Hamilton Lane

On the Right "Tack": Navigating the Complexities of the Energy Transition

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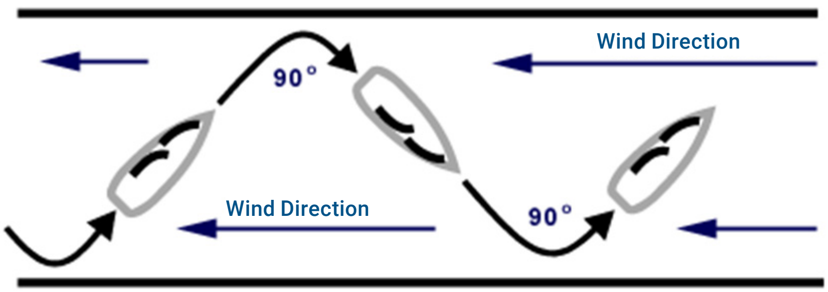
You could be forgiven, dear reader, for looking twice at the headline, thinking we probably just misspelled "track." But if you know us, you know we love a good sporting analogy. Tacking is a sailing maneuver used to advance a sailboat into the wind.

To effectively tack, the sailor turns the bow toward and through the wind so that the direction from which the wind blows changes from one side of the boat to the other, allowing progress in the desired direction. A simple illustration of a tack maneuver is included below:



Notice what is required to make progress on the desired course. Rather than confront the wind head on, the captain continues to position the vessel sideways to the wind in a series of temporary but deliberate deviations from a straight-line course. The result is an elongated but consistent approach to the target destination. To sail directly into the wind is futile.

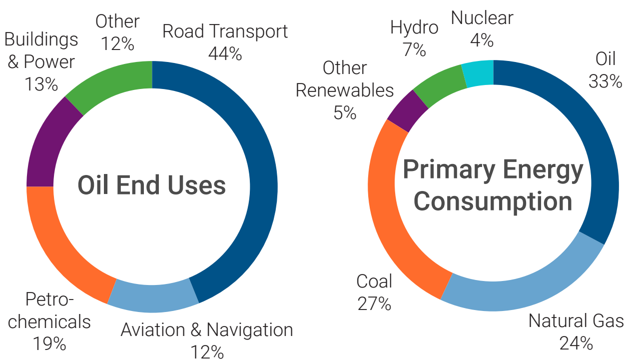
Although our own sailing experience is probably best represented by that of Bill Murray's character in "What About Bob," other knowledgeable sailors have explained to us the effectiveness of tacking. Tacking allows a skilled sailor to make headway on a course despite a stiff headwind.

What does this sailing maneuver have to do with transitioning our energy systems from fossil fuels to electricity? And what does this have to do with the environmental, social and governance issues that may confront us as investors during this energy transition period?

Headwinds

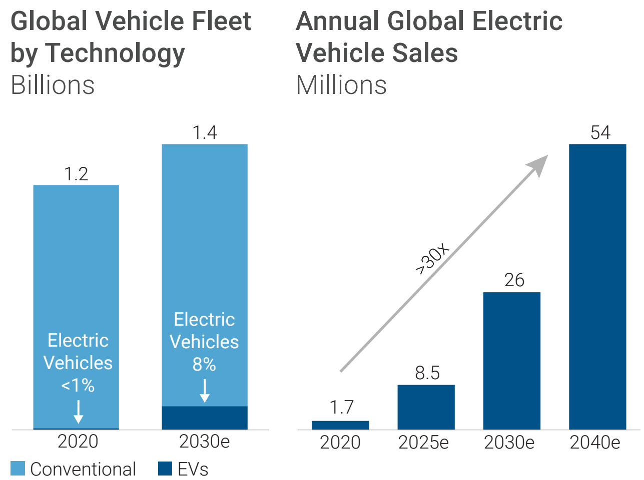
To start, let's look at some of the headwinds we face today.

In evaluating policy and investment objectives related to energy transition, it's important to recognize the baseline from which we are starting. The charts below show global energy consumption by fuel, as well as the largest end uses for oil as a fossil fuel source.



Source: IEA 2020

Notice that after years of energy transition, coal still accounts for nearly 30% of the global energy supply. Depending on the source, fossil fuels, including oil, gas and coal, account for 80-85% of global energy supply, which is roughly equivalent to where they were 10 years ago. While coal utilization has fallen, oil use has remained steady and use of natural gas has been expanding. This makes sense when you break down the end uses of oil as a fossil fuel energy source. As shown above, the largest end-use markets for oil-related energy are road and air travel. Well what about electric vehicles, you ask? With a market cap of $1 trillion, isn't everyone driving Teslas these days – and won't this surely spell the end of oil for transportation-related uses? Not so fast.

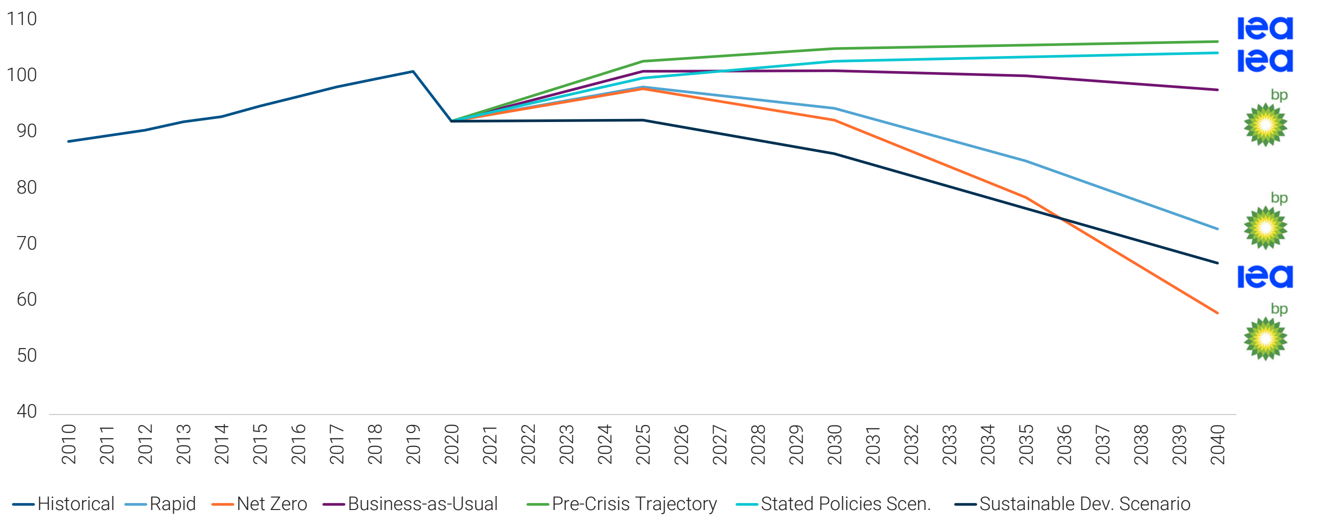


Source: Bloomberg New Energy Finance Electric Vehicle Outlook 2020. Accessed February 2021

You can see that, today, EVs account for less than 1% of the global vehicle fleet. While they are projected to grow by over 30x in the next 20 years, they are still projected to only account for about 8% of the fleet by 2030. While falling battery costs are expected to make EVs cost-competitive with conventional vehicles by 2023, road transport oil demand is still expected to grow through 2031 driven by the growth in commercial transport vehicles, which are still a long way off in terms of competing with diesel-fired conventional engines for heavy freight transport. Consumer preference for EV passenger vehicles is improving as more options are developed by the large auto makers, but EV adoption has a long way to go before EVs start to meaningfully displace traditional engines. State and federal emissions reduction targets and flat out mandates may change this, but absent these hardline policies, consumers are still overwhelmingly choosing conventional engines over EVs.

On the shipping and aviation side, the transition to electric battery technologies is even further out. While battery powered passenger ferries are gaining ground for short-haul trips, the energy requirements to move heavy cargo over long trade routes is only possible with conventional engines, largely propelled by conventional fuels. With transportation and petrochemical uses being the largest drivers of oil use, oil demand continues in all future scenarios. Consider some of the projections on the next page:

Oil and Liquid Fuels Demand - Various Scenarios
MMbd



BP Rapid: Numerous policies, including significant increases in carbon pricing, reduce carbon emissions from energy use by ~70% by 2050
BP Net Zero: Same policy assumptions as included in "Rapid Scenario," with shifting societal behavior further reducing emissions (by 95% by 2050)
BP Business-as-Usual: Policies, technological and societal changes continue to evolve in a manner and speed that is consistent with recent years
IEA Stated Policies: Scenario reflects impact of existing policy frameworks and announced policy intentions on future energy demand
IEA Sustainable Development: Scenario is aligned with the objectives of the Paris Accord
IEA Pre-Crisis: Trajectory for consumption prior to COVID-19 pandemic, which included more optimistic economic growth expectations
Source: BP Energy Outlook 2020. IEA World Energy Outlook 2020, EIA. Accessed February 2021

Under stated policies, oil and liquid fuels demand is expected to stabilize around 100mm barrels of oil equivalent per day (boepd) over the next two decades. Only significantly more aggressive policy targets, if adopted, are expected to meaningfully reduce oil and liquid fuel demand over the measurement period. But, are aggressive policy targets alone enough to move the needle? So far, most of the world's largest emission-producing economies are failing to meet stated policy objectives related to climate change:

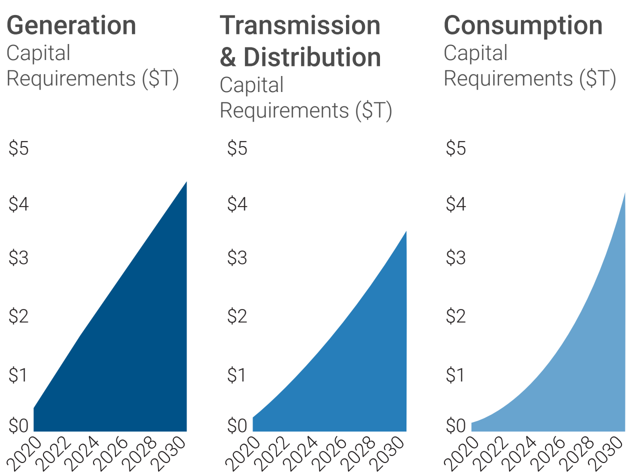
Country	2030 Emissions Reduction Goal	Current Emissions Standings	On Track Toward Pledges?	"Fair Share" Towards Objective?
China	60% to 65% below 2005 levels (based on carbon intensity)	CO_2 emissions are estimated to have risen 2.3% in 2018 and 2.6% in 2019 due to increased fossil fuel consumption and cement production.	Highly Insufficient	Highly Insufficient
Japan	26% below 2013 levels or 18% below 1990 levels (on an absolute basis)	It is projected that currently-implemented policies will lead to emissions levels of 10% to 15% below 1990 levels and 18% to 29% below 1990 levels in 2030.	Exceeding Pledges/1.5C Compatible	Highly Insufficient
European Union	40% below 1990 levels or 29% below 2010 levels (on an absolute basis)	The EU experienced emissions reductions of almost 2.3% in 2018, with 2019 emissions expected to have reduced further. It is estimated that CO_2 emissions from energy consumption decreased by 4.3% in 2018.	Compatible/2C	Insufficient
India	33% to 35% below 2005 levels (based on emissions intensity of GDP)	It is projected that greenhouse gas emissions (exlcuding LULUCF) will increase by 27% to 35% from 2010 levels in 2020; however, it is estimated that India can achieve its Paris Accord targets given recent reduced electricity demand and increased share of renewbale energy.	Compatible/2C	Compatible/2C
UK	57% below 1990 levels (on an absolute basis)	Emissions are projected to be between 51% and 53% below 1990 levels in 2020.	Exceeding Pledges/1.5C Compatible	Insufficient
Brazil	43% below 2005 levels (on an absolute basis)	By 2030, it is estimated that Brazil's currently implemented policies will take total emissions (excluding LULUCF) to between 22% and 23% above 2005 levels in 2030.	Highly Insufficient	Highly Insufficient

Please note that the U.S. is excluded given that the country only recently rejoined the Paris Climate Accord in February 2021. According to Climate Action Tracker, the U.S.' rating is "Critically Insufficient," a rating not shown in the table above

Source: Hamilton Lane, Climate Action Tracker. Accessed February 2020

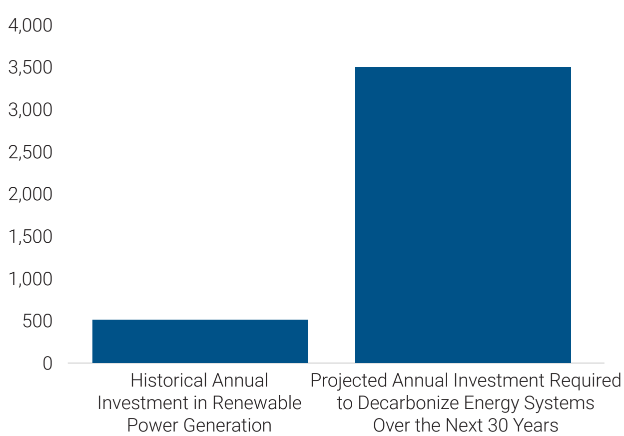
We didn't include the United States on here as the U.S. only recently rejoined the Paris Climate Accord in February 2021. That said, the U.S. rating would be "Critically Insufficient" if measured today.

Capital requirements also represent a significant headwind to the energy transition. Over decades, capital has been invested in energy generation, transmission and distribution infrastructure based on fossil fuels as the primary energy source. Transitioning this infrastructure to support renewable generation will take time and significant capex:



Source: Bloomberg New Energy Finance. New Energy Outlook 2020.

Capital Requirements for Decarbonization



Source: COP26, Intergovernmental Panel on Climate Change (IPCC) and the IEA

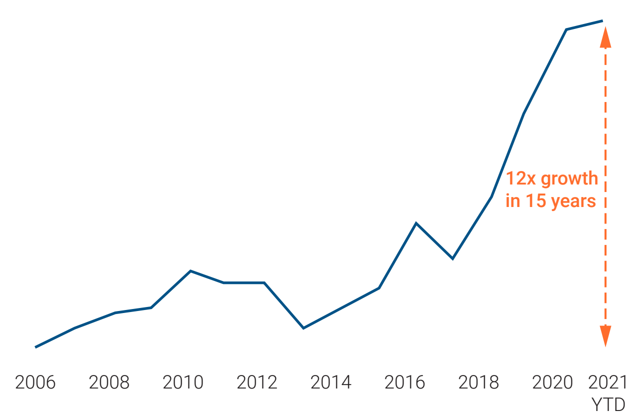
Over the next 30 years, nearly $100 trillion of capital will need to be spent to decarbonize existing energy systems, according to the Intergovernmental Panel on Climate Change (IPCC). These capital requirements are massive, and while it may represent a significant investment opportunity, the capital that is actually being invested in renewable generation is a fraction of what is required to achieve net-zero targets by 2050. Despite the investor interest in this space, capital formation relative to capital requirements remains a significant headwind to achieving energy transition goals.

Tailwinds

We've talked about the strong headwinds, of which there are many – so does this mean we should just give up and head back to port? Absolutely not. Despite headwinds, there has been some significant progress on the energy transition. Let's look at a few areas that are helping us tack into some fierce winds.

First, although capital requirements are expected to continue to outpace capital formation, private markets are catching on, with the number of energy-transition-oriented funds growing by over 12x in the last 15 years, and the bulk of that coming in the last three years. The energy transition has the potential to be a significant investment opportunity for private capital, and private investors are expected to be a driving force behind the energy transition. Why is that?

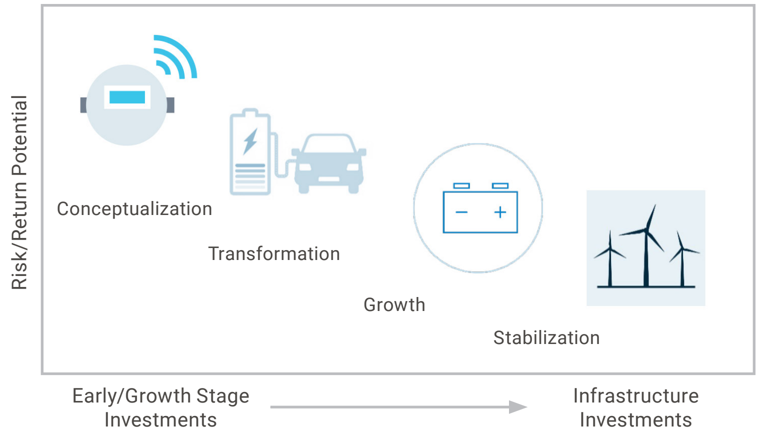
Energy Transition-Oriented Funds in Market
Shown as a Multiple of 2006



Source: Hamilton Lane data via Cobalt

Private capital is uniquely positioned to fund the conceptualization, commercialization and scalability of new technologies that will drive the energy transition. Consider the following:

Company Growth Cycle



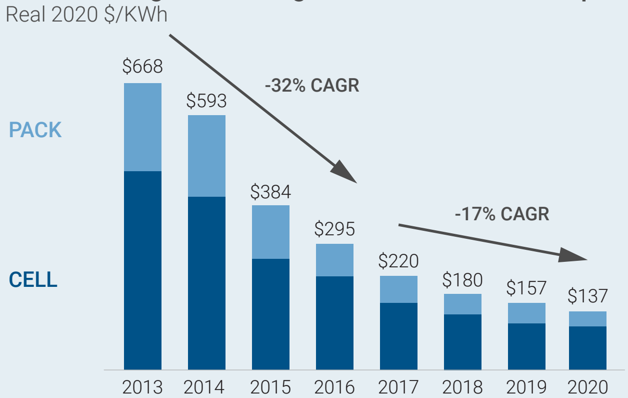
	Project Profile	Roles in Energy Transition	Investment Lifecycle	Impact
Battery Storage Development	Battery storage development project using new and reused lithium-ion batteries	Battery storage assets play a critical role in balancing intermittency associated with solar and wind power generation	Successfully constructed asset and exited to lower cost of capital Growth Equity Profile → Infrastructure Profile	

For illustrative purposes

As concepts move from development to transformation to growth to stabilization, private capital moves along with it. Some of the private capital subsectors attracting the most new capital in recent years have been venture/growth equity and infrastructure, both of which will play a critical role in developing new technologies and funding the energy transition. We've included an example of a battery storage company that illustrates the important role of private capital. The technology developed was originally funded from well-known venture sponsors. As the company reached a need for scaling its business model, growth equity capital played a significant role in its success. As the company scaled and de-risked its business model, infrastructure investors looking for more stabilized cash distributions and longer-dated contracts were the more natural owners. This company allows for renewable energy to account for a larger share of power generation in a given power market by helping to smooth the intermittancy and improve reliability of the renewable assets, and private capital played a critical role in its success.

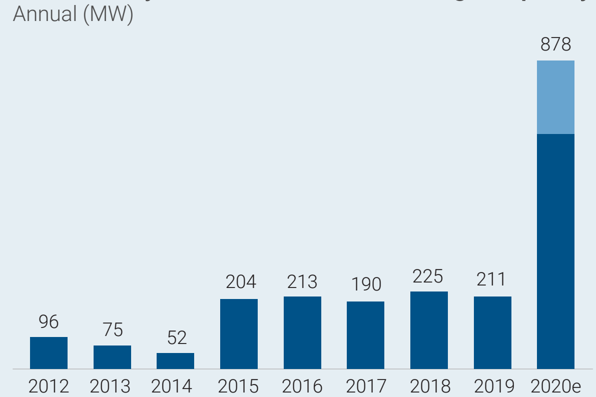
One of the issues facing the grid with large-scale renewable penetration is the lack of dispatchability of the renewable power source. Improvements in battery storage will help to change this:

Volume-Weighted Average Pack and Cell Price Split
Real 2020 $/KWh



Source: Bloomberg New Energy Finance, December 16, 2020

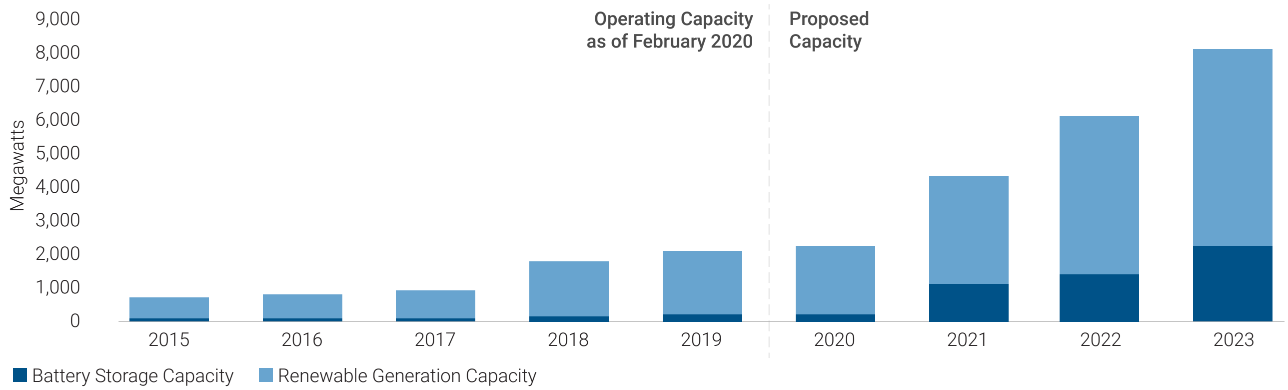
U.S. Non-Hydro Commissioned Storage Capacity
Annual (MW)



Source: Sustainable Energy in America 2021. Bloomberg NEF, The Business Council for Sustainable Energy. Accessed February 2021

Co-Located Renewables Generation and Storage

Co-Located Facility Capacity

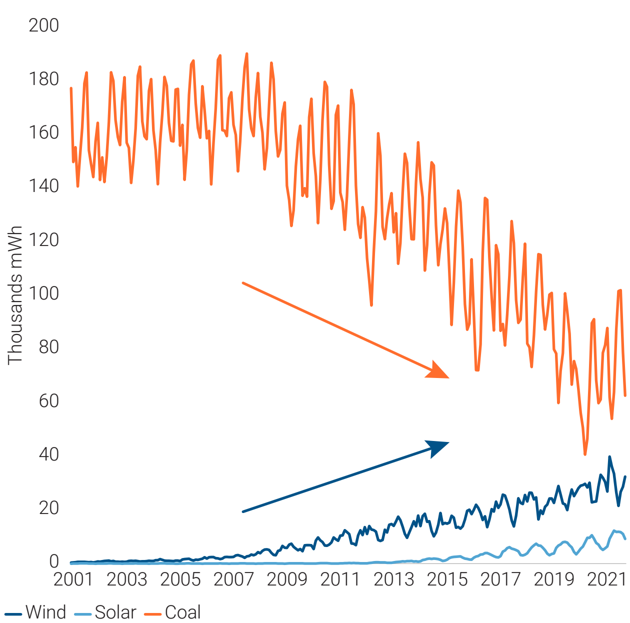


Source: EIA Preliminary Monthly Electric Generator Inventory Report 2020

Where else are we making progress? As we mentioned, the share of coal as a global energy supply has remained stubbornly high over the last decade, but that is finally starting to change as renewables account for an increasingly larger share of the global power stack.

This has been made possible by significant reductions in the costs and efficiencies of renewable technologies, which are now, on an unsubsidized basis, cost-competitive with many traditional power generation resources in the U.S.

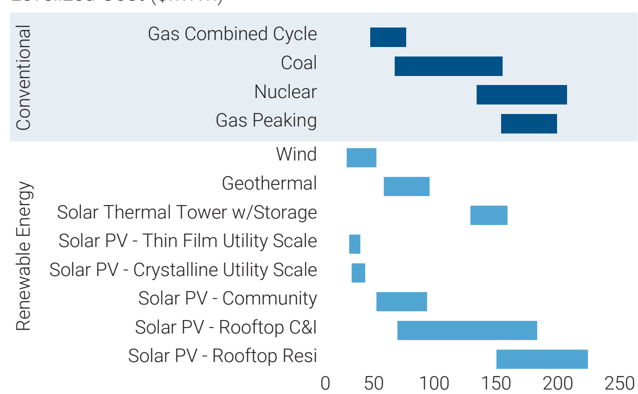
Net Monthly Generation - Coal vs. Renewables



Source: U.S. EIA. Data shown through year-end 2020. Accessed February 2021

Levelized Cost of Energy Comparison - Unsubsidized Analysis

Levelized Cost ($MWh)



Source: Lazard Levelized Cost of Energy and Levelized Cost of Storage 2020. Published October 2020

In addition to the technology improvements and capital investment noted earlier, an alignment of global stakeholders is beginning to form around energy transition and climate action plans. This alignment is evidenced by:

- Nearly 130 governments committed to net-zero targets;
- Approximately 1,300 companies agreeing to science-based, climate-related targets to reduce emissions in line with the Paris Agreement;
- Over 500 investors organizing to engage the world's highest GHG emitters in helping to drive the clean energy transition;
- An alliance of asset owners with $5 trillion of AUM pledging to transition their investments to net zero;

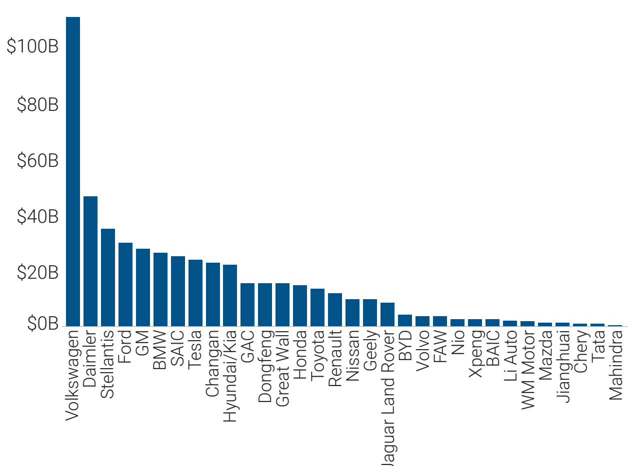
- More than 200 banks having signed on to the Principles for Responsible Banking, aligning financing portfolios with the Paris Agreement; and
- Organizations representing $139 trillion of AUM agreeing to support TCFD-aligned climate disclosures.

The points noted above represent an important alignment amongst governments, corporations, investors and lenders in driving global economies toward more sustainable energy practices.

As mentioned previously, passenger transportation is a big driver of fossil fuel energy consumption and consumers have been slow to adopt EV technologies. That said, state and federal mandates are driving large auto makers to invest significant capital in their EV fleets, offering consumers more choices and less sacrifices relative to the ICE vehicles they are accustomed to. The chart below illustrates the planned EV fleet spending for the world's largest automakers:

Global Automaker EV & Battery Investments

Auto industry investments in battery technology and electric vehicles are led by German automaker Volkswagen and total $515 billion



Note: Calculations based on company disclosures
Source: Reuters analysis of company disclosures

At What Cost?

As noted, we face significant headwinds in the energy transition, but we are effectively tacking into the wind and making slow, but steady progress on our desired course. That said, are there potential social costs we should be aware of as global economies shift toward electrification? And, how do we ensure that the transition costs are not borne disproportionately by those that are least able to afford it?

In a recent interview, BlackRock CEO Larry Fink said: "We need to reimagine how we could rapidly deploy new capital into the greening of the world, but not the avoidance of hydrocarbons in the short run or we're going to have $120, $140 oil, and that's not a fair or just transition." On moving toward green energy, Fink warned that emerging countries "will not come along because they can't afford it. [...] We need a fair and just transition. If we're not getting a fair and just transition we're going to create more polarization in the world, more political uncertainty," he warned.

Indeed, a recent study conducted by Portland State University and Vanderbilt found that increased renewable penetration in developed markets exacerbated income inequalities in those markets. Higher power prices from California to the UK resulting from aggressive renewable policies have also been criticized as a regressive energy tax on the poor.

Access to affordable and reliable energy are critical to lifting people out of poverty in developing nations and for sustaining quality of life in developed ones. As we transition to clean energy alternatives, how do we ensure that affordability and reliability are not sacrificed in the process, especially for the most vulnerable of communities?

The California Case Study

Let's look at California as a miscrocosm of the social complexities embedded in the energy transition. We'll use Kern County as a case study.

California has a state renewable energy target requiring an 80% reduction in emissions and a carbon-free electricity system by 2050. California has also indicated that the sale of new vehicles utilizing combustion-fired engines will be banned from the state starting in 2035. These are some of the most aggressive policy and consumer mandates in the country. And yet, despite these state policy objectives, Kern County, the largest oil and gas producing county in the state, recently expanded its oil and gas production. This expansion illustrates why these energy transitions are not as simple as policy mandates make them out to be. Consider the following:

- Property tax revenues generated by oil and gas producers in Kern County were $197.3 million in 2018-2019.
- Of this $197 million in property tax revenue produced by the oil industry, $103.8 million (~53%) goes directly to fund school districts.
- 1 in 20 people in Kern County is directly employed by the oil and gas industry.
- Kern County has a median income of $53,000, which is 30% below the California median, yet oil and gas-related jobs in Kern County pay 63% more than jobs in other industries.
- The county has a poverty rate of 18.3% versus the overall poverty rate in California of 11.5%.
- Kern County is also one of the largest renewable-producing counties, but renewable energy production does not produce the same royalty or property tax revenues as oil and gas, nor is it as people-intensive in terms of job creation as oil and gas production.

Contrast this with Marin County, CA, where much of the most stringent clean energy policies have originated in the state of California.

- Marin County has a median income of $115,000, which is 53% above the California median.
- Marin County has a poverty rate of 6% versus the overall poverty rate in California of 11.5%.

The comparison between Kern and Marin counties represents some of the extreme social costs embedded in the energy transition. School funding, well-paying jobs and increased economic growth prospects are all functions that we, as a society, believe are social goods. At the same time, we are also keenly aware of the long-term environmental and health consequences that emissions impose on populations, especially the most disadvantaged populations that tend to live in areas with higher emissions and have less access to quality healthcare.

Power prices in California are another example. The average cost per kW in California was about 57% higher than in the rest of the country in 2021. The EIA reports that the average American household utilized 10,700 kWh in 2020. With California prices at $.21/kWh and national prices at $.13/kWh, this would mean that Californians would spend ~$196 per month on electricity needs versus $124 per month for the rest of the country. An additional $70 per month spent on electricity may not be a concern or even noticed by higher income earners in the state, but for the nearly 12% of Californians living in poverty, the added cost to their power bills each month represents a heavy toll on their monthly budgets.

So what do they do? Naturally, they use less. The milder climate in much of the state and the higher prices results in Californians utilizing about 30% less electricity than U.S. households in other states. When adjusted for uses, Californians pay about the same as other U.S. households. In other words, they use much less but pay the same amount as other U.S. households.

One interesting observation: Despite Californians using less electricity, the end usage of their electricity looks very similar to the U.S. as a whole, with ~55% of the end uses going to heating and cooling needs for the home. Again, if you think about high power prices as a use tax, even for uses as essential as heating and cooling a residence, lower-income earners will bear that tax disproportionately and may be forced into making difficult trade-offs between heating or cooling a residence or taking care of other essential needs.

Consider also a simple illustration. Many states utilize a regulated utility model whereby the utility incorporates the capital costs of generation, transmission and distribution in determining what rate it charges for electricity to its rate base of users. Let's assume there are two participants in the rate base today. One of the participants is a high-income homeowner and the other is a low-income renter. Today, the capex costs for delivering electricity is incorporated into the cost per kW that each of these participants pays for electricity each month. The high-income homeowner may use more electricity each month and therefore may have a higher power bill, but the cost per kWh is the same.

The state then imposes well-meaning incentives for homeowners to reduce their electricity consumption and even provides for net metering, whereby excess electricity generated by the homeowner can be sold back to the utility at a pre-determined price. Eager to take advantage of these incentives, the homeowner installs more energy-efficient appliances and window coverings and even installs solar panels on her roof to provide most of her power needs and even allow for some net metering back to the utility. She is thrilled. She likely received tax rebate incentives on the costs of her home improvements. She lowered her monthly power bill and now, in some months, she even gets to sell electricity back to the utility. How is that not a win?

Now consider the renter. He bears his electricity bill directly and his landlord has not chosen to upgrade his rental home just to lower the monthly bills of the renter, which are a direct pass through. The renter still uses the same amount of power, but the price is higher. Why? Well the utility, which used to have two rate payers to spread their capital costs over, now only has one, as the other has essentially taken herself out of the rate base by installing a distributed power system on her home.

This is an overly-simplified example, admittedly. But it illustrates an important point – energy transition policies need to incorporate social transition costs that are likely to be borne by lower income and disadvantaged communities.

From an environmental perspective, we also can't pretend that renewable generation or electric vehicles are environmentally neutral. Are they better from an environmental standpoint than fossil fuel generation? Absolutely. But, renewable energy still requires mined commodities with environmentally intensive extraction methods. Wind blade waste is not recyclable and is frequently replaced well ahead of its useful life. Cobalt and lithium, some of the most critical minerals for today's battery technologies, are often mined in places with poor records of human rights and child labor protections.

As institutions continue to incorporate ESG policies into their investment decision-making, it will be important to avoid a myopic focus on the environmental component to their ESG initiatives and to focus on some of the social transition costs that may be incurred in the energy transition. These costs may include lack of school funding, high power prices, unreliable power resources, high gas prices, an inability to afford basic transportation and the exploitation of certain labor groups in securing valuable transition commodities.

All of this is to say that we are making great strides in the energy transition. The headwind is stiff, but deliberate progress is being made, although the timeline to arrive at the desired destination may take longer than anticipated. Private capital will play a defining role in the energy transition.

Energy transition policies need to incorporate social transition costs that are likely to be borne by lower income and disadvantaged communities.