Investment Insight

GLOBAL ECONOMIC TRANSFORMATION, TRANSITION TO A NET-ZERO ECONOMY AND THE UPCOMING SUPER-CYCLE IN CAPITAL INVESTMENT

> *"Real success can only come if there is a change in our societies and in our economics and in our politics"*
>
> *David Attenborough*

The UN Sustainable Development Goals (SDGs) provide a shared blueprint for peace and prosperity for people and the planet. As the UN itself puts it, the 17 SDGs are an urgent call for action by all countries. They recognise that ending poverty and other dispossessions must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth, while tackling climate change and working to preserve our oceans, forests and the precious species that live in them.

One of the key challenges for policy makers, advocates, businesses and investors is to balance the many contradictions inherent in the SDGs. Prosperity requires energy but the current sources of energy are major contributors to climate change. The UN Climate Change Conference COP26 held in Glasgow in November this year highlighted that one of the greatest and most urgent of these contradictions is the need for an energy transition towards a low carbon economy and net zero by 2050.

Innovation and technology are key to finding solutions to the climate crisis. Much of it will be provided by companies that have the knowledge and resources to develop the technology required and the capital to produce it at scale. That is why climate change, perhaps the greatest challenge of our generation, is not only a risk from an investment perspective but also an opportunity, with significant potential for financial returns for those companies that are the enablers in the transition to a net-zero economy.

COP 26 – the key achievements

As COP 26 drew to a close this November, it arguably lacked a transformational deal like the 2015 Paris Agreement. Nonetheless it achieved some important steps forward.

Coal was a major area of focus with over 40 countries signing the Global Coal to Clean Power Transition Statement. The agreement creates a pathway to transition away from unabated coal power generation, for major economies by the 2030s and globally by the 2040s. Signatory countries also committed to cease the issue of new permits for unabated coal-fired power generation projects as well as government financing of such projects internationally. Limiting the impact, however, China and India, who together consume roughly two thirds of the world's coal, did not sign the agreement, nor did Australia, a leading coal exporter.

Other important agreements during COP 26 included the Global Methane Pledge, signed by over 90 countries, committing to reduce methane emissions by 30% by 2030; the Glasgow Leaders' Declaration on Forests and Land Use, signed by 105 countries, pledging to commit to work collectively to halt and reverse forest loss and land degradation by 2030; a pledge by 14 countries to advocate for the International Maritime Organization to adopt a net zero goal

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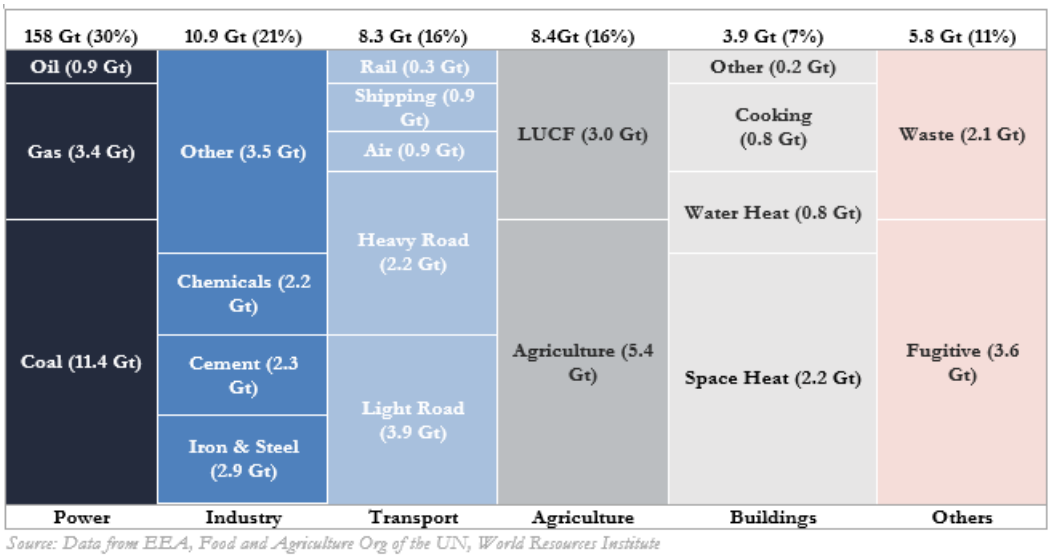
for shipping; the International Aviation Climate Ambition Coalition declaration, signed by 20 countries; advocating for the International Civil Aviation Organization (ICAO) to commit to a long-term emissions target; and a declaration to accelerate the transition to 100% zero emission cars, signed by 31 governments, committing to work towards phasing out sales of new gasoline and diesel-powered vehicles by 2040 worldwide. Finally, more than 40 countries pledged to achieve near-zero emission steel production by 2030, make affordable low carbon hydrogen globally available by 2030, make zero emissions vehicles the new normal by 2030, and make clean power the most affordable and reliable option for power needs by 2030. The US, the EU, India, Japan, Australia and the UK were among the signatories to all four pledges, while China only signed on to the Hydrogen pledge.

Importantly, COP26 saw major private sector companies stepping up to complement government action towards achieving the ambitions of the Paris Agreement. The Glasgow Financial Alliance for Net Zero (GFANZ) announced the commitment of 450 firms across 45 countries, representing $130 trillion in assets, to set science-based near-term targets within 12-18 months of joining, with more than 90 of the founding institutions having already done so.

Moving to a net-zero world – the transformation of the global economy

Global agreements and commitments are important but what will ultimately determine success in meeting the target of limiting the rise in mean global temperature to 1.5°C is actual implementation on the ground. The transition to a net-zero economy requires the complete, bottom-up transformation of the global economy.

This transformation will need to take place across all industries of the global economy, including the power, industrial, construction, transportation and agriculture sectors. The power sector is perhaps the most advanced in this journey with renewable power generation becoming an increasing part of the generation mix. In transportation, electric vehicles have been gathering pace in the decarbonisation of the road transportation sector. In construction, buildings are becoming more efficient with distributed solar and battery solutions further fuelling their pathway towards decarbonising.



Source: Data from EEA, Food and Agriculture Org of the UN, World Resources Institute

Other industries in transportation like trucking, aviation and shipping or heavy industry like chemicals, cement and steel, will be more difficult to decarbonise because of their greater resource requirements and higher energy densities. They will require innovation beyond current technological boundaries, for example through the development of hydrogen technology and the commercialisation of carbon capture & storage (CCS).

A super-cycle of investments in the global capital stock

This effective redesign of the global economy will inevitably translate into a once-in-a-generation super-cycle of investment in the global capital stock for the decades ahead. To meet the stated climate goals, an estimated USD 3 to 5 trillion annually will have to be invested. In its "Global Warming of 1.5°C" report, the UN Intergovernmental Panel on Climate Change (IPCC) suggested that to reach a 1.5°C world, the average annual amount of investment required would be USD 1.6 to 3.8 trillion per annum for the period 2016 to 2050. This estimate included a sixfold increase in the level of annual investments in low-carbon energy technologies and energy efficiency by 2050 compared to 2015.

A 2020 study, "Climate Finance Markets and the Real Economy" by the Boston Consulting Group (BCG) and the Global Financial Markets Association (GFMA), estimated that climate change mitigation investments required to decarbonise the ten sectors representing 75% of global emissions would total over USD 100 to 150 trillion cumulatively over the next three decades. This represents an average investment of USD 3 to 5 trillion per year. A similar study by UBS called "Energy Transition: How will USD 140 trillion of investment be allocated across the energy supply chain?" published in March this year placed the level of required investments at a similar amount.

The lowest hanging fruit along the pathway to a net zero world are efficiency and circularity initiatives. Such solutions are commercially viable and available at scale, with significant potential for efficiency improvements in industries such as chemicals, where process improvements could lead not only to emissions reductions but also lower production costs.

The second pathway towards decarbonisation is through commercially available solutions applied within industries to drive the switch towards electrification. A significant portion of these would represent the shift in the power generation sector towards renewable energy and associated strengthening in grid flexibility and reliability, for example through the deployment of grid-wide energy storage. Such large-scale renewable power will also be critical for the production of sustainable fuels, such as green hydrogen and synthetic fuels.

Some industries, however, like iron and steel, chemicals, heavy road transport and shipping, present unique challenges in the road to decarbonisation. These will require alternative technologies, still in early stages of development and with varying levels of commercial viability. CCS and green hydrogen are the highest potential levers, with a key role to play in decarbonising harder to abate industrial sectors but are also in nascent stages of development. The versatility and range of applications for hydrogen for example could position it as an important factor in the world's decarbonisation efforts. IRENA's latest 1.5°C scenario calls for a 12% hydrogen share of total final energy consumption by 2050, while the Hydrogen Council has suggested that an 18% share can be achieved by 2050.

The challenge by sector

($T)	Power	Steel	Cement	Chemicals	Transport	Aviation	Shipping	Agri-culture	Buildings	Total
Electrification and Renewables	56.7	-	-	<0.1	35.1	2.8	-	-	-	94.6
Efficiency and Circularity	-	0.7	0.4	0.2	4.0	0.2	0.7	0.6	5.3	12.1
Alternative Technologies	2.5	1.6	1.1	2.0	2.0	2.1	1.7	1.3	0.8	15.0
Total Investment	59.2	2.3	1.5	2.2	41.1	5.1	2.4	1.9	6.1	121.7

Source: GFMA

The pathway to decarbonisation will differ significantly by sector. The Power sector, representing 30% of global emissions, is expected to absorb about half the expected investments, requiring an approximate USD 59 trillion by 2050 to decarbonise according to the GFMA study.

For the sector to meet any decarbonisation targets it is essential that it rebalances toward renewable energy sources and away from fossil fuels. This transformation of power generation cannot take place without improvement of grid flexibility and reliability. To mitigate seasonality and variability risks associated with renewable energy, as well as to address the expected demand increase for electricity due to the electrification of other sectors, electricity providers will need to invest in enhancing network connectivity and improving grid flexibility, with significant investments required in transmission and distribution.

The build-out of new grids and upgrades of existing grids will require meters, power equipment (transformers, switchgear, power systems and substations), and smart grid infrastructure. New solutions are also under development for energy storage, including utility-scale batteries or hydrogen. Innovation in storage of electricity will play a significant role in decarbonisation, enabling the integration of renewable energy into electricity systems. This will be key in driving the further penetration of renewables into the energy generation system given their intermittent nature.

At the same time the transition has to take into account the growth of global energy requirements and not all of the power sector will be able to decarbonise. With the average life of a coal plant at an average of 40 years, implementing CCS technology on both existing and new coal plants will be critical to achieving emissions reductions while they are still in operation and contributing to global power supply, especially in countries where renewable power generation is in its infancy.

The transportation sector, which includes light and heavy vehicle transportation, aviation and shipping, accounts for 15% of global emissions. In passenger transportation, the shift to EVs, including the conversion of vehicle manufacturing capacity, the further development of battery technology and the expansion of public EV charging points, along with investments towards the electrification of buses, trains and rail to encourage the shift to mass transit, is expected to absorb USD 9 trillion of investments, with additional financing required to subsidise the transition of the global light vehicle fleet towards EVs.

In the commercial vehicle segment, significant investments, estimated by GFMA at over USD 32 trillion for the period 2020-2050, will be needed to support the transition to EVs for light

commercial vehicles and intra-city transport. Fuel cell powered commercial vehicles will be the pathway towards decarbonising the heavy duty, long-haul commercial transportation space, contingent on the development of a hydrogen economy with a corresponding refuelling station infrastructure.

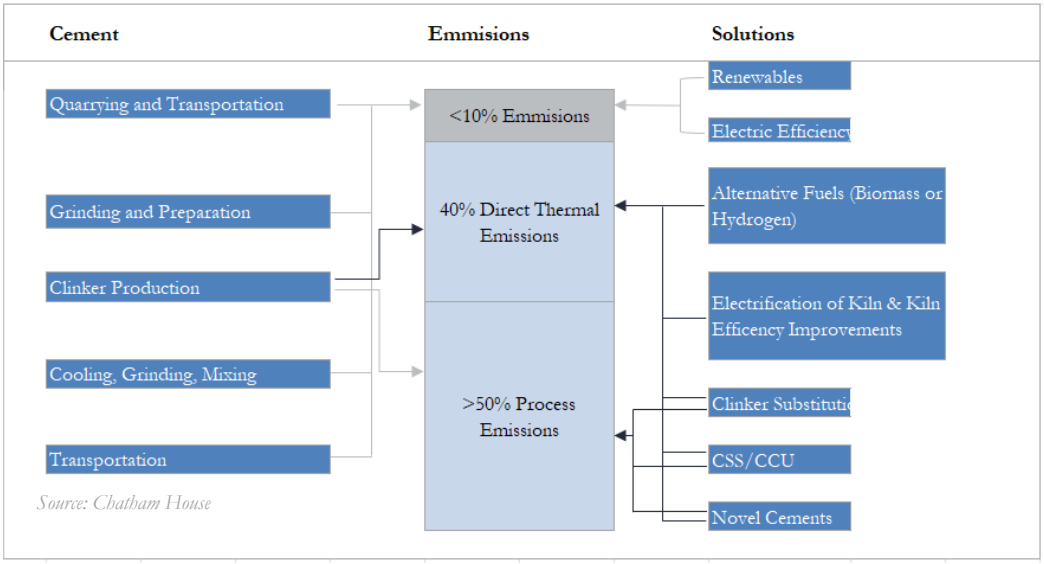
Aviation and shipping will be similarly tough to decarbonise. For the former, fleet efficiencies related to engine technology, aerodynamics and control systems will be key medium-term solutions, along with sustainable aviation fuels (SAFs). Longer-term, decarbonisation will require next generation propulsion solutions like hybrid-electric and fully electric engines, although even in an optimistic scenario on the pace of technological innovation this is likely to be viable only for short haul aviation given the immense power density requirements. Shipping will be equally hard to decarbonise. Ship efficiency can be enhanced by optimising hull design and on-board power systems. Improvements in operational efficiency can also be realised through digital solutions that optimise routing. Liquefied natural gas (LNG) could act as a potential transition solution in the medium term. But in the longer term the sector will require the use of alternative fuels such as e-ammonia and hydrogen, requiring the associated development of land-based infrastructure as well. Combined, aviation and shipping is expected to require over USD 7.5 trillion to make progress towards decarbonisation.

The construction sector is responsible for 7% of global CO2 emissions, primarily through heating and cooling requirements. Solutions on the path to net zero include advanced building envelope design, reducing heating loss; the electrification of conventional heating through the adoption of electric heat pumps; the development of solutions that utilise waste heat; onsite renewable energy generation for commercial spaces, and the deployment of energy efficient lighting and equipment. In all, over USD 6.1 trillion is estimated by GFMA to be required for the commercial sector for the period 2020-50, with an additional USD 4.6 trillion for the residential sector.

Finally, heavy industries, including steel, chemicals and cement, will be one of the hardest sectors to decarbonise. These sectors account for a combined 14% of global CO2 and generate particularly hard-to-abate emissions. This is because fossil fuels are used as both an energy source and a feedstock. In addition, the production processes in these industries often require high temperature industrial heat, or generate emissions as a result of chemical reactions during the actual production process rather than through the combustion of fossil fuels, making them particularly hard to decarbonise.

Part of the solution for these industries lies in efficiency improvements and plant redesigns. In the case of steel, recycling and the use of scrap steel would help reduce the carbon footprint, though this is dependent on the availability of high-quality scrap, with secondary production accounting for less than 25% of global production currently. But to fully decarbonise, the sector would require novel approaches, including the use of green or blue hydrogen and CCS.

Similarly, in cement, about half of the emissions are process emissions, a result of the chemical reactions to produce clinker, making it difficult to decarbonise. Reductions in the clinker content used in the end product through the introduction of alternative binders, including industrial by-products like fly ash from steel production, or natural alternatives like limestone, would help reduce the industry's carbon footprint. Such products are in early stages of development.



For chemicals, the use of alternative fuels and feedstocks would be needed, but as is the case with cement, the industry would need CCS technologies in order to achieve full decarbonisation.

In total, GFMA has estimated that over USD 7 trillion would be required over 2020-2050 to decarbonise the industry, an estimate that is most likely to be upwardly revised given the nascent stage of many of these technologies.

Financing the transition

The amounts involved are massive and will require both public and private sector involvement as well as regulatory frameworks to foster them. It is no coincidence that flagship infrastructure stimulus plans announced by both the US and the EU aim to modernise and future proof the regional infrastructure stock, making it greener and smarter.

The Biden administration's USD 1.2 trillion infrastructure bill contains significant allocations towards climate change related initiatives. USD 65 billion has been allocated towards energy transmission and grid upgrades, USD 7.5 billion towards building out a national network of 500,000 EV chargers and USD 66 billion to modernise and expand the country's rail network. In addition, USD 90 billion has been assigned to public transit, expanding public transit options and replacing old vehicles with clean, zero emission ones, and USD 55 billion to upgrade the country's water infrastructure in addition to significant investments in roads, bridges, ports and airports. The administration's proposed "Build Back Better Act" seeks to similarly foster the financing of green energy through the provision of tax credits for clean electricity generation, electric vehicles, energy efficiency, CCS, as well as clean hydrogen production.

These investments are much needed given that the US's energy infrastructure is largely obsolete, a fact highlighted by the American Society of Civil Engineers, which gave the country's energy infrastructure a D+ in its 2017 report card. The report stated that the majority of the country's transmission and distribution lines are exceeding their 50-year life expectancy and its more than 640,000 miles of high-voltage transmission lines are at full capacity.

Similarly, the EU's EUR 1 trillion Green Deal sets out a pathway for the region to achieve carbon neutrality by 2050. Key pillars include the increase of the EU's offshore wind capacity from 12GW to 300GW by 2050; the further development of green hydrogen, with the installation of 40GW of capacity by 2030; the expansion of circular economy initiatives; the acceleration of the renovation of the region's building stock; the expansion of high-speed rail traffic; the further penetration of EVs within the light vehicle market; the expansion of electric battery and hydrogen refuelling and charging stations; and the allocation of 35% of its EUR 100 billion Horizon R&D budget towards the development of climate technologies. Though still falling short of the required level of financing, these programs seek to foster climate mitigation efforts and are indicative of the level of ambition and financing that will be required on the path to net-zero.

Investment opportunities

Importantly for us as investors, this super-cycle in upcoming investments presents significant opportunities. Our focus has been on solutions providers with strong intellectual property and a leadership position in their industries. We look for companies with technologies that enhance mission-critical parts of the end product, often choosing to invest with lesser-known companies down the value chain that are shielded from the commoditisation that characterises parts of the industrial space.

Eaton, the US power management company, is a key beneficiary of the shift towards electrification. During its annual analyst day, held in March 2021, Eaton outlined its vision for the years ahead, as the transition to a low-carbon economy accelerates and as "everything as a grid" becomes a reality. As the sources of electricity become increasingly renewable and the uses of power more electric, the electrical industry's role will gain in importance, becoming the central switchboard that powers the future.

"Everything as a grid" translates into "homes as a grid", "offices as grid" and "datacentres as a grid", fuelling demand for edge computing and distributed IT and leading to dramatic changes in the electrical value chain. Eaton's decades-long domain expertise, rich IP, extensive network of partners and distributors and large installed base place it exceptionally well in this rapidly evolving market.

In fact, Eaton participates across the lifecycle of different energy transition projects. EV charging infrastructure is expected to be a revenue-generating USD 0.7-1.2 billion opportunity by 2030, with Eaton looking to participate in 12-20,000 EV multi-charging projects in Europe and the US by 2030. Larger-scale infrastructure projects will add additional revenue opportunities, with examples including flagship highway high-voltage projects in the US, Canada and China. Microgrids are expected to be a USD 40 billion market, supporting carbon footprint reduction targets as well as enhancing grid resilience, translating in a USD 0.4-0.7 billion opportunity for Eaton by 2030, with the company already participating in over 600 projects to date. Finally building applications is as another key opportunity, with Eaton tapping into demand for zero-energy buildings. The company believes it can generate USD 5.7 billion in revenues by 2025 in this area, a 30% increase from the current levels.

Sika, the Swiss specialty chemicals producer, is another of our holdings that is well positioned to facilitate the transition towards sustainable cement and buildings. As a provider of additives to the cement industry, it is an enabler of lower clinker cements, like LC^3 cement, which through the use of limestone and low-grade clays, can reduce the CO2 footprint of cement by 40% versus conventional Portland cement.

Similarly, Sika's new recycling process, reCO_2ver, allows for the re-use of concrete demolition waste, effectively separating it into sand, gravel and cementitious material that can be re-used. Other examples of sustainable products include the company's green roofs that increase the energy efficiency of buildings and reduce the urban heat effect, or its solar-reflective membranes for cool roofs that reduce a building's energy consumption.

These companies are not unique among our holdings. Honeywell, the industrial technology and software leader, through its Sustainable Technologies business, provides solutions for energy storage, renewable fuels, advanced plastics recycling, carbon capture and industrial autonomous solutions. Amphenol, one of the world's largest connector and sensor companies, benefits from the requirement for higher content of its products in electric vehicles in the light and industrial vehicle segments, and its leading position as supplier to the industrial battery and renewable energy segments. Finally, Raytheon, the world's largest Tier 1 aerospace engines and systems manufacturer, is a key solutions provider as the aviation industry seeks higher fuel efficiencies and ultimately moves towards electric propulsion.

Adaptation - the missing piece & the need to focus on physical risks

Despite all the innovation and investment outlined above, the sombre reality is that even with ambitious action it may be impossible to achieve the net-zero target in the timeframe required. The Intergovernmental Panel on Climate Change (IPCC) report released in August ahead of COP 26 found that without immediate, rapid and large-scale reductions in greenhouse emissions, 1.5°C and even 2°C will be beyond reach.

Following the commitments made at COP 26, the International Energy Agency (IEA) analysed the proposed actions in terms of NDCs (Nationally Determined Contributions) and the Methane Pledge, and concluded that if enforced, they would enable the world to limit global warming to 1.8°C. Climate Action Tracker, an NGO focused on monitoring climate commitments, released an analysis showing that even 1.8°C would be an optimistic outcome. In fact, in their analysis of real-world action and current policies they predicted a 2.7°C temperature increase by 2100.

It is therefore increasingly important for companies and investors to analyse not only transition risks and opportunities, but also to understand the physical risks of climate change and the likely impact of extreme weather on agriculture, infrastructure and productivity. Ultimately adaptation measures will be needed to complement mitigation action to protect human life, enhance infrastructure resilience and minimise economic loss.

As David Attenborough poignantly said, success can only be achieved through fundamental change. The decades ahead will be challenging as the world confronts climate change. However, the challenge comes along with opportunity. Companies with the knowledge and resources to facilitate the transition to a net-zero world will be exceptionally well placed to help to achieve the outcomes, whilst capturing the resultant financial returns that incentivise innovation and investment, and creating significant opportunities for long-term investors.

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