
THE GREEN CENTRAL BANKING SCORECARD

2022 EDITION



ACKNOWLEDGEMENTS

We would like to thank Hilal Atici (The Sunrise Project), Melanie Mattauch (The Sunrise Project), Siman Li (The Sunrise Project), Danqing Li (The Sunrise Project), Jamie Woolley (Green Central Banking), Graham Caswell (Green Central Banking), Paul Schreiber (Reclaim Finance), Julia Symon (Finance Watch), Lukasz Krebel (New Economics Foundation), Sebastian Guo (Council on Economic Policies), Julia Bingler (Council on Economic Policies), Maud Abdelli (WWF), Ivo Mugglin (WWF), Adam Ng Boon Ka (WWF), Anne Perrault (Public Citizen), Katie Kedward (UCL IIPP), Alex Speers-Roesch (Greenpeace Canada), Uuriintuya Batsaikhan (Positive Money EU), Danisha Kazi (Positive Money UK), Simon Youel (Positive Money UK), Zack Livingstone (Positive Money UK), Anna Pick (Positive Money UK), Chloe Musto (Positive Money UK) and Fran Boait (Positive Money UK) for helpful conversations, contributions and comments. We are also grateful to the central bankers across the G20 that engaged with this project.

AUTHORS

Nikki Eames, David Barmes.

SUGGESTED CITATION

Nikki Eames and David Barmes (2022). The Green Central Banking Scorecard 2022 Edition. Positive Money.

Available at: <https://positivemoney.org/publications/green-central-banking-scorecard-2022>

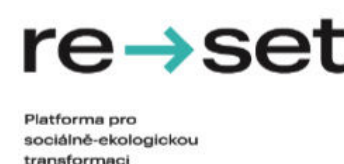
PERMISSION TO SHARE

This document is published under a creative commons licence. Attribution-NonCommercial-NoDerivatives 4.0 International.



Endorsements

The following organisations have expressed their support for the key messages of The Green Central Banking Scorecard. These organisations endorse the contents of this report as a whole, but not necessarily every score awarded to every country.



Re_Generation

Contents

| | |
|---|----|
| Acknowledgements | 2 |
| Endorsements | 3 |
| Contents | 4 |
| Executive summary | 6 |
| Green Central Banking Scorecard - Results | 8 |
| Summary of Recommendations | 9 |
| | |
| Section 1: Central banking in a period of multiple crises | 10 |
| 1.1 Materialising physical risk | 10 |
| 1.2 Volatile fossil fuel prices | 11 |
| 1.3 Hazards of delayed action | 11 |
| | |
| Section 2: Are central banks meeting the moment? | 13 |
| 2.1 Research and Advocacy | 15 |
| 2.2 Monetary Policy | 16 |
| 2.3 Financial Regulation | 18 |
| 2.4 Leading by example | 20 |
| | |
| Section 3: What is holding central banks back? | 22 |
| 3.1 Ambiguous mandates | 22 |
| 3.2 Analysis over action | 22 |
| 3.3 Commitment to the idea of market neutrality | 23 |
| 3.4 Fossil fuels classified as green assets | 23 |
| | |
| Section 4: How can central banks become green leaders? | 25 |
| Key recommendations | |
| 4.1 New frontiers in green central banking | 25 |
| 4.2 Green and expanded monetary policy toolkits | 27 |
| 4.3 Actively supervise environmental risks | 28 |
| 4.4 Lead by example | 29 |
| | |
| Conclusion | 31 |
| Bibliography | 32 |

Executive Summary

Central banks and financial regulators¹ are currently operating in a context of multiple, overlapping crises. Acute physical risks from climate change are materialising globally, with the most severe impacts in the Global South. Droughts, floods, wildfires and heat waves have wrought havoc on human lives and natural ecosystems, thereby severely impacting price stability (Caswell, 2022c). The price of the world’s “addiction to fossil fuels” has been further highlighted by soaring energy prices, which are leaving people across the world unable to afford basic essentials (United Nations, 2022). Central banks and financial regulators now stand at crossroads: they can either support socially and environmentally catastrophic economic pathways that will undermine their own price and financial stability mandates, or act decisively to help shift financial flows to a credible pathway to net zero (Network for Greening the Financial System, 2022b).

Since the first edition of the Green Central Banking Scorecard in March 2021, monetary and prudential authorities have made progress in their consideration of environmental factors (Barnes and Livingstone, 2021) . Almost all (17) G20 countries have now achieved full marks in the Research and Advocacy category of our scorecard, compared to 14 countries in 2021. 19 out of the 20 central banks assessed in this report are now members of the Network for Greening the Financial System (NGFS), highlighting the extent to which climate risk and sustainable finance has become mainstream. Central banks that are most advanced in their environmental work have begun acknowledging the principle of double materiality, accounting for both the financial causes and consequences of climate change in their research, disclosure standards, and policies.

Progress in recognising environmental breakdown² as relevant to monetary policy and prudential regulation has coincided with a drastic change in the macroeconomic context. Inflation, driven by the price of fossil fuels, has highlighted that a transition to renewable energy is not only necessary to mitigate climate change, but also an urgent social, economic and security requirement. In this context, the lack of central banking tools to address supply side inflation has become clear. Raising interest rates may threaten capital-intensive green investments, whilst increased fossil fuel lending will lock in long term environmental risks. It is now imperative that central banks expand their toolkits, and collaborate with fiscal, industrial and environmental authorities, to deal with multiple intersecting emergencies.

After topping the ranking in the first edition of the Scorecard, the People’s Bank of China (PBoC) has continued its innovation in green monetary policy by launching a carbon emission reduction facility. However, its position in the scorecard has deteriorated due to its extensive support for coal (PBoC, 2021). In parallel, the European Central Bank (ECB) has taken a leading role in greening its market operations by tilting its corporate asset purchase programmes towards companies with a better climate performance (Reclaim Finance, 2022b), and committing to limit and penalise the most carbon-intensive assets in its collateral frameworks, beginning in 2024 (ECB, 2022b).

Prudential regulators have also increasingly recognised the need to develop adequate macroprudential tools to deal with climate-related financial risk (Financial Stability Board, 2022). General developments have included extensive climate scenario analyses, and the inclusion of climate-related financial risks in the supervisory process, under Pillar II of the Basel Framework. Beyond monetary policy and prudential regulation, the leader of the 2022 edition of the Scorecard, the Banque de France, ranks ahead of its Eurosystem colleagues because it has aligned all non-monetary portfolios with 1.5 degrees of warming and adopted fossil fuel exclusions.

Although central banks and financial regulators are beginning to take action on climate change, it is far from impactful, ambitious, or timely enough to effectively mitigate the impacts of climate change on price and financial stability. Other than the Banque de France, all G20 central banks and financial regulators continue to score Grade C+ and below, revealing that they are yet to implement concrete, meaningful and impactful environmental measures. These institutions are maintaining excessively narrow interpretations of their mandates, prioritising exploratory analysis over action, staying committed to a carbon intensive idea of market neutrality, and classifying fossil fuels as green assets.

To prevent environmental risks from further materialising with catastrophic outcomes, central banks and financial regulators should utilise the concepts of double materiality, radical uncertainty, and a precautionary approach to implement high impact monetary and financial policies without delay.

¹ The institutional division of responsibilities for monetary policy and prudential regulation, which this report focuses on, differs from one country to the next. We cover the policies and initiatives of all central banks across the G20, and where prudential regulation sits primarily with separate institutions, we also assess these institutions’ green policies and initiatives. When we use the term “green central banking” or “green central banking and financial regulation”, we are referring to monetary and prudential authorities.

² We use the term ‘environmental breakdown’ to refer to climate change as well as biodiversity loss, air, water, and land pollution, and more broadly the degradation and collapse of natural ecosystems. Accordingly, we use the term ‘environmental risks’ to refer to the financial risks associated with environmental breakdown. This encompasses both ‘climate-related’ and ‘nature-related’ financial risks, which are often treated as separate types of risk.

GREEN CENTRAL BANKING SCORECARD - RESULTS

G20 COUNTRIES RANKED BY GREEN MONETARY AND FINANCIAL POLICIES

| Rank | | Country | Research and Advocacy (out of 10) | Monetary Policy (out of 50) | Financial Policy (out of 50) | Leading by Example (out of 20) | Aggregate Score (out of 130) | Grade (A+ to F) |
|----------|---|----------------|--------------------------------------|--------------------------------|---------------------------------|-----------------------------------|---------------------------------|--------------------|
| 1 (1) | - | France | 10 | 12 | 31 | 17 | 70 (52) | B- |
| 2 (6) | ↑ | Italy | 10 | 12 | 31 | 8 | 61 (45) | C+ |
| 3 (7) | ↑ | Germany | 10 | 12 | 30 | 8 | 60 (44) | C+ |
| 4 (4) | - | European Union | 10 | 12 | 28 | 8 | 58 (47) | C |
| 5 (5) | - | United Kingdom | 10 | 10 | 27 | 9 | 56 (46) | C |
| 6= (2) | ↓ | Brazil | 10 | 18 | 18 | 7 | 53 (51) | C |
| 6= (3) | ↓ | China | 10 | 12 | 31 | 0 | 53 (50) | C |
| 8 (9) | ↑ | Japan | 10 | 6 | 14 | 5 | 35 (25) | D+ |
| 9 (8) | ↓ | Indonesia | 10 | 1 | 14 | 5 | 30 (26) | D+ |
| 10 (14) | ↑ | Canada | 10 | 2 | 14 | 2 | 28 (15) | D |
| 11= (11) | - | Mexico | 10 | 4 | 4 | 5 | 23 (17) | D |
| 12 (10) | ↓ | India | 10 | 0 | 10 | 1 | 21 (18) | D |
| 13 (11=) | ↓ | South Korea | 10 | 1 | 6 | 2 | 19 (17) | D- |
| 14 (16) | ↑ | Russia | 8 | 0 | 8 | 2 | 18 (12) | D- |
| 15 (13) | ↓ | Australia | 10 | 0 | 4 | 3 | 17 (16) | D- |
| 16 (14=) | ↓ | United States | 10 | 0 | 6 | 0 | 16 (15) | D- |
| 17 (18) | ↑ | Turkey | 10 | 0 | 2 | 2 | 14 (4) | D- |
| 18 (17) | ↓ | South Africa | 10 | 0 | 2 | 1 | 13 (10) | D- |
| 19 (19=) | - | Argentina | 6 | 0 | 0 | 0 | 6 (0) | F |
| 20 (19=) | ↓ | Saudi Arabia | 0 | 0 | 0 | 0 | 0 (0) | F |

To see the full breakdown of policies and grading each country, please visit: <https://greencentralbanking.com/scorecard/>

SUMMARY OF RECOMMENDATIONS

Central banks and financial regulators should consider the following recommendations:

| | |
|-----------------------|--|
| Research and Advocacy | 1. Act on environmental risks beyond climate: explore and address risks related to biodiversity loss, water scarcity, and other ecological threats, as well as risks related to climate change. |
| | 2. Adopt a precautionary approach: recognise that environmental risks are characterised by radical uncertainty, and therefore early action is warranted to prevent catastrophic outcomes. |
| | 3. Adopt a double materiality framework: account for financial institutions' contribution to environmental impacts, and how this further increases systemic vulnerability to environmental risks. |
| | 4. Consider historical responsibility for climate change: G20 central banks with the greatest historic contribution to climate change should bear the most responsibility for action. |
| Monetary Policy | 5. Create green lending schemes: offer a green discount rate to incentivise and increase lending to sustainable activities. |
| | 6. Green asset purchase programmes: assets linked to the most environmentally harmful activities, such as deforestation and fossil fuel expansion, should be negatively screened for in standard and emergency asset purchase programmes. |
| | 7. Green collateral frameworks: assets linked to the most environmentally harmful activities should be negatively screened for, and subjected to higher haircuts, in collateral frameworks. |
| Financial regulation | 8. Adapt capital requirements: increase risk weights for new and existing fossil fuel exposures and introduce environmental systemic risk buffers. |
| | 9. Consider limits on dirty lending: consider imposing limits on lending to the most environmentally destructive projects and companies. |
| | 10. Require all financial institutions to disclose credible transition plans based on scientific evidence: make transition plans mandatory and supervise how financial institutions are achieving their targets. |
| Leading by example | 11. Align all non-monetary portfolios with the Paris Agreement and environmental goals: exclude assets linked to the development of new fossil fuel projects and other environmentally harmful activities. |
| | 12. Engage with citizens and civil society: As public institutions, central banks and financial regulators should engage with a wide cross section of society. |

Section 1:

Central banking in a period of multiple crises

The Network for Greening the Financial System (NGFS) began in 2017 with just eight central banks as founding members. The stated purpose of the group is to mobilise finance toward the goals of the Paris Agreement (Network for Greening the Financial System, 2019a). Since then, leaders across the G20 have increasingly recognised that acting on climate change falls within both the primary and secondary mandates of central banks. The NGFS now counts 121 central banks, prudential regulators and financial supervisors as members, reflecting widespread acceptance of the need for ambitious action to green international finance. Now, more than ever, in the face of severe physical climate impacts and volatile fossil fuel prices, it is critical that central banks seize this momentum to implement effective green policies.

1.1 Materialising physical risk

Environmental breakdown poses three main risks to central banks and financial regulators' core mandates of maintaining price and financial stability: physical risk, transition risk, and litigation risk. Physical risk refers to the potential financial loss resulting from the impact of climate change, such as extreme weather, rising sea levels, and loss of ecosystems. Transition risk reflects the possibility for the loss of value of assets due to sudden changes in policy, consumption, and technology to facilitate the adjustment to a low carbon economy (Bank for International Settlements, 2021). Litigation risk is directly related to both physical and transition risk, and refers to the potential for public or private entities to be held accountable in courts for negligence in dealing with environmental risks and aligning with environmental targets (Network for Greening the Financial System, 2021).

The acute physical impacts of climate change are no longer abstract risks. Climate disasters are being experienced across the world, with the impacts most severe in the Global South. Wildfires, flooding, droughts, and extreme weather have impacted millions of lives, and created huge economic costs. This physical destruction is already having an impact on both price and financial stability. Droughts across the EU, US, China, Latin America, and Africa have impacted agricultural production (European Commission Joint Research Centre, 2022) and driven up food prices, leaving millions in severe hunger (Caswell, 2022c). Last summer's severe drought in Europe, as a result of intense heat waves, caused food prices to rise up to 50% in some regions (Butler, 2022). Extreme weather events such as hurricanes, which have become more frequent and intense due to climate change, are now costing the United States over a billion dollars in damages every month (The White House, 2022). This is reducing long term economic growth, and threatening the safety and soundness of smaller banks. Such extreme events directly impact the financial sector by raising prices, damaging assets, and pushing up insurance premiums (European Central Bank, 2022d). One of the most acute climate catastrophes of 2022 resulted in the flooding of one third of the country of Pakistan, killing over 1,500 people and injuring nearly 13,000 (Hussain, 2022). Alongside the immense human cost, the floods caused supply disruptions and pushed prices of essentials up by 45% (Pakistan Bureau of Statistics, 2022).

The physical risks of climate change are already materialising with catastrophic human and economic consequences. A further intensification of this physical destruction, without preventative action, may include ecosystem extinction, more intense droughts, floods, and heatwaves, and

displacement due to sea level rises, causing food and water insecurity as well as physical loss and damage (Intergovernmental Panel on Climate Change, 2022).

1.2 Volatile fossil fuel prices

Towards the end of 2021, central banks across the G20 were faced with the beginning of an ongoing period of high inflation (International Monetary Fund, 2022). Multiple factors have contributed to rising prices, including supply shortages due to COVID-19 outbreaks and lockdowns, Russia's invasion of Ukraine, and corporate profiteering. However, soaring energy prices have further shown the cost of our "addiction to fossil fuels" (United Nations, 2022), is not just physically destructive, but is also causing energy prices to be subjected to high volatility.

Energy is an input for all goods and services across the economy, and is essential for heating homes and transportation. Therefore, demand for energy is highly inelastic, meaning that it will remain high despite price growth. Due to this systemic significance, an energy price shock has major impacts on macroeconomic variables, including inflation and economic growth (Battistini et al., 2022). Fossil fuels are notoriously subject to significant fluctuations in price, making them additionally risky and unsuitable sources of energy. As finite resources, fossil fuels give geopolitical power to countries and regions with large supplies, and incentivise the exportation of energy to often speculative international markets. This instability of fossil fuel prices has been termed 'fossilflation' (Schnabel, 2022).

Across the globe, the prices of oil, natural gas and coal have risen sharply, contributing to overall inflation levels. In the Euro area, between April and May 2022, higher energy prices were the cause of more than 50% of inflation, as measured by the Harmonised Index of Consumer Prices (HICP) (Reclaim Finance, 2022a). Similarly, the Bank of England found that goods and energy price inflation together accounted for around 80% of CPI above 2% in March, reflecting supply chain constraints for tradable goods and energy prices rises (Bank of England, 2022e). Subsequent bidding for natural gas between Europe and Asia has made energy unaffordable for economies in the Global South, causing power outages in Bangladesh and Pakistan (Koh, 2022). Oil prices have also risen sharply globally, due to OPEC plans to cut supply (International Energy Agency, 2022). The volatility of fossil fuels prices is highly contingent on geopolitical factors, meaning that there is no assurance that fossil fuel prices will fall in the short or medium term.

1.3 Hazards of delayed action

The International Energy Agency's pathway to net zero by 2050 requires that beyond 2021 there can be no new oil and gas fields, or new coal mines or mine extensions (International Energy Agency, 2021). National and international commitments to net zero also require short term deadlines. The Intergovernmental Panel on Climate Change has therefore determined that to limit global warming to 1.5 degrees, greenhouse gas emissions should peak by 2025, and at the latest be halved by 2030 (Intergovernmental Panel on Climate Change, 2018). These goals are complementary with, not contradictory to, goals of energy security. To tackle both the price instability resulting from dependence on volatile fossil fuels and the physical and transition risks that result from environmental breakdown, central banks should act in coordination with fiscal, industrial and environmental authorities to shift global financial flows in support of the green transition without delay.

Renewable energy offers an alternative energy source that is stable, clean, accessible, and efficient. Compared to oil, gas, and coal, which have continuous and unpredictable costs associated with discovery and extraction, renewable energy sources are naturally replenishing, offering the potential for long-term fixed prices (Melodia and Karlsson, 2022). With a much more equitable

spread of natural renewable energy resources, incentives for domestic production and consumption increase, reducing the risk of geopolitical price spikes. Green energy has the potential to become much cheaper than fossil fuels, as the cost of solar, wind, and batteries have dropped exponentially over the last several decades (Way et al., 2022). Deploying renewable energy can be coupled with increased energy efficiency measures, to reduce the overall energy demand, and its subsequent impact on inflation (Lagarde, 2022). Compared to continuing with a fossil-fuel based system of energy, a rapid transition to green energy and increased energy efficiency could enable trillions of dollars of savings, before even considering the climate costs of fossil fuels (Way et al., 2022).

The longer that the transition to renewable energy is delayed, the greater the risks to both price and financial stability will grow. The more carbon is released into the atmosphere, the greater the impacts of climate change will become, and the faster the transition will have to take place. A delayed or failed transition could result in extremely volatile energy prices (Reclaim Finance, 2022a), as an abrupt change to energy policy to meet net zero commitments could change the value of fossil fuel assets rapidly leaving assets stranded (Network for Greening the Financial System, 2022b). The extent of the potential for stranded assets is vast: think tank Finance Watch found that the world's 60 largest banks have exposures valued over £1.2 trillion (\$1.35 trillion USD) to fossil fuel assets (Finance Watch, 2022).

Faced with inflation primarily driven by supply shocks, the responses from central banks have been counterproductive in addressing the underlying causes of price instability. The majority of G20 central banks have focused on dampening demand, despite the fact that “interest rate hikes cannot increase the supply of gas from Russia, nor can they open up alternative energy sources” (Heimberger and Steininger, 2022). In fact, raising interest rates may threaten the green transition by choking the capital investment that is needed for the production of renewable infrastructure (Kedward, 2022). Even central banks with advanced supply-side tools, such as targeted green lending schemes, risk undermining long term energy security by providing subsidised lending to fossil fuels.

Central banks and financial regulators now stand at a crossroads. A delayed or failed transition will enable carbon lock-in and potentially catastrophic and irreversible damage to natural ecosystems, causing significant physical and transition risks to materialise (Seto et al., 2016). **Now, more than ever, central banks should follow an ambitious path to net zero through a decisive shift of financial flows away from fossil fuels and other environmentally harmful projects (Network for Greening the Financial System, 2022b). This would reduce the cost of the green transition, increase energy security, stabilise prices, and prevent catastrophic environmental risks from materialising.**

Section 2:

Are central banks meeting the moment?

The Green Central Banking Scorecard separates central banks and financial regulators' green policies into four main categories: Research and Advocacy, Monetary Policy, Financial Policy, and Leading by Example. Through analysis of green monetary and financial policies, expert consultation, and bilateral interactions with central banks and financial regulators, we have tracked updates to G20 monetary and prudential authorities' green policies over the past year (October 2021-2022), and factored these updates into our 2022 edition Scorecard. This section outlines the most prominent advances in green central banking and financial regulation, highlighting key reasons for movements in the ranking.

Box 1: Methodology of the Green Central Banking Scorecard

The Green Central Banking Scorecard methodology was developed for the first edition, published in March 2021.³

The green policymaking of G20 central banks and supervisors are evaluated across the four key categories: *Research and Advocacy*, *Monetary Policy*, *Financial Policy*, and *Leading by Example*.

- **Research and advocacy:** includes membership of the NGFS, adopting key principles and delivering environmental publications, such as articles, speeches, and research reports.
- **Monetary policy:** includes green policies related to asset purchases and monetary reserves, collateral frameworks, funding and refinancing schemes, reserve requirements and interest rates, direct credit allocation, and coordination with fiscal authorities.
- **Financial regulation:** includes green policies related to disclosures and stress-testing, capital and liquidity instruments, and the regulation of financial institutions' impacts.
- **Leading by example:** includes disclosing central banks' environmental risks, greening non-policy portfolios, supporting and using taxonomies and standards, educating on environmental risk and green finance, and embedding environmental principles in day-to-day activities.

Within each of the four categories, green policies are further divided into three impact levels: high, medium, and low impact.

- **High impact** policies actively contribute to shifting financial flows away from economic activity most responsible for causing the climate crisis: the extraction, processing and distribution of new fossil fuels.
- **Medium impact** encompasses other policies that are likely to have a positive impact on financial flows. This includes policies that shift finance away from some carbon-intensive assets, but fall short of applying such incentives or restrictions to all new fossil fuel projects. Policies that promote investment in green assets are also considered medium impact.

³ The full methodology for the Green Central Banking Scorecard (Barnes and Livingstone, 2021) can be found on page 26-31 of the Green Central Banking Scorecard first edition. Found here: <https://positivemoney.org/publications/green-central-banking-scorecard/>

- **Low impact** represents small positive steps that fall short of having tangible long-term impact on the financial system, such as research reports, voluntary guidelines, and educational initiatives.

The implementation of green policies takes place over a significant timeframe, so the Scorecard rewards points to reflect different stages of implementation. Each policy is assigned an implementation stage: under discussion, formal commitment, and fully implemented.

- **Under discussion** refers to significant discussion about the policy by senior leadership within the institution, such as at a conference, in a research paper, or in a consultation.
- **Formal commitment** refers to a commitment by the institution to implement the policy, through press releases, a long term strategy, or in bilateral interactions.
- **Fully implemented** is the stage where the policy has become fully applied to central bank operations or regulated entities.

To reflect both the impact level and implementation stage of a policy, the below scoring matrix is applied to each policy:

| | Low impact | Medium impact | High impact |
|--------------------------|------------|---------------|-------------|
| <i>Under discussion</i> | 0 points | 1 point | 2 points |
| <i>Formal commitment</i> | 0 points | 3 points | 6 points |
| <i>Fully implemented</i> | 1 point | 5 points | 10 points |

Each category policy category has two score limits: a category score limit, and a lesser impact score limit:

- The **category score limit** for each category determines the maximum number of points institutions can earn in that category. Once the category score limit is reached, any additional policies in that category are not awarded points.
- The **lesser impact score limit** determines the maximum number of points institutions can earn for policies in that category that have relatively lower impact for that category. This score limit ensures that countries can only score full marks in a category if they have implemented at least one policy with the highest impact level in that category.

| Policy category | Category score limit | Lesser impact score limit |
|-----------------------|---|---|
| Research and Advocacy | Policies score a maximum of 10 points . | Low impact policies score a maximum of 5 points . |
| Monetary Policy | Policies score a maximum of 50 points . | Low and medium impact policies score a maximum of 40 points . |
| Financial Policy | Policies score a maximum of 50 points . | Low and medium impact policies score a maximum of 40 points . |
| Leading by Example | Policies score a maximum of 20 points . | Low and medium impact policies score a maximum of 10 points . |

Green policies are measured cumulatively, without penalisation for carbon intensive policies. However, where a fossil fuel policy directly contradicts a previous green policy, points for this policy will be suspended. For example, a central bank will not receive points for requiring financial institutions to lend to green sectors, whilst also requiring financial institutions to lend to fossil fuel sectors.

The aggregate score of all four categories forms the total score. The maximum available score is 130 points. Grading from A+-F is then based on the total score of the country.

2.1 Research and Advocacy

Initiatives and activities that fall under the category of ‘Research and Advocacy’ may include: membership of the NGFS, central bank staff working papers on climate, speeches which advocate for climate related policies, or the incorporation of environmental risks into financial stability reviews. The majority of G20 countries already have full marks under 'Research and Advocacy' in our scorecard. While they continue to publish papers and speeches relating to environmental risks and sustainable finance, these will only lead to additional points if they lead to concrete policy actions. Argentina and Turkey are the only countries to have increased their points in this category, as their institutions recently joined the NGFS (Network for Greening the Financial System, 2022a). This leaves the Saudi Arabia Monetary Authority as the only central bank in the G20 that has not made a commitment to multilateral action on sustainable finance by becoming a member of the NGFS. Laggard central banks that are yet to gain maximum points within this category also gained points by incorporating climate change into their financial stability review, with specific research on physical and transition risks. In its financial stability reviews, the Bank of Russia acknowledged the large transition risks its carbon intensive economy is exposed to (Bank of Russia, 2021), and the Central Bank of Argentina reflected on the changes to climate-related financial regulation across Latin America (Banco Central de la República Argentina, 2022).

Double materiality

Higher scoring central banks have begun exploring the principle of double materiality in their research, recognising that central banks and financial regulators may have a responsibility to regulate both the financial causes and consequences of climate change, as the two cannot be separated. Banque de France researchers have further developed the concept of double materiality by identifying three different applications of this accounting practice to the financial system (Boissinot et al., 2022). This research distinguished between an idiosyncratic risk perspective, which considers the environmental impact of financial institutions’ balance sheets, and a systemic risk perspective, which proposes that environmental risks that financial institutions contribute to may not be borne by themselves but build up systemic physical, transition, and litigation risk. However, the Banque de France provides the most forward thinking contribution to green central banking theory by putting forward “the transformational perspective” of double materiality, which recognises that central bankers and financial regulators are currently constrained by mandates, which can come into conflict with one another (Boissinot et al., 2022). This perspective proposes that financial practices should be reshaped, including current conceptions of materiality, to enable institutions to proactively support the ecological transition.

Whilst the Banque de France has produced the most progressive research on framing environmental risk, multiple central banks and financial regulators have begun to adopt the concept of double materiality into policy. The Financial Research Institute of the People’s Bank of China published a policy research report which acknowledges the interaction between biodiversity and finance. This report recognised the impact that financial institutions can have on environmental

risks, by either providing financing to activities that finance biodiversity loss or contribute to conservation (Bei et al, 2022) . The UK’s Sustainability Disclosure Standards, for example, require investment disclosures that report on risks, opportunities, and impacts, reflecting the theory of double materiality (FCA, 2021). Central banks in China, Brazil, Japan, and Indonesia have not explicitly mentioned the concept of double materiality in their research, but have implemented green credit guidance policies that clearly consider the environmental impact of the financial sector, rather than solely the risks faced by finance. The US Federal Reserve has also recently acknowledged the importance of the concept (Stiroh, 2022).

Although there have been many advances in the category of ‘Research and Advocacy’, to prevent environmental risks from materialising, research must become action. The focus of central banks and financial regulators still needs to be shifted from a sole focus on gathering evidence, to taking emergency action in the face of radical uncertainty.

2.2 Monetary Policy

Green lending facilities

Renewable energy, over its lifetime, is much more affordable than fossil fuels. However, renewable infrastructure projects require significant upfront investments and are subject to relatively high funding costs (Kedward, 2022). To lower this high cost of capital, leading central banks in the G20 have made significant progress in creating green lending facilities, which offer lower interest rates for lending to green projects.

The People’s Bank of China (PBoC) has been a lead innovator in this policy area. Prior to COP26, the PBoC announced its carbon emissions reduction facility (CERF) and began rapidly deploying funding to “promote carbon reduction, and support the development of clean energy, energy conservation, environmental protection, carbon reduction technology and other key areas” (PBoC, 2021). This monetary policy instrument will subsidise financial institutions to lend close to the benchmark Loan Prime Rate (LPR), with the PBoC refinancing 60% of the loan principal at a rate of 1.75%, compared to the current LPR of 3.65%. This facility is stringent, requiring financial institutions to publicly disclose the amount of emissions reduction enabled by lending supported by the scheme, which is verified by third party organisations. The CERF is a cutting-edge monetary policy solution to fossilflation, and by the end of 2021, the PBoC had refinanced loans to 2,817 borrowers promising to cut 28.76M tons of carbon emissions, or 0.8% of China’s annual carbon dioxide (CO2) emissions from coal power (Waite, 2022). However, the climate benefits of this facility are partly, if not entirely, cancelled out by the support granted by the PBoC to the “green and efficient” use of coal (see Section 3.4).

The Bank of Japan has also implemented a green lending facility on a smaller scale. Through the Climate Response Financing Operations, the Bank of Japan provides 0% interest funding for investments or loans that contribute to domestic actions to address climate change, although the determination of whether a loan of investment makes such a contribution is left to the institutions participating in the scheme (Bank of Japan, 2021). Other central banks are making slow but significant progress on researching green lending facilities. South Korea is considering expanding the supply of green funds to SMEs through a Financial Intermediated Lending Support Facility (Bank of Korea, 2021), the Banco do Brasil conducted studies for the creation of a sustainable liquidity financial line (Banco Central do Brasil, 2022a), and the ECB appears to be considering the potential for a green targeted lending facility. As ECB president Christine Lagarde stated at the Green Swan conference (Caswell, 2022b): “Japan is doing it. China is doing it. Why wouldn’t we have an open mind about it?”

Collateral frameworks

Within their market operations, several central banks have begun to consider altering collateral eligibility criteria and applying haircuts to reflect climate considerations. Assets that are accepted in central banks’ collateral frameworks, and assigned lower or no haircuts, become more attractive to financial institutions. Those financial assets that are given favourable treatment by central banks’ collateral frameworks experience higher demand, and subsequently lower interest rates and higher prices, comparable to a subsidy (Dafermos et al., 2022). Despite the significance of collateral frameworks in shaping financial markets, and therefore, carbon emissions, existing collateral frameworks operational within G20 central banks tend to have a carbon bias, which provide market advantages to firms undertaking environmentally destructive activities (Dafermos et al., 2022).

Central banks’ action on greening collateral frameworks can be separated into two different approaches. The International Network for Sustainable Financial Policy Insights, Research, and Exchange (INSPIRE) distinguishes between the “environmental risk exposure approach”, which focuses on adjusting collateral frameworks to reflect the exposure of financial institutions and central banks to environmental risk, and the “environmental footprint approach”, where eligibility criteria and haircuts focus on the ultimate environmental impacts of financial assets. Whilst the risk exposure approach considers how the financial system can attempt to shield itself from what are perceived to be exogenous environmental risks, the environmental footprint approach takes a more holistic double materiality approach, accepting that the financial system itself impacts and contributes to environmental breakdown (Dafermos et al., 2022).

A few G20 central banks have made progress towards considering the impact of their collateral frameworks on the environment. The People’s Bank of China has begun accepting green bonds, loans, and securities with an AA rating and above as collateral in their medium term lending facility, and is accepting green loans as part of their standing lending facility (Choi et al., 2020). Further behind in their implementation timeline, the Bank of Canada⁴, Bank of Indonesia⁵, and Bank of Korea (Bank of Korea, 2021) are all considering the acceptance of green bonds within their collateral eligibility frameworks. These approaches to greening collateral frameworks follow the environmental footprint approach, by including green bonds due to their impact, rather than adopting a risk-based approach. Whilst green bond acceptance does not ensure an overall improvement in the environmental footprint of collateral frameworks, it does consider the ultimate impact of bonds on the environment, rather than just the risks posed to the financial sector. The ECB, on the other hand, has committed to collateral policies that may have a far more substantial impact on its environmental footprint, yet it has justified these policies using an environmental risk exposure approach. Specifically, the ECB has committed to limiting the share of assets issued by entities with a high carbon footprint that can be pledged as collateral and incorporating climate risks into its haircuts (ECB, 2022b).

Asset purchase programmes

In the current global inflationary context, many central banks have begun to pause asset purchase programmes and even move towards a period of quantitative tightening in which they sell bonds back to the market (Bank of England, 2022a). Despite such conditions, some central banks are continuing to consider how they can incorporate climate factors into the unwinding of such programmes, and what green policies could be applied to potential future asset purchase programmes. The ECB has made the most ambitious commitments towards decarbonising its holding of corporate bonds, with a pledge to tilt its corporate bond holdings on a pathway aligned with the goals of the Paris Agreement, or 1.5 degrees of warming (ECB, 2022b). This framework assesses the climate performance of corporate bond issuers “with reference to lower greenhouse

⁴ Referred to in bilateral interactions.

⁵ Referred to in bilateral interactions.

gas emissions, more ambitious carbon reduction targets and better climate related disclosures” (ECB, 2022b). Although the ECB has become a leader in greening its asset purchase programmes, it has fallen short of completely excluding the most polluting assets in its portfolio, preventing its policy from reaching the Scorecard’s high impact category (Caswell, G., 2022d).

Whilst the Bank of England has not gone so far as to align its asset purchase facilities with the Paris Agreement, it has created a framework for greening the Corporate Bond Purchase Scheme, which excludes issuers engaged in any coal mining activities (Bank of England, 2021), and has begun making sales from the Corporate Bond Purchase Scheme with climate change considerations as a secondary aim (Bank of England, 2022a). The Bank of Canada and Bank of Mexico, both slower in pace and lower in ambition, are considering implementing some form of environmental criteria into the framework for future asset purchase programmes.⁶

2.3 Financial Regulation

Scenario analysis

As central banks across the G20 have focused on a data-based, market-driven approach to climate risk, climate scenario analysis has become a key policy on central banks’ green agendas. Scenario analyses are useful for exploring the risks posed by environmental breakdown, but face multiple limitations that prevent them from accurately quantifying environmental risks. The models underpinning scenario analysis traditionally use historical data, so are unable to accurately model the long time horizons, tipping points, and unpredictability of environmental risks without historical precedent (Keen, 2019; Symon, 2021). Therefore, whilst scenario analyses are useful exercises for financial institutions, they cannot themselves substantially mitigate environmental risk, nor are they necessary prerequisites to taking action (Bolton et al., 2020).

While the terms ‘climate stress test’ and ‘climate scenario analysis’ are often used interchangeably, the Federal Reserve recently highlighted an important distinction between these terms, explaining that stress tests are “designed to assess whether large banks have enough capital to continue lending to households and businesses during a severe recession”, whereas climate scenario analyses are generally “exploratory in nature and do not have capital consequences” (Board of Governors of the Federal Reserve System, 2022a). Since no climate scenario analyses to date have drawn conclusions about capital adequacy, or led to further capital requirements from their outcomes, none should be considered as stress tests.

To achieve medium impact points for climate scenario analysis in our scorecard, central banks and financial regulators are required to include banks that collectively cover a majority of bank assets, and include insurers if they are regulated by the institutions that fall within the scope of our assessment. Climate scenario analysis should also use at least an early action 1.5 degree scenario, as well as a ‘Hot House World’ scenario that models the outcomes of our current trajectory.

The ECB’s climate scenario analysis was a bottom-up exercise that included participation from 104 banks, used both a 1.5 degree and a Hot House World scenario, and integrated systemic risk into its analysis. The exercise required banks to provide their own data submissions and stress test projections subject to a common methodology and scenarios (ECB, 2022b). The Bank of England’s Climate Biennial Exploratory Scenario also took a bottom-up approach, surveying seven major banking groups and building societies and twelve insurance companies (Bank of England, 2022b). Financial institutions were measured on their exposure to climate risks based on three common scenarios, including an “Early Action” transition to 1.5 degrees, and a “No Additional Action”

scenario where temperatures would rise to 3.3 degrees higher by the end of the scenario. The Bank of Canada and the Office of the Superintendent of Financial Institutions (OSFI) completed a bottom-up climate scenario analysis with six Canadian federally regulated financial institutions, including the two largest banks and insurance providers, and used a disorderly transition to 2 degrees, an orderly transition to 2 degrees, a baseline of 2019 policies, and a 1.5 degree of warming scenario (Bank of Canada, 2022). Japan conducted a similar joint exercise by the Financial Services Authority and Bank of Japan, with participation from three major banks and three major non-life insurance groups, and adopted three NGFS scenarios: Net Zero 2050, Disorderly Transition, and Hot House World.

In the first edition of the Scorecard, France had already completed its own Climate Pilot Exercise in 2020, which covered 75% of insurers’ technical provisions and 85% of banks’ total assets (Banque de France, 2021). The French Prudential Supervision and Resolution Authority (ACPR), used an “orderly transition” scenario to 1.5 degrees, as well as two “disorderly transition” scenarios to net zero, and a “physical risk” scenario in which temperatures may rise above 2.5 degrees. The ACPR exercise was a key innovator in this field.⁷

The Reserve Bank of Australia, working jointly with the Australian Prudential Regulation Authority, conducted a Climate Vulnerability Assessment that applied two NGFS scenarios: a Disorderly Transition to net zero by 2050 limiting warming to 2 degrees, and a “Hot House World” scenario (Australian Prudential Regulation Authority, 2021a). This scenario analysis included participation from Australia’s five largest banks. Its failure to include insurers and an orderly transition to 1.5 degrees meant that this scenario analysis was classified as low impact in our scorecard.

The Federal Reserve Board, Banco de México, Bank of Russia, Financial Supervisory Service Korea, South African Reserve Bank, and Turkey Banking Regulation and Supervision Agency have all committed to future scenario analyses that will assess their financial systems’ exposures to climate risk. For these scenario analysis exercises to reach the medium impact category in the Scorecard methodology, they must cover the majority of banks’ and insurers’ assets, and adopt both the Orderly 1.5 degree transition and the Hot House World scenarios developed by the NGFS.

Scenario analysis exercises are most impactful insofar as they are used to shape financial strategies and policies. Whilst all scenario analyses conducted thus far by central banks and prudential regulators have not yet been reflected in changes to their capital requirements, they have begun to influence the incorporation of climate risk into the wider Pillar II supervisory review process. Multiple central banks and financial regulators have issued voluntary guidance, detailing principles on how financial institutions should integrate climate-related financial risk into their own risk management frameworks. Australia (Australian Prudential Regulation Authority, 2021b), Canada (Office of the Superintendent of Financial Institutions, 2022), México (Banco de México, 2022a), Korea (Financial Services Commission, 2021), and the United States (Office of the Comptroller of the Currency, 2021) have all issued voluntary guidance, whilst Turkey (Banking Regulation and Supervision Agency, 2021) and South Africa (South African Reserve Bank, 2022) have made formal commitments to the publishing of a new supervisory framework that accounts for climate risks.

Climate risk management frameworks

Central banks and financial regulators that are relative leaders on climate have already made the incorporation of climate risks into risk management processes mandatory (as recorded in previous editions of the scorecard) and are now actively supervising these processes. Banco Central do Brasil is surveying financial institutions holistically on their socio-economic risk management processes, including: exposure assessments, climate scenarios, stress testing, and internal governance (Banco Central do Brasil, 2017). The Bank of England has assessed firms’ approaches

⁶ Referred to in bilateral interactions.

⁷ As France is a member of the Eurosystem, it only achieved low impact points for its Climate Pilot Scenario Analysis, as it had already received maximum medium impact points for scenario analysis from the ECB Climate Stress Test.

to climate in some of their risk management processes, namely capital adequacy processes, risk solvency assessments, and pillar 3 disclosures (Prudential Regulation Authority, 2021). The ECB has conducted a smaller supervisory assessment, focusing on financial institutions’ environmental risk disclosures (ECB, 2022a). Finally, the People’s Bank of China has assessed 21 commercial banks and two development banks’ capital adequacy ratios, focusing on the effect of increased emissions (Caswell, G., 2022a).

Transition Plans

The UK has committed to requiring the publication of “robust firm-level transition plans” from financial institutions (HM Treasury, 2021). Although the UK is the first jurisdiction to commit to requiring banks to publish transition plans, the content of these plans is unclear. A Transition Plan Taskforce will set out a “gold standard” for transition plans, but this standard will not be mandatory, casting doubt on the ultimate impact of the framework. Although the ECB has not made any formal commitments to mandatory transition plans for financial institutions, early indications of discussions suggest that proposals for mandatory transition could be more stringent. Frank Elderson has called for transition plans that are aligned with the Paris Agreement, have concrete intermediate milestones, and have clear criteria that are enforced by supervisors (Elderson, 2022). Although legally binding transition plans would have to come from the EU co-legislators via regulatory changes, such a clear mandate would enable supervisors to use stronger tools to ensure compliance, including by adjusting capital requirements (Evain, 2022).

2.4 Leading by example

The most impactful actions central banks can take beyond their monetary and financial policies is to effectively green their own non-monetary portfolios, aligning these investments with 1.5 degrees of warming. The Banque de France has the most advanced sustainable investment policy of G20 central banks, with stringent fossil fuel exclusion criteria. Recently, the Banque de France clarified that its responsible investment approach is aligned with 1.5 degrees of warming and that it opposes fossil fuel development through its voting policy, making it even more of a leader within this field (Banque de France, 2022).

The Bundesbank also updated its screening process for its euro-denominated portfolios, which includes negative screening on non-environmental humanitarian standards, followed by tilting investments based on their carbon risk rating and greenhouse gas intensity (Deutsche Bundesbank, 2022). Although this is a positive and concrete step towards aligning with the Paris Agreement, this policy was only applied to euro-denominated portfolios. Banca d’Italia also clarified its approach to sustainable investment, which takes a similar two-staged approach: first, negative screening on multilateral agreements, then positive screening for ESG criteria. The ESG criteria used by the Banca d’Italia are explicitly environmental, and seek to tilt corporate portfolios towards firms that have decarbonisation plans (Network for Greening the Financial System, 2022d). Whilst this transparency on ESG criteria is important progress, central banks must go further in their negative screening for fossil fuel assets.

Central banks in Indonesia (Warjiyo, 2022), Mexico (Network for Greening the Financial System, 2019b), and South Africa (South African Reserve Bank, 2022) have also committed to implementing Socially Responsible Investment (SRI) principles in their non-monetary portfolios with explicit climate considerations.

GREEN CENTRAL BANKING SCORECARD - RESULTS

Taking into account the categories Research and Advocacy, Monetary Policy, Financial Regulation, and Leading by Example, Table 1 shows the final scores for G20 central banks and financial regulators as of November 2022. These results reflect a comprehensive review of green monetary and financial policies.

TABLE 1: G20 COUNTRIES RANKED BY GREEN MONETARY AND FINANCIAL POLICIES

| Rank | | Country | Research and Advocacy (out of 10) | Monetary Policy (out of 50) | Financial Policy (out of 50) | Leading by Example (out of 20) | Aggregate Score (out of 130) | Grade (A+ to F) |
|----------|---|----------------|--------------------------------------|--------------------------------|---------------------------------|-----------------------------------|---------------------------------|--------------------|
| 1 (1) | - | France | 10 | 12 | 31 | 17 | 70 (52) | B- |
| 2 (6) | ↑ | Italy | 10 | 12 | 31 | 8 | 61 (45) | C+ |
| 3 (7) | ↑ | Germany | 10 | 12 | 30 | 8 | 60 (44) | C+ |
| 4 (4) | - | European Union | 10 | 12 | 28 | 8 | 58 (47) | C |
| 5 (5) | - | United Kingdom | 10 | 10 | 27 | 9 | 56 (46) | C |
| 6= (2) | ↓ | Brazil | 10 | 18 | 18 | 7 | 53 (51) | C |
| 6= (3) | ↓ | China | 10 | 12 | 31 | 0 | 53 (50) | C |
| 8 (9) | ↑ | Japan | 10 | 6 | 14 | 5 | 35 (25) | D+ |
| 9 (8) | ↓ | Indonesia | 10 | 1 | 14 | 5 | 30 (26) | D+ |
| 10 (14) | ↑ | Canada | 10 | 2 | 14 | 2 | 28 (15) | D |
| 11= (11) | - | Mexico | 10 | 4 | 4 | 5 | 23 (17) | D |
| 12 (10) | ↓ | India | 10 | 0 | 10 | 1 | 21 (18) | D |
| 13 (11=) | ↓ | South Korea | 10 | 1 | 6 | 2 | 19 (17) | D- |
| 14 (16) | ↑ | Russia | 8 | 0 | 8 | 2 | 18 (12) | D- |
| 15 (13) | ↓ | Australia | 10 | 0 | 4 | 3 | 17 (16) | D- |
| 16 (14=) | ↓ | United States | 10 | 0 | 6 | 0 | 16 (15) | D- |
| 17 (18) | ↑ | Turkey | 10 | 0 | 2 | 2 | 14 (4) | D- |
| 18 (17) | ↓ | South Africa | 10 | 0 | 2 | 1 | 13 (10) | D- |
| 19 (19=) | - | Argentina | 6 | 0 | 0 | 0 | 6 (0) | F |
| 20 (19=) | ↓ | Saudi Arabia | 0 | 0 | 0 | 0 | 0 (0) | F |

Box 2: Switzerland

Switzerland is not included in the scorecard as it is not a G20 country. However, the Swiss National Bank (SNB) is systemically important to the global financial system, meaning that green policies implemented by the SNB could have relatively high global impact. Since the last edition of the Scorecard, the SNB and Swiss Financial Market Supervisory Authority (FINMA) have introduced mandatory disclosures of climate-related financial risks and conducted a pilot climate scenario analysis on two banks. In this edition, Switzerland would score 26 points. This score would rank Switzerland 11th, down from 8th rank in the previous edition.

Section 3:

What is holding central banks back?

Central banks and financial regulators across the G20 have expressed clear motivations to deal with the risks to price and financial stability caused by climate change. However, despite broad membership of the NGFS and extensive research on climate-related financial risks, central banks remain hesitant to act meaningfully on climate and wider environmental breakdown. This section considers barriers to further action.

3.1 Ambiguous mandates

Acting on environmental breakdown falls under central banks' and financial regulators' primary objectives of ensuring price and financial stability, and secondary mandates of supporting government economic policy objectives (Schreiber, 2022). As outlined in Section 1, physical and transition risks presented by environmental breakdown are fundamental threats to financial stability, and fossil fuel prices are currently the main driver of inflation. Moreover, the vast majority of G20 countries have made international commitments to achieving net zero. At the very least, therefore, central banks should be aligned with these commitments, rather than working against them. Yet, there remains a hesitancy from central banks and financial regulators to act on environmental issues without a more explicit mandate to do so, and when faced with multiple, intersecting crises, their mandates may work in contradiction to one another (Tooze, 2022). Central banks should work in coordination with governments to create long term strategies to tackle threats to price and financial stability caused by environmental breakdown.

3.2 Analysis over action

Whilst the urgency of environmental breakdown requires that central banks and financial regulators proactively regulate against the risks associated with dirty assets, the majority of them overwhelmingly allocate resources to simply analysing risks rather than actively addressing them. Scenario analyses are clear that delayed action will result in the materialisation of substantial physical and transition risk in the long term. The ECB stress tests found that more than 60% of interest income was derived from the 22 most carbon intensive sectors, and that the combined credit and market risk losses without an orderly transition to net zero would amount to 70 billion euros at a minimum (ECB, 2022c). Similarly, the UK Climate Biennial Exploratory Scenario found that banks will face an extra £110 billion of losses in a 'Late Action' scenario, and that the total losses for the financial sector would reach almost £350 billion if no additional action is taken (Bank of England, 2022c).⁸ Yet neither the Bank of England nor ECB scenario analysis exercises will be used to set micro or macroprudential capital requirements, as is usually the basis under which stress tests are conducted. Prudential regulators' unwillingness to regulate against both idiosyncratic and systemic climate risk, and reliance on voluntary initiatives by financial institutions, will only serve to further entrench this risk within the financial sector.

Despite a steady growth in policies that subsidise or signal the benefit of green energy, no G20 central bank or financial supervisor has implemented a policy that actively reflects the risks associated with continued financing of fossil fuel assets. Central banks and financial regulators have instead sought to decarbonise the financial sector through a combination of market fixing and de-risking strategies (Kedward, Gabor and Ryan-Collins, 2022). This approach has assumed that with sufficient disclosures, climate risk will effectively be priced into the market, and market actors

will rationally reallocate capital accordingly. Such a risk-based, market-oriented approach has so far failed to green the financial sector: since the Paris Agreement, fossil fuel financing from the world's 60 largest banks has increased to USD \$3.6 trillion (Kirsch et al., 2022).

3.3 Commitment to the idea of market neutrality

The principle of 'market neutrality' proposes that the market operations of central banks are conducted in a 'neutral' way, such that they reflect the market and do not distort the relative prices of assets (Kyriakopoulou, 2021). However, commitment to this principle of market neutrality has enabled a bias of support towards carbon-intensive sectors, relative to these sectors' contribution to the overall economy measured by metrics such as total employment, contribution to Gross Value Added (GVA), and how much debt they issue. For example, asset purchases by the Federal Reserve to stabilise financial markets during the COVID-19 pandemic disproportionately benefited fossil fuel companies (Bailout Watch, 2020). Under the Secondary Corporate Credit Market Facility, the Federal Reserve purchased \$1 billion in fossil fuel company bonds (Shrago, 2021). The fossil fuel sector was over 2x overweight in the Federal Reserve's scheme on indicators of debt outstanding, equity values and employment (InfluenceMap, 2020a).

Commitment to market neutrality, which is itself a myth (Senni and Monnin, 2020), has meant that even attempts to green asset purchase programmes have fallen short. The Bank of England's Corporate Bond Purchase Scheme (CBPS) was aligned with 3.5 degrees of warming in 2020 (Bank of England, 2020). Sectors with high greenhouse gas emissions were over-represented in the Bank's eligibility criteria, compared to their contribution to UK employment and UK GVA (Dafermos et al., 2020). The Bank's subsequent approach to greening its CBPS made an important commitment to excluding activities that are incompatible with the goal of net zero by 2050 (Bank of England, 2021). However, whilst coal mining and thermal coal were excluded from purchases under this framework, it fell short of introducing outright exclusions on oil and gas, which would remain eligible if they disclosed climate risks and targets (Positive Money, 2021). This framework, therefore, did not follow the scientific guidance on net zero from the International Energy Agency, which includes no financing for new fossil fuel projects (International Energy Agency, 2021).

3.4 Fossil fuels classified as green assets

Central banks are also limited by taxonomies and standards that obscure the true meaning of "green". This is most clearly the case at the People's Bank of China, which lost a large number of points in the Scorecard due to its support for coal projects. PBoC's Carbon Emission Reduction Facility has been implemented alongside a programme of special central bank lending, which has provided RMB300 billion to support the "green and efficient use of coal" (People's Bank of China, 2022). This guidance of credit towards fossil fuels undermines PBoC's work towards greening the energy sectors, and its commitment to achieving net zero emissions by 2060. The categorisation of coal as green is not new. In the first edition of the Scorecard, China also lost points for its Green Industry Catalogue, which includes the "clean utilisation of coal", undermining its Green Bond Endorsed Catalogue (SynTao Green Finance, 2020).

The EU taxonomy has also rejected scientific definitions in its classification of sustainable activities. Following lobbying from energy companies (InfluenceMap, 2020b), the EU Taxonomy did not take the advice of the Technical Expert Group to outrightly commit to excluding fossil gas and nuclear power from the taxonomy (EU Technical Expert Group on Sustainable Finance, 2020). The Complementary Climate Delegated Act classified specific gas and nuclear activities as sustainable in the EU taxonomy, enabling greenwashing in sustainable finance standards (European Commission, 2022). This follows a trend in green finance standards, where fossil fuels are treated

⁸ The methodologies underpinning scenario analyses face significant limitations (see Section 2.3) and likely vastly underestimate the macroeconomic impacts of climate change.

as sustainable assets, supposedly in order to enable a transition (Rauhala, 2022). However, this approach creates incentives for financial institutions to continue financing fossil fuel assets, rather than shift investment towards genuinely green energy sources. Although decision-making on the EU taxonomy was beyond the scope of central banks or financial regulators, it has major implications for the activities that may be classified as sustainable in the ECB's green policies.

In international fora, multinational firms have been central in developing disclosure frameworks, including the Task Force on Climate-related Financial Disclosures (TCFD) (Kedward, Gabor and Ryan-Collins, 2022). Overall, this leaves industry actors with the power to set sustainability standards, rather than independent scientific experts (Petry, 2021).

Section 4:

How can central banks become green leaders? Key recommendations

Central banks and financial regulators are operating in a context of multiple crises and limited toolboxes. To deal with the unstable fossil fuel prices and the potentially catastrophic risks of climate change, G20 central banks and financial regulators should implement the following proposals.

4.1 New frontiers in green central banking

Recommendation 1. Act on environmental risks beyond climate: explore and address risks related to biodiversity loss, water scarcity, and other ecological threats, as well as risks related to climate change.

To the extent that central banks and financial regulators have begun paying attention to 'nature-related' risks, such as the loss of biodiversity, ecosystems and habitats, they have largely treated them as distinct from climate-related financial risks. Yet these two categories of risk are deeply interconnected and overlapping (Banco de México, 2022b), such that they should not be considered by central banks, financial supervisors, and regulators as separate when designing green policies.

All types of environmental risk, including but not limited to climate-related risks, should be acted on and tackled together, as negative feedback loops result in climate change and other elements of environmental breakdown reinforcing one another (Network for Greening the Financial System, 2020). Environmental risks beyond climate relate to the degradation and collapse of ecosystems and organisms that have highly complex interactions and interdependencies (Svartzman et al., 2021). They, in turn, have a greater potential for tipping points, which create non-linear, unprecedented and irreversible outcomes (Kedward, Ryan-Collins and Chenet, 2020). As international agreements on broader environmental damage have fallen behind climate, these types of risk are even more likely to be overlooked by financial institutions.

Recommendation 2. Adopt a precautionary approach: recognise that environmental risks are characterised by radical uncertainty, and therefore early action is warranted to prevent catastrophic outcomes.

The risks posed to monetary and financial stability by climate change are characterised by radical uncertainty (Chenet, Ryan Collins, van Lerven, 2021). Climate risks are "subject to multiple forces (natural, technological, societal, regulatory and cultural, among others) that interact with each other and are subject to uncertainty, irreversibility, non-linearity, and fat-tailed distributions" (Bolton et al., 2020). Climate risks are, therefore, impossible to accurately quantify as they do not have a calculable probability, are not represented in historical data, and do not have clear transmission channels. Wider environmental risks beyond climate are equally characterised by radical uncertainty. Therefore, central banks and financial regulators should follow the approach of other regulators, including the World Health Organisation (WHO) and International Panel on Climate Change (IPCC), and take a preventative approach to environmental risks (Chenet, Ryan-Collins and Lerven 2021; Kedward, Ryan-Collins and Chenet, 2020). Taking a precautionary approach requires central banks to act rapidly and decisively to mitigate unpredictable and potentially catastrophic climate outcomes.

Recommendation 3. Adopt a double materiality framework: account for financial institutions’ contribution to environmental impacts, and how this further increases systemic vulnerability to environmental risks.

Central banks and financial regulators mostly adopt a single materiality lens that seeks to understand in granular detail the physical and transition risks the financial sector is exposed to. This approach fails to account for the financial sector’s contribution to the build up of such risks, and therefore ignores the need for financial institutions to phase out the flow of finance to environmentally harmful projects. A double materiality framework considers not just the impact of environmental breakdown on financial institutions, but also the impact of a financial institution on the environment (Täger, 2021). This approach is much more equitable, as financial institutions that contribute to environmental breakdown by lending to destructive activities rarely face the immediate consequences of such risks materialising firsthand. Central banks and financial regulators should adopt a double materiality framework in their research and policymaking.

Recommendation 4. Consider historical responsibility for climate change: G20 central banks and financial regulators with the greatest contribution to climate change should bear the most responsibility for action.

Historical emissions are at the core of climate justice, which recognises that the impacts of global warming are not borne equally and intersect with a number of structural global inequalities including race, wealth and gender. The poorest communities in the Global South are disproportionately facing the impacts of global warming, yet bear the least responsibility.

The historical contributions of countries to climate change considers the cumulative amount of CO₂ emissions from the start of the industrial revolution to the present day. Historical emissions have strongly contributed to current levels of global warming of 1.2C, as CO₂ remains in the atmosphere for centuries. Recent analysis for the period 1850 to 2021 finds the US is responsible for the largest share of historical emissions at 20% of global total (Evans, 2021)⁹ followed by China (11%); Russia (7%); Brazil (5%), Indonesia (4%), and Germany (4%) and the UK (3%). Taking a regional perspective, the EU is also a large historical emitter of global warming at a combined 22% of global total. In contrast, Africa's regional contribution to historical emissions accounts for just 3% (Ritchie, 2019).¹⁰

Notably the US and many European countries are amongst the biggest historical emitters. These countries were the early drivers of the industrial revolution which was fuelled by colonial expansion and slavery across the Global South (Intergovernmental Panel on Climate Change, 2022).¹¹ Colonising nations banned land management practices of indigenous populations in order to extract resources and profits through the production and trade of goods like sugar, cocoa and tobacco. Today’s most extractive industries and fossil fuel multinationals have deep roots in colonial conquests (Koram, 2022). Central banks of colonising nations provided the long-term credit instruments and large scale financing to drive both the expansion of colonialism and slavery (Leger and Kazi, 2020), and the dominance of extractive industries that resulted in widespread desertification, deforestation, land degradation and nature loss in many formerly colonised nations (Varanasi, 2022).

To date, there has been little examination of the role of central banks in perpetuating these historical injustices. A starting point is for Global North central banks to undertake research into their historical role in colonialism and slavery, and how this links to climate and nature related crises in the Global South. Additionally, they should consult with climate justice leaders and communities in countries

⁹ Carbon Brief’s analysis of top global historical emitters the US is followed by China (11%), Russia (7%), Brazil (5%) and Indonesia (4%) Note that inclusion of Brazil and Indonesia is due to land use element of the measurement and itself a function of historical colonial practices and present day Global North multinationals extractive practices operating in these territories. Cumulative emissions measure includes both CO₂ emissions from burning fossil fuels and land use and forestry (Evans, 2021).

¹⁰ Regional measures cover the period 1750 to 2020. This measures cumulative carbon dioxide (CO₂) territorial emissions including fossil fuels and cement production (Ritchie, 2019).

¹¹ The Intergovernmental Panel on Climate Change (IPCC) 2022 report states colonialism is a historic and on-going factor driving climate breakdown (see page 12).

hardest hit by climate breakdown on the mechanisms through which reparative justice funds for climate and nature related loss and damage should be delivered (UN News, 2022).

4.2 Green and expanded monetary policy toolkits

Recommendation 5. Create green lending schemes: offer a green discount rate to incentivise and increase lending to sustainable activities.

The current global inflationary context has shown the inability of central banks to respond to supply-side shocks with their existing tools. By raising interest rates in an attempt to dampen demand, central banks are further stunting the green transition. Steps towards decarbonisation, such as improving the energy efficiency of homes, building green infrastructure, and manufacturing electric vehicles, require large upfront capital costs (Krebel and van Lerven, 2022). The global investment needed for the green transition is in danger of being choked by high costs of borrowing.

Monetary policy toolkits should be calibrated to reflect these dynamics, and offer lower interest rates to green infrastructure. The ECB’s Targeted Longer-Term Refinancing Operations (TLTROs) provides cheap funding to banks, incentivising them to provide targeted lending to the real economy (van ‘t Klooster and van Tilburg, 2020). Similarly, the Bank of England implemented a Term Funding Scheme with additional incentives for Small and Medium Enterprises (TFSME) during the pandemic, which incentivised banks to lend especially to small businesses at very close to the Bank Rate. These refinancing operations could be repurposed to offer low or negative interest rates for green projects. This would enable central banks to continue broader monetary policy tightening, without threatening the green transition. In the US, the Community Reinvestment Act requires regulators to encourage financial institutions to lend credit to communities in Low and Moderate Income (LMI) neighbourhoods (Board of Governors of the Federal Reserve System, 2022b). This scheme could also be updated to require banks to take climate considerations into account (Shrago, 2021). These green lending schemes should be aligned with existing or forthcoming science-based green taxonomies, and require conditional evidence from third parties that banks are passing on the lower interest rates (Krebel and van Lerven, 2022).

Recommendation 6. Green asset purchase programmes: assets linked to the most environmentally harmful activities, such as deforestation and fossil fuel expansion, should be negatively screened for in standard and emergency asset purchase programmes.

Central banks’ asset purchase schemes tend to have significant biases towards carbon-intensive activities (see Section 3.3). The Intergovernmental Panel on Climate Change has found that fossil fuels are the largest contributors to climate change, and its associated risks. In 2018, almost 90% of CO₂ emissions were due to fossil fuels and associated industry (ClientEarth, 2022). Therefore, to be aligned with the Paris Agreement and to manage their own climate risks, central banks must negatively screen for fossil fuels in their asset purchases. Central banks’ corporate bond portfolios have also been tied to other aspects of environmental breakdown. For example, analysing the ECB’s corporate bond purchases, Kedward, Buller, and Ryan-Collins (2021) find that “70% of the CSPP/PEPP portfolio is potentially contributing to key drivers of biodiversity loss.” To align themselves with environmental targets, central banks should also develop exclusionary criteria for assets that are linked to particularly environmentally unsustainable activities beyond fossil fuels, such as deforestation.

In the current inflationary context, many G20 central banks have begun a period of quantitative tightening, halting asset purchase programmes and beginning the sale of government and corporate bonds (Wu and Duguid, 2022). However, central banks should continue to create frameworks for negative screening of unsustainable activities in the event that monetary expansion resumes in the future.

In the case of emergency schemes, central banks should apply conditions to access public funding. The UK's new Energy Markets Financing Scheme, administered by the Bank of England with the Treasury, will offer £40 billion of financing to help energy firms operating in the UK wholesale market overcome the “extraordinary liquidity requirements faced by energy firms from high and volatile energy prices” (Musto, 2022). Conditions to access this financing include energy firms disclosing net zero transition plans and climate-related financial information. Consistent with guidance from the Task Force on Climate-related Financial Disclosures (TCFD) (Bank of England, 2022d), central banks providing emergency assistance to energy firms should make access to public funding conditional on credible transition plans in line with the Paris Agreement.

Recommendation 7. Green collateral frameworks: assets linked to the most environmentally harmful activities should be negatively screened for, and subjected to higher haircuts, in collateral frameworks.

Collateral frameworks determine the eligible assets that central banks accept as collateral when lending to financial institutions (Barnes and Livingstone, 2021). Assets that are accepted as collateral by central banks receive an implicit subsidy, as demand increases, resulting in higher prices and lower yields (Dafermos, et al., 2022). Central banks should follow a double materiality framework in greening collateral rules, by applying haircuts and assessing the eligibility of assets based on their environmental footprint (Dafermos, et al., 2022). This approach requires negative screening for assets that are linked to the most environmentally unsustainable activities, such as fossil fuels and deforestation.

4.3 Actively supervise environmental risks

Recommendation 8. Adapt capital requirements: increase risk weights for new and existing fossil fuel exposures and introduce environmental systemic risk buffers.

Despite the huge material risks presented by environmental breakdown and the climate commitments made by G20 governments, no central bank or financial supervisor has implemented regulation that would actively address the climate risk associated with environmentally unsustainable assets. If financial institutions continue to lend to destructive economic activities, the risks embedded in the NGFS' Hot House World and Disorderly Transition scenarios are more likely to emerge. The prudent approach, in line with the available climate science, is to implement higher Pillar 1 capital requirements on existing and new fossil fuel exposures (Intergovernmental Panel on Climate Change, 2021).

As lending to new fossil fuel developments is incompatible with the goals of the Paris Agreement and 1.5 degrees of warming, risk weights for exposures to any new fossil fuel projects should be particularly high. Central banks and financial regulators should follow the 'One-for-One' rule for stability, proposed by a coalition of civil society groups. Under this framework, every unit of currency of financing provided by a financial institution to new fossil fuel projects would be matched by an equivalent unit of currency of financial institutions' own funds (Finance Watch, 2021).

The application of higher capital requirements would have the dual effect of building sufficient capital buffers to deal with idiosyncratic exposures to climate-related transition risk, while preventing the further build-up of systemic physical risk by disincentivizing the accumulation of fossil fuel assets on financial institutions' balance sheets (Symon, 2021).

To complement higher risk weights, macroprudential capital-based tools, such as systemic risk buffers (SyRBs), can also be adapted to account for environmental risks. For example, when referring to SyRBs in the Eurozone, Monnin (2021) proposes: “1) varying such buffers across financial institutions to reflect individual exposures to climate risks, 2) focusing on high exposure to climate risks, and 3) relying on transparent rules and metrics to implement SyRBs for climate risks.”

As broader environmental risks become more widely studied and understood, both risk weights and systemic risk buffers should be calibrated according to exposures to environmental risks, rather than climate risks alone.

Recommendation 9. Consider limits on dirty lending: consider imposing limits on lending to the most environmentally destructive projects and companies.

In the case of particularly environmentally destructive activities, central banks and financial regulators should implement restrictions on certain types of lending. The NGFS has mentioned this as a potential supervisory tool, stating that “if supervisors find the level of risk driven by climate-related and environmental factors is excessively high, they could require institutions to reduce such risks by applying measures such as limiting or prohibiting them from carrying out certain categories of activities” (Network for Greening the Financial System, 2020).

The ECB has also discussed quantitative and qualitative portfolio restrictions to limit the build-up of climate risks, arguing that “tools such as concentration charges, large exposure limits or borrower-based measures may complement supervisory measures and allow for targeted reductions in the build-up of clearly identified risks restricting quantitatively and qualitatively the accumulation of new exposures” (Baranović et al., 2021).

The Banco do Brasil has imposed restrictions on financing for sugar cane crop expansion in ecologically important zones, and imposed conditions whereby borrowers of rural credit in the Amazon must show proof of environmental compliance (Banco Central do Brasil, 2022b). Applying this framework to the net zero transition, central banks should consider direct lending limits or exclusions on the exploration and production of new fossil fuels, in line with credible Paris-aligned pathways (Kedward, Gabor and Ryan-Collins, 2022).

Recommendation 10: Require all financial institutions to disclose credible transition plans based on scientific evidence: make transition plans mandatory and supervise how financial institutions are achieving their targets.

Central banks and financial regulators should not rely on financial institutions' voluntary pledges to transition to net zero. Instead, they must require financial institutions to disclose credible plans and actively supervise their commitments. Transition plans should chart viable pathways to their jurisdictions net zero commitments, with short term goals, ideally at five yearly intervals (Advisory Group on Finance for the UK's Climate Change Committee, 2020). Financial supervisors and regulators should actively monitor the implementation of these plans in the supervisory review process, to ensure financial institutions are sufficiently meeting short term goals (Elderson, 2022).

4.4 Lead by example

Recommendation 11: Align all non-monetary portfolios with the Paris Agreement and environmental goals: exclude assets linked to the development of new fossil fuel projects and other environmentally harmful activities.

Central banks often hold multiple different portfolios of assets, beyond their monetary operations, such as pension portfolios (Barnes and Livingstone, 2021). Several G20 central banks have already begun to green their monetary policy frameworks. However, to set an example to financial markets, and ensure that central banks themselves are aligned with the Paris Agreement, they should apply strict environmental exclusion criteria across all their non-monetary policy portfolios. Central banks should align all their non-monetary portfolios with environmental targets and 1.5 degrees of warming, transparently opposing fossil fuel development and other environmentally unsustainable activities (Schreiber et al., 2021).

Recommendation 12: *Engage with citizens and civil society:* As public institutions, G20 central banks and financial regulators should engage with a wide cross section of society.

Central banks and financial regulators can improve their accountability and democratic legitimacy by engaging with citizens and civil society. Decisions surrounding monetary and financial policy are often unduly influenced by the private financial sector (Barmes et al., 2022). However, civil society generally has much more interventionist preferences to regulation than the financial sector (Pagliari and Young, 2016). To ensure that central banks are operating in the interests of the public at large, rather than one interest group, they should commit to transparent communication and engagement on environmental issues with a wide cross section of society.



Conclusion

Central banks and financial regulators are operating in a context of multiple crises. To overcome both the price instability and systemic financial risk originating from dependence on fossil fuels, these institutions must move quickly and ambitiously to shift financial flows towards secure, stable and cheap renewable energy.

Since the first edition of the Green Central Banking Scorecard, central banks across the G20 have made some progress in dealing with the threats posed by climate change. The concept of double materiality has become more prominent, with research and policy development beginning to recognise that prudential authorities are responsible for regulating the financial system's involvement in both the causes and consequences of climate change, since climate impacts contribute to the build-up of systemic risk. Central banks, particularly in Asia, have begun to use innovative monetary policy tools such as green lending schemes to support sustainable projects. Prudential authorities have begun exploring in-depth the financial risks posed by climate change through scenario analysis, and integrating these findings into the supervisory review process. In non-monetary policy portfolios, the Banque de France in particular has made the furthest progress in aligning with the Paris Agreement.

However, faced with the existential threat that environmental breakdown poses to monetary and financial stability, central banks and prudential authorities must implement more impactful policies. G20 central banks continue to rely on voluntary initiatives over active supervision, despite their own analysis showing the systemic risk posed by climate change. Taxonomies have ignored scientific consensus and included fossil fuels, meaning that such sectors may perversely benefit from green initiatives. Finally, the continued commitment to the myth of market neutrality and market efficiency has reduced the impact of climate-related policies, by propping up the carbon intensive status quo of the existing economy.

For central banks and financial regulators to become true leaders in tackling environmental breakdown, they should act fully within both their core mandates to uphold price and financial stability, as well as their secondary mandates to support government policy, to proactively shift financial flows to the green transition. Doing so requires an impact-driven framework to align financial sectors with the Paris Agreement and other environmental targets. The most impactful policies that central banks and financial regulators could implement to achieve this include targeted green lending schemes in line with science based taxonomies, higher capital requirements that account for environmental risks, as well as outright restrictions on lending to particularly unsustainable activities.

The green transition must be led by governments, but central banks and financial regulators have a vital supporting role to play. To achieve the structural change necessary to avoid catastrophic and irreversible environmental impacts, central banks, financial regulators and governments must work together to implement a coordinated green industrial strategy.

Bibliography

Advisory Group on Finance for the UK’s Climate Change Committee (2020). The Road to Net Zero Finance.

<https://www.theccc.org.uk/wp-content/uploads/2020/12/Finance-Advisory-Group-Report-The-Road-to-Net-Zero-Finance.pdf>

Australian Prudential Regulation Authority (2021a). Information Paper - Climate Vulnerability Assessment.

https://www.apra.gov.au/sites/default/files/2021-09/Climate%20Vulnerability%20Assessment_1.pdf

Australian Prudential Regulation Authority (2021b). Prudential Practice Guide CPG 229 Climate Change Financial Risks.

<https://www.apra.gov.au/sites/default/files/2021-11/Final%20Prudential%20Practice%20Guide%20CPG%20229%20Climate%20Change%20Financial%20Risks.pdf>

Bailout Watch (2020). “Oil & Gas Dominates in "Main Street" Lending Program.”

<https://bailoutwatch.org/analysis/mslp-november-analysis>

Banco Central de la República Argentina (2022). Financial Stability Report.

<https://www.bcra.gob.ar/pdfs/PublicacionesEstadisticas/IEF0122i.pdf>

Banco de México (2022a). Principios internacionales y nacionales.

<https://www.banxico.org.mx/sistema-financiero/principios-financiamiento-v.html>

Banco de México (2022b). Moving beyond climate: The relevance of biodiversity loss for the financial system - Keynote by Irene Espinosa.

<https://www.banxico.org.mx/publications-and-press/speeches/%7B694BAA36-B028-E4C3-445F-9BA8AA7D0EF3%7D.pdf>

Banco Central do Brasil (2017) Resolution CMN 4,557 of February 23, 2017.

<https://www.bcb.gov.br/ingles/norms/brprudential/Resolution4557.pdf>

Banco Central do Brasil (2022a). Sustainability policies.

https://www.bcb.gov.br/en/about/bcbhastag_sustainability?modalAberto=sustainability_policies

Banco Central do Brasil (2022b). Social and environmental responsibility.

<https://www.bcb.gov.br/en/about/socialresponsibility>

Bank of Canada (2022). Using Scenario Analysis to Assess Climate Transition Risk.

<https://www.bankofcanada.ca/wp-content/uploads/2021/11/BoC-OSFI-Using-Scenario-Analysis-to-Assess-Climate-Transition-Risk.pdf>

Bank of England (2020). The Bank of England’s climate-related financial disclosure 2020.

<https://www.bankofengland.co.uk/-/media/boe/files/annual-report/2020/climate-related-financial-disclosure-report-2019-20.pdf>

Bank of England (2021). “Bank of England publishes its approach to greening the Corporate Bond Purchase Scheme.” Press release.

<https://www.bankofengland.co.uk/news/2021/november/boe-publishes-its-approach-to-greening-the-corporate-bond-purchase-scheme>

Bank of England (2022a). Asset Purchase Facility: Corporate Bond Purchase Scheme sales programme – Market Notice 5 May 2022.

<https://www.bankofengland.co.uk/markets/market-notice/2022/may/asset-purchase-facility-market-notice-5-may-2022>

Bank of England (2022b). “Bank of England publishes results of the 2021 Biennial Exploratory Scenario: Financial risks from climate change.” Press release.

<https://www.bankofengland.co.uk/news/2022/may/boe-publishes-results-of-the-2021-biennial-exploratory-scenario-financial-risks-from-climate-change>

Bank of England (2022c). Results of the 2021 Climate Biennial Exploratory Scenario (CBES).

[https://www.bankofengland.co.uk/stress-testing/2022/results-of-the-2021-climate-biennial-exploratory-scenario#:~:text=The%20Climate%20Biennial%20Exploratory%20Scenario%20\(CBES\)%20includes%20three%20scenarios%20exploring,Action'%20\(LA\)%20scenario](https://www.bankofengland.co.uk/stress-testing/2022/results-of-the-2021-climate-biennial-exploratory-scenario#:~:text=The%20Climate%20Biennial%20Exploratory%20Scenario%20(CBES)%20includes%20three%20scenarios%20exploring,Action'%20(LA)%20scenario)

Bank of England (2022d). Joint HM Treasury and Bank of England Energy Markets Financing Scheme (EMFS) - Market Notice 17 October 2022.

<https://www.bankofengland.co.uk/markets/market-notice/2022/october/joint-hmt-boe-emfs-market-notice-17-october-2022>

Bank of England (2022e). Monetary Policy Report - May 2022.

<https://www.bankofengland.co.uk/monetary-policy-report/2022/may-2022>

Bank of Japan (2021). Outline of Climate Response Financing Operation.

https://www.boj.or.jp/en/announcements/release_2021/re1210922c.pdf

Bank of Korea (2021). Bank of Korea’s Response to Climate Change.

https://www.bok.or.kr/ucms/cmmn/file/fileDown.do?menuNo=400007&atchFileId=FILE_000000000027882&fileSn=1

Bank of Russia (2021). Financial Stability Review Q2 – Q3 2021.

https://www.cbr.ru/Collection/Collection/File/39357/OFS_21-2_e.pdf

Bank for International Settlements (2021). Climate-related risk drivers and their transmission channels.

<https://www.bis.org/bcbs/publ/d517.pdf>

Banking Regulation and Supervision Agency (2021). Sustainable Banking Strategic Plan (2022-2025).

<https://www.bddk.org.tr/KurumHakkinda/EkGetir/19?ekId=71>

Banque de France (2021). Analyses et synthèses - A first assessment of financial risks stemming from climate change: The main results of the 2020 climate pilot exercise.

https://acpr.banque-france.fr/sites/default/files/medias/documents/20210602_as_exercice_pilote_english.pdf

Banque de France (2022). Rapport investissement responsable.

<https://publications.banque-france.fr/liste-chronologique/rapport-investissement-responsable?year=2022>

Baranović et al. (2021). The challenge of capturing climate risks in the banking regulatory framework: is there a need for a macroprudential response? European Central Bank.

https://www.ecb.europa.eu/pub/financial-stability/macprudential-bulletin/html/ecb.mpbu202110_1~5323a5baa8.en.html

Barnes, D., Livingstone, Z. (2021). The Green Central Banking Scorecard - How Green Are G20 Central Banks And Financial Supervisors?. Positive Money.

<https://positivemoney.org/publications/green-central-banking-scorecard/>

Barnes et al. (2022). The Power of Big Finance. Positive Money.

<https://positivemoney.org/publications/the-power-of-big-finance/>

Battistini, N. et al. (2022). Energy prices and private consumption: what are the channels? ECB Economic Bulletin, Issue 3/2022.

https://www.ecb.europa.eu/pub/economic-bulletin/articles/2022/html/ecb.ebart202203_01~f7466627b4.en.html

Bei, Z. et al. (2022). Financial Support for Biodiversity Conservation Research Report. Financial Research Institute of the People's Bank of China.

<http://m.gxfin.com/article/finance/yh/default/2022-09-09/5877189.html>

Board of Governors of the Federal Reserve System (2022a). "Federal Reserve Board announces that six of the nation's largest banks will participate in a pilot climate scenario analysis exercise designed to enhance the ability of supervisors and firms to measure and manage climate-related financial risks."

Press release. <https://www.federalreserve.gov/newsevents/pressreleases/other20220929a.htm>

Board of Governors of the Federal Reserve System (2022b). Community Reinvestment Act (CRA).

https://www.federalreserve.gov/consumerscommunities/cra_about.htm

Boissinot, J. et al. (2022) Aligning financial and monetary policies with the concept of double materiality: rationales, proposals and challenges. Policy Briefing Paper 05 - The INSPIRE sustainable central banking toolbox.

<https://inspiregreenfinance.org/wp-content/uploads/2022/06/Boissinot-et-al-2022-Aligning-financial-and-monetary-policies-with-the-concept-of-double-materiality-rationales-proposals-and-challenges.pdf>

Bolton, P. et al. (2020). The green swan - Central banking and financial stability in the age of climate change. Bank for International Settlements.

<https://www.bis.org/publ/othp31.pdf>

Butler, S. (2022). "Northern Italy drought threatens olive oil, risotto rice and passata supplies." The Guardian. <https://www.theguardian.com/business/2022/jul/13/northern-italy-drought-threatens-olive-oil-risotto-rice-and-passata-supplies>

Carattini, S. et al. (2022). Mandatory disclosure is key to address climate risks. Science, 378, 6618, 352-354, 2022.

<https://www.science.org/doi/10.1126/science.ade2017>

Caswell, G. (2022a). "PBoC warns of defaults following climate stress test." Green Central Banking.

<https://greencentralbanking.com/2022/02/21/china-defaults-climate-stress-test-pboc/>

Caswell, G. (2022b). "Lagarde seeks ECB green targeted lending." Green Central Banking.

<https://greencentralbanking.com/2022/06/10/lagarde-seeks-ecb-green-targeted-lending/>

Caswell, G. (2022c). "Worldwide droughts add to 'fossilflation' in price stability crisis." Green Central Banking.

<https://greencentralbanking.com/2022/08/22/drought-fossilflation-price-stability/>

Caswell, G. (2022d). "NGOs criticise ECB asset decarbonisation plan." Green Central Banking.

<https://greencentralbanking.com/2022/09/27/ngos-criticise-ecb-asset-decarbonisation-plan/>

Chenet, H., Ryan-Collins, J. and van Lerven, F. (2021). Finance, climate-change and radical uncertainty: Towards a precautionary approach to financial policy, Ecological Economics, Volume 183, 2021, 106957, ISSN 0921-8009.

<https://www.sciencedirect.com/science/article/pii/S092180092100015X>

Choi, J. et al. (2020). Green Banking in China - Emerging Trends - With a spotlight on the Industrial and Commercial Bank of China (ICBC). Climate Policy Initiative Discussion Brief.

<https://www.climatepolicyinitiative.org/wp-content/uploads/2020/08/081220Green-Bankin-trends.pdf>

ClientEarth (2022). Fossil fuels and climate change: the facts.

<https://www.clientearth.org/latest/latest-updates/stories/fossil-fuels-and-climate-change-the-facts/>

Dafermos, Y. et al. (2020). Decarbonising the Bank of England's Pandemic QE: 'Perfectly Sensible'.

<https://neweconomics.org/uploads/files/NEF-Decarbonise-BoE-report.pdf>

Dafermos, Y. et al. (2022). Greening collateral frameworks. Policy Briefing Paper 07 - The INSPIRE sustainable central banking toolbox.

<https://www.lse.ac.uk/granthaminstitute/wp-content/uploads/2022/08/INSPIRE-Sustainable-Central-Banking-Toolbox-Policy-Briefing-Paper-7.pdf>

Deutsche Bundesbank (2022). Climate-related disclosures by the Deutsche Bundesbank 2022: Part of the Eurosystem-wide climate-related disclosures on the non-monetary policy portfolios (NMPPs).

<https://www.bundesbank.de/resource/blob/838206/df8916fd80f723164101dd53d2768324/mL/2022-klimabericht-data.pdf>

Elderson, F. (2022). "Prudential pathways to Paris." Speech at Eurofi High Level Seminar 2022.

<https://www.bankingsupervision.europa.eu/press/speeches/date/2022/html/ssm.sp220223~e32add6881.en.html>

EU Technical Expert Group on Sustainable Finance (2020). Taxonomy: Final report of the Technical Expert Group on Sustainable Finance.

https://ec.europa.eu/info/sites/default/files/business_economy_euro/banking_and_finance/documents/200309-sustainable-finance-teg-final-report-taxonomy_en.pdf

European Central Bank (2022a). Supervisory assessment of institutions' climate- related and environmental risks disclosures - ECB report on banks' progress towards transparent disclosure of their climate-related and environmental risk profiles.

https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ssm.ECB_Report_on_climate_and_environmental_disclosures_202203~4ae33f2a70.en.pdf

European Central Bank (2022b). "ECB takes further steps to incorporate climate change into its monetary policy operations." Press release.

<https://www.ecb.europa.eu/press/pr/date/2022/html/ecb.pr220704~4f48a72462.en.html>

European Central Bank (2022c). 2022 climate risk stress test.

https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ssm.climate_stress_test_report.20220708~2e3cc0999f.en.pdf

European Central Bank (2022d). "Interview with Madame Figaro." Press release.

<https://www.ecb.europa.eu/press/inter/date/2022/html/ecb.in220825~7c5db6d1b3.en.html>

European Commission (2021). Questions and Answers: Corporate Sustainability Reporting Directive proposal.

https://ec.europa.eu/commission/presscorner/detail/en/QANDA_21_1806

European Commission (2022). EU taxonomy for sustainable activities.

https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/eu-taxonomy-sustainable-activities_en

European Commission Joint Research Centre (2022). Droughts in Europe in July 2022: almost half of the EU +UK territory at risk.

https://joint-research-centre.ec.europa.eu/jrc-news/droughts-europe-july-2022-almost-half-eu-uk-territory-risk-2022-07-18_en

Evain, J. (2022). Include mandatory banking transition plans within Pillar 2. Institute for Climate Economics.

<https://www.i4ce.org/wp-content/uploads/2022/08/220831-i4ce3588-Pilier2OPTB-VA.pdf>

Evans, S. (2021). "Analysis: Which countries are historically responsible for climate change?" Carbon Brief. <https://www.carbonbrief.org/analysis-which-countries-are-historically-responsible-for-climate-change/>

Finance Watch (2021). “Prevent a ‘Climate Lehman Moment’.” Joint Letter.

<https://www.finance-watch.org/wp-content/uploads/2021/11/One-for-One-Joint-letter-BCBS.pdf>

Finance Watch (2022). A safer transition for fossil banking - Quantifying the additional capital needed to reflect the higher risks of fossil fuel exposures.

<https://www.finance-watch.org/wp-content/uploads/2022/10/A-safer-transition-for-fossil-banking-Finance-Watch-report.pdf>

Financial Conduct Authority (2021). Sustainability Disclosure Requirements (SDR) and investment labels. Discussion Paper DP21/4.

<https://www.fca.org.uk/publication/discussion/dp21-4.pdf>

Financial Services Commission (2021). “4th Green Finance Taskforce Meeting Reviews Progress and Discusses Additional Tasks.” Press release.

<https://www.fsc.go.kr/eng/pr010101/77019>

Financial Stability Board (2022). Supervisory and Regulatory Approaches to Climate-related Risks - Final report.

<https://www.fsb.org/wp-content/uploads/P131022-1.pdf>

Heimberger, P., Steininger, L. (2022). ECB interest rate hikes will damage climate protection policies. London School of Economics and Political Science.

<https://blogs.lse.ac.uk/europpblog/2022/08/15/ecb-interest-rate-hikes-will-damage-climate-protection-policies/>

HM Treasury (2021) Guidance - Fact Sheet: Net Zero-aligned Financial Centre.

<https://www.gov.uk/government/publications/fact-sheet-net-zero-aligned-financial-centre/fact-sheet-net-zero-aligned-financial-centre>

Hussain, A. (2022) “Fears of more flooding as Pakistan death toll crosses 1,400”. Al Jazeera.

<https://www.aljazeera.com/news/2022/9/13/flood-related-death-toll-in-pakistan-as-rains-continue>

InfluenceMap (2020a). Is the Fed Being Sector Neutral?

<https://influencemap.org/report/is-the-fed-being-sector-neutral-3a1294e4de3b6275fae9370d6f68cc70>

InfluenceMap (2020b). Lobbying on the EU Taxonomy’s Green Criteria.

https://www.politico.eu/wp-content/uploads/2020/12/14/IM_Taxonomy_Industry_Lobbying_Dec2020_final.pdf

Intergovernmental Panel on Climate Change (2018). Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty - Summary for Policymakers.

<https://www.ipcc.ch/sr15/chapter/spm/>

Intergovernmental Panel on Climate Change (2021). Climate Change 2021 - The Physical Science Basis - Summary for Policymakers. Working Group I Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.

https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM_final.pdf

Intergovernmental Panel on Climate Change (2022). Climate Change 2022: Impacts, Adaptation and Vulnerability - Summary for Policymakers. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.

https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_SummaryForPolicymakers.pdf

International Energy Agency (2021). Net Zero by 2050 - A Roadmap for the Global Energy Sector.

<https://www.iea.org/reports/net-zero-by-2050>

International Energy Agency (2022).Oil Market Report - October 2022.

<https://www.iea.org/reports/oil-market-report-october-2022>

International Monetary Fund (2022). World Economic Outlook Update July 2022.

<https://www.imf.org/en/Publications/WEO/Issues/2022/07/26/world-economic-outlook-update-july-2022>

Kedward, K., Buller, A., Ryan-Collins, J. (2021). Quantitative easing and nature loss: Exploring nature-related financial risks and impacts in the European Central Bank’s corporate bond portfolio. UCL Institute for Innovation and Public Purpose.

https://www.ucl.ac.uk/bartlett/public-purpose/sites/bartlett_public Purpose/files/quantitative_easing_and_nature_loss_23_july.pdf

Kedward, K., Gabor, D. and Ryan-Collins, J. (2022). Aligning finance with the green transition: From a risk-based to an allocative green credit policy regime. UCL Institute for Innovation and Public Purpose, Working Paper Series (IIPP WP 2022-11). https://www.ucl.ac.uk/bartlett/public-purpose/sites/bartlett_public Purpose/files/kedward_gabor_ryan-collins_aligning_finance_with_the_green_transition_from_a_risk-based_to_allocative_green_credit_policy_regime.pdf

Kedward, K., Ryan-Collins, J. and Chenet, H. (2020). Managing nature-related financial risks: a precautionary policy approach for central banks and financial supervisors. UCL Institute for Innovation and Public Purpose, Working Paper Series (IIPP WP 2020-09).

<https://www.ucl.ac.uk/bartlett/public-purpose/publications/2020/aug/managing-nature-related-financial-risks>

Kedward, K. (2022). “Forget greenflation, central banks need to tackle fossilflation.” Green Central Banking.

<https://greencentralbanking.com/2022/05/19/greenflation-central-banks-fossilflation-inflation/>

Keen, S. (2019). The Cost of Climate Change - A Nobel Economist’s Model Dismantled.

<https://evonomics.com/steve-keen-nordhaus-climate-change-economics/>

King, M. and Kay, J. (2020). Radical Uncertainty: Decision-making for an unknowable future. Hachette UK.

Kirsch, A. et al. (2022). “Banking on Climate Chaos - Fossil Fuel Finance Report 2022.” Joint report from Rainforest Action Network, BankTrack, Indigenous Environmental Network, Oil Change International, Reclaim Finance, Sierra Club, and urgewald.

https://www.ran.org/wp-content/uploads/2022/03/BOCC_2022_vSPREAD-1.pdf

Koh, A. (2022). “Global Gas Crunch Leaves Bangladesh Facing Blackouts Until 2026.” Bloomberg.

<https://www.bloomberg.com/news/articles/2022-08-01/global-gas-crunch-leaves-bangladesh-facing-blackouts-until-2026?leadSource=verify%20wall>

Koram, K. (2022). Uncommon Wealth. Hatchette UK. Chapter 2.

<https://www.hachette.co.uk/titles/kojo-koram/uncommon-wealth/9781529338652/>

Krebel, L. and van Lerven, F. (August 2022). Green Credit Guidance - A Green Term Funding Scheme For A Cooler Future. New Economics Foundation.

https://neweconomics.org/uploads/files/NEF_GCG.pdf

Kyriakopoulou, D. (2021). “ECB market neutrality crumbling.” OMFIF.

<https://www.omfif.org/2021/02/ecb-market-neutrality-crumbling/#:~:text=The%20principle%20of%20market%20neutrality,the%20relative%20pricing%20of%20securities>

Lagarde, C. (2022). “Re: Your letter (QZ-013).” European Central Bank. Letter.

https://www.ecb.europa.eu/pub/pdf/other/ecb.mepletter220706_Niinisto~7a5c32683f.en.pdf

Leger, M. and Kazi, D. (2020). “The Bank of England and the slave trade - why apologies are not enough.” Positive Money.

<https://positivemoney.org/2020/07/the-bank-of-england-and-the-slave-trade-why-apologies-are-not-enough/>

Melodia L. and Karlsson K. (2022). Energy Price Stability: The Peril of Fossil Fuels and the Promise of Renewables.

<https://rooseveltinstitute.org/publications/energy-price-stability/>

Monnin, P. (2021). Systemic Risk Buffers - The Missing Piece In The Prudential Response To Climate Risks. Council of Economic Policies.

<https://www.cepweb.org/wp-content/uploads/2021/06/Monnin-2021.-Climate-systemic-risk-buffer-for-Europe-Final.pdf>

Musto, C. (2022). “Emergency BoE scheme should not give energy firms a ‘free pass’, say think tanks.” Positive Money.

<https://positivemoney.org/2022/10/emergency-boe-scheme-should-not-give-energy-firms-a-free-pass-say-think-tanks/>

Network for Greening the Financial System (2019a). Origin and Purpose.

<https://www.ngfs.net/en/about-us/governance/origin-and-purpose>

Network for Greening the Financial System (2019b). A sustainable and responsible investment guide for central banks’ portfolio management.

<https://www.ngfs.net/sites/default/files/medias/documents/ngfs-a-sustainable-and-responsible-investment-guide.pdf>

Network for Greening the Financial System (2020). Guide for Supervisors Integrating climate-related and environmental risks into prudential supervision. Technical document.

https://www.ngfs.net/sites/default/files/medias/documents/ngfs_guide_for_supervisors.pdf

Network for Greening the Financial System (2021). Climate-related litigation: Raising awareness about a growing source of risk. Technical document. https://www.ngfs.net/sites/default/files/medias/documents/climate_related_litigation.pdf

Network for Greening the Financial System (2022a). Information relating to the NGFS current composition (members and observers) and on the application process.

<https://www.ngfs.net/en/about-us/membership>

Network for Greening the Financial System (2022b). Not too late – Confronting the growing odds of a late and disorderly transition.

https://www.ngfs.net/sites/default/files/media/2022/09/07/not_too_late_-_confronting_the_growing_odds_of_a_late_and_disorderly_transition.pdf

Network for Greening the Financial System (2022c). Scenarios Portal. <https://www.ngfs.net/ngfs-scenarios-portal/>

Network for Greening the Financial System (2022d). In Conversation with Mr. Paolo Angelini - Deputy Governor, Banca d’Italia.

https://www.ngfs.net/sites/default/files/medias/documents/ngfs_in_conversation_with_banca_ditalia_paolo_angelini.pdf

Office of the Comptroller of the Currency (2021). Principles for Climate-Related Financial Risk Management for Large Banks.

[https://www.occ.gov/news-issuances/news-releases/2021/nr-occ-2021-138a.pdf](https://www OCC.gov/news-issuances/news-releases/2021/nr-occ-2021-138a.pdf)

Office of the Superintendent of Financial Institutions (2022). Climate Risk Management.

<https://www.osfi-bsif.gc.ca/Eng/fi-if/rq-ro/gdn-ort/gl-ld/Pages/b15-dft.aspx>

Oil Change International and Reclaim Finance (2021). NGFS Scenarios: Guiding finance towards climate ambition or climate failure? - Executive Summary.

<https://priceofoil.org/content/uploads/2021/02/NGFS-scenarios-final.pdf>

Pagliari, S. and Young, K. (2016). The interest ecology of financial regulation: interest group plurality in the design of financial regulatory policies. Socio-Economic Review, Volume 14, Issue 2, April 2016, Pages 309–337.

<https://academic.oup.com/ser/article-abstract/14/2/309/2451755>

Pakistan Bureau of Statistics (2022). Executive Summary: Sensitive Price Indicator (SPI) for the Week Ended on 25.08.2022. https://www.pbs.gov.pk/sites/default/files/price_statistics/weekly_spi/SPI_Executive%20Summary%26Report_25082022.pdf

People’s Bank of China (2021). “The People’s Bank of China Launches the Carbon Emission Reduction Facility.” Press release.

<http://www.pbc.gov.cn/en/3688110/3688172/4157443/4385345/index.html>

People’s Bank of China (2022). “PBC Provides Additional RMB100 Billion Quota of Special Central Bank Lending to Support Coal Development and Use and Enhance Coal Reserve Capacity.” Press release.

<http://www.pbc.gov.cn/en/3688110/3688172/4437084/4544388/index.html>

Petry, J. (2021) From National Marketplaces to Global Providers of Financial Infrastructures: Exchanges, Infrastructures and Structural Power in Global Finance, New Political Economy, 26:4, 574-597, DOI: 10.1080/13563467.2020.1782368.

<https://www.tandfonline.com/doi/full/10.1080/13563467.2020.1782368>

Positive Money. (2021). “Bank of England announces plan to green corporate bond purchases: Positive Money response.” Positive Money.

<https://positivemoney.org/2021/11/bank-of-england-announces-plan-to-green-corporate-bond-purchases-positive-money-response/>

Prudential Regulation Authority (2021). Climate-related financial risk management and the role of capital requirements - Prudential Regulation Authority - Climate Change Adaptation Report 2021. Bank of England.

<https://www.bankofengland.co.uk/-/media/boe/files/prudential-regulation/publication/2021/october/climate-change-adaptation-report-2021.pdf>

Rauhala, E. (2022). “E.U. labels natural gas and nuclear energy ‘green,’ prompting charges of ‘greenwashing’.”

<https://www.washingtonpost.com/world/2022/02/02/green-energy-gas-nuclear-taxonomy/>

Reclaim Finance (2020). “Joint Letter to the NGFS: We need NGFS’ work and commitment to push for a green recovery.” Reclaim Finance, Sunrise project, Positive Money Europe, Friends of the Earth, Veblen Institute for Economic Reforms, Sustainable Finance Lab. Joint Letter.

Reclaim Finance (2022a). Managing inflation by supercharging a clean energy transition: What the ECB should do. <https://u6p9s9c8.rocketcdn.me/site/wp-content/uploads/2022/09/Report-Supercharging-a-EU-clean-energy-transition-ECB.pdf>

Reclaim Finance (2022b). “NGOs’ receipt to decarbonize the ECB’s corporate quantitative easing.” <https://reclaimfinance.org/site/en/2022/09/15/ngos-receipt-to-decarbonize-the-ecbs-corporate-quantitative-easing/>

Ritchie, H. (2019) “Who has contributed most to global CO2 emissions?” Our World in Data.

<https://ourworldindata.org/contributed-most-global-co2>

Schnabel, I. (2022). “A new age of energy inflation: climateflation, fossilflation and greenflation.” Speech at The ECB and its Watchers XXII Conference.

https://www.ecb.europa.eu/press/key/date/2022/html/ecb.sp220317_2~dbb3582f0a.en.html

Senni, C. and Monnin, P. (2020). Central Bank Market Neutrality is a Myth. Council on Economic Policies.

<https://www.cepweb.org/central-bank-market-neutrality-is-a-myth/>

Seto, K.C., Davis, S.J., Mitchell, R.B., Stokes, E.C., Unruh, G. and Ürge-Vorsatz, D. (2016). “Carbon lock-in: types, causes, and policy implications”. Annual Review of Environment and Resources, 41(1), pp.425-452.

https://www.researchgate.net/profile/Steven-Davis-14/publication/308036498_Carbon_Lock-In_Types_Causes_and_Policy_Implications/links/582a360708ae004f74ae3f4f/Carbon-Lock-In-Types-Causes-and-Policy-Implications.pdf

Shrago, Y. (2021). How green is the Fed? - U.S. Supplement to The Green Central Banking Scorecard.

<https://www.citizen.org/wp-content/uploads/Fed-Green-Scorecard.pdf>

Schreiber, P. et al. (2021). Below the Radar: Central Banks Investing Unsustainably. Reclaim Finance.

<https://u6p9s9c8.rocketcdn.me/site/wp-content/uploads/2021/11/Report-Below-the-radar-Central-banks-investing-unsustainably.pdf>

South African Reserve Bank (2022). South African Reserve Bank Annual Report 2021/22.

<https://resbank.onlinereport.co.za/2022/downloads/Full-Annual-Report-2021-22.pdf>

Stiroh, K. (2022). Climate Change and Double Materiality in a Micro- and Macroprudential Context. Finance and Economics Discussion Series.

<https://www.federalreserve.gov/econres/feds/climate-change-and-double-materiality-in-a-micro-and-macroprudential-context.htm>

Svartzman et al. (2021). A “Silent Spring” for the Financial System? Exploring Biodiversity-Related Financial Risks in France. Working Paper. <https://publications.banque-france.fr/en/silent-spring-financial-system-exploring-biodiversity-related-financial-risks-france>

Symon, J. (2021). Report: A ‘silver bullet’ against Green Swans – Incorporating climate risk into prudential rules. Finance Watch.

<https://www.finance-watch.org/wp-content/uploads/2021/11/A-Silver-Bullet-Against-Green-Swans-capital-requirements-climate-risk.pdf>

SynTao Green Finance (2020). China’s New Green Catalogue - Harmonizing Standards.

https://www.sbfnetwork.org/wp-content/assets/policy-library/481_China_Chinas-new-green-catalogue.pdf

Täger, M. (2021) “Double materiality’: what is it and why does it matter?”. Grantham Research Institute on Climate Change and the Environment.

<https://www.lse.ac.uk/granthaminstitute/news/double-materiality-what-is-it-and-why-does-it-matter/>

Tooze, A. (2022). Debating Central Bank Mandates. Forum New Economy Working Papers No. 01 2022.

<https://newforum.org/wp-content/uploads/2022/01/FNE-WP01-2022.pdf>

United Nations (2022). “Addiction to Fossil Fuels Must End, Secretary-General Tells Sustainable Energy Forum, Stressing Need to Expedite Deployment of Renewables Everywhere.” Press release.

<https://press.un.org/en/2022/sgsm21278.doc.htm>

UN News (2022). “Barbados Prime Minister Mia Mottley calls for overhaul of unfair, outdated global finance system.”

<https://news.un.org/en/story/2022/09/1127611>

van ‘t Klooster, J. and van Tilburg, R. (2020). Targeting a sustainable recovery with Green TLTROs. Positive Money Europe and Sustainable Finance Lab.

<https://dev.toleftdesign.com/positive-money-europe/WP/wp-content/uploads/2020/09/Green-TLTROs.pdf>

Varanasi, A. (2022). “How Colonialism Spawned and Continues to Exacerbate the Climate Crisis.” Columbia Climate School.

<https://news.climate.columbia.edu/2022/09/21/how-colonialism-spawned-and-continues-to-exacerbate-the-climate-crisis/>

Waite, N. (2022). “China’s central bank is leading the way with bold green finance policies.” Institute For Energy Economics And Financial Analysis.

<https://ieefa.org/articles/chinas-central-bank-leading-way-bold-green-finance-policies>

Warjiyo, P. (2022). “Social bonds becoming more important in reserves portfolios”. OMFIF.

<https://www.omfif.org/2022/07/social-bonds-becoming-more-important-in-reserves-portfolios/>

Way et al. (2022). Empirically grounded technology forecasts and the energy transition. Joule 6, 2057–2082.

[https://www.cell.com/joule/fulltext/S2542-4351\(22\)00410-X](https://www.cell.com/joule/fulltext/S2542-4351(22)00410-X)

The White House. (2022). “The Rising Costs of Extreme Weather Events.” <https://www.whitehouse.gov/cea/written-materials/2022/09/01/the-rising-costs-of-extreme-weather-events/>

Wu and Duguid (2022). “Fed’s faster ‘quantitative tightening’ adds to strain on bond market.” Financial Times.

<https://www.ft.com/content/70e43592-30d0-4348-916b-673910ad7726>

104 Davina House
137-149 Goswell Road
London
EC1V 7ET
0207 253 3235

www.positivemoney.org
www.positivemoney.eu
www.positivemoney.us

PositiveMoney 

Positive Money is a not-for-profit company limited by
guarantee, registered in England and Wales.

Company Number 07253015

Copyright © 2022 Positive Money