Innovation Lab

Sustainable Investment | Climate Change

COP26: Bridging the gap of climate ambition

No time to wait

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AUTHOR

Guillaume Emin
Senior Sustainable Investment Manager
+33 0 1 87 44 88
guillaume.emin@lseg.com

Patrick Hubert
Senior Sustainable Investment Manager
+33 0 1 87 44 89 04
patrick.hubert@lseg.com

Nicolas Lancesseur
Senior Sustainable Investment Manager – Head of global climate research
+33 0 1 87 44 88 92
nicolas.lancesseur@lseg.com

Overview

Following recent revisions of commitments during the UN "Climate Ambition Summit" in December 2020 and the US-led "Leaders Summit on Climate" in April 2021, we estimate that the resulting global trajectory will lead to a 2.9°C warming – a level that still falls short from the "well below 2°C" Paris target.

To bridge the gap, the collective efforts to reduce GHG emissions would need to improve significantly in the next months and during COP26 to include:

- a strong reinforcement of policy interventions to limit GHG emissions;
- some profound economic transformations in the fossil fuel consuming sectors (power generation, transport, manufacturing activities, buildings, etc.);
- a massive asset reallocation, with key implications for investors globally in relation to risk management, asset prices and investment strategies.

The impetus to do so is both desirable (given its economic and social benefits compared to the severe impact of global warming), and increasingly possible due to positive policy and technological developments.

This paper examines (i) the "ambition" gap between countries' official commitments to limit greenhouse gas (GHG) emissions and their requirements to reach the Paris Agreement objective, and (ii) key levers available to meet that goal and some likely trends to anticipate in this context.

Contents

Executive summary

COP 26 is going to take place following a historic cut of energy-related CO_2 in 2020

- Due to COVID-19, energy-based CO_2 fell by about 5.8% in 2020, which was the biggest drop since the end of World War II, and the largest in absolute terms historically.
- This level of effort corresponds to the additional reduction of GHG emissions that has to be achieved every year to align with a 1.5°C target, but emissions are already picking up.

There has been a recent strengthening of countries' commitments (NDCs) but they need to accelerate

- The US President Biden hosted a "*Leaders Summit on Climate"* on April 22-23 whose objective was to galvanize the NDCs revision process prior to COP26.
- Based on our sovereign temperature methodology, we estimated that the implied global temperature of updated countries' goals is slightly below 3°C – still far from 1.5°C, or even the 2°C targets.
- Five years after COP21, it appears that emissions evolution is far from being aligned with the one required by countries' pledges, calling for a strengthening of both long-term goals and short-term policy action.

It is possible to meet the climate goals, although it will require strong political action

- Conditions for further action seem to be converging. In addition to promising recent long-term commitments, governments are under increasing pressure from their populations to address the rising problems of climate change; Today many low carbon technologies and production processes are sufficiently mature to compete with business as usual solutions; In addition, the extremely low level of interest rates provide an opportunity for large investments, *etc*.
- An ambitious energy transition is both a desirable scenario (given its economic and social benefits compared to the severe impact of global warming), and an increasingly credible scenario, thanks to positive policy and technological developments.

The breadth and size of strengthened climate action will have huge impacts on investors

- We have only just seen the tip of the iceberg of the impacts that a Paris-aligned transition scenario would have on investment activities. Massive asset reallocation should be expected in coming years, and decades, if the world shifts to a low-carbon economy, with key implications for investors globally in relation to risk management, asset prices and investment strategies.
- High low-carbon investments are needed in energy, transportation, buildings, industrial and manufacturing sectors, or food and agriculture, translating into investment needs and opportunities across sectors and asset classes. However, the value of many existing carbon-intensive assets also appears to be overestimated, as an ambitious climate transition scenario is not fully priced in today.
- Traditional financial analysis is insufficient to adequately assess climate risks, given that climate risk cannot be back-tested, involves time horizon uncertainties, and is systemic. This calls for new data and methodologies that can support forward-looking approaches.

Section 1. How 2020 highlighted the climate challenge

During the 2015 COP21 in Paris, 195 countries agreed to limit global warming well below 2°C to mitigate the physical risks of climate change. To achieve this goal, GHG emissions will need to decrease dramatically at global scale to reach “net zero” by the second half of the century.

This paper examines the gap between current climate action and required efforts to achieve objectives in a paradoxical context. The substantial fall in GHG emissions in 2020, of around -6%, provides a good estimate for scientists. 2020 may be the first year in the history of climate change mitigation, in which the world experienced not only a decrease in GHG emissions, but a genuine reduction that aligned with global targets. At the same time, the decline was not brought by climate policies, but a global pandemic.

As a result, 2020 provides a good illustration of both the magnitude of efforts required to meet global climate targets, and the gap that remains between the requirements to achieve the climate targets and business-as-usual trends. Fortunately, the societal changes at stake with climate transition are not as painful as the restrictions and lockdowns induced by COVID-19. However, the following review of GHG emissions – in previous decades and in 2020 – can give a sense of the effort required.

Analyzing COVID-19’s climate impact in 2020 provides some insights to investors on the size of structural changes implied by a transition scenario aligned with the Paris objective. This is particularly topical as the gap between ‘current’ policies and ‘needed’ policies bring key questions for investors, who are increasingly asking for more prospective scenario thinking.

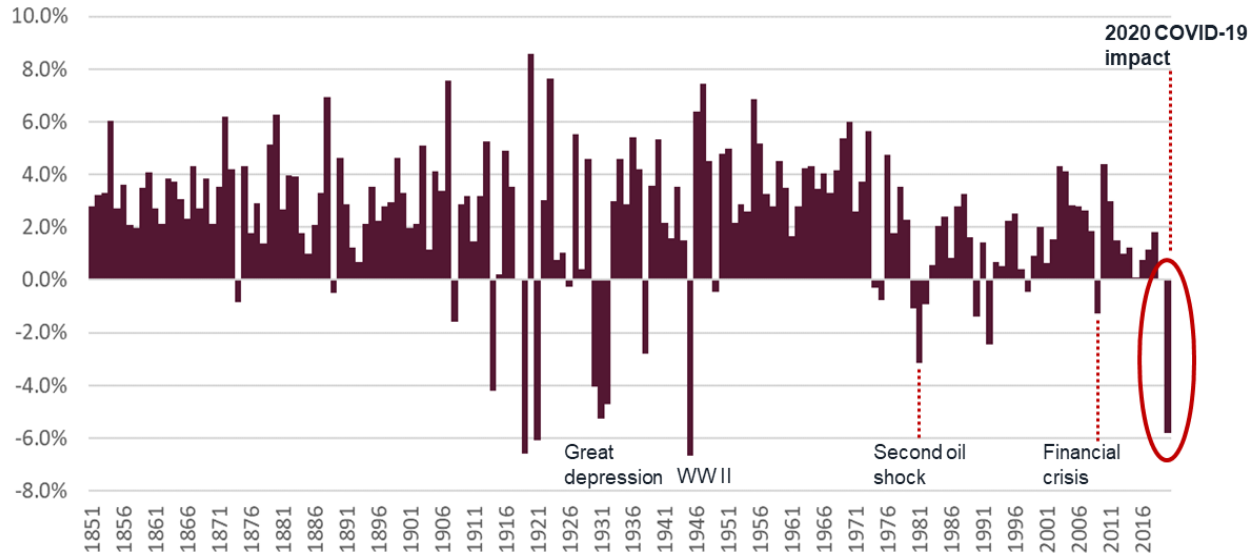
A shift towards stronger climate policies and action is necessary to reach the mitigation objective. Recent developments on political and technological aspects make this scenario increasingly credible. As this paper will discuss, greater efforts to tackle climate change would lead to significant reallocations of capital, making it increasingly important for investors to better understand today’s climate alignment gaps, both globally and with regards to their exposures to specific assets.

2020: A historical fall in GHG emissions

First and foremost, an historical fall in greenhouse gas emissions, unprecedented over the last decades, was recorded in 2020. Energy-related CO_2 fell by about 5.8% (IEA[1]), and this was the biggest fall since the end of World War II (see Figure 1). In absolute terms, it was the highest reduction in human history, echoing the broader economic and social shocks from the pandemic.

[1] IEA. Global Energy Review: CO_2 Emissions in 2020. March 2021.

Figure 1. Annual evolution of global greenhouse gas (GHG) emissions (excluding land use)



Source: PRIMAP-HIST; IEA. 2019 and 2020 data are estimates based on energy-related CO_2.

The 2008-2009 Global Financial Crisis had a far lower impact on emissions, with a 1.3% GHG drop in 2009. Likewise, the two oil shocks of the 1970s had a moderate impact. In addition, it can be noted that the trend in GHG emissions has been rising significantly in previous decades, with very few decreasing years, which highlights the fall observed in 2020 even further. There is a strong historical link between energy use and GDP growth at the world level. The effects of COVID-19 impacted both[2], resulting in the strong reductions of CO_2 emissions, particularly from the transport and industry sectors.

Yet, if mankind has to meet global climate goals, the 2020 historical cut of carbon emissions should become the new business-as-usual yardstick[3]. The international community has agreed to reach a global warming target of well below 2°C, ideally at 1.5°C. To achieve this goal, however, a 6% decrease is approximately what is required annually in the next decades. In spring 2020, several researchers anticipated a 2020 fall in GHG emissions to be of around -6%[4], which they assessed to be "comparable to the rates of decrease needed year-on-year over the next decades to limit climate change to a 1.5 °C warming"[5] (see Figure 2). Although we will hopefully find other ways than a major global pandemic, COVID-19 illustrated the magnitude of efforts required by climate goals.

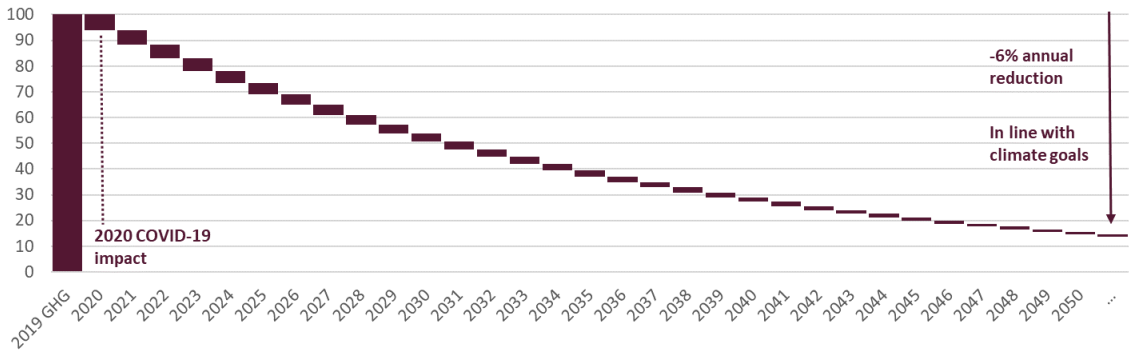
[2] The IMF estimates that, in 2020, real GDP fell by 3.3% in the world and by 4.7% in advanced economies. Source: IMF, World Economic Outlook, April 2021.

[3] Echoing to some extent the recent EU BMR regulation that requires any PAB (Paris-Aligned Benchmark) or CTB (Climate-Transition-Benchmark) to achieve a 7% reduction in carbon intensity on a year-on-year basis (measured through EV intensity).

[4] -4.2 to -7.5% depending on their sensitivity tests.

[5] Corinne Le Quéré et al., Temporary reduction in daily global CO_2 emissions during the COVID-19 forced confinement, May 2020.

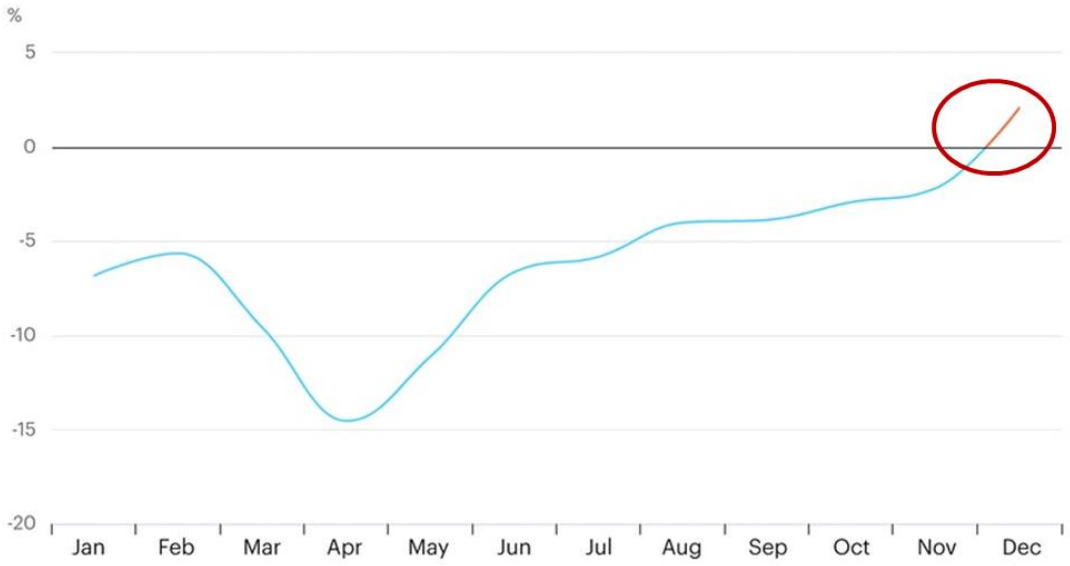
Figure 2. A 6% reduction of fossil GHG is needed every year in the next decades to stay under 1.5°C global warming: illustration on a 2020-2050 period



Source: FTSE Russell & Beyond Ratings Research.

Even carrying on with the changes brought by COVID-19 and lockdown measures in 2020 would not be sufficient as this would only extend a 6% lower level of emissions compared to 2019. Reductions in GHG emissions must be incremental in the next decades towards a net zero level[6], but COVID-19 impacts have largely been of a temporary nature. This is illustrated by the Figure 3 showing that the uptrend in GHG emissions already started picking up at the end of 2020, driven by economic recovery and a lack of investments in energy efficiency or low-carbon energy[7].

Figure 3. Monthly evolution of global CO2 emissions in 2020 relative to 2019



Source: IEA.

As a result, in December 2020, global CO_2 emissions were already back to their pre-crisis uptrend, with an increase of 2% compared with December in 2019. In countries like China, Brazil and India, the rebound in carbon emissions was even quicker and stronger.

[6] In other words, a 6% additional reduction per year corresponds to a further reduction of emissions every year.

[7] IEA, Press Release, After steep drop in early 2020, global carbon dioxide emissions have rebounded strongly, March 2021.

A massive capital reallocation needed to support transition

A positive aspect is that, in absolute terms, the impact of a 6% annual reduction of CO_2 emissions would decrease over time. However, this extra 6% reduction might become increasingly challenging to achieve over time after emissions are cut from the easiest and most obvious sectors.

In the next decade, the global emission uptrend must sharply reverse. This sheds light on the scale and speed of capital reallocation and new investment needs at stake, in the activities that can support the massive needed reduction of global GHG emissions. A shift towards significantly stronger climate action is both a credible scenario deserving particular attention, and a scenario that could materially impact investments across asset classes. This is why it is relevant to assess the gap between historical trends and climate goals.

Section 2. The COP26 momentum

The Paris Agreement is based on an iterative process. On ratifying the agreement, countries submitted a first commitment to reduce GHG emissions via their respective "*Nationally Determined Contribution*" (*NDC)*. A general review conducted with civil society and experts will take place every five years, where countries revise their commitments and submit new, and more ambitious NDCs.

The first revision is due in November 2021 prior to COP26[8]. This is a decisive test for the agreement and its ability to make countries converge towards the long-term objective.

The secretariat of the UNFCCC[9] published a NDC synthesis report[10] on February 26, 2021. At the time of writing[11], 75 countries had already revised their NDCs, accounting for about 30% of global GHG emissions. These countries generally increased their committed efforts, albeit to a moderate extent. The projected level of emissions in 2030 resulting from the revised NDCs is around 3% lower compared to the previous NDCs.

Even so, these efforts remain far from the expected minimum. If these adherent countries reach their new targets, the level of their GHG emissions in 2030 would be only 0.5% lower than their 2010 level. According to the last IPCC[12] report[13], global emissions should decrease by 45% in 2030 compared to the 2010 level to be consistent with a 1.5°C goal (and by 25% for a 2°C goal). Figure 4 below illustrates the NDCs general lack of ambition', even after revision. In 2030, the level of emissions per capita in countries which revised their NDCs would be almost twice as high as the level recommended by the IPCC to align with a 1.5°C global warming target.

It should be recalled that some of the mitigation efforts from developing countries are conditional on financing from developed countries, which committed to mobilize US$100 billion per year by 2020 for climate action in developing countries. The finance chapter of climate negotiations is key to enhance the global ambition.

[8] Initially scheduled in December 2020 but postponed due to the Covid-19 pandemic.

[9] United Nations Framework Convention on Climate Change.

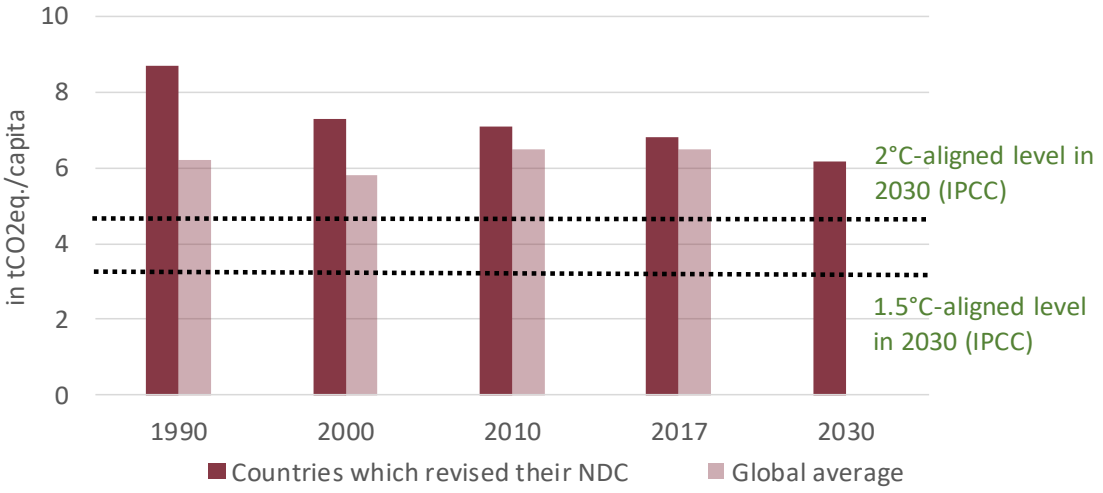
[10] Available at NDC Synthesis Report | UNFCCC.

[11] Among the four biggest emitters (China, the United States, the European Union and India), only the European Union had updated its NDC (increase of target from -40% to -55% in 2030 compared to 1990 level) at the time of the report. This report does not include the NDCs' revisions announced during the Biden's Summit, especially the US one.

[12] Intergovernmental Panel on Climate Change.

[13] IPCC. 2018. IPCC Special Report on the Impacts of Global Warming of 1.5 °C above Pre-industrial Levels […]. Masson-Delmotte *et al*. Available at https://www.ipcc.ch/sr15/.

Figure 4. Per capita emissions – historical and projected levels in 2030



Source: FTSE Russell & Beyond Ratings from the UNFCCC NDC Synthesis Report.

US President Biden hosting an international summit on climate change on April 22-23, 2021, marked the US return to the Paris Agreement after the withdrawal by the Trump administration. A more ambitious NDC was announced on this occasion, trying to galvanize efforts by the world's main economies to reduce emissions and fill the ambition gap before COP26 (see part 3.3 for more details on the summit's results).

In the next sections, we assess the ambition gap between countries' most recent commitments (taking into account the summit's outcomes) and what would be required to achieve the Paris Agreement target. To this end, a temperature indicator developed by Beyond Ratings is used to evaluate the gap at country level. Some analyses are developed afterwards in a transition risk perspective, giving insights on the policy and economic changes needed to fill that gap.

Section 3. The gap between countries' commitments and climate goals

In this study, the alignment assessment of countries' commitments is based on NDCs, whose target is usually defined at a 2030 horizon. After a rapid description of the methodology, the temperature results are provided for countries, groups of countries (OECD, EU, etc.), and at the global level. The position of individual countries can be very diverse but our results reveal a clear lack of collective ambition. Other approaches, like estimating the ambition of actual actions implemented by countries, would lead to an even worse alignment for most countries[14].

3.1. How to measure the temperature of a country commitment

In a recent report *How to measure the temperature of sovereign assets*, we present our methodology to measure the temperature of sovereign assets[15]. Our approach is based on the comparison of two variables and summarized as follows:

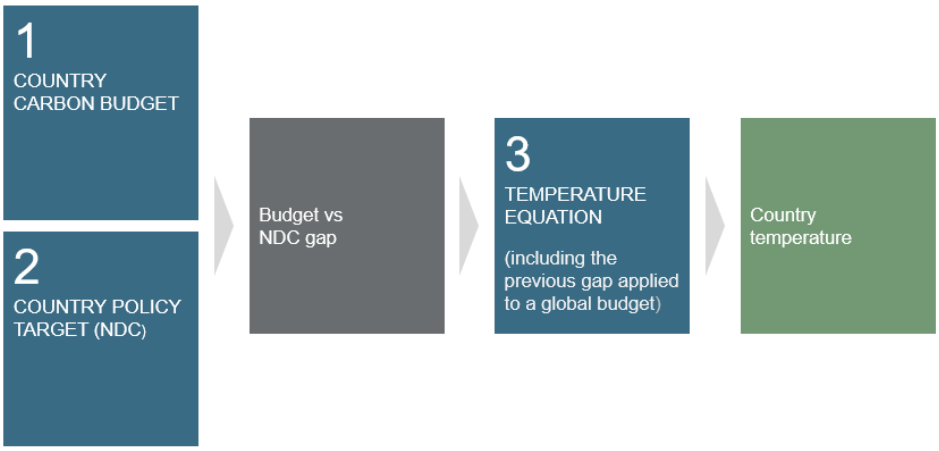
[14] See for instance the Climate Action Tracker website.

[15] FTSE Russell, How to measure the temperature of sovereign assets, 19 April 2021.

- The country's remaining GHG budget consistent with a given global warming limit (here 2°C) and depending on past and current emissions levels. The estimation of this budget is based on a statistical approach (*i.e.* our CLAIM[16] model).
- The projected GHG emissions estimated based on a country's policy commitment to limit the level of its emissions (looking at its NDC).

The comparison of these two variables allows the assessment of any gaps between a country's "share of the burden" to achieve global climate goals (level of effort to be expected, based on its climate profile) and its policy commitment (NDC goal). This gap can then be applied to the global budget in line with the selected objective (*e.g.,* 2°C). This allows the implicit global warming to be gauged if all countries have the same level of ambition.

Figure 5. Overview of the methodology to measure sovereign temperatures



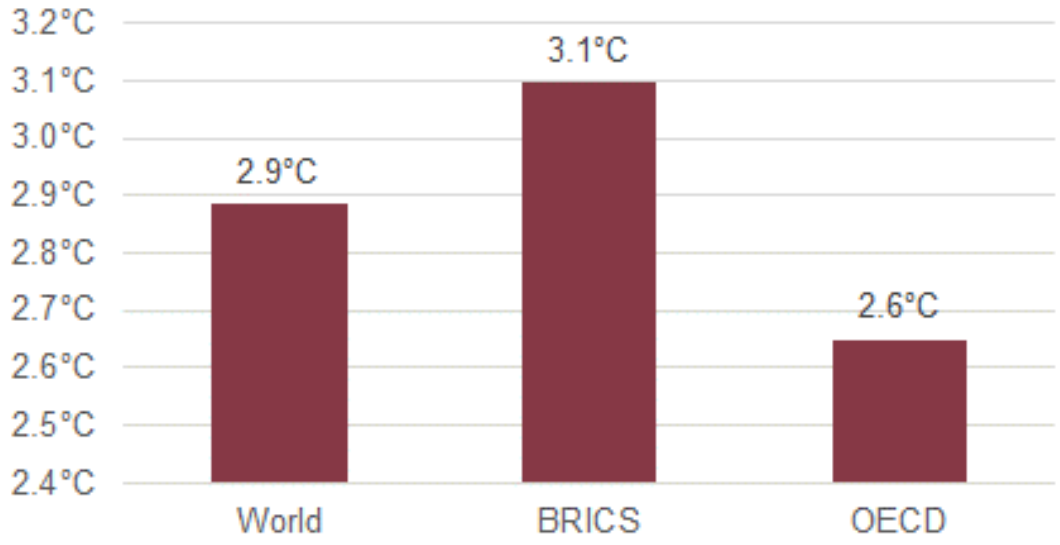
Source: FTSE Russell & Beyond Ratings Research.

3.2. Total NDC pledges imply a 3°C global warming

Looking at the results of our methodology based on countries' most recent commitments, Figure 6 describes the current global warming trajectory of NDCs, both at the global level and in selected country groups. For each country, we assess a temperature corresponding to the level of global warming implied by their NDC commitments (i.e., if all countries had a similar level of ambition). The aggregated results are weighted by countries' 2018 territorial GHG emissions.

[16] The CLAIM model enables the computation of national GHG budgets compliant with any average temperature target and time horizon (2°C compliant scenario here). This method does not assign a national budget following a unique criterion – such as "capacity" or "responsibility." It offers a statistical, and non-normative, approach, which avoids choosing between either egalitarian or "grandfathering" sharing that would be seen as non-consensual (see Giraud *et al.* 2017 for further details).

Figure 6. Implied global warming based on country NDC temperatures globally and representative groups of countries



Source: FTSE Russell & Beyond Ratings Research. Note: Based on country temperatures weighted by their 2018 territorial GHG emissions.

A main outcome of this analysis is that current country targets remain far from their alignment with the international goal of keeping global warming well below 2°C. At the global level, NDC trajectories are pointing towards a 2.9°C warming by the end of the century. The implied global warming of the OECD group is 0.5°C lower than for the emerging countries in the BRICS group, partly as a result of the lower temperatures of the European countries (see also Figure 8).

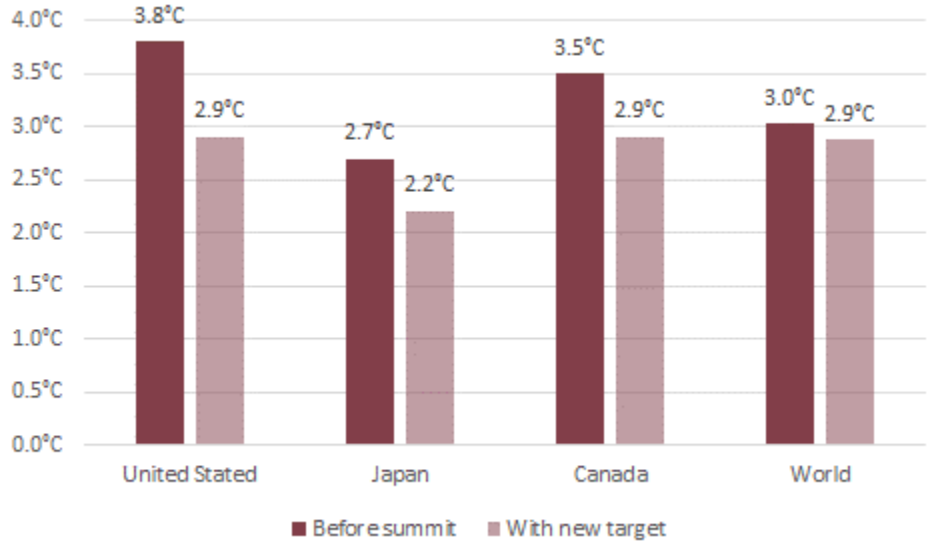
3.3. Country positions reflect diverse alignment levels

Outcomes of the "Leaders Summit on Climate"

First, it is interesting to assess the outcomes of the summit organized by the Biden's administration in April 2021. In addition to the United States, Japan and Canada also made an announcement on higher NDC's ambition. The additional efforts committed by these countries are significant, especially with Japan getting closer to a 2°C alignment. Despite these improvements in NDCs, the resulting 2.9°C implied global warming of the US and Canada remain high, which reflects the very strong carbon intensity of their economies. For instance, if the US reach its new NDC target, its level of emissions per capita in 2030 would still be higher than the EU level in 2019.

The summit was aiming to foster the NDCs revision process prior to COP26. However, the impact on the overall implied global warming is quite limited, representing a decrease of only 0.1°C, from 3°C to 2.9°C. As a result, it is critical that the collective efforts to reduce emissions improve significantly in the next months and during the COP26 summit.

Figure 7. Evolution of the NDC temperatures following the summit's new pledges



Source: FTSE Russell & Beyond Ratings Research.

NDC temperature of the 20 biggest economies

Figure 8 provides the level of implied temperature by country for the 20 main economies (based on 2020 GDP). As can be seen, temperatures vary from 6.5°C in Saudi Arabia, to below 2°C in France, Switzerland or the UK.

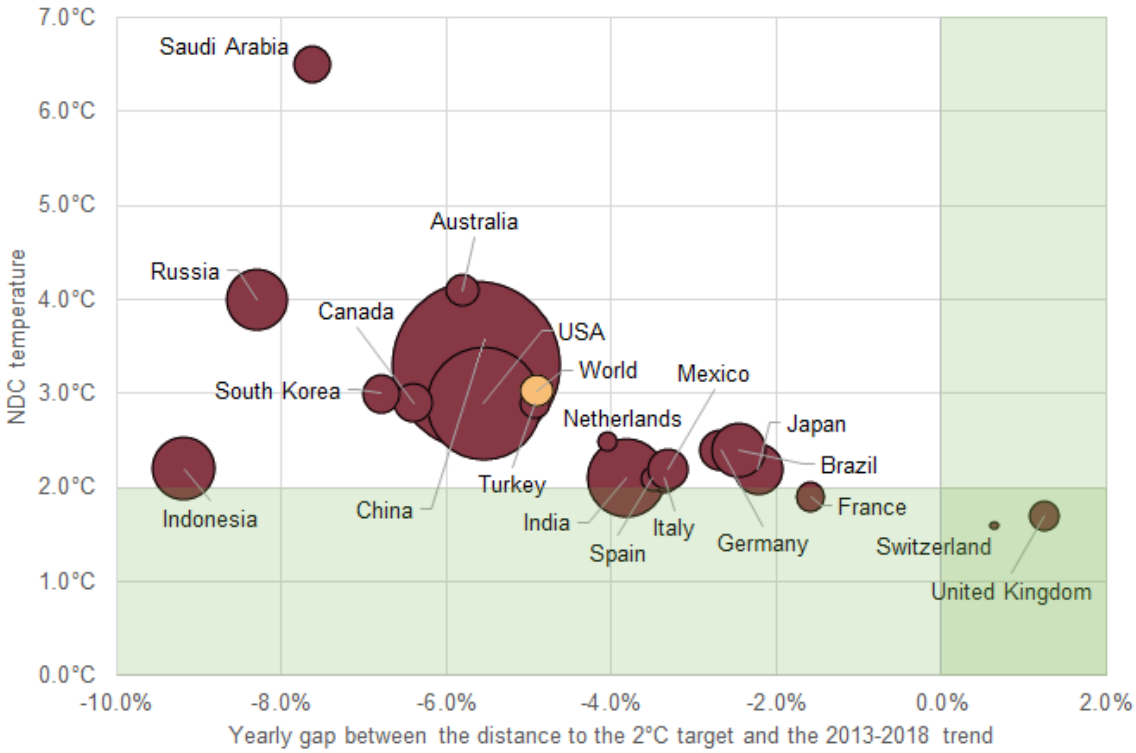
In addition to temperatures, Figure 8 shows the trends of countries' territorial GHG emissions, and to which extent they are consistent with the distance to their 2°C targets[17]. Countries with a positive gap (above 0%) between their distance to target and their 5-year trend follow the right pace of emissions reduction.

Only the UK and Switzerland have a positive evolution of emissions. These countries are the only ones to be currently aligned with a 2°C trajectory, both in terms of their NDC targets and recent trends. Although imperfect, there is a correlation between the lack of NDC's ambition and the lack of effective efforts to cut emissions. Overall, no country is aligned with a 1.5°C target within the group of the 20 main economies.

In general, this figure shows that the main emissions contributors are far from a 2°C pathway, either in terms of commitments or historical trends. As is shown in Figure 8, the misalignment of the US and China is all the more worrying as they are the two largest contributors to global emissions.

[17] The distance to the 2°C target of a country is defined based on its projected trend consistent with its 2°C carbon budget calculated with the CLAIM model for the year 2050.

Figure 8. NDC's implied global warming for the 20 biggest economies and alignment of their recent trend with their distance to the 2°C target18



Source: FTSE Russell & Beyond Ratings Research.

Note: The X-axis measures a 2°C trend alignment based on the gap between the projected CAGR[19] aligned with the 2°C target (distance to the 2°C target) and the recent GHG emissions CAGR (based on the 2013-2018 period). A positive gap means that the historical trend is consistent with a 2°C trajectory. The bubble size is proportional to the volume of territorial GHG emissions in 2018 (including LULUCF) – except for the World bubble.

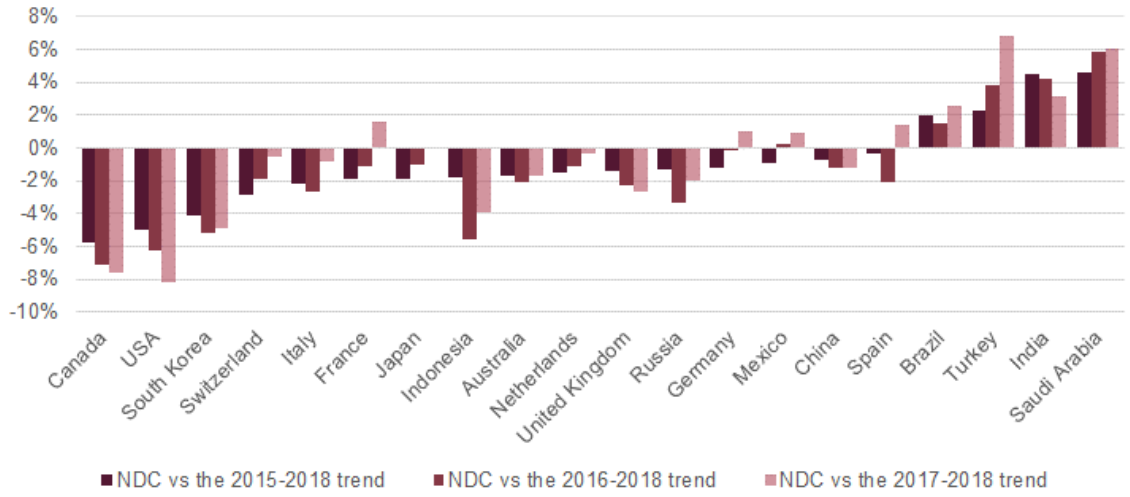
The temperature assessments described in this section are based on NDC commitments. They show that country commitments are usually not sufficient to meet the global climate goal of keeping warming well below 2°C. As suggested by the comparison of recent trends and distances to a 2°C target in Figure 8, the alignment of individual countries should also be assessed in light of past trends.

Therefore, we have also analyzed the gaps between countries' NDCs and their recent trends to evaluate whether countries are on course to respect their pledges. While we now have several years of comparable track record following the submission of NDCs, few countries have had trends in line with their latest NDCs (see Figure 9). In addition, the alignment can reflect the country's initial lack of ambition such as in Saudi Arabia. In most countries, the annual trend of territorial GHG emissions on 2015-2018, 2016-2018 or between 2017 and 2018 was insufficient compared with the annual efforts implied by their targets.

[18] The assessments for the EU Member States are based on the 2016 European NDC. We will accordingly update our assessments when the breakdown by Member States of the updated NDC submitted by the European Union in December 2020 is available (ongoing negotiations).

[19] Compounded annual growth rate.

Figure 9. Gaps between the trends aligned with latest NDCs and recent trends since 2015



Source: FTSE Russell & Beyond Ratings Research.

Note: The rates shown on this graph are the gaps between the emissions CAGR needed to achieve the NDC targets and the recent emissions CAGR. A positive rate corresponds to a performance in line with the NDC during the considered period. It should be noted that above data are based on latest submitted NDCs, that for some countries have been updated since 2015 with strengthened ambition.

3.4. How other approaches could result in different results

Long-term objectives

It is important to note that long-term commitments (usually on a 2050 horizon, above the 2030 horizon of NDCs) are not taken into account in our analytical framework. Some significant pledges have been made in recent months, including net zero targets for Japan, South Korea, and the European Union in 2050, or for China in 2060. These targets are in line with the provisions of the Paris Agreement, which assumes a global net zero emissions level in the second half of the century.

Despite these pledges, the submission of long-term strategies to the UNFCCC is not mandatory in the Paris Agreement, and very few countries have done it. Net zero objectives are very significant signals to be sent to economic actors, but targets with such a far horizon should be integrated cautiously in the evaluation of a country's ambition. We consider at this stage, for methodological and comparability reasons, that NDCs should continue to be preferred. Long-term strategies are expected to become a more important component of our assessments in the future. In addition to the long-term target, those assessments will address the consistency of the intermediary targets and the effective measures implemented by the countries.

Policies alignment

Relying on pledges to evaluate the alignment of countries (individually and collectively) on the Paris Agreement objectives is not the only possible approach. To complement this initial analysis, effective policy measures to limit GHG emissions should also be taken into account. According to

literature – see for instance UNEP (2020)[20] – the ambition gap is generally higher when considering effective mitigation actions implemented by countries.

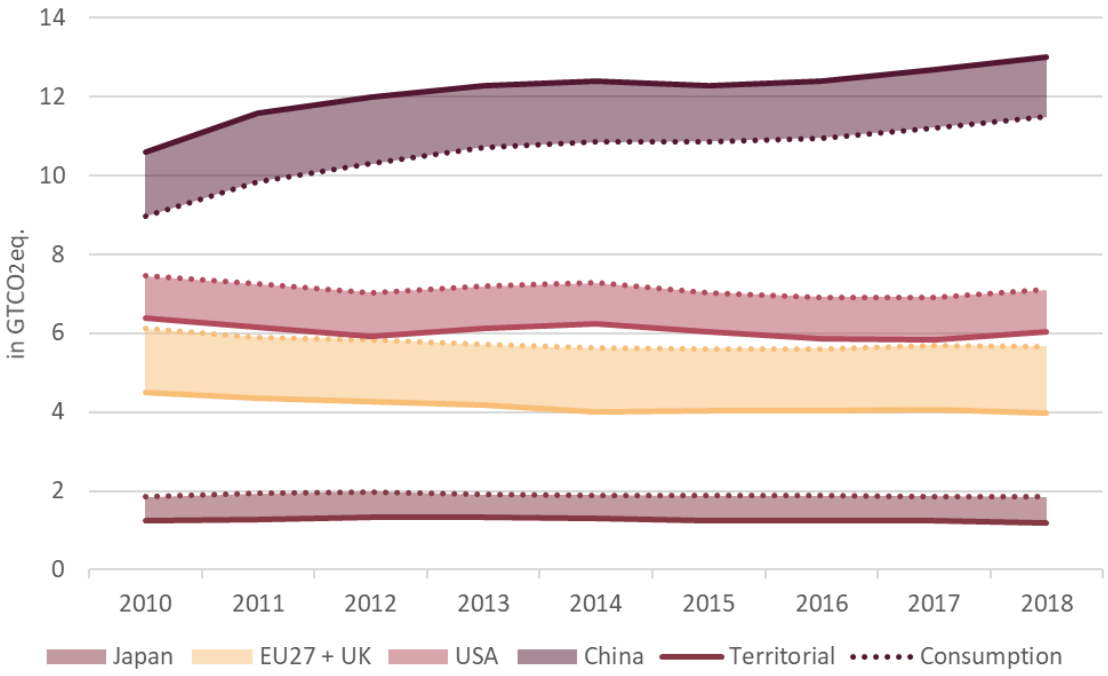
From an alignment and a transition risk perspective, the assessment of "current policies" trajectories is relevant. FTSE Russell intends to include this dimension in its future evaluations.

GHG emissions embedded in trade

The countries' pledges, as well as our estimations on ambition gaps, are based on territorial emissions (production-based approach). A consumption-based approach would result in some different outcomes. Countries with a higher consumption-based than territorial-based emissions are net importers of emissions, and therefore have a higher "consumption-adjusted carbon footprint." Most developed countries belong to this category (see Figure 10).

However, solely focusing on a consumption-based approach to correct this bias would not be relevant, as exported emissions also reflect the economic structure of countries and some of their key carbon exposures, as in the case of China. Some methodologies have been recently developed trying to tackle this issue (see for instance Jakob et al. 2021[21]). Production and consumption approaches are complementary. In this regard, FTSE Russell already includes the assessment of exported and imported GHG emissions in sovereign carbon data.

Figure 10. Territorial-based emissions vs. consumption-based emissions



Source: FTSE Russell & Beyond Ratings Research BASED ON EORA DATABASE

[20] United Nations Environment Programme (2020). Emissions Gap Report 2020.

[21] Jakob et al. (2021), Sharing responsibility for trade-related emissions based on economic benefits, *Global Environmental Change*.

Section 4. Economic and policy pathways to bridge the gap

4.1. Achieving the Paris Agreement objective: a credible scenario?

Coordinating international economic and policy efforts to solve a global environmental problem is not unprecedented. One such crisis in the 1980s was the hole in the ozone layer. The Montreal Protocol signed in 1987 successfully tackled the issue, and by 2030 will have saved an estimated two million people each year from skin cancer. Current climate change is, by comparison, a much more formidable challenge. Not only does it encompass a significantly broader range of sectors and activities and a complex relationship to energy, but solutions are more diverse and demanding.

However, like in the case of the ozone layer crisis, a scenario of international cooperation towards stronger climate action appears to be increasingly credible and the Montreal Protocol can serve as a template. In particular, one little-discussed, but important factor which contributed to the successful phasing out of ozone depleting substances, was the fact that alternatives had been found and that by 1987 their production could be scaled up, bringing their costs down[22].

On climate, reasonably affordable alternatives to GHGs have long seemed a distant dream: the 1997 Kyoto Protocol hoped to replicate the Montreal success, but no widespread industrial capacity was available then to displace coal, gas and oil. Besides public opinions did not feel that climate change was a priority. Nevertheless, climate negotiators ploughed on and, by the time the Paris Agreement was signed in 2015, industrial capacity for some alternative energy sources like wind, or solar photovoltaic had reached reasonable levels of competitiveness, while some other technologies (e.g., electric vehicles) were only emerging.

Six years on, by COP26 in November the world will face a still much changed situation: climate events are wreaking havoc worldwide and worrying the public, and a growing number of countries, large corporations, investors and local governments worldwide are supporting the fight against climate change. In addition, the COVID-19 pandemic is demonstrating that to tackle global crises, coordinated international action is a prerequisite. Last, but not least, the costs of critical technologies for energy transition, such as renewable energies, have considerably decreased and become cost-competitive in many places[23].

It seems likely now that, with the help of the right regulatory framework, the post-COVID-19 investment cycle will be driven to a significant extent by the energy transition. Among other recent signals, the United States and the European Union are articulating their large recovery plans around the transition towards a carbon neutral economy. The “Green economy” capitalization measured by FTSE Russell[24] is globally equivalent to a 5.4% of the total value of global listed equities *vs.* around 3% for the oil and gas sector[25]. Figure 11 shows a clear market outperformance of the “green economy” over the oil & gas sectors in recent years, indicating the growing support of investors to the energy transition.

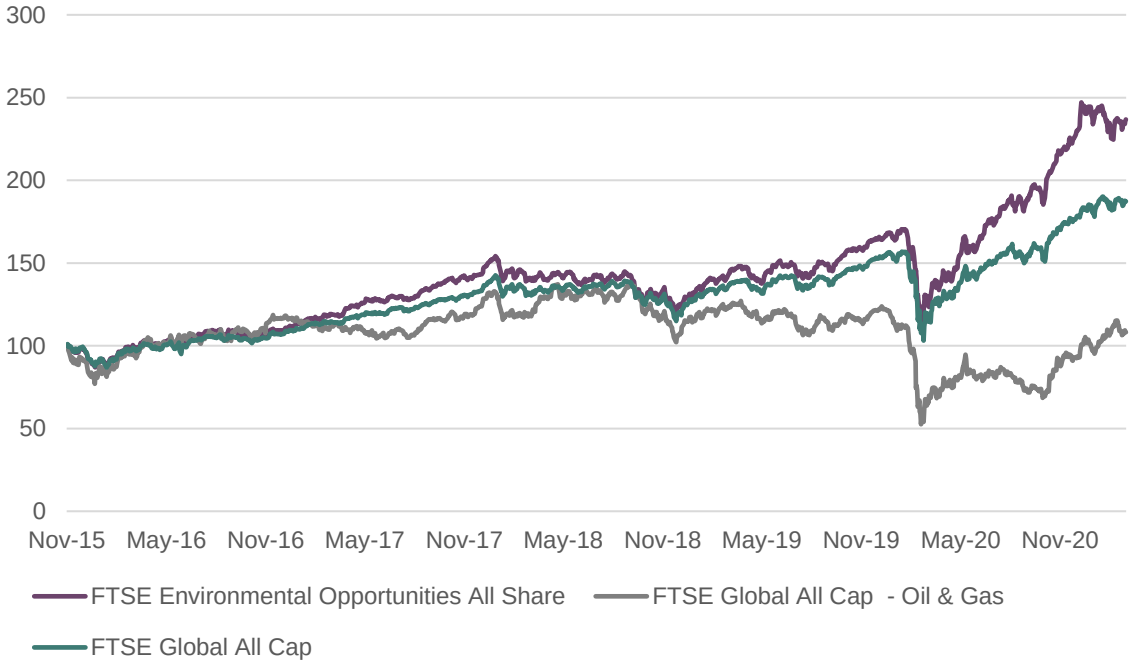
[22] Remembering the Montreal Protocol | MIT Technology Review.

[23] According to IRENA, for instance “56% of capacity additions for utility-scale renewable power in 2019 achieved lower electricity costs than cheapest new coal plant”. See https://www.irena.org/newsroom/articles/2020/Jun/How-Falling-Costs-Make-Renewables-a-Cost-effective-Investment.

[24] The green economy comprises here 10 sectors, including: decarbonated energy generation; energy efficiency; environmental resources; sustainable food and agriculture; clean transport; waste and pollution control; and water infrastructure.

[25] Putting numbers to the global green economy | FTSE Russell.

Figure 11. FTSE Environmental Opportunities Index vs FTSE Global All Cap Index & FTSE Global All Cap ex Oil & Gas since 2015 Paris Agreement



Source: FTSE Russell as of March 31, 2021, in USD. Past performance is no guarantee of future performance.

All that might also explain why in 2021 the world's largest economies – including the US – intensify their discussions on increasing their commitments and pledges to fight against climate change, through more demanding NDCs and net-zero targets. Besides, the necessary colossal investments towards energy transition, which are often more heavily tilted towards capital expenditures (*vs.* OpEx) than traditional ones, can today be financed at attractively low interest rates. Finally, the scaling up of industrial production for renewable energy or storage equipment should continue to bring costs down.

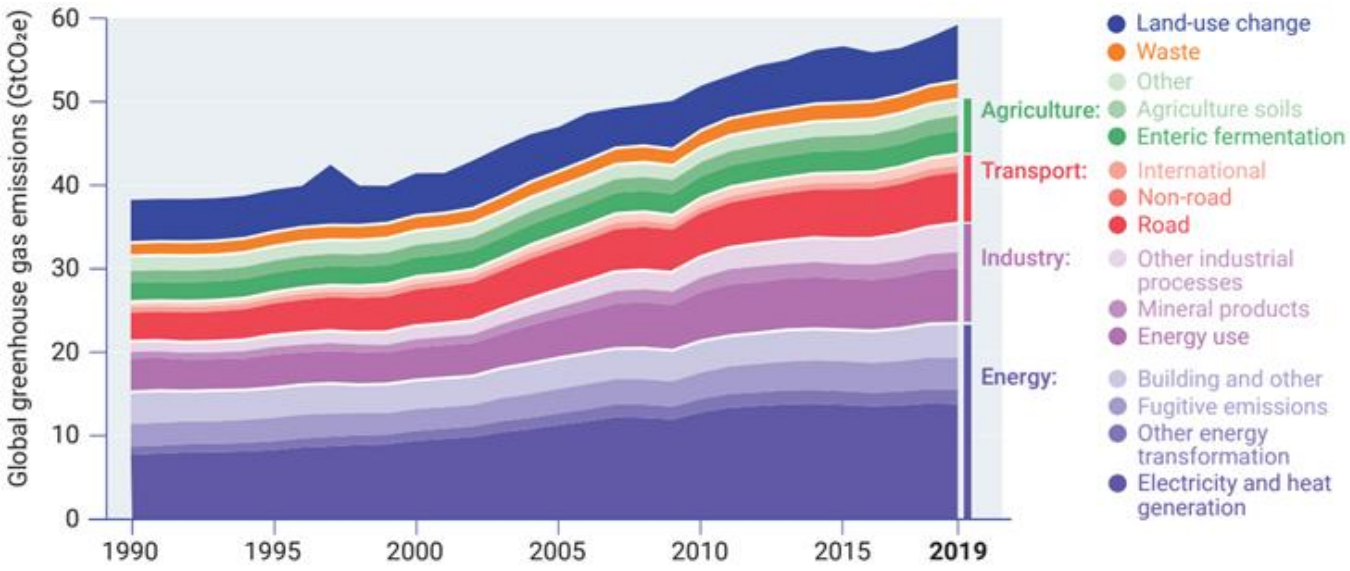
Therefore, the scenario of a global transition to keep global warming well under 2°C may have never looked as affordable and achievable. It is, in any case, a credible scenario to be considered by investors. To mitigate transition risks, the structural changes induced by a carbon-neutral economy should be at the heart of their strategies (with diverse implications in terms of asset allocation, risk management*, etc*.). The next parts will investigate the main levers available to reach that target, outlining some of the likely trends that investors should anticipate under ambitious transition scenarios.

4.2. Emissions abatement: the main sectoral and technological options are well-known

The UN Environment Programme Emissions Gap Report 2020[26] provides a representation of global GHG emissions by sector over the last 30 years in Figure 12. Industry, transport and power generation are the biggest contributors to emissions growth since the 1990s.

[26] https://www.unep.org/emissions-gap-report-2020

Figure 12. World share of GHG emissions by sector



Source: UNEP, Emissions Gap Report 2020.

The same report later logically identifies the major long-term transformations needed by sector to reach net-zero GHG emissions globally, including:

> **Energy**: Full decarbonization of the sector, based on renewable energy, storage and electrification across sectors, including phasing out coal-fired and fossil fuel power plants
>
> **Industry**: Shifts in processes towards electricity, (near-) zero carbon, substitution of carbon-intensive products (e.g., hydrogen steel and low-carbon cement), circularity and material efficiency
>
> **Transport**: Decarbonization of the sector in parallel with modal shifts to public transportation, cycling and walking
>
> **Building** sector: Decarbonization, including electrification and energy efficiency improvements through energy renovations
>
> **Agri-food**: Enhanced agricultural management as well as demand-side measures such as dietary shifts to more sustainable, plant-based diets and measures to reduce food waste
>
> **Land use**: Zero net deforestation and adoption of policies to conserve and restore land carbon stocks and protect natural ecosystems, aiming for significant net CO2 uptake in this sector

Moving these activities towards net-zero will mobilize every sector. The green economy with segments such as batteries, renewable energy equipment, public transportation solutions, recycling services, buildings' renovation materials, or efficiency management goods and services will play a central role and call for increased investments. Conversely, one could expect pure-play fossil fuel operators to face dim prospects if adoption of low-carbon products becomes widespread[27]. Nevertheless, the existing automotive stock would, for example, not stop running overnight, and even in an optimistic scenario, electric vehicles should still take a few years before

[27] For instance, some analysts expect price parity between electric and fossil-fueled cars very soon. It could happen as soon as 2023 (see Batteries For Electric Cars Speed Toward a Tipping Point - Bloomberg).

their market share becomes dominant[28]. Still, a Paris-aligned scenario would involve significant cuts in our fossil fuels consumption. The elusive “peak oil” could be reached within the current decade (if it is not already behind us).

In parallel to the too high average level of emissions per capita, the UNEP report stresses the role of equitable low-carbon lifestyles, which are critical to tackling climate change, given the striking disparities in consumption patterns across the globe and within many countries: the bottom 50% income earner of the global population emitted just 1% of global GHGs in 2015, against 15% of emissions for the top 1%. This also illustrates the magnitude of potential economic changes, with unavoidable consequences for financial assets and investors.

4.3. Public incentives: critical to drive the transition

Three types of instruments are available for policy makers to help them to drive the transition:

- carbon pricing (via a tax or an emissions allowances market),
- subsidies to low-carbon solutions, and/or
- standards regulation (emissions standards, technology bans, etc.)

According to mainstream climate economists[29], carbon pricing is considered the most cost-effective instrument to abate emissions by minimizing the social costs of these abatements. The other instruments can, however, be relevant given specific contexts. For instance, a carbon price alone will not be enough to overcome households’ difficulties to invest in expensive thermal renovations. The choice of instruments by policy makers can be also influenced by other constraints than cost-effectiveness, such as social equity. Therefore, subsidies or emissions standards can be considered as more relevant solutions than carbon pricing measures, according to the situation.

It should be noted that every instrument implies costs for some economic actors (financing the subsidies, investments to respect emissions standards, etc.) whose counterpart is an “implicit” carbon price. If well-calibrated, all these instruments result in less GHG emissions, and then lower associated economic damages. They can all impact asset valuations and have implications for investors, although in different ways.

Table 1. Range of global carbon price consistent with the Paris Agreement temperature target (in US$/tCO2eq.)

	Low	High
2020*	40	80
2030*	50	100
2050**	350	800

Sources: *Stiglitz, J. & Stern, N. (2017) Report of the High-Level Commission on Carbon Prices, CPLC; **IPCC, 2018

Table 1 shows a range of global carbon price evolution consistent with the Paris Agreement. These prices should be considered as proxies to illustrate the level of constraint on the economy through regulatory pressures to limit GHG emissions, covering both explicit and implicit carbon

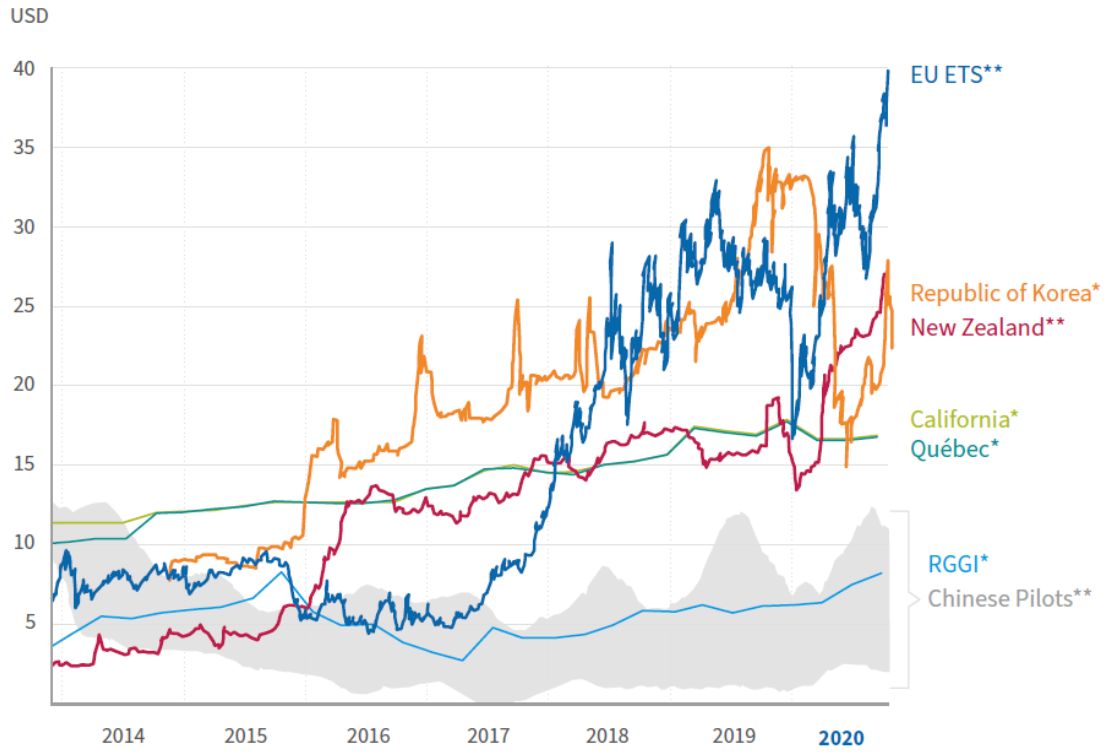
[28] Electric vehicles should be combined with low carbon power generation to be consistent with climate objectives

[29] See for instance What is a carbon price and why do we need one? - Grantham Research Institute on climate change and the environment (lse.ac.uk).

prices. The price reaches a very high level in 2050 of several hundreds of dollars per $tCO_2eq.$, reflecting the fact that carbon intensive technologies would become very marginal by then[30].

In terms of explicit pricing, only six countries[31] in 2020 had implemented a carbon price higher than the floor of US$40 recommended by the Stern & Stiglitz commission. At global level, the pricing gap is very large. The dynamics are nevertheless positive with rising prices (see Figure 13) and larger emitters adopting new measures. For example, the Chinese emissions trading system was implemented in 2021 and became the world's largest system, covering about 40% of national emissions.

Figure 13. Allowance price evolutions in selected emissions trading systems



Source: ICAP, Emissions trading worldwide: Status report 2021.

Irrespective of their nature, policies limiting GHG emissions imply higher costs and lower revenues for a number of corporates and sovereigns alike, especially those having carbon-intensive economic basis and relying on fossil reserves. Among transition risks, credit risk is often emphasised[32]. By decreasing companies' cashflows, climate regulations (such as carbon prices) could increase default risks. This could cause in return, financial losses for banks and bondholders[33].

A policy framework in line with the Paris Agreement generates significant transition risks for companies and investors which currently do not sufficiently anticipate the radical changes for business models. However, ambitious energy transition remains both a desirable scenario –

[30] For instance, a carbon price of 800 US$ is equivalent to an increase by more than US$2 per liter of gasoline.

[31] Sweden, Liechtenstein, Switzerland, Finland, France and Norway.

[32] See for instance Bouchet, V. and Le Guenedal, T., (2020) Credit Risk Sensitivity to Carbon Price. Available at SSRN: https://ssrn.com/abstract=3574486.

[33] See Monin (2018) Integrating climate risks into credit risk assessment (…) CEP report 2018/4.

given its economic and social benefits in comparison with a high global warming impact – and a credible scenario, as discussed above. To mitigate transition risks, investors might want to consider issuers relying on low-carbon models, and, among issuers still reliant on carbon-intensive models, those which have clear decarbonisation strategies.

4.4. A favorable economic context to bridge the investment gap

The low interest rates environment has been prevailing since the subprime financial crisis. It creates challenges for investors but is important for the analysis of climate action scenarios. On the one hand, low rates give more value to future damages of climate change through a higher discount factor[34], and on the other they facilitate the financing of large capital-intensive investments such as energy transition infrastructure projects[35], by spreading their financing costs over several generations.

Large-scale investments will indeed be required to plug the gap. If NDC commitments stretch to limiting warming to 1.5°C, the IPCC anticipates that a marked shift in investment patterns would be necessary. Additional annual average energy-related investments for the period 2016 to 2050 are estimated to be around US$ 830 billion[3637]. Figure 14 illustrates this massive reallocation of capital in the global energy system. This evolution mirrors the abatement solutions presented in part 4.2, especially the shift in energy source for electricity, energy efficiency and higher demand for electricity in end-use sectors (buildings, industry and transport).

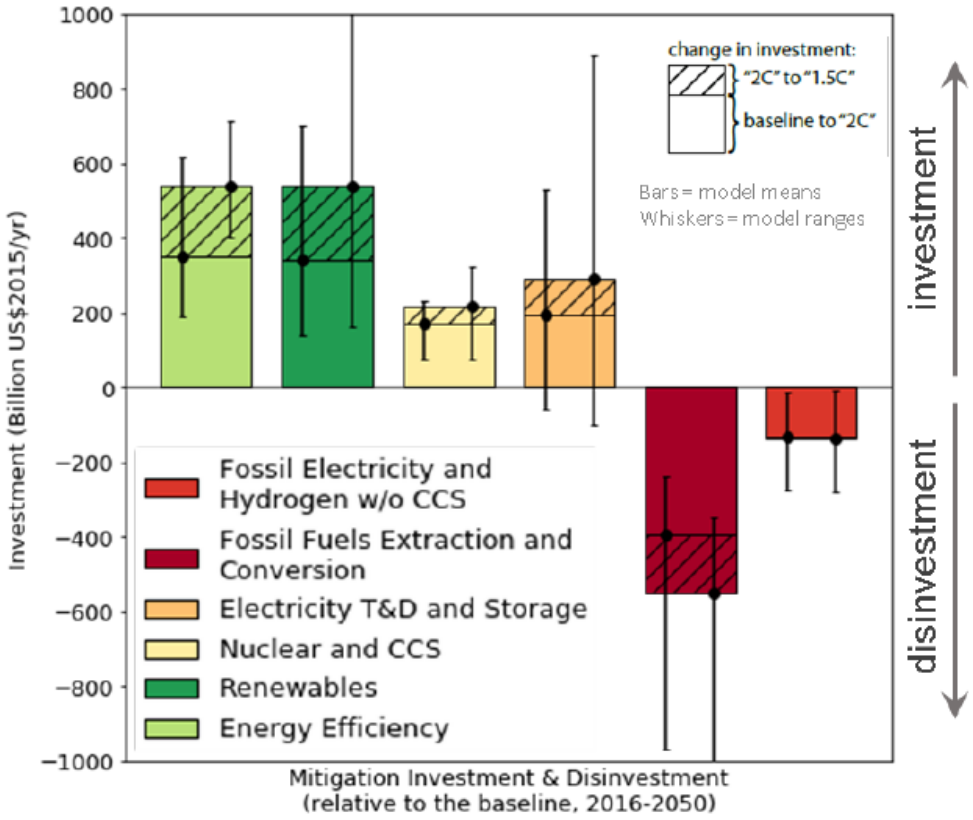
[34] The discounting's influence in the assessment of future damages of climate change is a controversy topic (see for instance Stern, N., 2007. *The Economics of Climate Change: The Stern Review)*

[35] See for instance Kosgrup, S. and Oman, W. (2019) *Macroeconomic and financial policies for climate change mitigation: a review of the literature*. IMF Working Paper.

[36] Constant 2010 US$.

[37] Chapter 2—Global Warming of 1.5 ºC (ipcc.ch).

Figure 14. Projected evolutions of yearly global investments in the energy system to reach Paris objective (compared to baseline)



Source: IIASA (2018)[38]

Note: T&D stands for transmission and distribution; CCS for carbon capture and storage.

Investment flows of such magnitude obviously create huge reallocation possibilities, with opportunities, but also potentially damaging side-effects (e.g., herd behaviour, run on some securities) and associated risks to be regulated[39]. However, given the expected dozens of USD trillions required in investment shifts, it is inevitable that quite a few securities in pivotal sectors (e.g., transport electrification, battery technology, grid infrastructures, "low carbon" foods, insulation, etc.) would experiment some wild gyrations, while the Green economy segment at large should flourish in the context of more demanding policy constraints.

Conversely, the stranding of fossil fuels assets would be a distinct possibility if NDCs were tightened towards the 1.5°C trajectory. The IEA's scenarios' projections, in the 2020 World Economic Outlook[40], provide estimated present value of future oil and natural gas production to 2040. The shock of the COVID-19 pandemic has implied a strong decrease in this present value – from US$23 trillion to US$18 trillion (due to lower prices and expected future demand). In their assessment, a Paris-aligned scenario would further decrease this value to US$12 trillion.

[38] IIASA Policy Brief (2018), What investments are needed in the global energy system in order to satisfy the NDCs and 2 and 1.5 °C goals?

[39] The 2021 "green SPAC" IPO phenomenon might be a warning sign in that respect.

[40] IEA, Estimated present value of future oil and natural gas production to 2040 by scenario, IEA, Paris https://www.iea.org/data-and-statistics/charts/estimated-present-value-of-future-oil-and-natural-gas-production-to-2040-by-scenario.

Section 5. Conclusion: could Glasgow bring further changes for investors?

A growing number of countries, large corporations, investors and local governments throughout the world are supporting the fight against climate change. There have been over the last months several high-profile announcements from sovereign and private actors, especially around new long-term net zero targets. Regarding initiatives from the financial sector, it is worth mentioning the "UN-convened net-zero asset owner alliance" or the "Net-zero asset managers initiative."[41]

However, on the sovereign side, the intermediary objectives contained in the NDC are inconsistent with the long-term targets and with the global mitigation goal. The forthcoming COP26 is a key moment in the Paris Agreement process to fill the ambition gap. The US President Biden hosted a "Leaders Summit on Climate" in April 2021, whose objective was precisely to galvanize the NDCs revision process prior to COP26.

According to our estimates, the overall implied temperature of updated NDCs post the summit is about 2.9°C. It is therefore critical that the collective efforts to reduce emissions improve significantly in the next months and during COP26.

On a positive note, conditions for further action seem to be converging. In addition to the promising long-term commitment already mentioned, governments are under increasing pressure from their populations to fight devastating impacts of climate change; Today, many low carbon technologies and production processes are sufficiently mature to compete with *business as usual* solutions; In addition, extremely low interest rates provide an opportunity for massive investments.

An ambitious energy transition is both a desirable scenario – given its economic and social benefits versus a high global warming impact – and an increasingly possible scenario due to positive policy and technological developments.

The odds of a Paris-aligned transition scenario are, in any case, high enough for investors to anticipate much more seriously the transition risks and opportunities. A policy framework in line with the Paris Agreement supposes regulations which would have impacts on financial returns.

More generally, in a Paris-aligned scenario, the underlying structural changes and massive capital reallocation at stake imply that most business models will have to adapt. We have only just seen the tip of the iceberg of the impacts that a 1.5°C or 2°C transition scenario would have on investment activities in relation to risk management, asset prices and investment strategies, This calls for urgent action from investors to prepare for the changes in the socio-economic and financial landscape involved by the climate transition

[41] For more details on finance initiatives, see "The investor guide to climate collaboration: from COP26 to net zero", a FTSE & PRI special report (2021).

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EMEA
+44 (0) 20 7866 1810

North America
+1 877 503 6437

Asia-Pacific
Hong Kong +852 2164 3333
Tokyo +81 3 4563 6346
Sydney +61 (0) 2 8823 3521