Sustainability Insights

The roadmap for fighting climate change in Europe

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- Devastating floods and extreme weather continue to underscore that Europe, and the world at large are at a pivotal moment in the fight against climate change. Decisive action is needed to meet the commitment to the Paris Agreement and the race is on; with the finishing line being "net zero" greenhouse emissions.
- The recent IPCC report pulled no punches and concluded that the Paris Agreement goals of limiting temperature rises to 1.5°C and 2°C will be exceeded this century "unless deep reductions in CO2 and other greenhouse gas emissions occur in the coming decades."
- Policymakers have stepped up their commitments, leading to a dizzying amount of legislation passed or in the pipeline. But are the climate goals realistic or just a pipedream? We take stock of climate policy in Europe, measure it against previous commitments, and see if there are any lessons to learn from Germany.
- The COP26 is pivotal in fleshing out the policy ambitions into tangible policy, in what is seen as the last chance to realistically work towards the Paris Agreement. To claim success, expect a finalisation of some of the sticking points on the Paris agreement, as well as funding commitments. The COP will also be measured by the ambition and scope of nationally defined climate change targets.
- We conclude that there are certainly reasons to be hopeful but there is a very long road ahead that will require unprecedented public and private investment. Investors will need to be part of the solution, not just be there for the ride. This isn't a hard sell, because this is the start of a mega-trend that can richly reward those that are prepared to share the vision of the innovators, corporation and policymakers in their drive to "net zero".

The ambition

The EU is "Striving to be the first climate neutral continent". The timeline for this target is by 2050, but the latest "Fit for 55" package under the European green deal is more front-loaded than previously suggested, aiming to reduce carbon emissions by 55% from 1990 levels by 2030. Once approved, the targets are legally binding through the European Climate Law. EU countries are then required to develop National Energy and Climate Plans (NECPs) so that the EU can deliver on the climate and energy targets. The EU Green Deal sets the following blueprint, that will be share at Glasgow's COP26 in November:

EU's Climate Agenda

55% reduction in car emissions and a 50% van emission by 2030	A 55% reduction in car emissions and a 50% van emission by 2030. By 2035 zero emissions from cars. Transport, including the previously exempt aviation and maritime, to also be covered by the Emissions Trading Scheme (ETS). The European Commission is also aiming to tax importers of carbon intensive goods based on the EU carbon price. Target of 1 million charging points by 2025 and 3.5 million by 2030.
35m buildings to be renovated by 2030	35 million buildings to be renovated by 2030, providing an additional 160,000 jobs in the construction sector.
40% energy provided by renewable source by 2030	40% of energy provided by renewable source by 2030. As well as an increase in energy efficiency so that primary end financial consumers of energy use 36-39% less energy by 2030. EU's announced explicit 6GW target of green hydrogen capacity by 2024 and 40GW by 2030, while seven European countries have announced 2030 targets, providing greater clarity on growth and support for investments.
49% of renewables in buildings by 2030	Renovate 3% of floor space of public buildings annually and increase use of renewable energy in heating and cooling by 1.1% annually. Target 49% of renewables in buildings by 2030.
3bn trees planted by 2030	Increase the carbon sink, through forests, soils, wetlands and peatlands, from 268Mt to 310Mt. Aims to plant 3bn trees by 2030.

Note: 1. The European Commission has released its "Fit for 55" legislation package, supporting its commitment to reduce net greenhouse gas emissions by at least 55 per cent by 2030.
Source: HSBC Global Private Banking, October 2021

It is hard for a direct comparison between the UK and EU proposals as many EU states will also have additional targets, and it can even be the case that regions/cities have their own even more ambitus goals – for example, Germany is committed to hit "net zero" five years earlier at 2045. That said, the broad goals are similar because alignment with the Paris Accord is the overriding ambition – that is to cap global temperatures to within a 1.5°C rise from pre-industrial levels.

The UK government too is aiming for carbon neutrality by 2050, with a 78% reduction form 1990 levels by 2035, which is even more front-loaded than the EU target. Other targets have been presented in the Ten Point Plan.

UK's Climate Ambition

- Increase renewable power generation through offshore wind (quadrupling output to 40GW by 2030), low carbon Hydrogen (5GW by 2030) and nuclear.
- Installation of 600,000 heat pumps every year in homes and public buildings by 2028.
- Capture carbon through investment technology to remove 10MT of carbon dioxide by 2030, as well as planting 30,000 hectares of trees every year.
- Phasing out the sale of new diesel and petrol heavy goods vehicles (HGVs) by 2040, as well as the 2035 phase out date for polluting cars and vans.
- Creating a "net zero" rail network by 2050, ensuring "net zero" domestic aviation emissions by 2040 and leading the transition to green shipping.

The actions

For even the most avid follower, it is hard to keep up with all the policy announcements over the last month, let alone the last 12-18 months. But the devil will be in the details when it comes to ensuring tangible outcome. We've sifted through the key EU and UK pledges to take stock of the broad funding commitments that turns dreams to a reality.

The key components of the European Green Deal

EU Emissions Trading System

Set up in 2005, the European Commission (EC) estimates that this scheme has "successfully brought down emissions from power generation and energy-intensive industries by 42.8% in the past 16 years". This is a 'cap and trade' system, where there is a cap on carbon emissions in 'installations' within the EU. The proposal is to increase the cap by 4.2% each year, almost doubling the previous commitments. Installations can then trade with each other, and as there are limited allowances these carry a value (chart). At the end of the year an installation should have enough allowances to cover their emissions, else they are heavily fined. As a part of the "Fit for 55" package, road and transport emissions are proposed to be included, which could raise fears of protests due to their impact on the more vulnerable. To tackle this the EC has recommended "Member States should spend the entirety of their emissions trading revenues on climate and energy-related projects." as well as setting up the €72bn Social Climate Fund to aimed at providing green investment skewed towards helping the more vulnerable.

Carbon Border Adjustment Mechanism

To prevent cheaper imports of carbon intensive goods that could be produced in countries with less climate mitigation costs, the EC has proposed a Carbon Border Adjustment Mechanism (CBAM). When fully implemented by 2026 this is expected to raise about €10bn a year. This will initially affect the cement, fertiliser, iron, steel, electricity and aluminium sectors.

Energy Taxation Directive

The Energy Taxation Directive (ETD) sets the minimum rates of taxation on fuels for heating, transport and electricity. The EU argues that fossils fuels are subsidised to the effect of €40bn (in 2016), and tax rates aren't aligned to the pollution caused by each fuel. In the first update since 2003, the new ETD would tax in proportion to the level of pollution, encouraging cleaner fuels such as hydrogen.

Aviation Fuel

The EC has proposed regulating for an increasing amount of Sustainable Aviation Fuel (SAF), starting a 2% in 2025 and rising to 63% by 2050.

EU

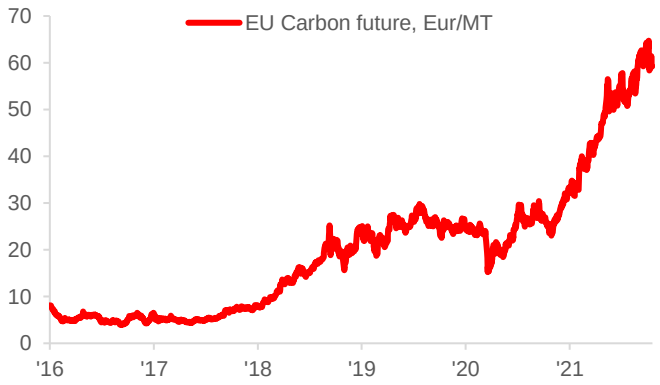
Funding will be achieved through an allocation from the EU budget and borrowing as part of the Next Generation EU package. In total, around one third of the €1.8tn investments from this funding (€2bn in today's money) will tackle climate change as part of the European Green Deal. Prompted by the COVID crisis, the EU agreed to tap capital markets for €800bn in today's money to pay for the Next Generation EU fund between now and 2026 – that's about €150/yr.

The centrepiece of Next Generation EU with €723.8 billion in loans and grants available to support reforms and investments undertaken by EU countries – called the Recovery and Resilience Facility (RRF). The aim is "to mitigate the economic and social impact of the coronavirus pandemic and make European economies and societies more sustainable, resilient and better prepared for the challenges and opportunities of the green and digital transitions." Member States are working on their plans to access the funds under the RRF and are required to spend 37% tackling climate change. Grants will amount to €338bn with Spain and Italy receiving the lion's share for the largest economies with €69.5bn and €68.9bn, respectively. This is because one of the criteria for allocating the funds - other than population size, the inverse of GDP per capita and amount of lost GDP over the pandemic - was average unemployment in the five years until 2019. This will be almost completely funded with the issuance of EU-Bonds and EU-bills, which was seen as a large step in the further integration of the EU.

In June the EU issued €20bn in 10-year bonds, the largest institutional issuance ever in Europe. In total the EC plans to raise €80bn this year in bond issuance.

The European Green Deal is the channel for directing climate change investments. This will issue the tools to deliver on the European Climate Law that will legally bind the carbon reduction targets, with the first review of progress towards the goals in September '23, and then every five years afterwards.

Carbon prices have exploded as EU moves to lower emissions targets



Source: Bloomberg, HSBC Global Private Banking, October 2021. Past performance is not a reliable indicator of future performance.

Germany: A case example

There are a number of lessons to be learnt from the German experience. The country actually achieved its self-imposed reduction target that was set in 2007, but only thanks to the pandemic. Total emissions were 1,250m t (carbon dioxide equivalent) back in 1990, the year of German unification. The target was set at -40% in 2020 – the actual result was -40.8%, down to 739m t. Without the pandemic-driven recession Germany would have missed the target by 3-4%.

Lesson 1

The political and financial effort to achieve this reduction was enormous. To achieve an even bigger change in the coming three decades will require a whole new framework (e.g. more determined CO2 pricing); there will be no point in trying to just optimise the existing structures even more. The margins for implementing climate policy can also be very tight: The Green party has come under heavy criticism for pushing for a 16 cent tax per litre on fuel by 2023, which damaged their poling ahead of this Autumn's election. Likewise, when France tried to introduce a 10 cent increase on fuel, the 'Yellow Vests' movement was born. Furthermore, the UK government has dodged slated increases in fuel duty despite the clear case for driving consumers towards electric vehicles. Therefore, when the public impression is that taxes are targeted at the more vulnerable, there can be a sharp response that, which the politicians are keen to avoid.

Lesson 2

Given the different degrees of fulfilment in different sectors 1990-2020 it is quite obvious that a flexible approach is needed. Some sectors will manage to save even more than initially planned (in Germany it was power generation in particular, beating the minimum target by more than 20% - 221m t actual vs. 280m t target); others will struggle to deliver

Lesson 3

It is easier for big players to deliver (such as the energy/utility sector) – they have deep pockets and access to political decision makers so they can set the scene according to their needs

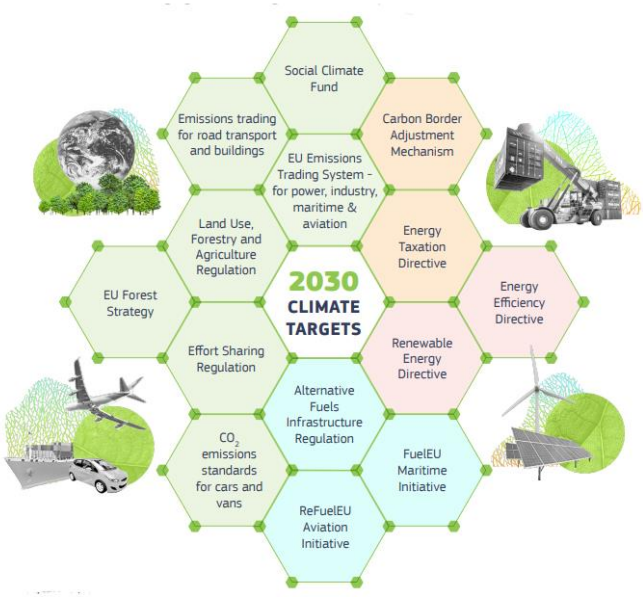
Lesson 4

It is much more difficult to deliver when you need literally everybody to play along – such as in mobility and in residential heating. In Germany both sectors underperformed. Such challenges have also been mirrored by the recent Green Homes Grant in the UK, where only a fraction of the £1.5bn fund was spent before it was wound down.

Lesson 5: You need a bit of luck.

Lesson 6: It can be done.

Delivery of the European Green Deal



Source: European Union; HSBC Global Private Banking, October 2021

UK

After leaving the EU, the UK preserved the ETS, keeping the 'cap' and 'trade' system.

Within the 'ten-point plan' announced last November the UK Government has committed to spending £12bn by 2030. £1.3bn will be used to build out electric car changing infrastructure, while both hydrogen and nuclear are in line for around £500m in investment.

About £1bn has been committed towards green investment in public buildings.

£1bn investment to support the setup of 4 Carbon Capture, Usage and Storage (CCUS) industrial clusters by 2030 (an extra £200 on top of that already spent announced in the ten-point plan).

The bulk of the funding will be split between "greener ways of travel including cycling, walking, and buses" (£5bn) and protection of coastal areas and flood prevention (£5.2bn), with the latter point more about mitigation of the climate change impact rather than tackling the root cause.

Can any lessons be learned from past experience in Germany?

The role of carbon on climate change has been understood for some time but it is fair to say with hindsight, that global leadership has been relatively slow to react. Yet some countries have been more proactive to tackle the climate risks, and government policy in Germany in an example of this. Like many Western governments in the 60 and 70s energy policy was more

reactive, to the growing supply of cheaper (but not cleaner) alternatives from abroad. Carbon taxes were there to protect and subsidise the domestic hard coal industries, with little thought about the environment, but even they couldn't arrest the decline. Nuclear power further sealed the fate of the more labour intensive coal industry across Western Europe. In the US, action was in response to health concerns over water and air pollution, with President Nixon forming the EPA in 1970.

During the 1980s, climate change moved more into the political arena, not least because of the public awareness of the hole in the ozone layer, and by 1988 at the Toronto Conference, the chairman of the International advisory group on greenhouse gases, Professor Hare, predicted that a doubling of CO2 in the atmosphere would lead to an increase in the global surface temperature by between 1.5°C and 4.5°C. This was followed by the "earth summit" in Rio de Janeiro and then eventually by 1997, in the third Conference of the Parties (COP-3) at Kyoto there were the first legally binding climate change commitments – one of which was to reduce carbon emissions by 5% from 1990s levels sometime between 2008 and 2012.

While in the US there were plenty warnings of the need for a cleaner future, Germany was making greater strides in implementing policy amid the stark warnings from the COP meetings. There are a number of factors behind this, but a combination of activism and a political structure that gives more influence to smaller parties has been key. The Green party quickly gained a foothold in politics because they could tip the balance of power to a coalition with the SDP, making mainstream policy more "green" as a result.

The role of the private sector and the demand for sustainability from the consumer is a huge plus, compared to even just a few years ago. The European Commission (EC), as part of its sustainable finance strategy, has introduced a new green bond 'gold standard'. By creating a common EU taxonomy of sustainable classifications, as well as a comprehensive disclosure scheme, the EC is providing the framework to lubricate a market that is underpinned by central banks in both the UK and EU as asset purchases favour more sustainable corporates, while the pension reform in the UK is pushing investor demand towards investing in sustainable business models.

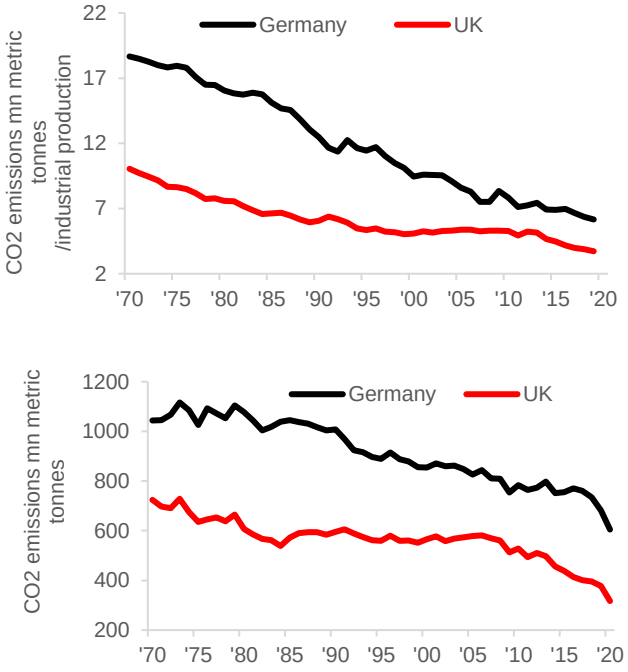
Cost is another reason to hopeful. The cost of solar panels, for example, has fallen dramatically: in less than a decade the cost of solar panels has fallen five-fold, helped by China's drive to lead in clean technologies and the increased demand providing economies of scale. Nuclear energy, until recently, was the mainstream alternative to fossil fuels, by now it struggles to compete with alternatives such as wind or solar.

Like most of the Western hemisphere, Germany has the tailwind of de-industrialisation, but its achievement still compares favourably, when viewed alongside industrial production and measured against other countries. Amid the climate of stronger collaboration, increased private sector involvement, and more affordable and sophisticated energy alternatives there is greater hope that these ambitious government targets can be met.

It was as early as 1824 that mathematician and physicist Joseph Fourier argued that Earth would be too cold if it simply relied on the heat from the sun, suggesting that the atmosphere was insulating and regulating the temperature. To help interpret his insight, he would compare the surface of the earth to air in a box with a glass cover, following experiments performed in the previous century by another physicist, Horace-Bénédict de Saussure, with the panes of glass analogous to the 'greenhouse effect'. A later experiment by American Eunice Foote showed that Carbon Dioxide (CO2) and water vapour retained solar heat three years before, in 1859, John Tyndall narrowed down the cause of the Greenhouse effect to the absorption of long-wave infrared radiation by certain gases. He even considered the impact on earth's climate, saying "Such changes may in fact have produced all the mutations of climate which the researches of geologists' reveal".

Later work on the atmospheric concentration of CO2 by Charles David Keeling in 1958, confirmed the man-made increases in atmospheric carbon, and since then the understanding has continued to blossom.

Both UK and German emissions have fallen but Germany's have fallen more relative to industrial production.



Source: HSBC Global Private Banking, BP, October 2021

The investment opportunities

Governments can set targets and pass regulations but there is no doubt that such ambitious targets hinge on the private sector working towards the common net zero goal. The good news is markets have proudly evolved to enable sustainable investments. Green bonds' issuance has nearly doubled this year compared to last year. Even during the time of bond outflows green bond inflows have shown resilience. What's more is that yield spreads on green bonds are more often than not slightly tighter than the equivalent non-green alternative. This virtuous circle encourages firms to issue more green bonds and lowers the cost of green investment.

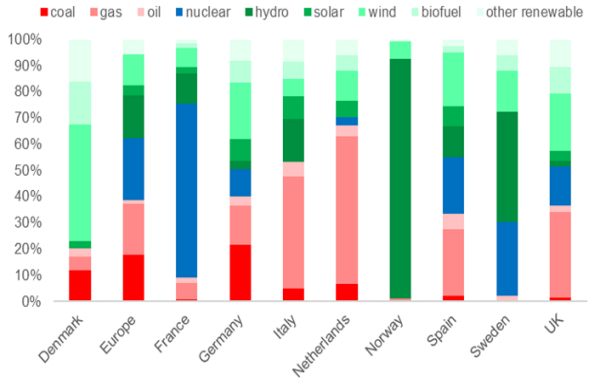
For opportunities, the obvious choice is to follow the money: Electrification of transport; renewable or low carbon energy; infrastructure redevelopment; carbon capture technologies. Some of these sectors are well established with a number of leading public listed companies, while smaller players in carbon capture or hydrogen technologies can be limited in number and hard to access as an investor.

Clean energy

There is no silver bullet in the transition to decarbonisation in energy for Europe: it will likely come from a mix between upscaling proven methods from wind to solar, to new technologies like hydrogen and old, such as nuclear. The Joint Research Centre, an expert group for the EC, concluded that nuclear was sustainable, but this is hotly contested across different states. In France, for example, three-quarters of electricity is nuclear, while in Germany, nuclear energy is due to be phased out in 2023 due to environmental concerns (the phase-out of coal is targeted for 2038). Meanwhile Poland is targeting nuclear power to move away from a predominantly coal powered electricity generation. Some have speculated that ultimately nuclear energy has to be a large part of the solution, driving stock prices of uranium manufactures higher. However, there are very few options to invest in this space in Europe and uranium prices can be highly volatile. Some countries, like Norway, are blessed with natural resources that point to one clear strategy.

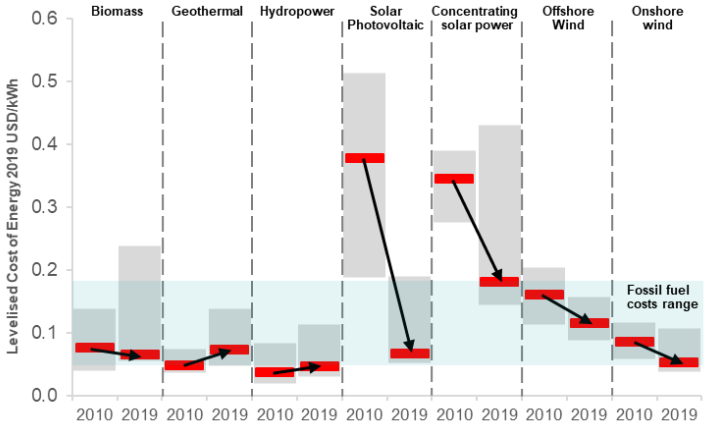
Despite its vast reserves of oil and natural gas, Norway produces virtually all its primary electricity power through renewable energy and around two thirds of that through hydropower. Eversince the late 19th century, the Norwegian state used its first waterfall to generate electricity for the Setesdalsbaren railway, and since then hydropower went from strength to strength, thanks to the advantageous topology and abundant freshwater. Such is the abundance of electricity in Norway, electric cars are extremely cheap to run and make up a third of new car sales, making Norway one of the largest markets for sales. Norway could also become a major electricity exporter and an effective 'green battery' storage centre by storing potential green energy in reservoirs. The opportunity in hydropower mainly lies in upgrading and increasing capacity due to the limited possible sites in the rest of Europe given the large potential environmental impact of building dams on the surrounding ecosystem. Also, as the chart below shows, the cost of solar and wind power production has fallen dramatically, making these relatively more attractive, and more suitable for most of the Europe.

Breakdown of Electricity production in Europe



Source: HSBC Global Private Banking, OWID Energy data, October 2021

Cost of power generation – solar and wind show the sharpest declines



Note: Grey box is the 5th – 95th percentile range of utility-scale power generation.
Source: HSBC Global Private Banking, IRENA, October 2021

Solar

With the revised EU target of 40% of power generated from renewable energy by 2030, solar and wind will be at the forefront of investment. The exact mix between the renewables will be set by each EU state in their NECP. Large-scale manufacture of solar panels in China, as well as technological innovations leading to larger photovoltaic panels, have led to a dramatic fall in prices over the last decade: by International Renewable Energy Agency estimates solar costs have declined 82% over this period.

Italy, which stands to gain €200bn from the Next Generation EU (NGEU) programme, is reported by Italia Solare to invest €1.5bn in solar panels on buildings in the agricultural and agro-industrial sectors. Another €1.1bn is expected in agrivoltaics investment – this is where land is cultivated for both agriculture and

solar power, using specialist solar panels and more shade resistant crops, which have huge potential given the vast landmass used for farming.

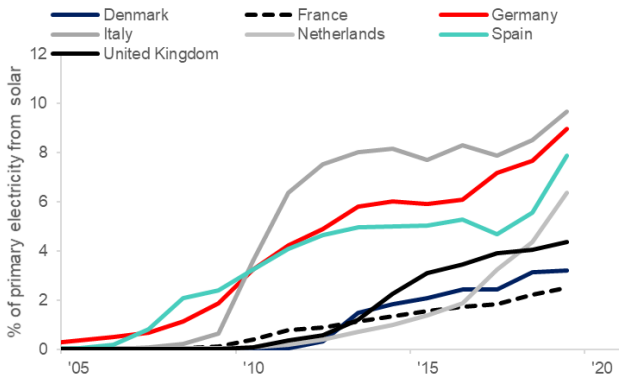
Germany installed 4.9GW of solar power last year and 6.2GW is expect for this year. Germany is already the European leader for solar power, with 0.65 kW per inhabitant – second only to Australia, and just ahead of Netherlands. By 2024 SolarPower Europe forecasts that Germany will be adding 10GW each year and utility firms and investors are very actively involved.

The Dutch are taking a broad and versaatile approach to solar installation, including floating sites, solar parks and a large array of commercial and residential rooftops. Installed power last year amounted to over 3GW and over 13GW of projects were awarded under the subsidised SDE+ scheme.

According to IHS Markit, Spain is the fifth most interesting market for investing in renewables. Unlike the Netherlands, Spain has focused on ground-mounted projects, and less on rooftop supplies, accounting for 2.8GW of 3.4GW total new supply in 2020. At the start of this year, there are a further 20GW worth of projects in the process of obtaining approval and another 97GW that have obtained connection permits. The future is very bright for solar in Spain given the huge potential for rooftop growth and continued ground-mounted investment.

Consolidation is occurring within the space as the larger companies start to gain economies of scale and acquire smaller competitors. The industry grew 22% in 2020 even under the pressures of the pandemic. Falling polysilicon prices saw Chinese companies benefit and acquire market share as a result of their lower production costs. 77% of the world's polysilicon is now produced in China.

The Netherlands: adept at finding room for solar



Source: HSBC Global Private Banking, OWID Energy data, October 2021

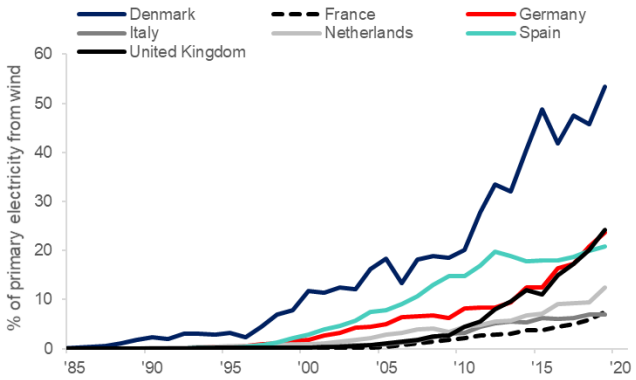
Wind power

Europe as a whole installed 14.7GW of wind power last year, with 10.5GW within the EU. Germany is leading the way for total capacity installed, through mainly onshore wind, with a total of 62GW capacity. Overall the EU has 179GW of capacity installed while the UK has 24GW of mainly offshore wind turbines. Both the UK and Germany managed to generate 27% of their electricity power from wind in 2020, ahead of Europe's total of 16% (the honour of greatest share of power goes to Denmark at 48%, followed by Ireland at 38%). Despite the lower share of total capacity, the UK punches above its weight because of the offshore capacity which can run at between 35-55%, whereas new onshore installations run at 30-35%. It will come as no surprise that wind is highly seasonal, with February being the best month, where on a blowy day almost all electricity can be generated by wind.

The combination of the CBAM and target for clean energy in the EU NextGen fund should provide strong tailwinds for EU demand for wind generation. According to WindEurope another 105GW of wind power capacity is likely to be installed over the next five years to meet the NECP plans. Of this they expect over almost three quarters will come from onshore wind, with the UK an exception as investment is ramped up in large-scale offshore wind farms, in a bid to reach the 40GW target by 2030. The UK wants to invest in innovation, with the aim of directing the investment to UK suppliers, with a target of 60% of UK content in offshore wind projects. Around £90m has been made available so far to invest in technologies, with the hope that the UK's specific focus on offshore wind will drive innovation. Rather than use public money to invest in wind, however, the government is hoping that around £20bn of private investment will deliver the goal of making the UK the "Saudi Arabia' of wind. To that end, they are constructing world's largest offshore wind farm c.50 miles off the Yorkshire coast in the North Sea and it will have a 1.4GW capacity in 2022 when it goes into service.

Globally wind power is likely to boom thanks to the Biden administration in the US also targeting renewables. Luckily for investors, Europe has some of the leading turbine manufacturers and servicers in the world, providing ample investment opportunities.

Germany and UK follow Denmark's example



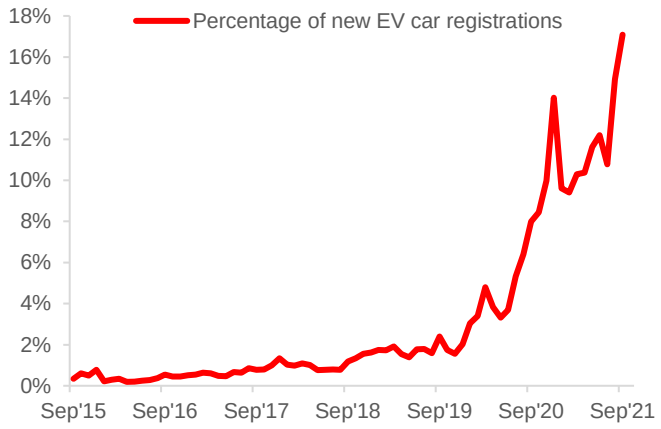
Source: HSBC Global Private Banking, OWID Energy data, October 2021

Electrification of transport

As of 2018 transport accounted for 24.6% of EU emissions, with almost half coming from cars. As noted above, both the UK and EU have ambitious targets for electrification of the car industry and, in the case of the EU there are already fines for auto manufacturers that exceed an average of 95g CO2/km cars

and 147g CO2/km for vans (although companies can pool their allowances with other companies). The migration to electric cars has taken off over the last 5 years in Germany, with 266,582 battery electric cars sold in the 12 months to July – that's an effective growth rate of 86% each year over the last five years. If demand for cars stayed at current levels (likely given the demographics in Germany) then a consistent 20% year-on-year growth in electric car sales would be enough to reach the 2035 target. The UK's more ambitious target of 2030 requires a much stronger take-up: year-to-date just over 8% of cars sold were Battery Electric Vehicles (BEV), which would translate to a required growth in sales of about 30% each year. Yet, with over 350 EV launches planned by 2025 there is growing consumer choice. On the policy side 12 countries in the EU offer bonus payments to buyers of BEVs, while most grant tax exemptions. According to analysis by BloombergNEF electric car and vans will be cheaper to produce than fossil fuel powered vehicles by 2027 as economies of scale and tighter regulations, such as the CBAM make conventional cars less competitive. As well as directly through the automakers, most notably in Germany, there are opportunities for BEV components. Around 40-70% of these are supplies through China, but there are also opportunities with Europe. Battery demand is likely to provide ample demand for commodities such as lithium and nickel, hence we believe that there is a select super-cycle in commodities that are used more heavily in clean energy (this includes copper). However, in battery production, we expect this to be more consolidated, with the top five battery producers growing their market share from 60% now to 76% by 2025.

Electric vehicles sales are booming in Germany



Source: HSBC Global Private Banking, Bloomberg, October 2021

With the EC targeting 3.5 million charging points by 2030 and the Alternative Fuels Infrastructure Directive (AFID) member states will need charging point no more than 60km apart on motorways, although a McKinsey report reckons 6 million will be needed by 2030 to reach targets. To accommodate the growing fleet of BEVs, and more ambitious targets on net zero, the UK will have to move fast to invest the £1.3bn earmarked for charging infrastructure. While funding in the EU varies across member states, it clear than it will be a boom time for charging infrastructure investment, for at least the next decade. The key players in the space are likely to be traditional oil and gas companies, some of whom have outlined significant plans for the installation of ultra-fast connectors. Most are shifting their company strategies and associated investment towards a net zero future and also partnering up, combining resources with expertise, to gain an advantage in the rapidly growing space.

Alternative fuels

Hydrogen

While battery storage has gone mainstream, it's not the only alternative to fossil fuels. Hydrogen, for example, has some devoted followers and it's not hard to see why. Hydrogen is a very versatile energy source as it can be stored or transported, much like natural gas. It also has the advantage of being used for chemical feedstock, so it can be part of the solution for greener farming.

There are a handful of ways of producing carbon on an industrial scale, and we are more focused on 'green' hydrogen produced by two primary electrolyser technologies - Proton Exchange Membrane (PEM) and alkaline. Currently 'grey' hydrogen is the cheapest, but also the most polluting method of producing hydrogen, usually using natural gas with high temperature steam. Using the steam method 10x more CO2 is emitted than hydrogen produced. 'Blue' Hydrogen still uses methods that produce CO2, but this is captured using Carbon Capture Technology (see below). Given the cost differential, three quarters of production facilities use natural gas as the input, but we have reason to believe this will rapidly change.

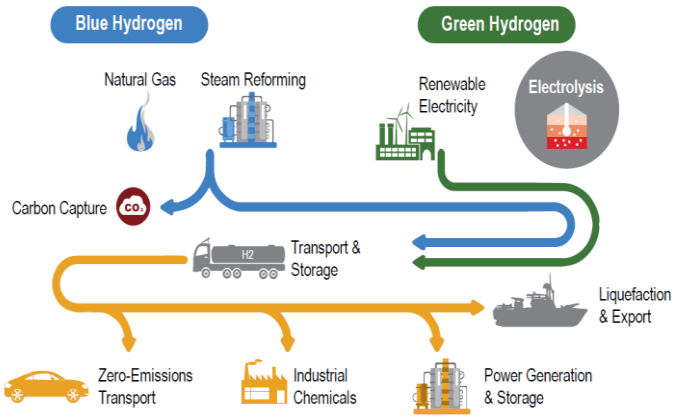
The Hydrogen Roadmap Europe proposed a roadmap for hydrogen energy development towards 2030 and 2050:

Transition to one-third ultra-low carbon hydrogen production by 2030	3,700 hydrogen refueling stations are expected by 2030
3.7 million fuel cell passenger vehicles on road by 2030	500,000 fuel cell LCVs, 45,000 fuel cell trucks and buses on road by 2030

Source: European Commission; HSBC Global Private Banking, October 2021

Why? While using water electrolysis to produce hydrogen is again very energy intensive, if the energy source is renewable there is no overall CO2 in production. With power being a large part of the cost of production, a country that has invested heavily in renewable energy, lowering the cost of power, can also lower the cost of hydrogen production. This is why we are more optimistic on PEM (Polymer Electrolyte Membrane) technology, because its quicker start-up times mean that it is better adapted to taking advantage of excess renewable energy supply. Therefore, when a windy day drives down the cost of wind power, the cost of production will also fall and hydrogen can be part of the energy storage solution to intermittent wind power.

Visualisation of low-carbon hydrogen value chain



Source: HSBC Global Private Banking, Ballard Power Systems, October 2021

We estimate the cost of grey hydrogen to be around $1.0-1.5/kg, blue to be around $1.5-2.5/kg and green to range about $4.0-6.0/kg currently. But with energy accounting for about two-thirds of the cost of green hydrogen and in Europe much of this will be tied to the increasing capacity of wind power. Once the pipeline of green hydrogen reaches about 50GW, which should be soon after 2030, combined with the continued reduction in the cost of wind power, we expect green hydrogen will be close to parity with grey. This could be sooner in some places, according to the International Renewable Energy Association (IRENA), where production plants near abundant renewable energy sources could see cost parity within five years.

The EU is on track to meet their 6GW target of green hydrogen capacity by 2024 and 40GW by 2030, according to Constantine Levoyannis, head of policy at the Hydrogen Europe association, speaking at a Reuters event. When measured against wind or solar, hydrogen looks only to be a part player, but its uses are so adaptable that adoption could take off under the right conditions. The EU thinks that even current targets could amount to €24-42bn in spending over the next decade. In July, seven European countries announced their 2030 targets, providing greater clarity on growth and support for investments. For existing plants €11bn will be invested in retrofitting with CCUS.

Thanks to the region's explicit green hydrogen targets and numerous country-level strategies – with Germany, Portugal and France, all pledging around €7bn each to hydrogen - we believe Europe is well placed to lead the charge on green hydrogen. In line with the stated target of 6GW and 40GW of electrolysers installed respectively by 2024e by 2030e, we expect a 2.1GW annual market for electrolysers in 2024e, rising to 10.1GW per annum by 2030e.

This should lead to huge growth in the electrolyser Original Equipment Manufacturers (OEMs) which saw some strong interest at the end of 2020 but some of this has abated and the prices of these companies have come back in 2021. But the application of hydrogen broadens, with heavy goods vehicles, central heating, chemical feedstock and even shorter haul flights all beneficiaries.

The UK is aiming for 5GW of production by 2030 and analysis by the Department for Business, Energy & Industrial Strategy (BEIS) suggests the 20-35% of final energy consumption will need to be hydrogen powered by 2050 to reach net zero. The UK differs in the focus on blue hydrogen, rather than just retrofitting existing plants, with funding coming from the £1bn fund directed towards CCUS. This strategy depends on the scaling up of technologies there are currently at much smaller scale.

Sustainable Aviation Fuel (SAF)

Hydrogen and batteries are likely to be part of the solution to zero carbon air travel, but the former is in the more distant future and the latter is constrained to short haul flights. A more suitable solution are the SAFs – a low carbon alternative to kerosene, made from biofuels, waste and synthetic kerosene made from the combination of clean hydrogen and CO2 (known as 'power to liquid'). Biofuels are the most common SAFs but their production can be reliant on waste from crops grown at the expense of forests, such as palm oil. Power to liquid is exciting as the potential net zero supply is limited only by the amount of hydrogen or CO2, which, in turn, is limited only by the amount of renewable energy or carbon capture.

As of 2023, "Fit for 55" proposals, would lead to a tax, which airlines had largely been exempt from, on aviation fossil fuels. This tax will ratchet higher each year for the next decade, meanwhile the ReFuelEU aviation initiative aims to put a floor on the amount of SAFs included within air fuels, starting at 2% in 2025, increasing to 63% in 2050. Therefore, as with other clean energy transformations, as combination of push (regulation) and pull (lower costs and technological improvements) should accelerate the take-up of SAFs.

The UK is consulting on SAF fuel targets of up to 10% by 2030 and up to 75% by 2050. Consultation also asks for industry for views on the limits to each type of biofuels, with those from hydro processed esters and fatty acids (HEFA) should be capped.

With this in mind some airlines are already taking action, especially as sustainability is becoming an important factor in passengers' considerations when shopping around for flights - a survey from Inmarsat found that 42% of fliers see sustainability as an important factor when choosing an airline. Those airlines that can get ahead of the regulation could be seen more favourably by the market, while low cost airlines could be more vulnerable to the higher carbon costs.

The FuelEU Maritime initiative has the ambition to work towards net zero in the shipping industry, while the UN International Maritime Organization (IMO) has made a detail $5bn proposal to accelerate the research and development of technologies, including sustainable fuels, to reach net zero. The International Chamber of Shipping claims the sustainable fuels are essential for this

There are also opportunities in the production of biofuels, of which there are many in Europe. These have an opportunity to expand production while we expect companies producing renewable fuels to triple by 2025 from 20 to 60.

SAF policies in Europe

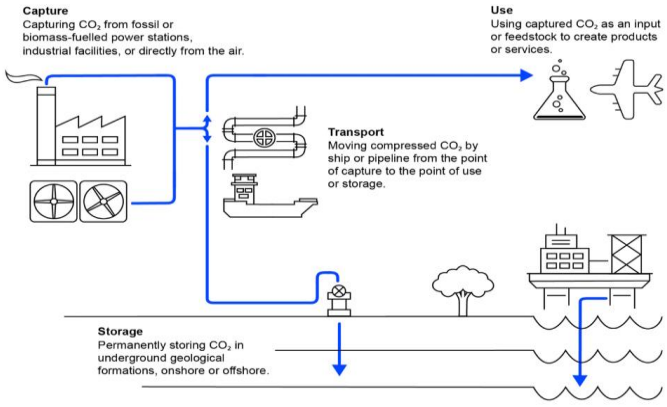
Supplier	Country	Site	Start/ *Expansio	Total Fuel Capacity, Mt/Yr
Neste	Finland	Porvoo	Existing	0
Neste	Netherlands	Rotterdam	Existing	1
UPM	Finland	Lappeenranta	Existing	0
Total Energies	France	La Mede	Existing	1
Cepsa	Spain	San Roque	Existing	0
Repsol	Spain	Cartagena	2023*	0
ENI	Italy	Venice	2024*	0
Preem	Sweden	Gothenburg	2025*	1.0
Enerkem	Netherlands	Rotterdam	2021	<0.1
Colabitoil	Sweden	Norssundet	2021	1
ENI	Italy	Gela	2021	1
ST1	Sweden	Gothenburg	2022	0
Kaldi	Finland	Kemi	2022	<0.1
SkyNRG	Netherlands	DSL01	2023	0
Sunfire	Norway	Nordic Blue	2023	<0.1
Caphenia	Germany	Dresden	2023	<0.1
TotalEnergies	France	Grandpuits	2024	0
Preem	Sweden	Lysekil	2024	1
Neste	Netherlands	Rotterdam	2025	1.0
Velocys	UK	Altalto	2025	0
LanzaTech	UK	Wales	2025	0
UPM	Finland	Kotka	2025	1
Fulcrum	UK	Stanlow	2025	0
Synkero	Netherlands	Synkero	2027	0
Engle	France	Normandy	TBD	TBD

Source: HSBC Global Private Banking, October 2021

Carbon Capture

Although carbon capture has been in operation commercially for over 20 years, capturing up to 90% of carbon emissions, it's has been left behind by renewable energy sources such as wind, solar and hydropower. Yet, as the above text on hydrogen makes clear, CCS is set to become a bigger part of the pathway to net zero, with both the IPCC and IEA saying that without it reaching net zero is very challenging. Not only does carbon capture allow for retrofitting of newer more conventional methods of power generation, but it can also tackle emissions that are hard to cut through renewables, such as cement, steel and iron. It can also offer a better alternative to offsetting carbon through reforestation, which can take longer to yield results. The captured carbon can also be combined with hydrogen to make clean SAF.

The carbon capture and sequestration chain

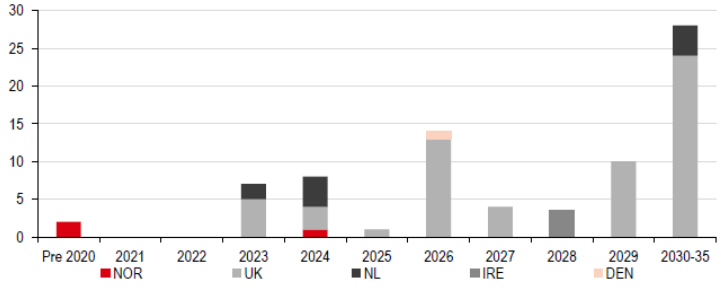


Source: IEA, HSBC Global Private Banking, October 2021

Despite the advantages, it offers no 'silver bullet' due to the variable cost, depending on project, the difficultly in working applying to some structures and escape of some carbon during the process. Investment in innovation that reduces cost and finds more flexibility in applying the technology is key to the policy approach, with the UK hoping this could lead to a surge in blue hydrogen production.

As part of the push for less polluting hydrogen production the EU intends to invest £1bn in CCS, but that is earmarked for retrofitting existing sites, unlike the UK's focus on blue hydrogen. DNV – a risk and research company - estimates that there are around 1,000 large industrial sites that could be suitable for carbon capture in Europe that include: cement plants, steel production installations, fossil power and waste-to-energy plants.

Planned capacity for CCS in Europe (m tonnes CO2 pa)



Source: HSBC Global Private Banking, Rystad Energy, October 2021

Building materials

Since the beginning of 2021, all new buildings constructed within the EU must be nearly zero energy buildings (nZEBs), and that all new buildings occupied and owned by public authorities constructed after 31 December 2018 must have been nZEBs.

On top of this, the "Fit for 55" package also has the proposal that 3% of floor space in public buildings should be renovated.

While this should lead to plenty of work for construction firms, the CABM is likely to impact cost of inputs, such as cement, iron or steel from 2026, when the EC aims for it to become operational (by 2023 EU imports would have to supply detail of the emissions embedded in the imports).

The outlook is further complicated by the lack of a clear definition of nZEBs across EU states, and also to what point the emissions involve with construction of retrofitting should be accounted for. While nailing down regulations is an ongoing process, a report from the EC expects that energy renovation investments will likely have to exceed non energy renovations. The 2019 report also claims that "*additional work force is needed if the intensity of energy renovations (speed and depths) should increase significantly in the next few years. Additional spill-over effects would be generated amongst manufacturers*". Clearly this points to increased demand across Europe for the building industry and it seems, on balance, that despite the potential for rising costs the vast investment in this area means that we will likely be digging for opportunities for years to come.

The impact on commodity prices is likely to be more uneven than the super-cycle witnessed during the first 10 years of the millennium. Metals used in the building of wind turbines, retrofitting buildings or electric cars should be in constant demand. These include Nickel, Lithium and Copper. Meanwhile oil, coal and gas will be faced with higher taxes as well as more uncertain demand. Higher taxes on energy intensive materials such as cement and iron may also dampen demand or limit profit margins across the supply chain.

Turning to the past for inspiration, the EU has launched the New European Bauhaus initiative. There will be a fund of €85m, plus a number of policies, aimed at spurring creative development in design to provide access for goods that are circular and less carbon intensive. The original Bauhaus was formed in 1919 with the aim of radically reimagining architecture and design, making is accessible and increasing its utility. The moment was highly influential and illustrates how changes at the design stage can have a profound impact on construction techniques and productivity.

The Bauhaus building in Dessau

Source: Wikipedia; HSBC Global Private Banking, October 2021

Some areas need more clarity

All the "Fit for 55" proposals still need to be approved by European Parliament and the implemented in NECPs, so it is hard to imagine all these proposals with ease through without amendments. Furthermore, some of the targets, such as those in reforestation and reducing emissions in agriculture or constructions are lacking in definition and more consultation with industry groups is needed. There can also be difficulties in policing the new rules of collation of taxes. For example, the International Chamber of Shipping points to the operational difficulty in the proposal that ship operators rather than fuel suppliers should have the responsibility of meeting the legal requirements for fuels. There should also be more details to come ahead of early November's COP26, while in the EU the NCEPs will have to add more flesh to the bone of the border EC targets.

Central banks and pensions to play a helping hand

The BoE has already announced that it will skew its corporate bond purchases (as part of the quantitative easing programs) towards companies with a more favourable ESG profile. The BoE will tilt its bond portfolio to "high climate performers", rewarding those companies that can transition away from a high carbon footprint. We expect the ECB will follow suit with a similar strategy.

In the UK, pension schemes of more than 100 members already have to lay out policies on ESG that they consider to be financially material. Draft proposals of the UK Pension Schemes Act 2021 go much further by calling for pension schemes to set out the climate change risks, including downside scenario analysis of rising global average temperatures.

And so does the private sector

In early July, the EC published its proposal for the EU Green Bond Standard (EUGBS). Although voluntary, should the standards get approved by European legislators, only a bond aligned with these standards can be called a "European green bond". The EC hopes this will set a gold standard that will get global take-up which should benefit both issuers and holders. There are four main requirements:

- **Taxonomy-alignment**: The funds raised by the bond should be allocated fully to projects that are aligned with the EU taxonomy.
- **Transparency**: Full transparency on how the bond proceeds are allocated through detailed reporting requirements.
- **External review**: All European green bonds must be checked by an external reviewer to ensure compliance with the regulation and taxonomy alignment of the funded projects.

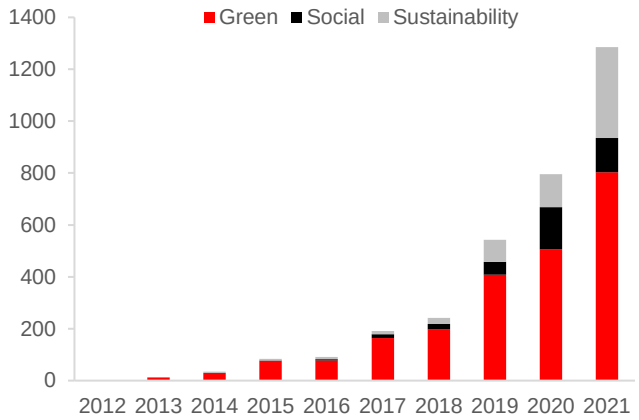
- **Supervision by the European Securities Markets Authority (ESMA) of reviewers**: External reviewers providing services to issuers of European green bonds must be registered with and supervised by the ESMA.

Although the taxonomy still needs work, we think that the industry should be able to adhere to the requirements, which will also help provide clarity and security to investors, helping the market grow and provide funding for green projects. Performance shouldn't suffer either as most green bonds trade with credit spreads that are slightly lower than the equivalent non-green bond.

The UK issued the first green gilts in September 2021, with a second tranche expected later in 2021. It is expected to issue a minimum of £15bn by March 2022. They will fall into 6 categories, with each one aligned to UN Sustainable Development Goals. These are: Clean Transportation; Renewable Energy; Energy Efficiency; Pollution Prevention and Control; Living and Natural Resources; Climate Change Adaptation. The UK government wants to go further than the EU in green standards, setting up the Green Technical Advisory Group (GTAG) which hopes to add more rigorous and ambitious standards to the taxonomy, such as singling out hydrogen.

With both the EU and UK it is clear the market for financing green investments is growing deeper and will play a crucial part of the transition to net zero.

ESG bonds' issuance has surged



Source: HSBC Global Private Banking, Bloomberg, October 2021

Conclusion

Heading into the COP26, there is a sense of urgency, that targets need to be more front-loaded to realistically meet climate change goals. The aim of the COP will be to set detailed policy that turns ambition into reality. As Europe has shown, each country will need to have a different approach, based on their natural resources and starting positions. For example, in Norway, as well as paying 25% VAT, buyers are faced with hefty purchase taxes on cars, where the overall tax burden is around the same price as the car itself. This gave policymakers, looking to encourage electric cars, a large lever to pull by waiving of this tax for electric vehicles. Alongside additional policies, electric vehicles now account for 40% of sales.

The UK's approach is to focus more on carbon capture and wind power, given the offshore wind supply and existing natural gas derived primary power output, while the more obvious choice for Spain is solar power. Industrial demand will also shape policy, particularly with respect to imports and public opinion. This will vary across Europe, suggesting ongoing negotiations and compromises on top of NECPs. Therefore, there is not 'one size fits all' approach and a broad thematic investment exposure would better capture the various opportunities – especially when the technological change and policy environment is moving so quickly.

The migration to cleaner energy will also bring costs down, which will likely change consumption patterns, particularly as consumers look buy more sustainable goods. For example, renting goods rather than outright purchases could shape demand more in the future – for example, when Ms. Carrie Symonds married PM Boris Johnson, she reportedly rented an almost £3,000 dress for £45, shining the light on the 350,000 tonnes of clothes that are estimated to go to landfill in the UK each year (according to Clothesaid).

The adoption and development of new technologies and wider adoption of proven methods fit into our broad umbrella theme of **'Investing in a Sustainable Future'** as well as touching on '**Digital Transformation'** through our '**Smart Mobility'** theme. Some 'pure play' companies have seen very strong investors' interest on the back of the clear growth opportunities, but companies that can adapt and contribute towards 'net zero' should also have an edge. This opens the door for good stock selection, where an experienced analyst can chart a company's progress to net zero, as well as assess the risk to their business model. It's increasingly clear that central bankers and broader policy is migrating towards more sustainable investments, providing cheaper funding for companies that tackle climate change. In other words, sustainability is fundamental to the investor landscape already, and this will only increase with time.

Risk Disclosures

Risks of investment in fixed income
There are several key issues that one should consider before making an investment into fixed income. The risk specific to this type of investment may include, but are not limited to:

Credit risk
Investor is subject to the credit risk of the issuer. Investor is also subject to the credit risk of the government and/or the appointed trustee for debts that are guaranteed by the government.

Risks associated with high yield fixed income instruments
High yield fixed income instruments are typically rated below investment grade or are unrated and as such are often subject to a higher risk of issuer default. The net asset value of a high-yield bond fund may decline or be negatively affected if there is a default of any of the high yield bonds that it invests in or if interest rates change. The special features and risks of high-yield bond funds may also include the following:

- Capital growth risk - some high-yield bond funds may have fees and/ or dividends paid out of capital. As a result, the capital that the fund has available for investment in the future and capital growth may be reduced; and
- Dividend distributions - some high-yield bond funds may not distribute dividends, but instead reinvest the dividends into the fund or alternatively, the investment manager may have discretion on whether or not to make any distribution out of income and/ or capital of the fund. Also, a high distribution yield does not imply a positive or high return on the total investment.
- Vulnerability to economic cycles - during economic downturns such instruments may typically fall more in value than investment grade bonds as (i) investors become more risk averse and (ii) default risk rises.

Risks associated with subordinated debentures, perpetual debentures, and contingent convertible or bail-in debentures
- Subordinated debentures - subordinated debentures will bear higher risks than holders of senior debentures of the issuer due to a lower priority of claim in the event of the issuer's liquidation.
- Perpetual debentures - perpetual debentures often are callable, do not have maturity dates and are subordinated. Investors may incur reinvestment and subordination risks. Investors may lose all their invested principal in certain circumstances. Interest payments may be variable, deferred or canceled. Investors may face uncertainties over when and how much they can receive such payments.
- Contingent convertible or bail-in debentures - Contingent convertible and bail-in debentures are hybrid debt-equity instruments that may be written off or converted to common stock on the occurrence of a trigger event. Contingent convertible debentures refer to debentures that contain a clause requiring them to be written off or converted to common stock on the occurrence of a trigger event. These debentures generally absorb losses while the issuer remains a going concern (i.e. in advance of the point of non-viability). "Bail-in" generally refers to (a) contractual mechanisms (i.e. contractual bail-in) under which debentures contain a clause requiring them to be written off or converted to common stock on the occurrence of a trigger event, or (b) statutory mechanisms (i.e. statutory bail-in) whereby a national resolution authority writes down or converts debentures under specified conditions to common stock. Bail-in debentures generally absorb losses at the point of non-viability. These features can introduce notable risks to investors who may lose all their invested principal.

Changes in legislation and/or regulation
Changes in legislation and/or regulation could affect the performance, prices and mark-to-market valuation on the investment.

Nationalisation risk
The uncertainty as to the coupons and principal will be paid on schedule and/or that the risk on the ranking of the bond seniority would be compromised following nationalization.

Reinvestment risk
A decline in interest rate would affect investors as coupons received and any return of principal may be reinvested at a lower rate. Changes in interest rate, volatility, credit spread, rating agencies actions, liquidity and market conditions may significantly affect the prices and mark-to-market valuation.

Risk disclosure on Dim Sum Bonds
Although sovereign bonds may be guaranteed by the China Central Government, investors should note that unless otherwise specified, other renminbi bonds will not be guaranteed by the China Central Government.
Renminbi bonds are settled in renminbi, changes in exchange rates may have an adverse effect on the value of that investment. You may not get back the same amount of Hong Kong Dollars upon maturity of the bond.
There may not be active secondary market available even if a renminbi bond is listed. Therefore, you need to face a certain degree of liquidity risk.
Renminbi is subject to foreign exchange control. Renminbi is not freely convertible in Hong Kong. Should the China Central Government tighten the control, the liquidity of renminbi or even renminbi bonds in Hong Kong will be affected and you may be exposed to higher liquidity risks. Investors should be prepared that you may need to hold a renminbi bond until maturity.

Risk disclosure on Emerging Markets
Investment in emerging markets may involve certain, additional risks which may not be typically associated with investing in more established economies and/or securities markets. Such risks include (a) the risk of nationalization or expropriation of assets;
(b) economic and political uncertainty; (c) less liquidity in so far of securities markets; (d) fluctuations in currency exchange rate;
(c) higher rates of inflation; (f) less oversight by a regulator of local securities market; (g) longer settlement periods in so far as securities transactions and (h) less stringent laws in so far the duties of company officers and protection of Investors.

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The price fluctuation of FX could be substantial under certain market conditions and/or occurrence of certain events, news or developments and this could pose significant risk to the Customer. Leveraged FX trading carry a high degree of risk and the Customer may suffer losses exceeding their initial margin funds. Market conditions may make it impossible to square/close-out FX contracts/options. Customers could face substantial margin calls and therefore liquidity problems if the relevant price of the currency goes against them.

Currency risk – where product relates to other currencies
When an investment is denominated in a currency other than your local or reporting currency, changes in exchange rates may have a negative effect on your investment.

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There is a liquidity risk associated with CNY products, especially if such investments do not have an active secondary market and their prices have large bid/offer spreads.

CNY is currently not freely convertible and conversion of CNY through banks in Hong Kong and Singapore is subject to certain restrictions. CNY products are denominated and settled in CNY deliverable in Hong Kong and Singapore, which represents a market which is different from that of CNY deliverable in Mainland China.

There is a possibility of not receiving the full amount in CNY upon settlement, if the Bank is not able to obtain sufficient amount of CNY in a timely manner due to the exchange controls and restrictions applicable to the currency.

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In the case of investments for which there is no recognised market, it may be difficult for investors to sell their investments or to obtain reliable information about their value or the extent of the risk to which they are exposed.

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