-Carbon Policies:** A vast number of both national and subnational governments have signed commitments to reduce their carbon footprints. Although the Trump administration formally withdrew the U.S. from the 2015 Paris Climate Agreement, the withdrawal will not take effect until after the next presidential election. Regardless, governments across the globe are enacting policies that support renewables and clean transportation. These policies include renewable portfolio standards (up to 100% targets in some cases), energy storage mandates, and incentives. Many U.S. states are continuing to raise their targets for clean energy use, and a dozen states now have either goals or mandates to achieve 100% clean energy, including California, Hawaii, New Mexico, New York, and Washington.

- **Public Demand:** The demand for low-carbon sources of energy is coming not only from governments, but also from corporations and individuals. A 2019 Pew Research Center survey found that 77% of Americans give priority to developing clean energy sources, compared with just 22% who would emphasize expanded production of fossil fuel sources (with both Democrats and Republicans favoring clean energy)[5]. Contributing to this increased public and corporate support has been the international attention brought to climate change by Swedish teenage activist Greta Thunberg. Often called the "Thunberg effect," this broadening awareness has resulted in private companies increasing their efforts to become carbon neutral. More than 230 multinational corporations including Apple, Nestle, Bloomberg, and GM, have committed to getting 100% of their electricity from renewables as part of the RE100 campaign, a global initiative uniting businesses committed to 100% renewable electricity[6].

Alternative Energy vs. Fossil Fuels: U.S. Adults Based on Priority for Addressing America's Energy Supply (%)

	DEVELOP ALTERNATIVE ENERGY (WIND, SOLAR, HYDROGEN TECHNOLOGY)	EXPAND FOSSIL FUEL PRODUCTION (OIL, COAL, NATURAL GAS)
2011	63	29
2012	47	39
2013	58	34
2014	60	30
2017	65	27
2019	77	22

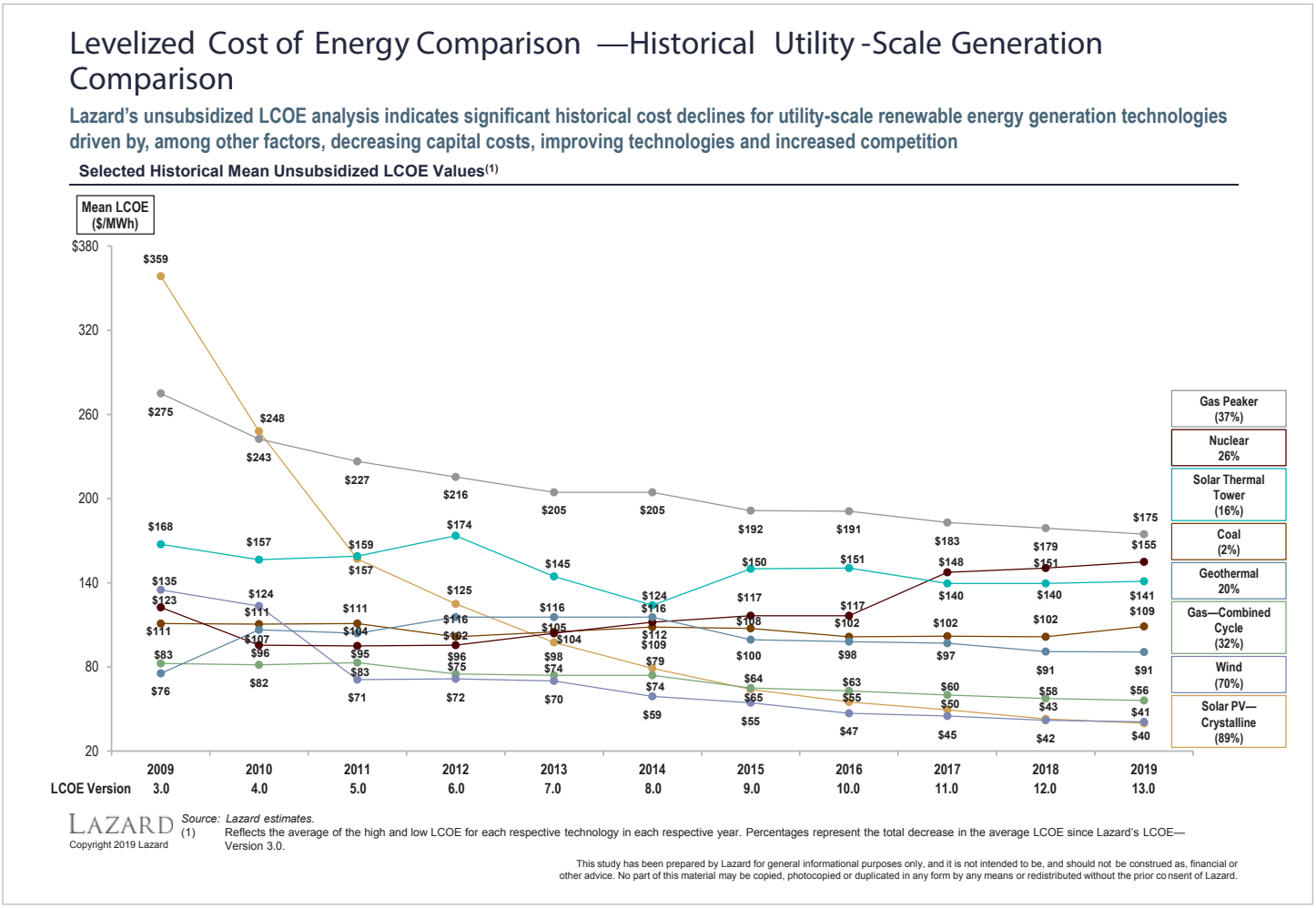
Source: Pew Research Center's American Trends Panel. Latest survey conducted Oct 1-13, 2019[5]

Economics and the Rise of Clean Energy

As noted earlier, solar and wind power are now the most cost-effective forms of new electricity generation in many regions – beating out coal, nuclear, and even natural gas. Lazard, a financial advisory and asset management firm which has been tracking the levelized cost of energy (LCOE) for more than a decade, has research showing that the LCOE for wind power declined from $135 per megawatt hour (MWh) in 2009 to just to $40 per MWh in 2019[7], a decline of 70%. Similarly, utility-scale solar declined 88% over the same period, from $359 to $41 per MWh. As a result, 2019 marked the fifth consecutive year in which wind and solar both cost less than natural gas combined-cycle power generation. And both coal and nuclear power were above the $100 per MWh range, making them approximately two to three times the cost of new solar and wind on a levelized cost basis.

The lower cost of renewable power is having a huge impact, with solar and wind power now overtaking coal in the U.S. for overall electricity generation. During the month of April 2020, renewable power (wind, solar and hydro) outproduced coal generation in the U.S. for the first time, according to the non-profit energy research firm the Institute for Energy Economics and Financial Analysis[8]. In 2020, renewable electricity generation is projected to exceed coal power production in the U.S. for the first time, and by 2046, renewable electricity will be double that of coal, according to the EIA[9].

Renewables and Conventional Comparison (2009-2019)



Source: Lazard, 2019[7]

The Short-Term and Potential Long-Term Impacts of COVID-19

The coronavirus (COVID-19) outbreak has had a significant impact on the U.S. and global economy and broader energy sectors – and the clean energy sector has not gone untouched. Similar to other sectors, the impact on the clean energy sector includes job losses, supply chain disruptions, and delayed or canceled investments.

And lower energy usage, likely a temporary impact, has also disrupted the sector. Both industrial retail and commercial retail electricity demand in the U.S. are expected to fall by 6.5% in 2020 due to COVID-19, according to the EIA[10]. Residential electricity consumption is expected to increase slightly with more people staying and working at home – but not enough to make up for the reduction in commercial and industrial usage.

According to Environmental Entrepreneurs (E2), a nonpartisan group of business leaders, investors, and professionals that advocates for clean energy, the U.S. clean energy sector (including the energy efficiency, renewables, clean vehicles, grid and storage, and clean fuels sectors) lost nearly 600,000 jobs in March and April of 2020[11]. As a result of COVID-19, some companies and government agencies have cancelled or delayed clean energy projects. Some of the delays have been due to a lack of financing, while others have been caused by supply chain disruptions.

The electric vehicle industry (not dissimilar to the broader vehicle market) is also expected to see a decline in sales due to the unprecedented economic downturn caused by COVID-19. EV sales are projected to fall 18% during 2020, slightly lower than the projected overall industry reduction in light-duty vehicle sales of 23%, according to research firm Bloomberg New Energy Finance[12]. In response, several automakers have delayed the launch of their new EVs. Ford has cancelled an all-electric SUV planned for its luxury-brand Lincoln and delayed its Mustang Mach-E launch by two months. Rivian and Lordstown Motors have both delayed the launch of their electric pickup trucks until 2021.

Higher COVID-19 related fatality rates have been recorded in communities with poor air quality, according to a study by Martin Luther University Halle-Wittenberg in Germany[13]. And the temporary reduction in vehicle traffic and shuttered factories has resulted in many cities reporting their cleanest air in decades – with a growing awareness of what a low-carbon future might look like. Such air quality concerns, and awareness, are likely to drive the promotion of new clean energy incentives and investments by governments, corporations, and investors. Since the outbreak of COVID-19, for example, companies including General Mills, BMO Financial Group, and Intel have joined the pledge to use 100% renewable electricity.

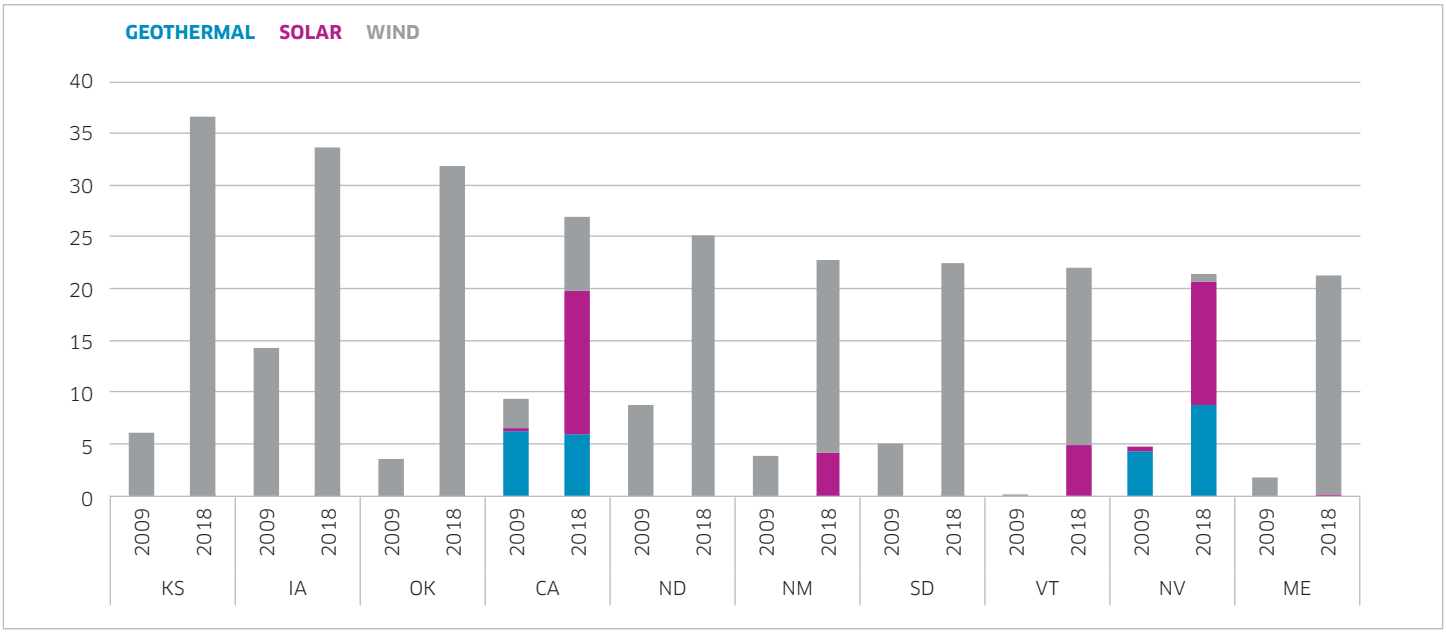
Finally, more investors will likely be compelled to shift away from fossil fuel investments in the aftermath of the pandemic as clean energy looks like a more favorable investment option. The significant drop in the price and demand for oil due to COVID-19 and a price war between Russia and Saudi Arabia means that overproduction is expected to last throughout 2020, if not longer. As a result, financing for new oil drilling is all but drying up. Lower oil prices, which have historically resulted in a boom in consumption, are likely to have little to no impact on renewable energy investment this time around. Indeed, many governments are looking to expand clean energy investments as part of their resilient and sustainable infrastructure stimulus plans. In fact, the head of the International Energy Association (IEA), Dr. Fatih Birol, has called on national governments to make green stimulus the cornerstone of their COVID-19 recovery plans[14].

Investment in coal, in particular, will continue to weaken due to its higher cost and carbon footprint. For example, JPMorgan Chase, which has been the largest funder of fossil fuel projects, announced in February 2020 that it would no longer provide financing for any new or existing coal plants unless the plants implement costly carbon capture technology. Other banks to completely abandon future investments in any new coal plants include HSBC, Standard Chartered Bank, and Citigroup. All of these announcements were made in the wake of the COVID-19 outbreak.

This reversal of fortune, with once lower-cost fossil fuel-generated electricity now more expensive than renewables, has contributed to the rapid expansion of both solar and wind generation. In the U.S., solar and wind experienced compound annual growth rates of 30.0% and 23.3% respectively between 2000 and 2019, while coal declined an average of 3.7% annually over the same time period, according to data from the EIA[15]. As a percent of total U.S. electricity generation, coal declined from a 51.4% share in 2000 to 23.4% in 2019, compared to wind's increase from a 0.1% share in 2000 to 7.3% in 2019.

At the state level, the rise in renewable energy sources is even more dramatic. Back in 2010, just three states received 10% or more of their in-state electricity generation from non-hydro utility-scale renewables (solar, wind, and geothermal). By the start of 2019, 16 states were part of the 10% club, with three states – Iowa, Kansas, and Oklahoma – getting 30% or more of their electrons from wind (primarily) and solar, according to the EIA[16]. Another seven states exceeded 20% non-hydro utility-scale renewables generation (California, Maine, New Mexico, Nevada, North Dakota, South Dakota, and Vermont).

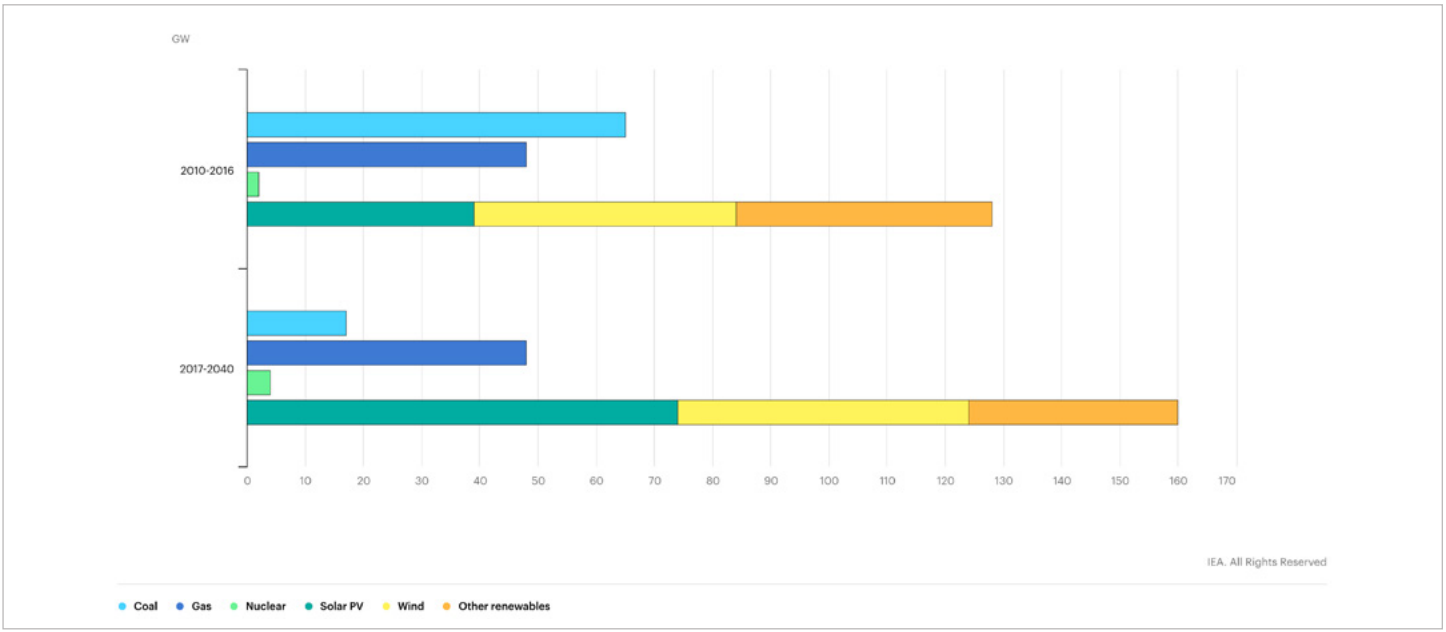
Top 10 Clean Electricity States (%), 2009 & 2018



Source: U.S. Energy Information Administration, 2019[16]

The adoption of low-cost, low-carbon energy solutions has seen a similar uptick globally. Solar thermal + PV (photovoltaic) grew by an average of 39.8% annually and wind by 23.4% per year between 2000 and 2017, according to the IEA's World Energy Outlook 2019 report[17]. Electricity generation from renewables grew by 7% globally in 2018 and accounted for more than 25% of total power generation, according to the IEA. Between 2017 and 2040, the organization projects that annual net capacity additions from renewables will exceed those from coal, gas, and nuclear combined.

Global Average Annual Net Capacity Additions by Type



Source: International Energy Association, 2019[18]

Smart Grid Infrastructure: The Great Enabler

Unlike computer technology, which saw the number of transistors crammed onto computer chips double every 18-24 months for more than 50 years (Moore's Law) and the dramatic move from large mainframe computers to today's smart phones, the electric grid's underlying technology has remained relatively constant. In fact, more than a century after its invention, early grid innovators such as Thomas Edison and Nikola Tesla would still be familiar with much of today's grid technology. This has offered great reliability and consistency, and until recently, grid operators were wary of messing with a system that has been ranked as one of civilization's greatest engineering achievements. But with the dawn of the always-on, digital internet-driven era, along with the recent upsurge in demand for low-carbon energy sources and greater resiliency to counter natural and human-made disasters, the grid is now experiencing its own technological renaissance.

This new emerging grid is based on advances in big data, artificial intelligence, distributed networks, and other technologies, enabling the digitization of the electric grid. A host of relatively recent innovations, from demand-side management and smart meters to blockchain-enabled energy trading networks and microgrids, are changing the grid from a centralized network to a nodal one, with a myriad of connected devices. It is creating a distributed ecosystem of "prosumers" who can sell their surplus energy (whether produced onsite or stored in a battery pack), as well as buy from sources across the network.

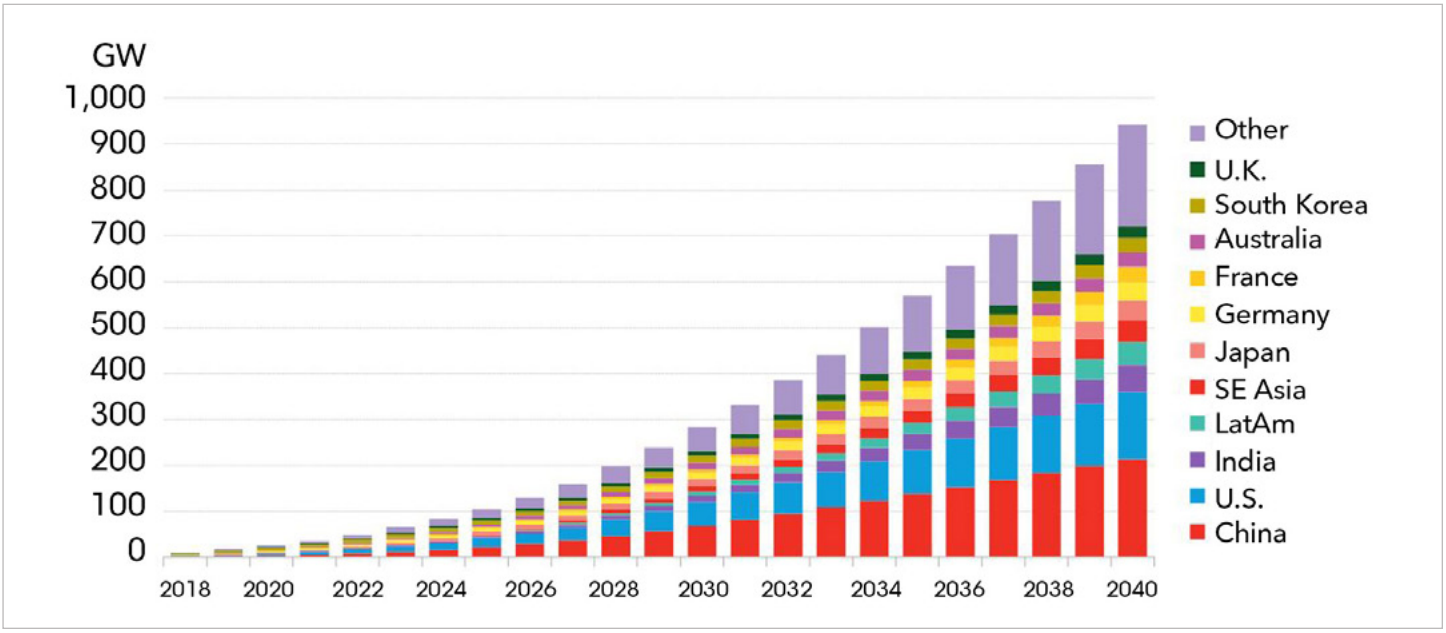
To reduce the cost of energy trading and enable a more diverse group of players to participate, blockchain technology is enabling customers of various sizes to engage in real-time energy transactions with a range of energy providers – among them large wind farms, distributed solar panels, microgrids, and aggregated demand-side management from multiple users. Brooklyn-based transactive energy company LO3 Energy, for example, is working with retail electricity provider Direct Energy in Texas and Marubeni in Japan to enable small and large energy producers to perform transactions in the energy marketplace using blockchain.

Smart meters, which similarly can be used to manage aggregated demand from residential and commercial buildings, can also help to provide greater customer insights, pinpoint outages, and better manage electrons overall. In recent years, smart meter deployment has climbed to 30% penetration globally, and is projected to reach 58% by the end of 2028, according to Guidehouse Insights[19]. Residential smart meters are enabling more consumers to participate in demand response programs, and OpenADR (Automated Demand Response) 2.0 has become the prevailing communications standard, which will spur the market to grow even faster. California's 2019 energy code, for example, specifies that all demand response controls need to be OpenADR 2.0-certified.

Smart meters and other IoT devices are being connected to utility back-office systems via new networking technologies to provide greater visibility into device reliability, performance, and security. Utilities are expected to spend up to $53.8 billion on IoT devices and software in 2024, up from $28.6 billion in 2019, according to research firm Market and Markets[20]. These devices, communicating via 5G and LTE networks, will improve service reliability by optimizing usage in real time while also reducing costs. As a result, distributed energy, electric vehicles, and energy storage are poised to dramatically rewire the electric grid, much like cell phones did for the telecommunications system. We are moving beyond siloed technologies and into a new age where it's the interplay of technologies that matter. Technology mash-ups such as rooftop solar + energy storage, wind turbines + offshore platforms, and microgrids + blockchain-enabled trading networks are becoming the norm. Helping investors to understand these megatrends and to track the growing connections between diverse companies and industries is the goal of the Nasdaq-Clean Edge clean energy and smart grid infrastructure indexes.

Energy storage, for example, is about to experience growth rates similar to the expansion of the solar PV market over the past 15 years (where solar PV installations doubled seven times). Both the size and sale of utility energy storage projects blossomed in 2019. According to analysis from research and consulting firm Wood Mackenzie, 10 utilities made energy storage part of their 2019 integrated resource plans, up from six in the prior year, and the average capacity of those storage projects was five times larger than projects initiated in 2018[21]. The global cumulative energy storage market is expected to grow to 942 gigawatts in 2040, representing a total investment of $620 billion between 2019 and 2040, according to Bloomberg New Energy Finance[22].

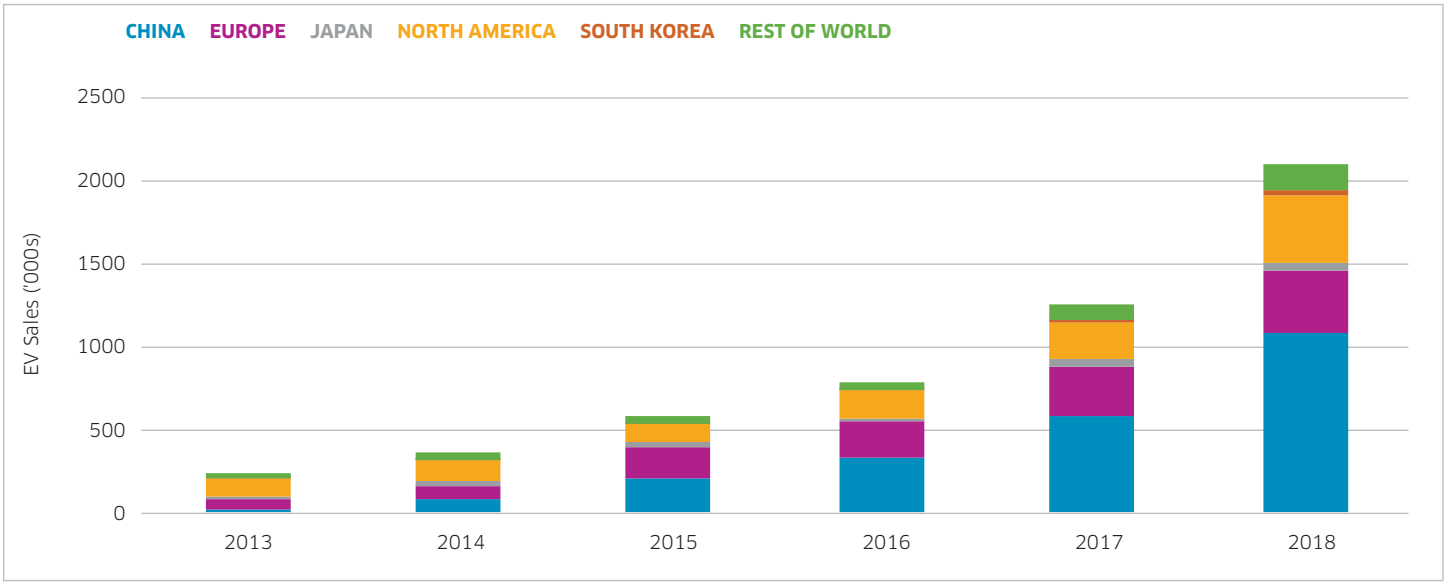
Global Energy Storage Market (Projected Growth 2018-2040)



Source: Bloomberg New Energy Finance, 2018[22]

Electric vehicles are on a similar growth curve. Between 2011 and 2018, global sales of EVs increased from just 52,000 to more than two million annually. Global annual sales of EVs are expected to reach 23.2 million units in 2030, according to Guidehouse Insights[23]. Despite reduced EV purchase incentives, China is predicted to continue to represent 45% of the global market in 2030, according to Guidehouse.

Global Sales of Electric Vehicles (2013-2018)



Source: International Energy Association Global EV Outlook 2019[24]

*Totals include battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs). Does not include conventional hybrids.

Momentum is also growing to electrify bus fleets, with companies such as BYD and Proterra rapidly expanding their production capacity to keep up with demand. The city of Shenzhen, for example, converted its entire fleet of 16,359 buses to battery-operated vehicles, and many other cities such as New York are transitioning to fully electric fleets. Global sales of electric buses are expected to reach 935,000 vehicles annually by 2027, according to research firm Research and Markets[25]. Countries are setting targets to decarbonize their light duty fleets; Norway and the Netherlands now require all new vehicles sold to be zero emission by 2025 and 2030 respectively.

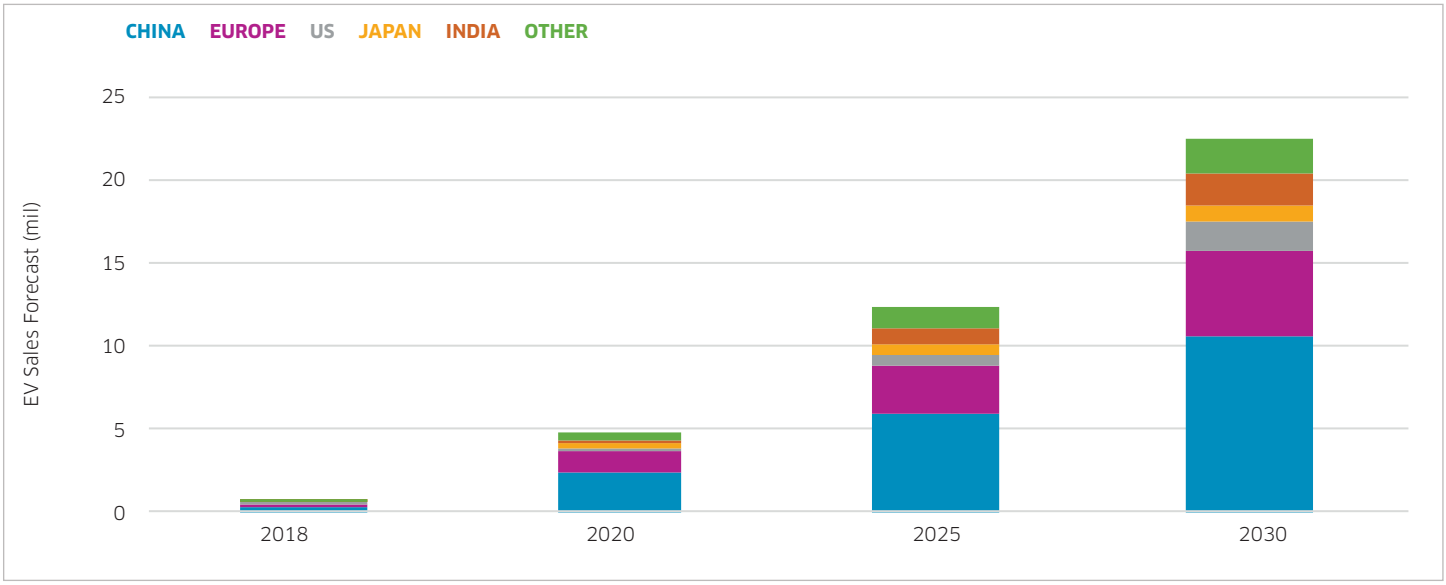
Major auto manufacturers and technology startups are positioning themselves to compete in this new electrified world. Electric car innovators such as Tesla and BYD proved the viability of the technology, while Audi, BMW, Ford, Daimler, GM, and Volvo are expanding electrification to their entire model lineups. The growing need to recharge vehicle batteries will require innovations in developing higher power and more ubiquitous EV charging infrastructure. Many energy generation and distribution companies see offering charging infrastructure as a necessary means of diversifying beyond liquid fuels to safeguard future revenue. Also, many utilities are developing or have applied for permission to develop a limited backbone of charging locations to better serve customers in their service territories.

Integrating electric vehicles provides grid operators with a somewhat flexible load that can absorb excess capacity and offset the variability of renewable generation. The vehicle grid integration services market is expected to reach $1.4 billion annually by 2030, according to Guidehouse Insights[26]. To grow the market, utilities and automakers have launched pilot programs that use the Open Vehicle Grid Integration Protocol (OVGIP) to send demand response messages from the utilities directly to the EV's telematics systems. These programs run by utilities such as Xcel Energy and Southern California Edison enable EVs to stop, slow, or ramp up their charging based on price signals, demand response events, or the fluctuating levels of renewables on the grid. Vehicle grid integration services will become even more critical when there are tens of millions of EVs plugging in.

One component of grid infrastructure that has been trailing in intelligence has been the transformer, the critical equipment that helps maintain necessary power and voltage levels at the edge of the distribution grid. Transformers were not designed to accommodate the large loads of electric vehicles, and if multiple EVs are charging simultaneously at higher AC rates (known as Level 2), they can overwhelm a transformer. However, new smart transformers from companies such as ABB, Eaton, and Siemens provide greater security by protecting against cyberattacks and enhance reliability by preventing overloading from buildings and EVs. The global market for smart transformers is expected to rise from $1.7 billion in 2019 to $5.04 billion in 2026, according to research firm 360 Market Updates[27].

High voltage (HV) DC transmission lines are also needed to deliver power from areas of abundant wind and solar power to states that have insufficient local capacity for generating renewable power. Several long distance HVDC transmission projects linking the clean energy haves with the have-nots are underway, including the SOO Green HVDC Link, Gateway West, and TransitWest Express initiatives in the U.S., as well as the SuedOstLink and GW A-Nord links in Germany, and the Viking Link connecting Great Britain and Denmark.

Global Sales of Electric Vehicles (2018-2030)



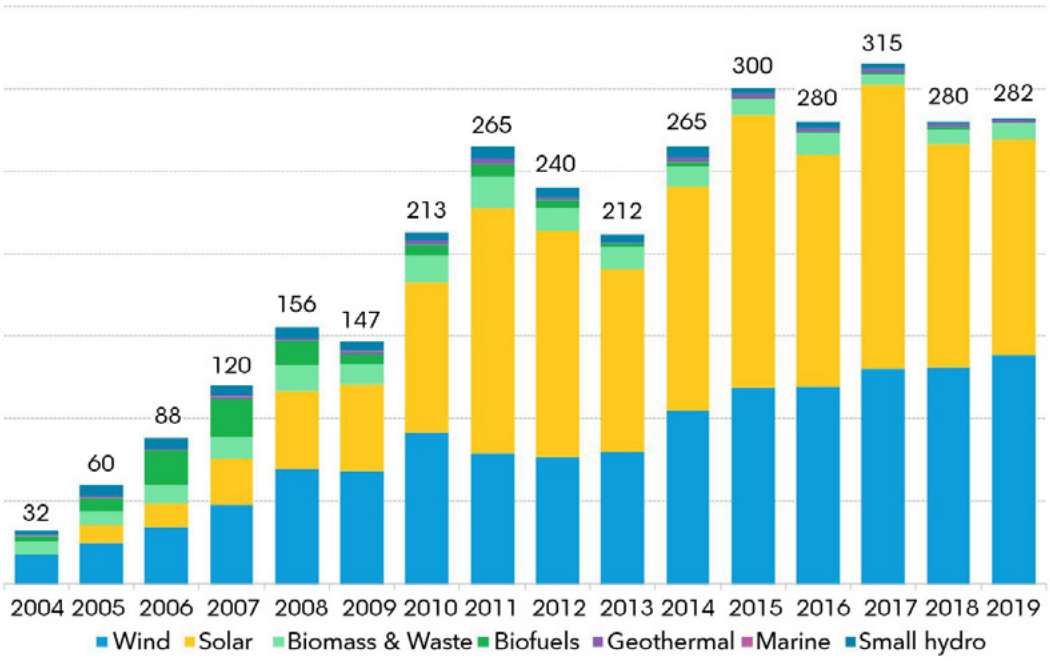
Source: International Energy Association Global EV Outlook 2019[24]

Investments Fuel Clean Energy and Grid Modernization

As highlighted in the introduction, Bloomberg New Energy Finance tracked global clean energy investments of $282.2 billion in 2019, up more than eight-fold from $32 billion in 2004. In recent years, the top three areas of clean energy investment have been solar, wind, and energy smart technologies such as efficiency, demand response, energy storage, and electric vehicles (covering many of the smart grid infrastructure companies tracked and discussed here). Moving forward, investments in renewables are projected to outpace those for traditional fossil fuel-generated electricity by a significant margin. Bloomberg projects that renewable energy is set to attract nearly 77% of the $13.3 trillion the world will invest in new power generating technology through 2050[28].

This represents a once-in-a-lifetime investment opportunity as corporations, governments, and other institutions shift their support from fossil fuels to clean energy, electrified transportation, and a smart, resilient 21st century grid. Nasdaq and Clean Edge's clean energy and smart grid infrastructure indexes offer investors efficient vehicles for tracking these key sectors, both within the U.S. and globally.

Global New Investment in Clean Energy by Sector, 2004-2019 ($bn)



Source: Bloomberg New Energy Finance, 2020[1]

How does someone track the Clean Energy and Smart Grid Infrastructure sectors?

Now that we have covered clean energy and smart grid infrastructure sectors in great detail, the following sections of this piece will review the two Nasdaq Clean Edge Indexes covering this space (and the respective First Trust ETFs tracking them).

Nasdaq Clean Edge Green Energy Total Return Index (CEXX)

The Nasdaq Clean Edge Green Energy Index is a modified market capitalization weighted index designed to track the performance of companies that are primarily manufacturers, developers, distributors and/or installers of clean energy technologies, as defined by Clean Edge. The index began on November 17, 2006, at a base value of 250.00. As of August 31, 2020, the index had 42 components. Investors can gain exposure to the index through the corresponding ETF, which is the First Trust Nasdaq Clean Edge Green Energy Index Fund (QCLN).

Eligibility Criteria:

To be eligible for inclusion, issuers of the security must be classified – according to Clean Edge – as technology manufacturers, developers, distributors, and/or installers in one of the following sub-sectors:

- Advanced Materials (silicon, lithium, bio-based, and/or other materials and processes that enable clean-energy and low-carbon technologies);
- Energy Intelligence (conservation, efficiency, smart meters, energy management systems, LEDs, smart grid, superconductors, power controls, etc.);

- Energy Storage & Conversion (advanced batteries, electric vehicles, hybrid drivetrains, hydrogen, fuel cells for stationary, portable, and transportation applications, etc.); and
- Renewable Electricity Generation (solar, wind power, geothermal, water power, etc.).

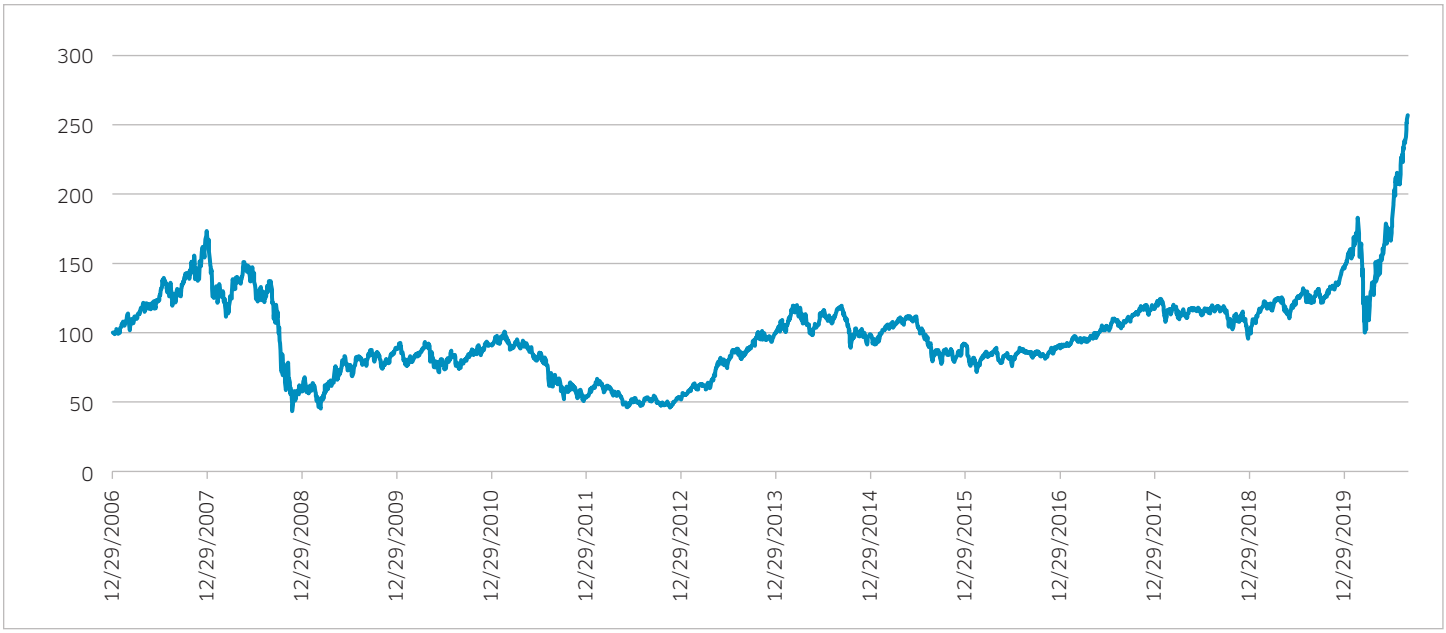
In addition, a security must meet the following criteria:

- Be listed on the Nasdaq Stock Market® (Nasdaq®), the New York Stock Exchange, NYSE American, or the CBOE Exchange
- Have a minimum market capitalization of $150 million
- Have a minimum average daily trading volume of 100,000 shares

Performance:

The chart below captures cumulative performance of the Nasdaq Clean Edge Green Energy Total Return Index (CEXX) from December 29, 2006 to August 31, 2020, rebasing the index to 100. The index hit a peak re-based value of 173.41 on December 26, 2007, which was not surpassed for over 12 years until February 18, 2020, right before the COVID-19 crash. The index generally trailed most benchmark equity indexes in the U.S. during the post-financial crisis period, with multiple oscillations within a range of +50/-50 before establishing more consistently upward momentum in late 2016. Thereafter, the index has remained more consistently positive with a rolling one-year return from late 2016 through August 31, 2020, in positive territory more than 85% of the time with an average one-year rolling return during that period of over 19% and median over 16.5%. YTD in 2020 the index return can be marked by three periods: pre-Covid crash strong returns (24.6% from 12/31/19 to 2/20/20), Covid crash (-45.3% from 2/20/20 to 3/18/20), and a very strong rebound from the Covid crash (156.5% from 3/18/20 to 8/31/20). Across the entire timeframe from year-end 2006 through August 31, 2020, the cumulative return was +156.8%, which equates to an annualized return of 7.1% along with an annualized volatility of 33.3%.

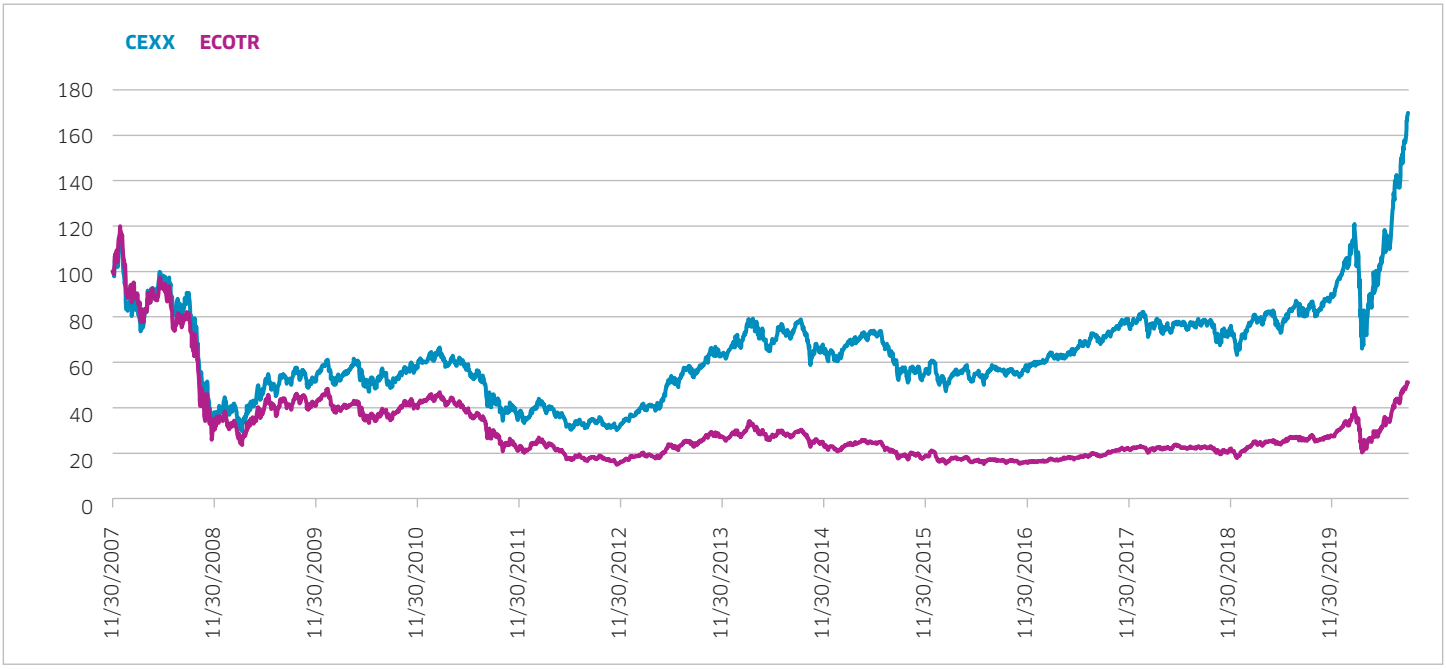
CEXX: Cumulative Performance (2006-2020)



The following table and graph illustrate the performance of both the Nasdaq Clean Edge Green Energy Total Return Index (CEXX) and the Wilderhill Clean Energy Total Return Index (ECOTR), since just before the financial crisis (November 30, 2007) to current-day (August 31, 2020). The Nasdaq Index has substantially outperformed on a cumulative basis, on both an absolute and risk-adjusted level.

	CEXX	ECOTR
Cumulative Return	69.79%	-48.83%
Annualized Return	4.24%	-5.11%
Annualized Volatility	33.63%	34.62%

CEXX vs. ECOTR: Cumulative Performance (2007-2019)



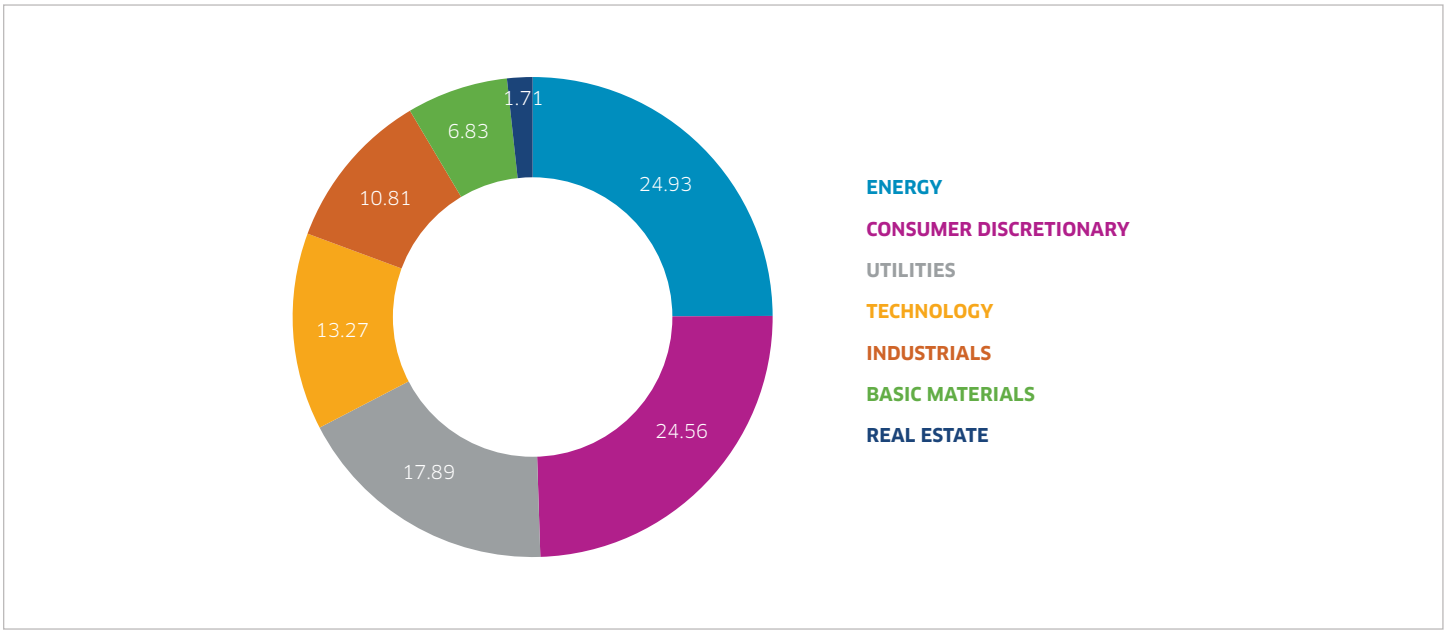
Below is a breakdown of calendar-year performance. On an annual basis, the Nasdaq Index outperformed in most periods. The largest outperformance of CEXX vs. ECTOR was in 2013 at 30.82%, followed by 2016 (19.35%). The top performing full calendar years for CEXX were 89.34% (2013), followed by 44.72% (2009). The worst performing year for both CEXX and ECOTR was during the financial crisis in 2008, down -63.44% and -69.89%, respectively. Despite the Covid crash, YTD 2020 (through August 31) has been quite good to both indexes amidst the subsequent run-up in returns, with CEXX up 74.87% and ECOTR up 66.84%. Even during a period of very strong returns for the competitor index, CEXX still outperformed by over 8% through the first 8 months of the year.

CEXX vs ECOTR: Annual Performance (%), 2008-2020 YTD

	CEXX	ECOTR	DIFFERENCE
2008	-63.44	-69.89	6.45
2009	44.72	29.78	14.94
2010	2.71	-4.76	7.47
2011	-40.81	-50.43	9.62
2012	-1.32	-18.11	16.79
2013	89.34	58.51	30.82
2014	-3.13	-16.94	13.81
2015	-6.38	-10.24	3.87
2016	-2.65	-22.00	19.35
2017	32.05	39.32	-7.27
2018	-12.11	-14.57	2.46
2019	42.66	59.31	-16.65
YTD 2020	74.87	66.84	8.03

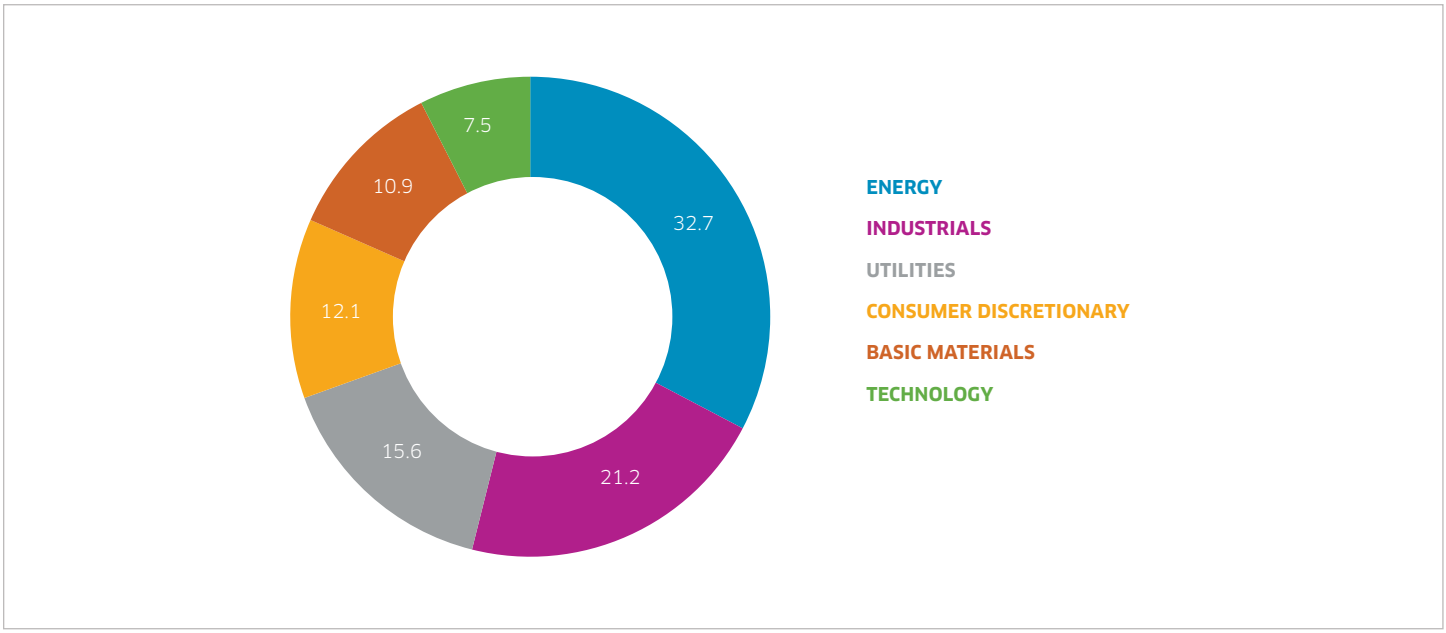
CEXX currently allocates to seven of the eleven ICB industries across 42 securities with the largest index weights across Energy (24.9%), Consumer Discretionary (24.6%) and Utilities (17.9%). CEXX's allocation to Real Estate stems from one company - Hannon Armstrong Sustainable Infrastructure Capital, Inc. Other than Real Estate, ECOTR allocates to the same industries across its 40 securities, with its largest weights in Energy (32.7%), Industrials (21.2%), and Utilities (15.6%). CEXX's larger allocation to Consumer Discretionary can be attributed to the much higher weights in Tesla and NIO, as illustrated in a comparison of the top 10 index holdings.

CEXX ICB Industry Allocation Comparisons (%)



*As of 8/31/2020

ECOTR ICB Industry Allocation Comparisons (%)



*As of 8/31/2020

Top 10 Security Comparisons: CEXX

NAME	WEIGHT	ICB INDUSTRY
Tesla, Inc.	15.41%	Consumer Discretionary
NIO, Inc. (China)	9.15%	Consumer Discretionary
SolarEdge Technologies, Inc.	5.66%	Energy
Albemarle Corp.	4.99%	Basic Materials
Enphase Energy, Inc.	4.99%	Energy
First Solar, Inc.	4.24%	Energy
Brookfield Renewable Partners LP	4.19%	Utilities
SunRun, Inc.	3.76%	Utilities
ON Semiconductor Corp.	3.35%	Technology
Cree, Inc.	3.09%	Technology

*As of 8/31/2020

Top 10 Security Comparisons: ECOTR

NAME	WEIGHT	ICB INDUSTRY
Vivint Solar, Inc.	5.15%	Utilities
SunRun, Inc.	4.80%	Utilities
NIO, Inc. (China)	4.76%	Consumer Discretionary
Tesla, Inc.	4.46%	Consumer Discretionary
Workhorse Group, Inc.	3.65%	Industrials
SunPower Corp.	3.45%	Energy
Canadian Solar, Inc.	3.21%	Energy
Bloom Energy Corp.	3.11%	Industrials
Plug Power, Inc.	3.06%	Energy
First Solar, Inc.	2.87%	Energy

*As of 8/31/2020

NASDAQ OMX CLEAN EDGE SMART GRID INFRASTRUCTURE TOTAL RETURN INDEX (QGDX)

The Nasdaq OMX Clean Edge Smart Grid Infrastructure index is designed to act as a transparent and liquid benchmark for the smart grid and electric infrastructure sector. The index includes companies that are primarily engaged and involved in electric grid; electric meters, devices, and networks; energy storage and management; and enabling software used by the smart grid and electric infrastructure sector. The index began on September 22, 2009, at a base value of 250.00. As of August 31, 2020, the index had 58 components. Investors can gain exposure to the index through the corresponding ETF, which is the First Trust Nasdaq Clean Edge Smart Grid Infrastructure Index Fund (GRID).

Eligibility Criteria:

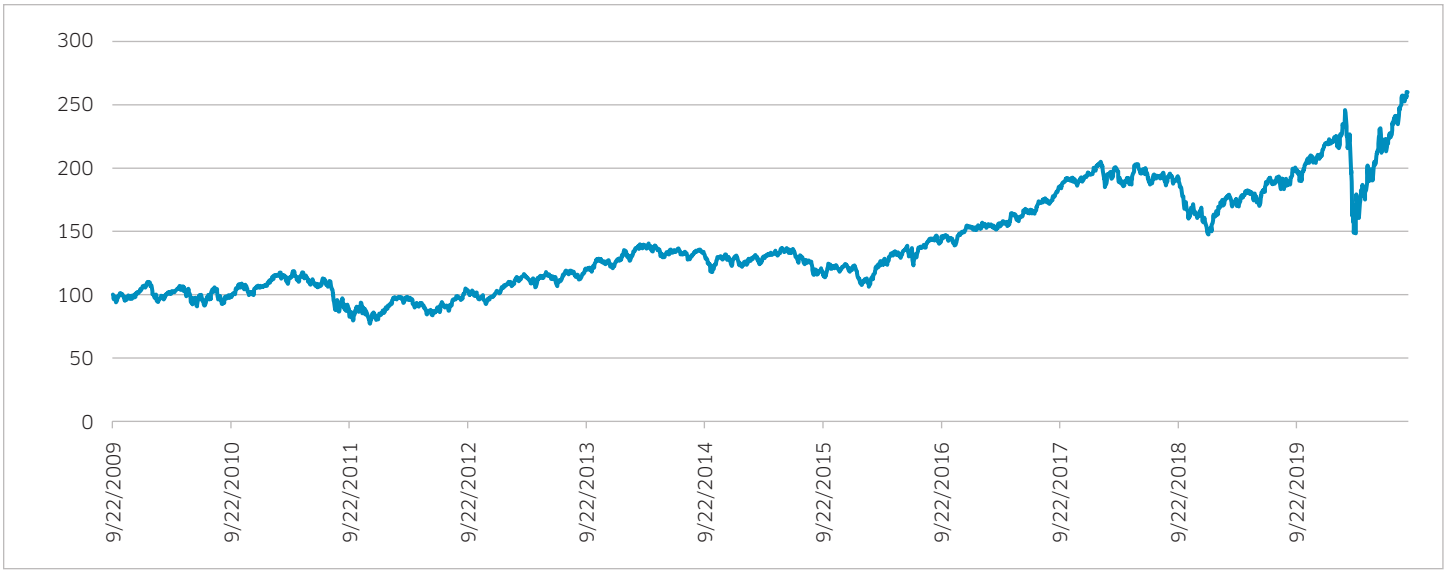
To be included in the index, a security must meet the following criteria:

- Be classified as a smart grid, electric infrastructure EV network, smart building, software, and/or other grid-related activities company according to Clean Edge
- Be listed on an index-eligible global stock exchange
- Have a minimum worldwide market capitalization of $100 million
- Have a minimum three-month average daily dollar trading volume of $500,000
- A minimum free float of 20%

Performance:

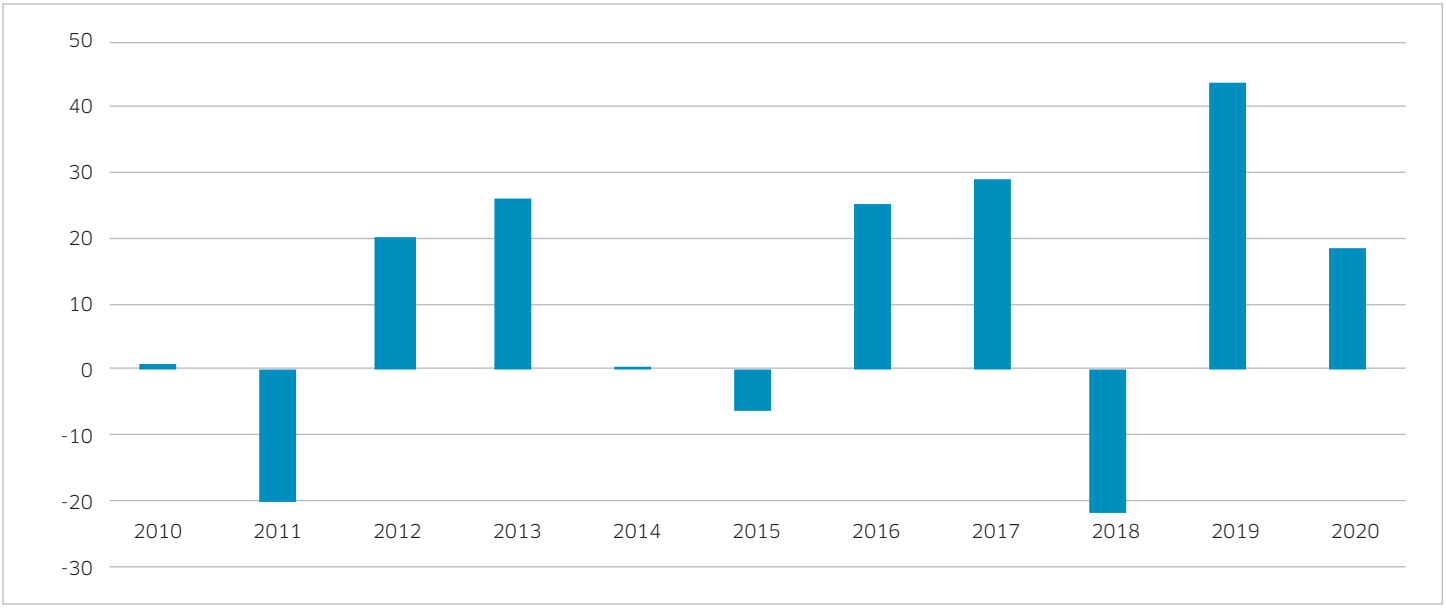
Below is a brief look at the performance of the index since inception. The index has generated a cumulative return of 160%, with an annualized return of 9.1% and an annualized volatility of 20.5%. The chart shown here is rebased at 100 on September 22, 2009. Much like CEXX above, 2020 marked a very tumultuous period of performance, with a strong beginning to the year hitting all-time highs in mid-February just before the Covid crash caused the index to drop precipitously in mid-March, then a strong rebound leading to new all-time highs in August. The mid-February to mid-March decline of 40% led the index to revisit values last seen near the end of 2018. What followed was a historic resurgence, with the index hitting its peak all-time value (re-based) of 260.3 on August 28, 2020, notching a gain of over 75% during that five-month period (3/23/20-8/28/20).

QGDX: Cumulative Performance (2006-2020)



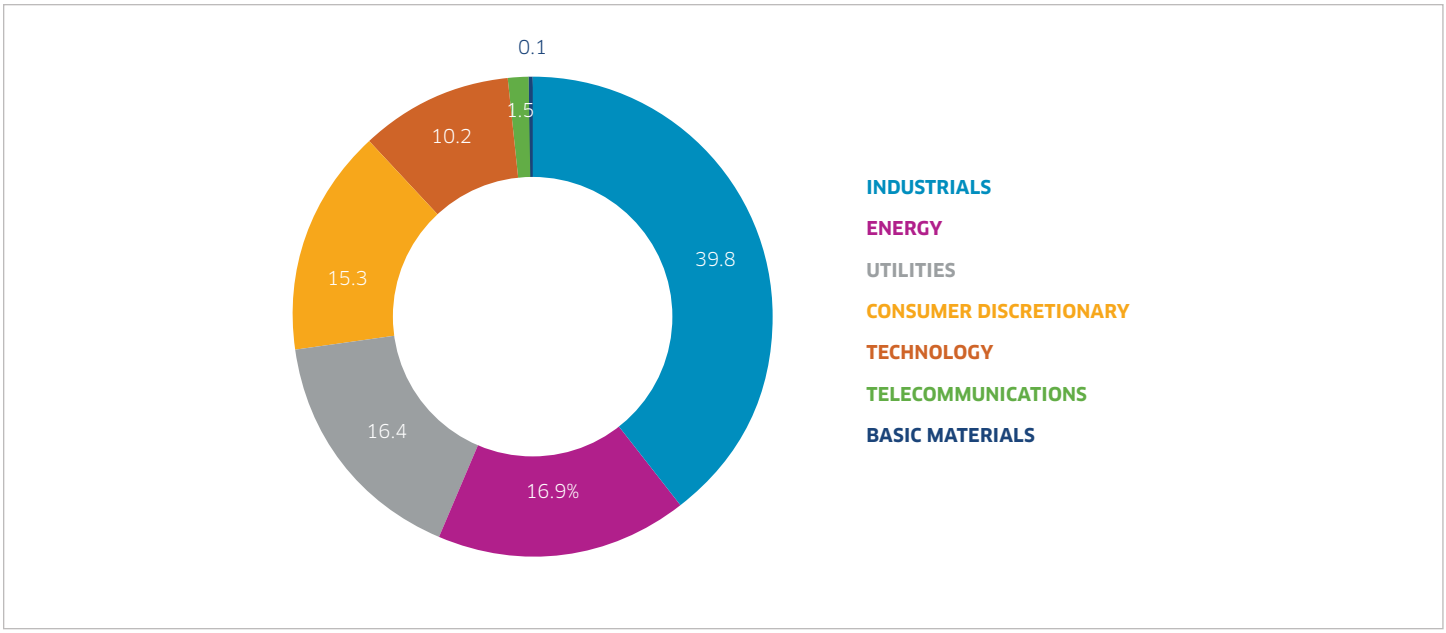
QGDX: Annual Performance (%), 2010-2020 YTD

On a calendar-year basis, the top-performing years were 2019 (43.9%), 2017 (28.8%) and 2013 (26.2%). YTD through August 31, 2020, QGDX is up 18.6%.



QGDX ICB Industry Allocations (%)

The index currently allocates to seven of the eleven industries, with the largest weights across Industrials (39.8%), Energy (16.9%) and Consumer Discretionary (15.3%).



*As of 8/31/2020

Top 10 Securities: QGDX

NAME	WEIGHT	ICB INDUSTRY
SolarEdge Technologies, Inc.	10.28%	Energy
Schneider Electric SE	8.24%	Industrials
Aptiv Plc	7.54%	Consumer Discretionary
Red Eléctrica Corp. SA	7.17%	Utilities
TERNA Rete Elettrica Nazionale SpA	7.08%	Utilities
Quanta Services, Inc.	4.58%	Industrials
Tesla, Inc.	4.44%	Consumer Discretionary
Enphase Energy, Inc.	4.38%	Energy
Prysmian SpA	4.34%	Industrials
Advanced Energy Industries, Inc.	3.66%	Technology

*As of 8/31/2020

Conclusion

In this research piece we initially discussed how, over the past decade, clean energy has gone from niche to mainstream and covers a wide range of products and services. We also noted how smart grid infrastructure is the enabler of a 21st century electric grid and supports the convergence of renewable energy, EVs, IoT grid devices, smart transformers, and energy storage. A number of other important points covered include:

- Clean energy, in many regions, is now the lowest cost option (less expensive than coal and nuclear, and attracting an increasing share of new capacity additions).
- Energy storage and EVs are not far behind in terms of cost reduction, now following growth trajectories similar to solar over the past 15 years.
- A growing number of investors are shifting their focus away from coal and other fossil fuels to clean energy and smart grid technologies – driven by economics, the health link between COVID-19 and air quality, a greater awareness of the impacts of climate change, and public and private actions that support this new infrastructure. Examples of major actions include the recent law passed in New York for the state to reach 100% renewable electricity by 2050, and countries such as Norway and the Netherlands requiring all new light duty vehicles to be emissions free by 2025 and 2030 respectively.
- According to Bloomberg and others, growth prospects for renewable energy remain highly positive moving forward.

These and other developments create unique opportunities of which investors should be aware. The Nasdaq Clean Edge Green Energy Total Return Index (CEXX) and the NASDAQ OMX Clean Edge Smart Grid Infrastructure Total Return Index (QGDX) both provide access to companies involved in these businesses in their respective capacities. Investors can gain exposure to the indexes through the corresponding ETFs, which are the First Trust Nasdaq Clean Edge Green Energy Index Fund (QCLN) and the First Trust Nasdaq Clean Edge Smart Grid Infrastructure Index Fund (GRID), respectively.

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