



The Global Green Finance Index 11

Supplement: The Carbon Transition



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The Carbon Transition

“The Stone Age didn’t end for lack of stone, and the oil age will end long before the world runs out of oil.” Ahmed Zaki Yamani, Minister of Oil for Saudi Arabia 1962 – 1986¹

Background

In 2006, the Long Finance team raised the issue of un-burnable carbon². At the time (before shale gas and fracking) a back of the envelope calculation showed that using all known fossil fuel reserves would result in CO₂ levels in the atmosphere around 1,200 parts per million (ppm) - nearly three times the levels required to keep temperature rises below 2 degrees centigrade.

In 2011, Carbon Tracker, a London-based financial services think tank, published ‘Unburnable Carbon’³. This ground-breaking piece of research calculated that if the world was to meet the objective of keeping global warming below 2°C (above pre-industrial levels), the total amount of CO₂ which could be released globally could not exceed 565 gigatonnes for the 40 years to 2050.

At the climate talks in Bonn in October 2015, (the last in a series of meetings under the UNFCCC prior to COP 21 which took place in December in Paris) the UN published a “non-paper”⁴ warning that limiting global warming to 2°C was not sufficient to avoid the most severe impacts of climate change. The non-paper ultimately led to the Paris Agreement⁵, which backed a long-term goal to limit global temperature rise to “well below 2°C” and to “pursue efforts towards 1.5°C”. The Paris agreement, which came into force in December 2015, was endorsed by 195 countries.

Despite the promise shown by Paris, subsequent COPs failed to make substantive process. COP 27, held in Sharm el-Sheikh⁶, did not achieve much success around mitigation and was unable to reach agreement on the phasing out of coal and other fossil fuels or for setting emission peaking periods. This severely impedes efforts to limit the average global temperature increase to 1.5°C. Ultimately, limiting temperature rises to 1.5°C means delivering “net-zero” emissions by 2050.

The UN defines Net Zero as “cutting greenhouse gas emissions to as close to zero as possible, with any remaining emissions re-absorbed from the atmosphere, by oceans and forests”⁷. It is this transition to net zero which poses the greatest challenge currently facing the world. A myriad of definitions exist for the term “carbon transition”, but in simple terms it refers to the fundamental changes required to move society and the global economy from a high carbon pathway to a low carbon pathway. These changes are far reaching, covering every human activity – from transport and power generation, to farming, manufacturing and waste disposal. The economic risks and opportunities are enormous, and the political and societal changes will be seismic.

¹ <https://www.energyintel.com/0000017b-a7dc-de4c-a17b-e7deb0a00000>

² <https://www.zyen.com/research/research/sustainability/carbon-burn-it-all/>

³ <https://www.longfinance.net/programmes/sustainable-futures/london-accord/reports/unburnable-carbon-are-the-worlds-financial-markets-carrying-a-carbon-bubble/>

⁴ <https://unfccc.int/resource/docs/2015/adp2/eng/8infnot.pdf>

⁵ <https://unfccc.int/process-and-meetings/the-paris-agreement>

⁶ <https://www.un.org/africarenewal/news/cop27-outcome-reflections-progress-made-opportunities-missed#:~:text=The%20conference%20did%20not%20achieve,above%20pre%2Dindustrial%20levels>

⁷ <https://www.un.org/en/climatechange/net-zero-coalition#:~:text=What%20is%20net%20zero%3F,oceans%20and%20forests%20for%20instance>

Mind The Gap

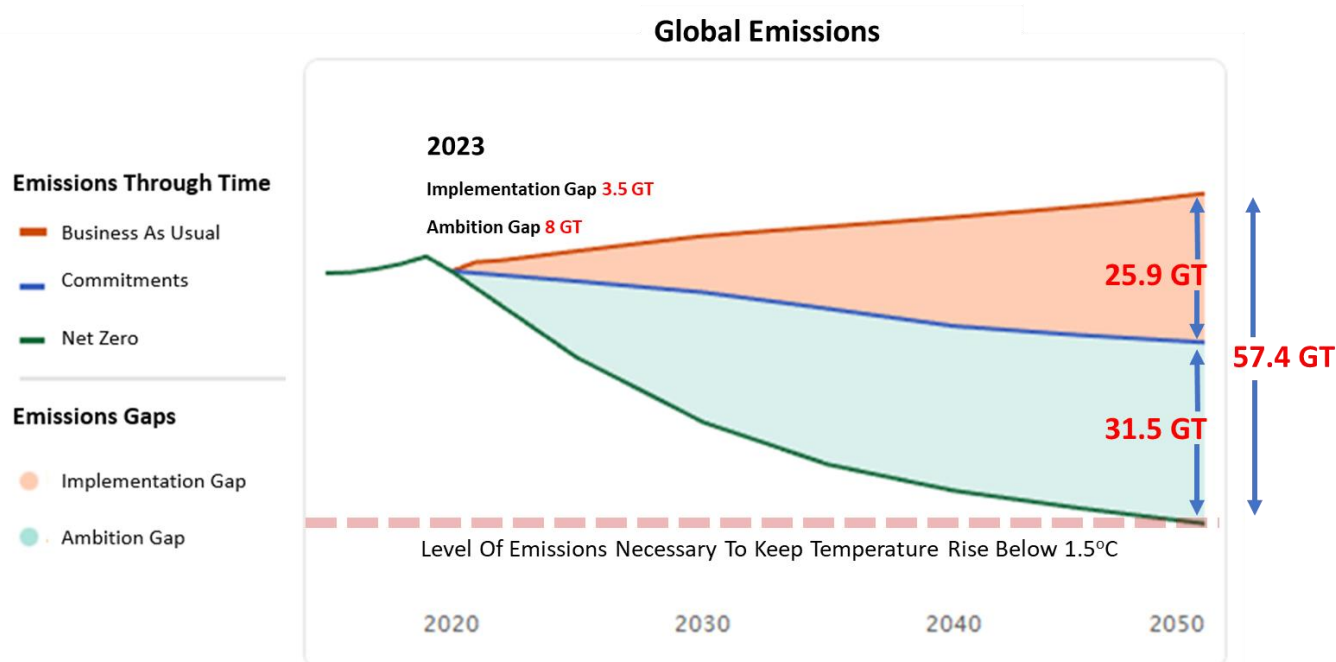
Policy makers frequently use the term net-zero, but the extended horizons of the carbon transition, which cross multiple electoral cycles, combined with conflicting demands from sectoral lobbyists, mean that there is rarely deep thought either into delivery or its implications for the short to medium term policy environment.

[The World Emissions Clock](https://worldemissions.io/)⁸ (a tool launched at COP27 in Sharm el-Sheikh by the World Data Lab), lays this challenge bare (see figure 1):

- First, there is an “implementation gap”, which reflects the deficit of actual emission reduction relative to the commitments made in countries’ Nationally Determined Contributions (NDCs). This currently stands at 3.5 Gigatonnes rising to 25.9 Gigatonnes by 2050.
- Second, there is an “ambition gap” which reflects the shortfall of NDCs relative to actual reductions needed for the world to stay on course for a 1.5 degree trajectory. This currently stands at 8 Gigatonnes, rising to 31.5 gigatonnes by 2050.

In other words, countries have not promised to do enough to cut emissions and, regardless of this, they are not sticking to the (inadequate) commitments they have made. Furthermore, the cost of failing to transition to a low carbon trajectory will rise as time goes on and paths become more divergent. The World Emissions Clock is an interactive tool and readers are encouraged to view the sobering implementation and ambitions gaps for their own countries and regions.

Figure 1 | Global Implementation and Ambition Gaps

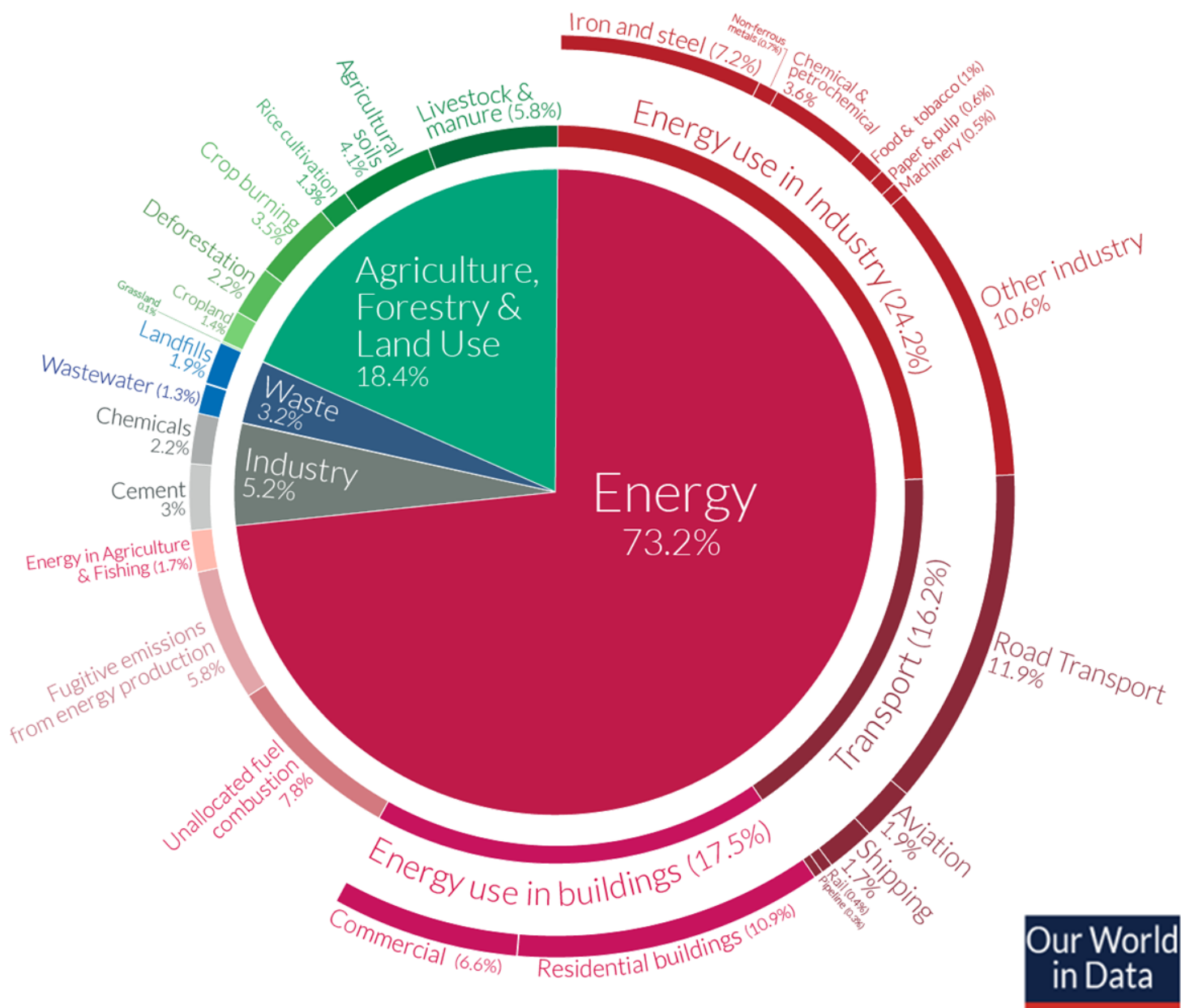


⁸ <https://worldemissions.io/>

A Dirty Business

Carbon emissions arise from four main sources (see figure 2) – energy use, agriculture and forestry, industry, and waste management. Each of these can be further subdivided into industry sectors and sub sectors.

Figure 2 | Sources Of Green House Gas Emissions



OurWorldinData.org – Research and data to make progress against the world's largest problems.

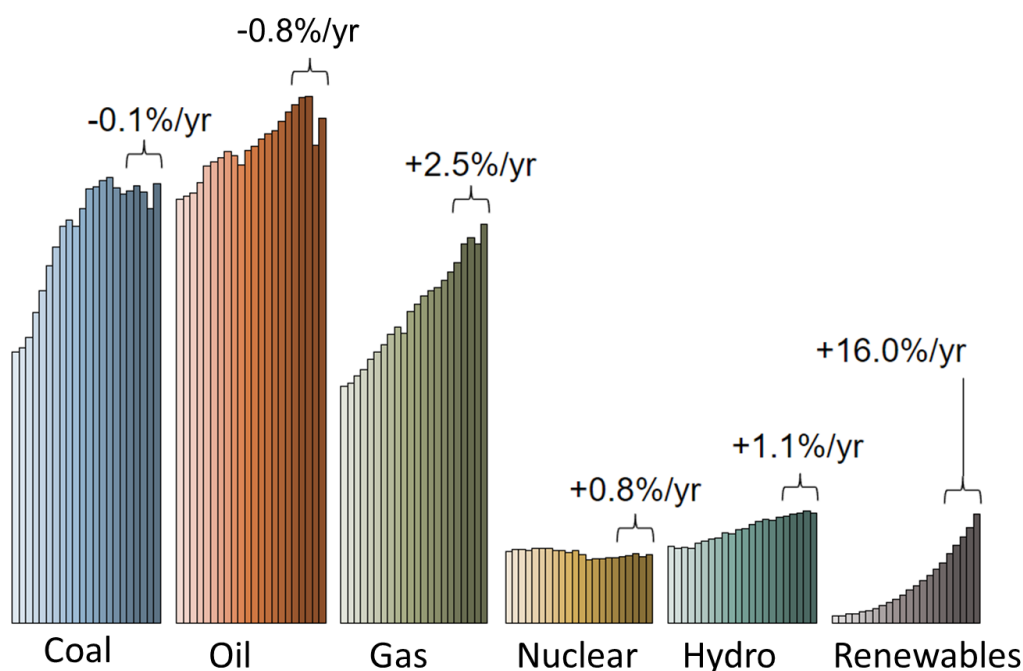
Source: Climate Watch, the World Resources Institute (2020).

Licensed under CC-BY by the author Hannah Ritchie (2020).

Energy is by far the largest contributor to emissions. The sources of emissions from this sector can be subdivided into industry (24.2%), transport (16.2%) and energy use in buildings 17.5%. Ultimately, the carbon intensity of energy is derived from its source and, regardless of a rapidly growing contribution of renewables to the global energy budget (see figure 3), fossil fuels still provide the world with 70%

of its energy. Without radical action and unprecedented investment, fossil fuels are likely to continue to contribute a significant proportion of total energy for decades to come.

Figure 3 | Changes In Composition Of Primary Energy Sources 2000-2021 (change in contribution for the last 5 years averaged as percentage/year)



Source: <https://commons.wikimedia.org/w/index.php?curid=87755970>

Given the slow progress being made to decarbonise the world's energy sources, logically, attention should be focussed on energy use in industry, transport, and buildings. However, despite rising energy prices and a well-publicised “cost of living crisis” in most major economies, policy makers have been leaden footed in creating regulations and standards that bake carbon costs and energy efficiency into new development, whilst crumbling, high carbon, legacy infrastructure holds back investment and growth.

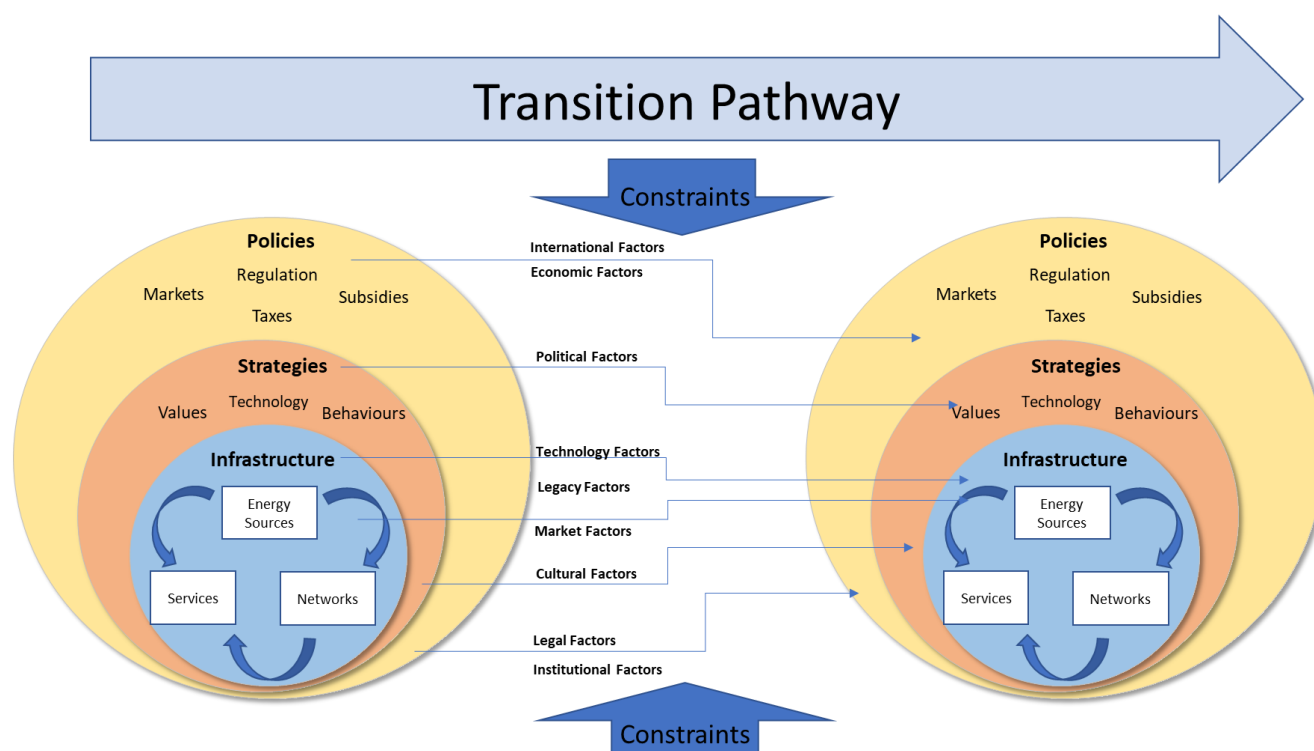
None of this is news; all of these points were raised in The London Accord, which was published a decade and a half ago⁹, but attempts to get to grips with the climate crisis are still showcasing the reduction of agricultural emissions (see the [US](#), [the UK](#), [the EU](#), [New Zealand](#), and [China](#)) whilst failing to get to grips with the fundamentals – energy generation and use.

Despite this, economic forces, including the plummeting cost of renewable energy and the steadily rising price of fossil fuels, as well as new imperatives such as the importance of energy independence in the face of geopolitical uncertainty, are steadily nudging things in the right direction.

None of this detracts from the sheer complexity policy makers must manage to achieve carbon transition (see figure 4).

⁹ <https://www.longfinance.net/programmes/sustainable-futures/london-accord/london-accord-2007/>

Figure 4 | Transition Pathways



Tools And Techniques For Carbon Transition

Despite the obstacles placed on the transition pathway, a number of successful tools have emerged which can be used to ensure that carbon budgets are moved towards the right trajectory. These include:

Carbon Trading

There are two types of carbon markets: compliance and voluntary. With respect to the former the long established EUETS¹⁰ and the newer (and far less extensive) CETS¹¹ are the largest markets. The EUETS has proven extremely effective¹², saving about 1.2 billion tons of CO₂ between 2008 and 2016 (3.8%) relative to a world without carbon markets, or almost half of what EU governments promised to reduce under their Kyoto Protocol commitments¹³. Issues remain however, notably fungibility between schemes and a requirement for long term policy stability in order to allow markets to mature.

Voluntary carbon markets – national and international – refer to the issuance, buying and selling of carbon credits, on a voluntary basis. The current supply of voluntary carbon credits comes from private entities that develop carbon projects, or (in rarer cases) governments that develop programmes certified by carbon standards that generate emission reductions and/or removals. Significant issues surround the voluntary markets, particularly around a lack of regulations or standards.

¹⁰ https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets_en

¹¹ <https://chinadialogue.net/en/climate/the-first-year-of-chinas-national-carbon-market-reviewed/>

¹² https://climate.ec.europa.eu/system/files/2021-10/policy_ets_allowances_bm_curve_factsheets_en.pdf

¹³ <https://www.pnas.org/doi/10.1073/pnas.1918128117>

Carbon Accounting

Carbon accounting, is the process of quantifying the amount of greenhouse gases (usually referred to as CO₂ equivalent (CO₂e)), arising directly (scope 1 and 2) and indirectly (scope 3) from a business' or organisation's activities within a defined set of boundaries. The terms scope 1,2 & 3 are derived from the GHG Protocol¹⁴, the globally recognised standard for accounting for greenhouse gas emissions.

Essentially, scope 1 and 2 are those emissions that are owned or controlled by a company, whereas scope 3 emissions are a consequence of the activities of the company but occur from sources not owned or controlled by it.

In addressing the carbon transition, companies can adopt six distinct, but non-exclusive pathways to lower emissions.

- i. Different feedstock and/or energy sources,
- ii. Different process technologies,
- iii. CO₂ capture and storage or re-use,
- iv. Recycling of the produced products at the end of their life-cycle,
- v. Changes in the carbon content of the products made, and
- vi. The reduction over time of the carbon intensity of electricity, hydrogen, or heat that is bought by the site.

Understanding, capturing and communicating the value of each of these pathways to investors is critical, but currently requirements to provide carbon accounts vary by jurisdiction:

- In the UK, all large companies and large LLPs are required to report certain energy usage and carbon emissions under the Streamlined Energy and Carbon Reporting requirements¹⁵. Quoted companies under the Streamlined Energy and Carbon Reporting (SECR) need to report their full Scope 1 and Scope 2 emissions.
- Since 2009, the United States has required facilities emitting at least 25,000 metric tons or more of carbon dioxide to report their greenhouse gas emissions to the Environmental Protection Agency every year¹⁶.
- France, in 2015, became the first country to require investors such as pension funds and insurance companies to disclose their GHG emissions¹⁷.
- Since 2007, Australia has mandatory emissions reporting under the National Greenhouse and Energy Reporting Scheme (NGERS)¹⁸. Only companies that meet certain emissions thresholds are required to report. Companies use an online tool called the Emissions and Energy Reporting System (EERS) to report their data.

¹⁴ <https://ghgprotocol.org/>

¹⁵ <https://www.gov.uk/government/publications/academy-trust-financial-management-good-practice-guides/streamlined-energy-and-carbon-reporting>

¹⁶ <https://www.epa.gov/climate-change>

¹⁷ <https://climate-laws.org/geographies/france/laws/law-no-2015-992-on-energy-transition-for-green-growth-energy-transition-law>

¹⁸ <https://www.cleanenergyregulator.gov.au/NGER>

Policy Performance Bonds

Governments claim they are committed to pursuing sustainability and tackling climate change, but despite numerous conferences, papers, and communiqués, there is still a lack of confidence that governments are serious about meeting sustainability or carbon emission reduction targets.

This affects investment, particularly when the worsening economic environment leads governments to row back on commitments. Missed targets, low fossil fuel prices, and low carbon prices reduce the profitability of clean energy and other sustainability projects, but Sovereign Sustainability-Linked Bonds (SSLBs) allow these risks to be hedged¹⁹.

The ability to hedge facilitates investment in green projects, because if there are changes in policy (such as subsidies or tax breaks) which affect the profitability of those investments, the government bears some of the direct costs by having to pay higher interest rates on government debt.

Policy performance bonds can be issued against a range of sustainability issues which is why they are also known as sustainability-linked bonds. Because SSLBs effectively sidestep the logjam caused by international treaties, countries issuing SSLBs can deliver on climate action and the UN's Sustainable Development Goals, whilst simultaneously attracting inward investment.

In 2022, the Republics of Chile²⁰ and Uruguay²¹ released world's first-ever Sovereign Sustainability-Linked Bonds (SSLBs).

Carbon Risk Exposure

Also known as transition risk, this refers to the exposure firms and investors face as jurisdictions accelerate the adoption and implementation of policies to cut CO₂ emissions.

Due to the implementation and ambition gaps, described earlier, carbon reduction policies will asymmetrically affect different national and supra-national regions, as well as different industry sectors and individual companies. Some, such as EV battery manufacturers may flourish. Others, such as airline caterers may face an increasingly hostile fiscal environment as margins are squeezed and carbon costs rise.

Transition risk can be subdivided²² into:

- **Policy risk:** Policy actions regarding climate change mitigation and adaptation are fluid, and subsidies and tax breaks are subject to the whims of politicians and change frequently, often with little notice (see Policy Performance Bonds).
- **Legal risk:** This is a relatively new risk and involves litigation against organisations perceived to be failing in their duty of care to tackle climate change effectively. In 2021, 38 law suits were filed against private sector companies²³ (often in combination with government

¹⁹ <https://www.longfinance.net/programmes/sustainable-futures/london-accord/reports/sovereign-sustainability-linked-bonds-chile-sets-a-high-bar/>

²⁰ <https://www.hacienda.cl/english/work-areas/international-finance/public-debt-office/esg-bonds/sustainability-linked-bonds>

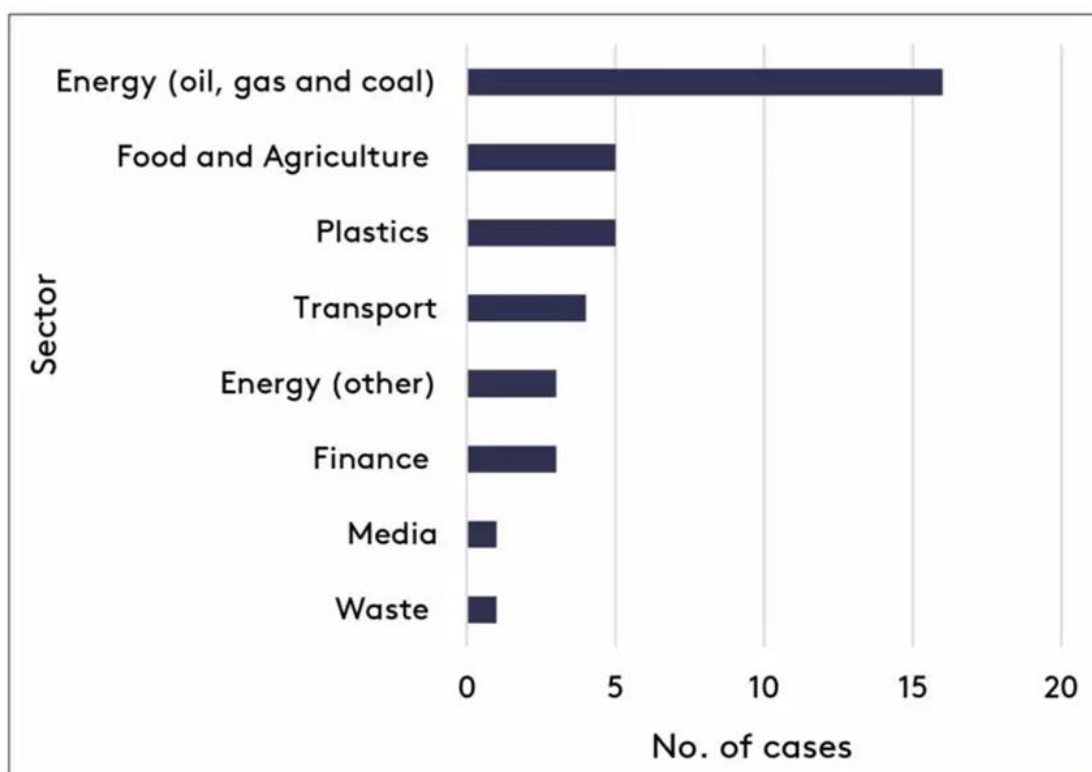
²¹ <http://sslbuguay.mef.gub.uy/>

²² <https://hbr.org/2022/01/how-to-evaluate-your-companys-carbon-risk>

²³ <https://www.lse.ac.uk/granthaminstitute/news/taking-companies-to-court-over-climate-change-who-is-being-targeted/>

actors), All but one of these cases were filed in the United States, Australia, and Europe. Figure 5 illustrates the sectors where cases are being brought.

Figure 5 | Climate Change Litigation In 2021



Source LSE 2022

- **Technology risk:** Firms may need to consider technological innovation and the transformation of processes and supply chains, both to comply with climate change legislation, and to mitigate physical risks. Those that fail to invest may lose market share to disruptive incomers or more fleet footed rivals.
- **Market risk:** Climate change may trigger a fundamental shift of supply and demand for certain commodities, products, and services.
- **Reputation risk:** Social media pile-ons resulting from customer or community perceptions have the potential to cause enormous damage to a firm's bottom line.

Financial Sector implications and opportunities

From an investor perspective, a recent study by Bolton, Halem & Kacperczyk²⁴, published in the Journal of Applied Corporate Finance, showed that a carbon-transition premium does exist and is economically meaningful. The study found a significant link between performance and carbon emissions and can be interpreted as a measure of how fast the company is transitioning and so can

²⁴ **Bolton P, Halem Z, Kacperczyk M, 2022**, The financial cost of carbon, Journal of Applied Corporate Finance, Vol:34, ISSN:1078-1196, Pages:17-29

be considered a short term risk factor from investors' point of view. This should have implications for the cost of capital for firms, although banks have been slow to price in carbon risk²⁵.

From a financial centre perspective, closer attention must be paid to the transition risks highlighted above. In 2019, we published a supplement to the Global Green Finance Index 3²⁶ focussing on carbon risk, which highlighted the financial centres that were most exposed (see Figure 6). Little has been done to ameliorate this risk.

Figure 6 | Percentage of Listed Companies Revenues Derived From Fossil Fuels

Financial Centre	Percentage Of Revenue Derived From Fossil Fuels
Moscow	58%
Bangkok	36%
Warsaw	33%
Amsterdam	32%
Bombay	23%
London	21%
Shanghai	18%
Istanbul	18%
Vienna	17%
Toronto	16%

Source GGFI 3 2019

Recommendations For Financial Centres

Given the evident risks associated with the carbon transition, financial centres should consider how the transition may affect medium to long-term market stability. Specifically it is recommended that centres:

- Identify and promote investment in critical sectors and technologies, including FinTech.
- Investigate innovative financial products and services which facilitate carbon transition, particularly with respect to policy performance bonds which assist in reducing political risk for investors.

²⁵ Ehlers T, Packer F & de Greiff K 2021 The pricing of carbon risk in syndicated loans: which risks are priced and why? BIS Working Papers No 946

²⁶ <https://www.longfinance.net/programmes/sustainable-futures/london-accord/reports/value-and-values-warming-world/>

- Identify and ameliorate transition risk exposure, in particular consideration should be given to whether new listings for high carbon industries (such as fossil fuels) are desirable or conducive to long term market stability.
- Lobby for regulations and standards on carbon accounting to ensure that carbon costs are factored into valuations and risk assessments.
- Communicate the risks and opportunities with policy makers – financial centres are apolitical and trusted voices and effective communication can lead to effective policy making.
- Adopt a leadership position and work in partnership with other national and regional centres.

Conclusions

A great deal more research is needed on both transition risk and the physical risks to firms associated with climate change, although financial markets are beginning to price these risks, in anticipation of the policy and reputational risks that are beginning to surface.

Financial centres must take a lead in addressing their exposure to transition risk in order to ensure long term market stability as effective capital reallocation is an essential component of a successful transition to a low carbon pathway.