Transition Finance (and Climate Change)

What Does it Mean, To Whom, Why Is It Critical, and How Much It Might Cost

A brief overview

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Executive Summary

The idea of integrating environmental (and then sustainability, climate, and species) considerations into the financial decision-making process was a 100% alien concept just 32 years ago. It entered the realm of public discussion in Rio at the UN's Conference on Environment and Development, also known as the Rio de Janeiro Earth Summit. At this meeting, the United Nations Environment Programme (UNEP) and 31 banks introduced the UNEP Statement by Banks on the Environment and Sustainable Development. It was the first time that bankers had publicly talked about funding issues like "environment, sustainable development, and global warming". Since then, the Conference of the Parties to the United Nations Framework Convention on Climate Change has met 26 times—most recently in Glasgow in 2021—and is about to meet again in Sharm el-Sheikh. Finance continues to be given a bigger role every year.

Many terms have been created since then, such as climate change, climate crisis, net-zero, and dozens of others. In addition, a wide range of initiatives, protocols, working groups, non-governmental organizations, guidelines, and standards have arisen. The landscape is also full of greenwashing activities and numerous programs that have never been funded or have failed, while others have succeeded at raising capital in modest amounts.

In 2019, a new term, transition finance, appeared enough times that the Organisation for Economic Co-operation and Development (OECD) defined it: "We call 'transition' the journey towards the achievement of sustainable development and the 2030 Agenda's Goals, and 'transition finance' the financing of that journey." (1). Or possibly, we should look to Hervé Duteil from BNP Paribas, who on Sept. 13, 2019, wrote, "Transition Finance is about transitioning from brown to… brown; a lighter shade of brown, of course. Put simply, Transition Finance is for sectors that (1) are not green today; (2) cannot become green tomorrow; yet (3) can and need to get greener (by which we mean 'less brown') faster." (12)

Since 2019:

- The term has been given many other definitions.
- Many other terms with the words "transition" and "finance" have been created and used.
- A great deal of discussion at very senior levels has occurred.
- Many excellent papers have been written.
- Some research has been done.
- There is little consensus on terminology, definitions, and the magnitude (from a financial perspective) of the challenge.
- Few are talking about intermediary steps on the way to 2050 (i.e., like securities regulators are doing for ESG). (32)
- All the big players seem to want to be involved.
- No one has emerged as a clear leader (OECD has tried, as well as the NGFS, TCFD and the IFRS Foundation).

Unfortunately, very little actual funding, in comparison to investments in hydrocarbons, has occurred.

This paper does not include any original research and is designed to give a strategic overview and summary of the excellent work done by others. Briefly, the paper attempts at a very macro level to:

- Summarize what appears to be the best papers by others that are available in the public domain.
- Estimate the amount of funding that will be needed in the next 2+ decades (by 2050).
- Identify the biggest finance-related hurdles that exist and will arise over the next 25 years
- Explore some of the public policy issues that appear to be delaying funding efforts.
- Identify the major gaps of information needed by governments, civil society, and financers.

To put the breadth of this paper in perspective, it is 10+ pages in length, while McKinsey's excellent paper on the subject has a 64-page Executive Summary. McKinsey's paper currently may be the seminal paper on this subject (as of August 2022) and should be on the reading list for anyone focusing on "transitional finance." (24)

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1. Introduction

Transition finance is a bit like the start of a horse race where the horses and riders are jockeying for position, but it is too early to tell who will win (i.e., establishes terms and definitions, deciding what industries are included, in setting the standards, establishing public policy, and gaining the most financially).

"Transition finance" is a relatively new term. It first appeared in March 2019 in an Organisation for Economic Co-operation and Development (OCED) publication entitled Transition Finance: Introducing a New Concept, with the following introduction in the abstract: "This paper introduces the concept of transition finance and initiates research to advise the DAC on its role as a major provider of development assistance among other public and private providers of financing for the 2030 Agenda." (20)

Given the newness of the term, that there are many similar terms, and that there is no clear agreement on terminology or definitions, it is not surprising that we have a lack of data sets or financial projections on how expensive the transition is going to cost.

There is also little to no consensus on (a) leadership on the subject (i.e., OECD to NGFS) or (b)

labels, taxonomies, metrics, standards, or reporting guidelines (which has led to many claims of greenwashing). In addition, the work that is being done in these areas is all from an end-of-the-line perspective (i.e., only what we will do by 2050), with virtually no focus on interim targets like those being put forth on environment, social, and governance (ESG) by various governmental securities regulators. (32)

The players in this field seem to include all of the usual "green investors" and also many new players. The central banks and government treasuries are involved, plus all the major financial institution associations; sector associations are also involved and in attendance at the meetings.

When it comes to quantifying the situation, there are a great many individual numbers but no real aggregate data or full financials available in any of the following areas: (a) potential stranded assets, (b) the actual industry sectors that will be classified "transition fundable," (c) what the transition will cost by industry, or (d) what the transition will cost by country.

Last and possibly most important, almost no material amounts of funding have been committed as of 2022. Relatively speaking, there has been a handful of "transition bonds" issued, and South Africa's coal industry is close to receiving western "insurance guarantees" as it transitions to renewables. But the amounts of money are small, and private sector investors have not yet fully committed to them.

In conclusion, the term and the idea are relatively new. A great many leading organizations and people are actively engaged in supporting research and having many big meetings on the issue of transition finance. However, little actual action has been taken, there are huge information gaps, and almost no capital has been committed to funding the transition.

The urgency to make the transition from talking to actually funding activities continues to grow year by year, and ideally, 2023 will see major steps forward in moving from talking to taking real action (e.g., the commitment of capital). In addition, at this time, the projected total costs of the transition need to be more accurately projected, and the terminology and definitions need to be agreed to so the data gaps that currently exist can start to be filled in.

2. What is the "Term" and How Has It Been Defined

Based on a literature review, it appears that the term transition finance, as mentioned in the introduction, was first defined by the OECD. It first appeared in March 2019 in an OCED publication entitled Transition Finance: Introducing a New Concept, with the following introduction in the abstract: "This paper introduces the concept of transition finance and initiates research to advise the DAC on its role as a major provider of development assistance among other public and private providers of financing for the 2030 Agenda." (20)

Many definitions have appeared since then:

In June 2020, HSBC proposed, "Transition finance means any form of financial support that helps high-carbon companies start to implement long-term changes to become greener." In the same paper: "Transition finance targets sectors which are energy-intensive and hard-to-abate, and which cannot be green in the short-term as they do not have access to green alternatives which are economical or technically feasible." (11)

In December 2020, the International Capital Market Association (ICMA) put forth this definition in the first attempt at a handbook/guide to investors: "The concept of climate transition focuses principally on the credibility of an issuer's climate change-related commitments and practices." They appear to assume that the reader knows they are referring only to new bond issuances. It clarified: "a 'transition' label applied to a debt financing instrument should serve to communicate the implementation of an issuer's corporate strategy to transform the business model in a way which effectively addresses climate-related risks and contributes to alignment with the goals of the Paris Agreement." (10)

In May 2021, Nordea suggested that transition finance is industry-inclusive (spanning green to brown) and aims to offer especially high-emitting companies financing for the shift. (7)

In October 2021, the World Economic Forum changed the term slightly but the definition significantly. Calling it financing the transition, it is defined as "accelerating the mobilization of capital towards these early-stage decarbonization technologies." (5)

In March 2022, Fortune Magazine further refined the term: "A relatively new tool, transition finance is focused on supporting firms in emissions-intensive and hard-to-abate sectors to decarbonize, rather than on allocating capital to activities that already meet green standards. It

is typically structured as a use-of-proceeds bond, so issuers need to demonstrate that proceeds are used for activities that contribute to decreasing carbon emissions." (8)

In March 2022, the Bank of China narrowed the term: "Bank of China's (hereinafter referred to as "BOC") Transition Bonds enables BOC to achieve its decarbonization targets of business strategy by financing and/or refinancing eligible transition projects which are in line with strategic pathways of carbon neutrality goals and strategies of the countries and regions where the projects are located in." (19)

Most recently, in July of 2022, a paper published by the Natural Resources Defense Council (NRDC), Center for Macroeconomy and Finance of PKU, Institute of Finance and Sustainability (China) stated: "Although there is yet a ununified definition of transition finance, its connotation can be summarized as 'the use of diversified financial instruments to provide financial services for the low/zero-carbon transition of high emitting market entities with high environmental risks, economic activities, and project assets, in order to address climate change and achieve sustainable development.' Transition finance applies to all types of financial instruments, including but not limited to loans, bonds, funds, insurance, trusts, bills, asset-backed securities, etc." (28)

This list is not meant to be 100% inclusive and only provides examples from leading entities from 2019 to July 2022.

3. Lack of Agreement on Many Things: Leadership, similar terms, labels, taxonomies/definitions, metrics, frameworks, reporting/disclosure

According to an October 2021 analysis by the advisory firm Oxford Analytica, a lack of international standards and insufficient clarity over what constitutes a transition bond have held back uptake from many ESG investors. (3)

Who is leading and who should be leading the efforts around defining terms, labels, taxonomies, metrics, and reporting are all in flux and in a bit of a state of chaos based on what has been written.

3.1 Leadership

The G20 may be trying to lead on the subject based on a communication in February 2022 and reported by the London School of Economics (LSE) in late March 2022.

One area of focus for the G20's Sustainable Finance Working Group (SFWG) this year is transition finance, with finance ministers pledging to 'take actions to enable transition finance to support orderly, just and affordable transitions towards a low-greenhouse gas emissions and climate-resilient economy'. Supporting the shift from unsustainable activities. A relatively new tool, transition finance is focused on supporting firms in emissions intensive and hard-to-abate sectors to decarbonise, rather than on allocating capital to activities that already meet green standards. It is typically structured as a use-of-proceeds bond, so issuers need to demonstrate that proceeds are used for activities that contribute to decreasing carbon emissions. (13)

3.2 Similar Terms

The terms vary greatly; below is just a partial list of terms identified during this literature search. The definitions of these terms also are not consistent, but for space considerations, they are not included here.

- Adaptation Finance
- Climate Finance
- New Energy Finance
- Renewable Energy Finance
- Sustainable Finance
- Environmental Finance
- Green Funding
- Green Finance
- ESG Funding
- Climate Transition
- Energy Transition Finance
- Energy Transition Funding
- Transition Finance
- Green Bonds
- Targeted Impact Funds
- Impact Funds
- Socially Conscious Funds

3.3 Labels

In mid-July 2022, a coalition of funders—including Scottish Widows, Schroders, Railpen, Nest, Ninety-One, and others—claimed to represent GBP 3.6 trillion in assets under management at the Finance for Impact Summit by the Impact Investing Institute and said they would release a draft of a common set of criteria that will underpin a new label for "**transition finance.**" (30)

3.4 Taxonomies/Definitions

Taxonomies may currently have a bad name or label given the heated disagreements at the EU regarding the inclusion of natural gas and nuclear as "green." Although that decision is not connected to transition finance, it will most likely taint the term "taxonomy" related to green or climate change going forward.

On the somewhat brighter side, the NGFS is trying to lead in this area. A major subject being discussed by most groups is the need for the creation and implementation of a functioning taxonomy. In April 2022, the NGFS put forth the following:

Taxonomies are classification systems that define criteria to identify assets, projects and activities with environmental benefits or costs. At the same time, the challenges posed by a fragmented global landscape with many different taxonomies highlight the need to enhance comparability and interoperability across jurisdictions. According to an NGFS survey, most central banks and financial supervisors are either using or considering the use of taxonomies, whether they be national, regional or private sector-based taxonomies. (27)

3.5 Metrics and Frameworks

There is a great deal of talk and disagreement on transition metrics and transition frameworks for the long run. The NGFS's April 2022 paper does an excellent job of exploring these subjects.

Climate transition metrics and frameworks are important tools for central banks and financial authorities that may be looking to assess and guide an orderly climate transition through the use of market-based approaches. This chapter also offers a stocktake of the climate-related metrics, environmental pillar ratings and transition frameworks currently in use in financial markets. Moreover, a range of transition frameworks are emerging to help assess factors such as issuers' awareness of climate transition risks, ambition and readiness to decarbonise, governance and strategy, and medium and long-term science-based net zero targets. (27)

One topic that has been mostly unaddressed is the complete lack of focus on interim metrics and targets (for dates between now and 2050). In contrast to growing clarity on ESG standards and metrics that are being promulgated by various securities regulators (32), there is virtually no discussion about interim targets for:

- Specific amounts of capital being allocated by certain years,
- Specific use of funds by sector, or
- Standards or metrics for reporting on the actual usage of the funds.

3.6 Reporting/Disclosure

It appears that there is growing consensus but not full agreement that the International Financial Reporting Standards Foundation (IFRS Foundation), which was established in

November 2021 by the International Sustainability Standards Board (ISSB), will try and drive the creation of a global standard that will facilitate the widespread and consistent disclosure of sustainability information across sectors. The standard will be based on the Taskforce for Climate-related Financial Disclosure (TCFD) framework, which in recent years has been widely adopted by many entities across sectors and jurisdictions. (29)

4 Who Are the Players

Although the term and the subject may be only three years old, it has garnered a huge amount of attention. Some of the key groups writing, meeting, and working on the subject include but are not limited to:

- Central banks (individually, Basel Committee, BIS)
- Securities regulators (China, EU, USA and many others)
- Private sector banks (GSIBs and DSIBs)
- Other financial institutions (pension funds, issuance companies, hedge funds, etc.)
- Working groups (TCFD, FSB, NGFS)
- Major carbon-producing sectors (see the section of this paper on sectors)
- Governments and governmental created entities (UN, OECD, World Bank Group, regional, national, local; and a range of agencies)
- Standard-setting organizations (ISO, IFRS Foundation's ISSB)
- Academic institutions
- Research institutes
- Think tanks
- Consultants

This issue appears critical, and some anticipate that over many decades it will involve hundreds of trillions of US dollars or euros.

5 Activity in China

China has just recently approved the first official offering of transition bonds in the country, starting with the issuance of eight bonds by five firms. As of August 2022, available details in the public domain are still limited, but what we know is detailed below.

"China's first batch of interbank transition bonds was launched earlier this week (20/6/22), aimed at funding green transformation projects as Beijing pushes its sweeping decarbonization drive. Five state-owned enterprises (SOEs) issued the bonds. The issuers were Huaneng Power International Inc., Datang International Power Generation Co. Ltd., Aluminum Corp. of China Ltd., Wanhua Chemical Group Co. Ltd., and Shandong Iron and Steel Group Co. Ltd." (2)

"Companies in eight sectors — electricity, construction materials, steelmaking, nonferrous metals, petrochemicals, chemicals, papermaking and civil aviation — can issue bonds to help them shift to greener modes of operation, according to a notice published Monday by the National Association of Financial Market Institutional Investors (NAFMII), a self-regulatory body of China's interbank bond market under the central bank." (28)

6 Stranded Assets

One of the huge data items that is missing is how much coal, oil, and natural gas will need to be left in the ground and the book value remaining of the fixed assets that have been built to extract, move, process, and use them. Besides the raw materials, these stranded assets will include drills, pumps, mines, mining equipment, pipelines, ships, cars, trucks, planes, refiners, power plants, and many other hard assets. These items will be worth tens of trillions of euros based on when we stop building more capacity and when we decide we need to stop burning these raw materials.

Managing climate change and global warming will have an enormous impact on many industries but none greater than the extraction industries focused on coal, oil, and natural gas. By many estimates, we will need to leave well over 50% of the assets already known as "hydrocarbon raw materials" in the ground for perpetuity.

"If we are to meet climate targets consistent with limiting temperatures to 2° above pre-industrial times, a third of global oil reserves, half of gas reserves and 80% of current coal reserves will have to remain in the ground." (4)

In addition, downstream infrastructure, such as ports, pipelines, refineries and power generation, also risk being stranded or rendered obsolete before the end of useful working lifetimes. So too do fossil fuel-dependent heavy industrial processes. As these risks proliferate, they can quickly devalue the physical, human, and intangible assets of slow-moving companies and regions. Financial service businesses that are heavily invested in fossil fuel-entangled assets will also be hit, with concerns around systemic risk and sovereign risk, if large financial institutions or governments become insolvent. (4)

In its first attempt at understanding the impact on the finance world of stranded assets, the Bank of England performed a simple stress test on UK banks in the first half of 2022 with the results being losses in the hundreds of billions of pounds over the next three decades.

"The Bank of England said UK banks and insurers face climate-related losses of £209 billion to almost £334 billion over the next three decades depending on how quickly the government acts to shift the economy toward net zero emissions." (23)

The fossil fuel industry alone could result in losses that bring the global banking industry to bankruptcy. "According to the Bank of England, the loan exposures to fossil fuel producers and other transition assets in the UK amount to about 70% of all banks' capital." (11)

Decommissioning is a normal part of the life cycle of coal-fired power generation. In the past, coal plants have been retired at an average age of 46 but have a potential lifespan of 50–60 years. Accelerated decommissioning policies pose financial risks to utility companies by bringing forward their asset retirement obligations (AROs)—the financial liabilities associated with the dismantling of plants. According to a recent World Bank study, decommissioning costs can range from an average of USD 58,000/megawatt (MW) in India to USD 117,000/MW in the USA, implying multi-billion-dollar liabilities falling due in the coming years. In addition to plant closures, utility companies face costs associated with the removal of hazardous waste and environmental remediation. In Germany, for example, the coalition government plans to bring forward its coal phase-out to 2030, having previously set 2038 as the target date. This could feasibly entail a ramping up of its compensation scheme for coal operators, which in its current form envisages EUR 4.35 billion in direct compensation to be paid to lignite generators over 15 years. (17)

Access to cheap finance and investment will increasingly depend on demonstrating that assets will not be stranded in a carbon- and resource-constrained world. Outdated infrastructure, skills, and ideas that were previously assets will become liabilities. The risk of stranded assets means that firms will have to go beyond merely disclosing their emissions and resource use. Businesses must now demonstrate that their revenue model is resilient to, and profitable in, the low-carbon, resource-efficient economy of the 21st century through rigorous stress testing in rapid-change scenarios. (4)

A paper from the University of Oxford noted:

In developed markets such as the EU, stranded asset risks have arguably already materialized, with asset write-downs increasing six-fold since 2008 among the largest 14 coal utilities (Caldecott et al. 2017). While in the oil & gas sector, the growth of undeveloped reserves on a firm's balance sheets is shown to reduce firm value, especially when extraction costs are high (Atanasova & Schwartz 2019). These risks can be material for financial institutions holding real assets or equity and corporate bonds. In a climate stress-test of the financial system Battiston et al. (2017) calculate the direct equity exposure of investors to the fossil fuel sector. (24)

McKinsey's assessment of the stranded assets is summarized as follows:

The transition could also lead to asset stranding; whereby existing physical assets are either underutilized or retired before the end of their useful life. In the context of the net-zero transition, the capital stock associated with fossil fuels and emissions is worth many trillions of dollars, a significant share of the total global capital stock—and even more capital stock depends indirectly on these assets. Stranding large portions of this capital stock in a disorderly or abrupt way could impede value generation in many industrial sectors and indeed the global economy and would therefore need to be carefully managed. In power alone, for example, we estimate that some $2.1 trillion worth of assets could be stranded by 2050. About 80 percent of these stranded assets would pertain to fossil fuel-based power plants in operation today, primarily coal-fired plants in countries such as China and India that are relatively new (less than 15 years old) and would normally have many more years of productive life. Moreover, many assets that

could be stranded are capitalized on the balance sheets of listed companies. Early retirement of these assets would potentially lead to the reduction of (currently perceived) value and to bankruptcies and credit defaults, with potential knock-on effects on the global financial system. And markets may well pronounce their verdict before the actual stranding has taken place. Unsurprisingly, then, the possibility of asset stranding has prompted concerns about financial-sector risk and the need to build the capabilities to quantify and manage it. (22)

For a small example, when it comes to animal husbandry in relationship to stranded assets, we can look at the Netherlands: "Sustainability, relocation or termination are the options that farmers are faced with, and the government has made available €24.3 billion in subsidies during the transitional period." (18)

This is EUR 24 billion for only the cow and pig sectors of a single country with 17 million people.

The situation in regards to stranded assets is critical, yet no one has effectively quantified it by taking a country-by-country and sector-by-sector assessment of current balance sheets compared to a net-zero world set of balance sheets.

7 The Numbers

There is virtually no agreement on what the transition to net-zero emissions (NZE) will cost. There are some solid researched based numbers at the individual sector and smaller country level. This lack of hard data appears to be one of the main areas where extensive work done by one major player could be of great value if the results were seen as not biased in favour of any one country or sector.

In a study by Oxford Sustainable Finance Group in the fall of 2021, the cost to the financial services industry in write-offs is projected at 2.2 trillion (USD) or more based on when action is taken by governments.

We find that analysed firms are insufficiently aligned with the NetZero transition, highlighting that even in a scenario where climate action is taken by these companies as early as 2026, the cost to the financial sector is estimated to be US$ 2.2 trillion in total by 2035. We find that this financial cost increases by an additional US$ 150 billion for each year climate action by these companies is further delayed. (25 page 7)

Per the World Economic Forum, "in order to avert a catastrophic climate disaster, global clean energy investments of approximately $4-5 trillion are required annually by 2030 – a more than threefold increase from existing investment levels." (5)

In January 2022, McKinsey published some of the most detailed numbers thus far. Some of the highlights are covered in this summary paragraph from their paper:

> Capital spending on physical assets for energy and land-use systems in the net-zero transition between 2021 and 2050 would amount to about $275 trillion, or $9.2 trillion

> per year on average, an annual increase of as much as $3.5 trillion from today. To put this increase in comparative terms, the $3.5 trillion is approximately equivalent, in 2020, to half of global corporate profits, one-quarter of total tax revenue, and 7 percent of household spending. An additional $1 trillion of today's annual spend would, moreover, need to be reallocated from high-emissions to low-emissions assets. Accounting for expected increases in spending, as incomes and populations grow, as well as for currently legislated transition policies, the required increase in spending would be lower, but still about $1 trillion. The spending would be front-loaded, rising from 6.8 percent of GDP today to as much as 8.8 percent of GDP between 2026 and 2030 before falling. (22)

A NZE (Net Zero Emissions) scenario expands annual investment in energy from just over USD 2 trillion globally on average over the last 5 years to almost USD 5 trillion by 2030 and to USD 4.5 trillion by 2050. The total annual capital investment in energy in the NZE scenario rises from around 2.5% of global GDP in recent years to about 4.5% in 2030 before falling back to 2.5% by 2050. Electrification is the dominant focus in the NZE scenario. In addition to more investment in electricity generation, there is a huge increase in investments in the expansion and modernization of electricity networks. Annual investment increases from USD 260 billion on average in recent years to around USD 800 billion in 2030 and remains at about that level to 2050 (9)

The largest increase in investments over the next decade is in electricity generation: annual investment increases from about USD 0.5 trillion over the past 5 years to USD 1.6 trillion in 2030. By 2030, annual investment in renewables in the electricity sector is around USD 1.3 trillion, slightly more than the highest level ever spent on fossil fuel supply (USD 1.2 trillion in 2014). Annual investment in clean energy infrastructure increases from around USD 290 billion over the past 5 years to about USD 880 billion in 2030. This is for electricity networks, public electric vehicle (EV) charging stations, hydrogen refueling stations, import and export terminals, direct air capture, and CO2 pipelines and storage facilities. (9)

Our latest research estimates cumulative spending of US$275 trillion globally over the next 30 years on physical assets in energy and land use to reach net-zero. This represents an annual average of $9.2 trillion, about $3.5 trillion more than we are spending today. By comparison, that annual increase would be equivalent to half of 2020's global corporate profits, one quarter of total tax revenue, and 15% of gross fixed capital formation. (7)

The transition bond market is still nascent compared with other types of sustainable

finance. In the first three quarters of 2021, 14 transition bonds were issued, accumulating to USD 5 billion, according to the Climate Bonds Initiative. In September 2021, the volume of transition bonds stood at USD 9.9 billion, with 31 issuances in total. In comparison, green bond issuances grew to USD 354.2 billion in the first three quarters of 2021, bringing the total volume to USD 1.4 trillion. (14)

On the bright side, some say the world can afford it:

Highlights show how the global balance sheet has tripled in size in the past 20 years, with total global net worth rising to about $500 trillion. Utilizing a part of that wealth toward productive uses to fund the net-zero transition could and should be a priority. The financial outlay in response to the current pandemic is also an indication of what can be done when a necessity is recognized. (8)

The projections range enormously, and most of the projections do not appear to be based on actual balance sheets, income statements, or product pricing in any robust analytical manner.

8 Very Big Open Questions: Sector data, a just transition for all, greenwashing, standard reporting, and certification

8.1 Sector Data

Given the following facts, it is not surprising that we have a lack of data sets or financial projections on how expensive the transition is going to be:

- the newness of the term,
- the fact there are actually many similar terms, and
- the fact that there is no clear agreement on terminology or definitions.

Although we were unable to find a great deal of global data that has actually tried to calculate the total global cost by sector or sub-sector, the best version appears to be McKinsey's early 2022 seminal piece.

The entire following extraction is a shortened version of their piece. The shortened piece is used in order to keep this paper brief. They focus on seven key sectors.

We find that, while all sectors of the economy are exposed to a net-zero transition because of their participation in energy and land-use systems, some are more exposed than others. Together they account for about 85 percent of global GHG emissions through their operations or products, and we present our analysis of the economic changes they would likely experience in the Net Zero 2050 scenario.

- **Fossil fuels**. Combustion of fossil fuels produces 83 percent of global CO_2 emissions. In the scenario analyzed here, oil and gas production volumes in 2050 would be 55 percent and 70 percent lower, respectively, than today. Coal production for energy use would be nearly eliminated. Under the net-zero transition, demand for jobs within the fossil fuel extraction and production sector could be lower by about nine million direct jobs by 2050.

- **Power**. To decarbonize, the global power sector would need to phase out fossil fuel-based generation and add capacity for low-emissions power to meet the additional demand arising from both economic development and the growing electrification of other sectors. It would require substantial annual capital spending from 2021 to 2050, which we estimate at about $1 trillion in power generation, $820 billion in the power grid, and $120 billion in energy storage in the NGFS Net Zero 2050 scenario. Our analysis suggests that about $2.1 trillion of the sector's capital stock could be stranded by 2050 in the Net Zero 2050 scenario.
- **Mobility**. Our analysis of mobility focuses on the road transportation segment, which accounts for about 75 percent of all mobility emissions. Decarbonization would involve replacing ICE vehicles with battery-electric vehicles or vehicles powered by hydrogen fuel cells. In the Net Zero 2050 scenario, annual spending would be $3.5 trillion on both vehicles and to build charging and fueling infrastructure between 2021 and 2050.
- **Industry**. We focus on two sectors, steel and cement, that together account for approximately 14 percent of global CO_2 emissions and 47 percent of industry's CO_2 emissions. While technology pathways are still emerging, steel and cement production could be decarbonized by installing CCS equipment or switching to processes or fuels—such as hydrogen—that can have zero or low emissions. Production costs in both sectors could increase by more than 30 percent by 2050 compared with today.
- **Buildings**. In the net-zero scenario, the buildings sector would decarbonize by improving energy efficiency. The average annual spending on physical assets between 2020 and 2050 would be $1.7 trillion per year. The buildings sector's biggest adjustment during this transition would be managing the up-front capital costs for end consumers to retrofit equipment.
- **Agriculture and food**. Through 2050, more than $60 billion of annual capital spending would be needed to enable more emissions-efficient farming.
- **Forestry and other land use**. Reaching net zero in this scenario would involve halting deforestation and accelerating efforts to restore forests and other natural environments to serve as a net sink of emissions. Making these changes would require capital spending of $40 billion per year between 2021 and 2050 in the scenario analyzed here, about 75 percent of which would be spent in the next decade, primarily on acquiring and protecting land.

8.2 Sector-Specific Guidance

In Japan, "the Ministry of Economy, Trade and Industry (METI) will set up a task force to formulate sector-specific roadmaps for the transition to decarbonization, with the aim of promoting climate transition financing. It will also start a project to create case examples of good practice by calling for examples of finance that conform to the Basic Guidelines and are deemed to have model qualities." (14).

METI has identified certain industries for transition finance: “target sectors for FY2021 include steel, chemistry, electric power, gas, petroleum, cement and paper/pulp. (14)

8.3 A Just Transition for All

As the G20 Finance Ministers pointed out last month (February 2022), successful transitions need to be “orderly, just and affordable.” This builds on the major shift made at the 26th Conference of the Parties (COP 26) to the UN Framework Convention on Climate Change. There, the just transition idea moved into the mainstream of climate policy and finance with at least 10 new initiatives launched that had a direct or indirect focus on making the just transition a reality. Indeed, the Glasgow Financial Alliance for Net Zero (GFANZ) has recognized the just transition as a “best practice” component for the transition plans of both the real economy and the finance sector. (13).

Another perspective on a just transition is an “unjust transition.” The issue of a just transition, which refers to mitigating the negative socio-economic consequences of switching to a low-carbon economy, is gaining prominence. These consequences, which are becoming more visible, include unemployment and the potential cessation of essential services following the loss of tax or export revenue. Coal and agriculture are at the forefront of the issue, though it can manifest across a range of economic sectors. These issues can add to concerns that ambitious decarbonization policies will trigger a backlash as net-zero pledges are implemented. Governments may choose to channel public spending to affected sectors to mitigate these problems. (15)

The Just Energy Transition Partnership (JETP)—a USD 8.5 billion funding deal agreed in principle at COP 26 by several developed nations to help South Africa transition away from coal—appears to be making progress. In May, Bloomberg reported that the partners (including the USA, the UK, Germany, France, and the EU) have proposed debt guarantees as part of the deal, which may also include grants, concessional loans, and private investment. This could alleviate some pressure on the South African government to guarantee debt taken on by state-owned utility Eskom Holdings SOC Ltd.’s (B/Stable), which produces about 90% of the country’s electricity, to fund its low-carbon transition. (16)

8.4 Standard Reporting, Greenwashing Identification, and Certification

Many entities are talking about Standard Reporting, Greenwashing Identification, and Certification and putting forth proposals. At this time, it appears very unclear who will emerge as the leader on these topics or what the definitions will be.

One of the leaders on these topics might be Climate Bonds, which is based in the UK. In September of 2021, they published a paper with the following goals:

> It is also Climate Bonds' intention to certify instruments beyond use-of-proceeds bonds, including SLBs and similar (e.g., Sustainability Linked Loans - SLLs). The intention is to provide transparency over the science-based criteria for credible SLBs and similar instruments, and assurance for investors that those requirements have been met in respect of any certified issuance. Consideration is also being given to the certification of companies (i.e., not in association with any particular financial instrument). This paper presents Climate Bonds' proposal of the five hallmarks of a credibly transitioning company, i.e., a company whose transition is rapid and robust enough to align with the global goal to nearly halve emissions by 2030 and reach net zero by 2050, in line with the Paris Agreement. These would be the key elements that would be the focus of assessment for certification, and all five hallmarks would need to be satisfied. (21).

As was reported by Caixin Global in June of 2022:

> ***Transition bonds*** have drawn controversy as critics view them as a form of subsidy to polluting companies. According to an October analysis by advisory firm Oxford Analytica, a lack of international standards and insufficient clarity over what constitutes a transition bond have held back uptake from many environmental, social and governance (ESG) investors. Some companies have used funds raised from transition bonds to pay for routine upgrades rather than significantly reducing their carbon footprint, the analysis said. As a result, ESG-focused investors could favor ***green bonds*** — which are reserved for specific environmentally friendly projects — over ***transition bonds***. (28)

9 Conclusions/Recommendations

9.1 Conclusions

Transition finance is a bit like "the wild west"—almost no rules and no one in charge—and it is also like the start of a horse race where the horses and riders are all jockeying for position, but it is too early to tell who will win (i.e., everyone is establishing terms and definitions and talking about what industries are included, who will set the standards and establish public policy, and no one knows who is gaining the most financially).

There are many needs, but the most prominent active issues at this time include:

- Establishing one set of terms.
- Establishing a single definition for each term.
- Agreeing on what industries qualify for "transition finance."
- Establishing clear "auditable" conditions for what qualifies as a transition finance financial instrument.
- Establishing intermediary goals for amounts funded and gradually more stringent reporting requirements and metrics.

- Deciding whether transition finance goes beyond just the company receiving the capital to include workers and civil society overall.
- Reporting high-quality firm and country data that is disclosed and audited/verified, as well as comparable across national boundaries.
- Identifying and quantifying a range of potential "write-offs" related to stranded assets by country/sector.
- Issuing more debt instruments that specifically target the greening of brown industries.

9.2 Recommendations

These recommendations identify two specific areas where the working group could act.

1. **Understanding the possible costs of stranded assets**

Understanding the value of stranded assets by major category based on what is currently on corporations' and countries' balance sheets would provide critical information. At a minimum, we need to understand the current book value of:

- Coal, natural gas, and petroleum reserves on the books.
- The write-off impact of the early retirement of equipment and hardware linked to fossil fuel extraction, processing, movement, pipelines, distribution, and use.
- The early equipment obsolescence of major industries such as steel, cement, and other metals and construction materials.
- Transportation (cars, trucks, planes, boats, etc.).
- Agriculture (animal husbandry and crops).

2. **Issuing actual transition finance securities**

China established a baseline for bonds when the five state-owned firms issued guidelines for eight industries in July/August 2022. This action could rapidly expand in the coming 12–18 months by taking the following actions:

- Document the rules and guidelines on how something qualifies as a "transition bond," including establishing criteria for qualification, the review process, the verification process for the use of transition bonds, etc.
- Make the rules and guidelines industry-specific and get expert input from outside of China so they have global credibility.
- Create a suite of debt products that go beyond bonds.
- Get the private sector industry to issue, finance, and underwrite the issues.
- Make the use of the funds "newsworthy". Show the funds are moving China closer to net-zero.

What not to do: We do not recommend trying to take the lead on the various areas of terms, definitions, policies, greenwashing policing, or the other topics mentioned above and throughout this paper.

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