

University of Groningen

In the fight against climate change, did the financial sector cut secular ties with the oil industry or merely camouflage them?

Ruzzenenti, Franco; Hubacek, Klaus; Gabbi, Giampaolo

Published in:
Cleaner Production Letters

DOI:
[10.1016/j.cpl.2023.100040](https://doi.org/10.1016/j.cpl.2023.100040)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2023

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Ruzzenenti, F., Hubacek, K., & Gabbi, G. (2023). In the fight against climate change, did the financial sector cut secular ties with the oil industry or merely camouflage them? *Cleaner Production Letters*, 4, Article 100040. <https://doi.org/10.1016/j.cpl.2023.100040>

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.



In the fight against climate change, did the financial sector cut secular ties with the oil industry or merely camouflage them?

Franco Ruzzenenti^{a,*}, Klaus Hubacek^a, Giampaolo Gabbi^b

^a *Integrated Research on Energy, Environment and Society (IREES), Energy and Sustainability Research Institute Groningen (ESRIG), University of Groningen, Groningen, 9747AG, the Netherlands*

^b *SDA Bocconi School of Management, Via Sarfatti, 10, Milan, 20136, Italy*

ARTICLE INFO

Keywords:
Finance
Fossil fuels
Decarbonization

ABSTRACT

At a time when the links that bind the oil industry – both corporate and state-owned - to finance and governments seemed inextricable and unquestionable, some major changes have occurred that have prompted major financial players and governments to seek a separation strategy. From the Paris Agreement to the change of administration in the United States, the wind suddenly seems to be blowing in the opposite direction, and many banks change course. The UN-convened Net-Zero Banking Alliance (NZBA) is one prominent example of this new trend. However, banks are only one part of this complex and varied landscape of global finance, which, among institutional investors, includes investment funds, hedge funds, mutual funds, insurance funds, pension plans and ETFs (exchange-traded funds). Despite the promise to divest or reduce investments, global finance still holds profound ties with the fossil fuel sector. The high energy prices due to the war in the Ukraine and concerns over energy security are seemingly strengthening these ties. We provide an insight of the complexity of these inter-linkages and explain to what extent the domain of public governance is trying to exert (still insufficient) control over the financial sector under the scope of climate mitigation policies.

1. The role of finance to achieve climate goals

Limiting warming to achieve the goals of the Paris Agreement to stay “well below” 2 °C and to “pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels” requires unprecedented transformation and decarbonisation of the economy and society (IPCC, 2022). In other words, this requires strictly limiting the total amount of carbon emissions (CO₂) or allowable carbon budget¹, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 and 14 that can be emitted in the future. Estimates of the size of this cumulative carbon that keeps the global community within temperature thresholds vary depending on the type of model (earth systems or simple climate models), on the starting point of the budget (pre-industrial or more recent average time periods), the definition of the temperature level, or if negative emissions allow the budget to be exceeded (Peters, 2018). Despite these uncertainties, given that the global temperature is already about 1.1 °C above pre-industrial levels -which has already led to a considerable increase in climate extremes, the inertia in physical and social systems means that there is only a small

window of opportunity (and cumulative emissions) before 1.5 °C is exceeded after which we must have achieved (net-) zero emissions (Peters, 2018). Examples of this inertia in the economy, are the continuous heavy investments in fossil fuel infrastructure by governments and oil companies (e.g. only 1% of the combined budget of ‘big oil’ was spent on green energy schemes in 2018) (Coady et al., 2019); or the substantial and unwavering subsidies in fossil fuel-based energy, which amounted to almost 770 billion dollars in the G20 economies in 2021 (OECD, 2022). Today’s investments in hydrocarbon exploration and infrastructure, often with several decades of lifetime, commit to future carbon emissions and severely restrict future mitigation options (Tong et al., 2019).

1.1. A global mobilisation

The article 2.1 c of the Paris Agreement established the goal of ‘making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development’, and points to

* Corresponding author.

E-mail address: f.ruzzenenti@rug.nl (F. Ruzzenenti).

¹ A carbon budget is “the maximum amount of cumulative net global anthropogenic carbon dioxide (CO₂) emissions that would result in limiting global warming -rising in average temperature, to a given level with a given probability.

the required transformations of the financial system to achieve them (Zamarioli et al., 2021). In its last report, in Chapter 15, the IPCC recognizes an increased awareness of climate-related financial risks arising from “physical impacts of climate change and from a disorderly transition to a low carbon economy”, “leading also to concerns about financial stability”, and has moved financial regulators and institutions to respond with “multiple regulatory and voluntary initiatives to assess and address these risks” (p. 15). Yet despite these initiatives, the report also signals that “the climate-related financial risks remain greatly underestimated by financial institutions² and markets limiting the capital reallocation needed for the low-carbon transition” (IPCC, 2022, p. 15). This unprecedented awareness and the new, pointed out, crucial role have fuelled an increased interest and activity in the financial sector, arguably further attracted by the staggering investments required to achieve net-zero carbon emissions (Fig. 1).

In March 2021, some of the United States’ biggest banks, the so-called Big Six, made a public pledge to achieve zero climate targets and align their investments with the Paris Agreement. In April, 43 international banks made the same public commitment, under the umbrella of the UN-convened Net-Zero Banking Alliance (NZBA or Race to Zero), that their investment and lending portfolios would have achieved net-zero emissions by 2050. According to Bloomberg, 2021 was the first year in which green bonds and loans in the global banking sector (203 billion³) exceeded the value of fossil fuel-related loans (189 billion) (Comfort N. and Aron S., 2021). According to the last report of the Global Sustainable Investment Alliance, the share of “global sustainable investments” in five major markets (the USA, Europe, Canada, Japan and Australia), as of the start of 2020, stood already at 35% of total assets under management, for an amount of USD 35.3 trillion, a 15% increase compared to the previous two years. Finance also permeated many aspects of the COP26 in Glasgow (Carbon Brief, 2021). Whereas rich countries acknowledged to have failed to mobilise 100 billion US\$ of public money in the Global Finance Delivery Plan, the private sector took the stage with the Glasgow Financial Alliance for Net Zero (GFANZ) claiming that 130trn US\$ of private capital would be “deployed” to limit global warming (Walker O., 2021).

1.2. After enthusiasm, realism?

The announcement of the “hundreds of trillions” by Mark Carney, former Bank of England governor and chair of GFANZ “became a running joke among those working on finance for Glasgow” (Bryan K., 2022) and was not reiterated (though neither withdrew) in the COP27, where promises were less thunderous and commitments less adamant, after a series of resignations of early signatories (Masters and Temple-West, 2022) and threats of legal actions (Sustainable Views, 2022). At COP27 in Sharm El-Sheikh, finance was still under the spotlight and though major attention was given to the role of public finance in tackling the two-pronged issue of energy security and energy transition. On that occasion the sector’s representatives, in a climate less euphoric (with respect to COP26), but more pragmatic, raised and forward looking (van Steenis, 2022), invoked the necessity for the standardisation of voluntary carbon markets, the need for better, science-based metrics and targets, and for transparent and enhanced data. In June 2022 GFANZ promised a much tougher set of membership rules drawn from Race to Zero (such as that members must “restrict” their facilitation of all new fossil fuel projects, and that “no new coal” must be supported). But after exit threats from several major banks (including JP Morgan) GFANZ retreated and issued a “statement

highlighting its members’ legal rights to follow whatever voluntary pledges they chose” (Bryan K., 2022). At COP27, however, GFANZ renewed her vows by backing a new data-initiative (together with NZBA) designed to “systematically embed across the financial system” the net zero targets by 2027.

2. The ‘big three’ and the oil industry

In his 2020 annual letter to the CEOs of investee companies,⁴ Larry Fink, CEO of BlackRock, one of the world’s big three asset managers, made an explicit statement about the future of the asset management industry, saying that climate risk will trigger a “fundamental reshaping of finance”. In 2021, BlackRock’s Global Executive Committee further explained to clients how BlackRock intends to address climate change and its associated risks by 1) incorporating impacts into portfolio construction; 2) implementing a high-control asset management model; and 3) launching investment products with explicit temperature alignment objectives. He also stated that BlackRock will vote in shareholders’ meetings and on boards against unsustainable decisions by investee companies.

Who are the big three? BlackRock with \$9.01 trillion under management (a third of which is in Europe), Vanguard Group with \$7.5 trillion and State Street Global Adv with \$5.1 trillion; they are currently the largest shareholder in 90% of the S&P500; and Blackrock has a 40% stake and voting rights in 17 k US companies and 18 k German companies. Most importantly, BlackRock has been appointed by the EU as the sole advisor on future environmental regulations for banks (without any competitive bidding) and is likely to play a major role in shaping the EU’s climate change agenda, despite any possible conflict of interests.⁵

Despite its promise to divest from fossil fuels, Black Rock still owns such assets. For example, the market value of BlackRock’s investments in coal was more than \$12 billion (through other estimates reach \$85 billion and \$90 billion in oil and gas (Kuykendall T. et al., 2021); a not insignificant amount, considering that between 2015 global oil and gas financing amounted to about \$700 billion, \$200 billions of which were stocks and bonds, the rest bank loans (Cojoianu T.F. et al., 2021).

Funds marketed as ‘climate-themed’ often hold shares in major polluters, including large oil companies, and many are inconsistent with the goals of the Paris Agreement, despite claiming to be ‘aligned’ with it, according to an analysis by the think-tank InfluenceMap (2021). More than half, or 72 of the 130 climate-focused funds reviewed - which collectively hold more than \$67bn in assets and are managed by leading investment houses including BlackRock and State Street Global Advisors - are not aligned with the Paris Agreement goals. Collectively, the 130 funds in 2020 held \$153 million in companies belonging to the fossil fuel supply chain. By way of example, a State Street Global Advisors’ mutual fund that claims to have no ‘fossil fuel reserves’ and a BlackRock fund that claims to be ‘fossil fuel shielded’ held shares in Marathon Petroleum and the petroleum refineries company Phillips 66. More generally, passive funds, i.e., those that tend to replicate stock market benchmarks, hold large shares of their portfolios in such companies (Hodgson and Mooney, 2021).

3. Tech-finance and institutional investors

It would be too naive to expect that loans, shares and bonds, amounting to hundreds of billions of US dollars, would simply be written

² Main financial institutions as listed by the EU: Monetary financial institutions, Investment funds (IFs), Financial vehicle corporations (FVCs), Payment statistics relevant institutions (PSRIs), Insurance corporations (ICs) and Pension funds (PFs).

³ Only in 2022 332 bn \$ of green bonds were issued.

⁴ <https://www.blackrock.com/uk/individual/larry-fink-ceo-letter>, accessed on 6-12-2021.

⁵ For a more informed overview of the pending issue, we suggest the reading of the Decision of the European Ombudsman in joint inquiry 853/2020/KR on the European Commission’s decision to award a contract to BlackRock Investment Management to carry out a study on integrating environmental, social and governance (ESG) objectives into EU banking rules.

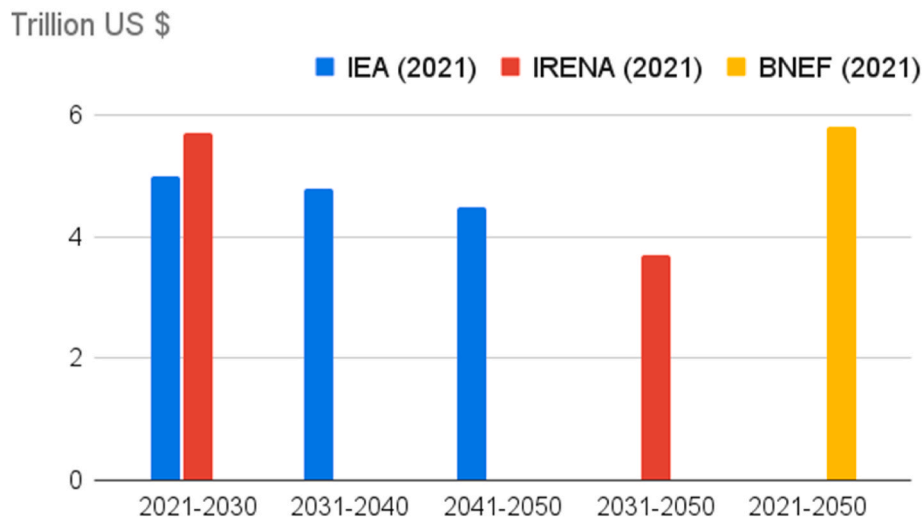


Fig. 1. Investments required to achieve net-zero carbon emissions before 2050 according to: International Energy Agency (IEA); International Renewable Energy Agency (IRENA); Bloomberg New Energy Finance (BNEF). Source: [Lenaerts et al., 2021](#)

off with a blink of an eye. There is an intrinsic inertia that has to be acknowledged. However, it is along the path of converting intention into action that this inertia poses the most common, though unknown or underestimated, threat to success. Strampelli has listed two possible limitations of institutional investors' commitment to climate mitigation policy ([Strampelli G., 2020](#)). The first is obviously the costs: how much will it cost to implement a heightened-scrutiny model for managing assets over, say 17 K U.S and 18 K German companies? In BlackRock's case, it is estimated that investment in stewardship activity would cost 13.5 million dollars, 0.15% of management fees collected, but that estimation ignores the costs of the additional personnel required to implement such a global monitoring system, arguably more than the current 47 employees ([Strampelli G., 2020](#)). Recently, Lieberknecht has further delved into the legal and economic limitations that could curb the "enthusiasm" in portraying institutional investors as "climate activists" ([Lieberknecht Markus, 2022](#)). He then summarized them in the main one, the "chasm" of a looming conflict of interests "between the portfolio-level goal of GHG reduction and the company-level goal of value maximization", which could ultimately trigger conflicting fiduciary duties. A sour taste of this potential conflict, in that case exacerbated by a political whirl, was given by the recent decision of some Republican administrations to pull \$1bn from BlackRock over ESG investing considerations ([Ali S., 2022](#)); or the investigation into six large U.S. banks over their involvement in the United Nations' "Net-Zero Banking Alliance" launched by nineteen Republican-led states ([Laco K., 2022](#)). Others have raised the concern that a collective action by financial institutions to boycott assets in carbon intensive sectors might face "genuine issues" of antitrust authorities, ([Bryan, 2022](#)). An issue that was indeed taken seriously by Race to Zero as they recently removed any reference to "no new coal" after the UN-backed body had taken legal advice on the matter.

Based on PRI Public Signatory Reports, none of the major asset management firms have decided to phase out their investments in fossil fuel holdings, but they have reduced portfolio exposure to emissions-intensive or fossil fuel holdings; or used emissions data or analysis to inform investment decision-making ([UN, 2021](#)). The rising role of *passive (or indexed) investments* raises further concerns. If the choice remains to replicate indices, index managers have very little incentive to monitor the activities of the companies in which they hold shares (reduced margins and no performance fee) and even if ETFs (exchanged traded funds) will develop, as they are doing, there will always be a third-party index, whose composition is beyond their control and, if profitable, palatable to clients. A similar concern was expressed by some GFANZ

signatories who argued that the selling of high-emitting assets does not necessarily prevent the associated carbon from reaching the atmosphere, but only shifts the asset allocation ([Bryan K., 2022](#)).⁶

A further, imponderable hurdle to a sustainable path of finance in the direction of climate mitigation goals is that of the new complex landscape of tech-finance: *dark pools, tax heavens* and the new generation of financial tools (and virtual money) enabled by Information Technology, among which block-chain⁷ is the most notorious -or infamous, for the remarkable carbon footprint, either being in the form of cryptocurrencies or non-fungible tokens ([Lemercier J., 2021](#)), and, in some cases, its ties with fossil industry ([Köhler and Pizzol, 2019](#)). Another rabbit pulled out of the hat of Information Technology is automated trading through algorithms, the most prominent -between 40% and 70% of global transactions, depending on estimations. Some estimate the share of algorithmic trading to have ranged between 40% and 60% in equity markets in EU and USA in 2012 ([Gerig A., 2015](#)). In the commodity markets figures seems to be very similar: some have estimated that at CME in 2012 this share to be 46% of total volume ([Haynes R. and Roberts, J.S., 2015](#)) and recently, the Commodity Futures Trading Commission ([Commodity Futures Trading Commission U.S., 2019](#)) estimated that AT (automated trading) orders in the U.S. Futures and Options markets increased from 2013 to 2018, on average, by 7%, reaching a staggering level of 90% in currencies and 80% in equities and energies. Beyond regulatory and political issues, AT has had a structural impact on price formation, leading to a synchronization between markets and assets, further intertwining the action of traders and speculators ([Chiarelli, R. et al., 2017](#)).

Nevertheless, automatic trading could be positively (theoretically) used to stir Socially Responsible Investments (SRI) through Responsible AI (artificial intelligence whose algorithms include social and environmental goals). It is plausible that ESG fund managers have already developed proprietary algorithms for data processing to search for investment opportunities under the "alpha" assumption ([King and Pucker,](#)

⁶ As for January 2021, according to Urgewald, which provides an updated *Global Oil and Gas Exit List*, only La Banque Postale, among major global investors, announced that it is suspending financial services to all oil and gas companies. More recently, HSBC also announced that it will be stopping funding projects aimed at developing new oil & gas reserves ([Bryan K. and Dunkley E., 2022](#)).

⁷ https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/overview-sustainable-finance_en. Accessed on 4-10-2021.

2022), though the reliability of ESG data it is still an open question as it is whether or not ESG investing performs better than the market (the “alpha” of a portfolio) (Berg, F. et al., 2020). Dark pools are private, electronic share-trading systems by which financial traders can evade the structural dependency on investment banks and other financial institutions by trading anonymously financial assets (MacKenzie, D., 2019). In the same vein, some have noticed how the rising power of tech-finance (and supporting infrastructures) could end the “age of sanctions” for the USA and its privilege tool, the unmatched, global role of the Dollar for trade and reserves (Demarais, 2022).

In conclusion, the complex landscape generated by the application of Information Technology and AI to finance (tech-finance) poses new formidable challenges for the goals of tracking and accounting of financial flows in relation to carbon flows and stocks, but at the same time creates new opportunities of intervention, whose depth are still far from being explored.

4. Big money chasing new exploration opportunities

In spite of their domestic commitments, many giant financial institutions hold significant overseas assets in exploration and development. A consortium of eighteen NGOs has recently investigated twelve of the largest fossil-fuel (mainly oil and gas) development projects accounting for 175 GT of CO₂, almost half of the budget of 395 Gt to limit a 1.5 °C increase with a 50% probability (InfluenceMap, 2021). According to their investigation, financial institutions have provided \$1.6 trillion in loans and underwriting since January 2016 and, as of August 2, 2020,⁸ invested \$1.1 trillion in bonds and shares in 133 involved companies. Significantly, the twenty largest investors provided almost half of the total cash, the Big Three are top of the list and among the non-US investors are the Norwegian Government Pension Fund, UBS and Deutsche Bank (Fig. 2). According to the *Fossil Fuel Finance Report*, the world's 60 largest banks funnelled \$4.6 trillion to the fossil fuel industry in the six years since the adoption of the Paris Agreement, with \$742 billion in fossil fuel financing in 2021 alone (Kirsch, A. et al., 2022). As 2022 just elapsed, the long-awaited turn of the tide seemed still far in the horizon. JPMorgan Chase, for example, underwrote a \$788mn share issuance by the Indian miner Vedanta Resources in November (ironically, a month after it joined the Carney's GFANZ alliance). Nevertheless, the same year, JP Morgan was surpassed as the top global financier of the fossil fuel industry by the Royal Bank of Canada (42.1 bn versus 39.2). Even though checks from the world's 60 largest banks decreased by 16% (to \$673bn) in 2022 (Mooney C. et al., 2023), globally, the financing of high-emissions industries has not slowed as expected, as new underwritings were already well above one trillion in November compared to 1.5 trillion in the whole 2021 (Bryan K., 2022).

The problem is not how to reconcile these huge projects with the aforementioned new climate sensibility of the boards of the major global financial institutions -whose good intentions have never been questioned, but how long this process of reconciliation (“alignment with goals”) will take and how many more emissions will it release. A task, that of aligning corporate greenhouse-gas emissions targets with climate goals, still far from being achieved and, somehow, altogether difficult to be defined in terms of (science-based) metrics (Krabbe, O. et al., 2015; Le Guenedal, T. and Roncalli, T., 2022; Rekker S. et al., 2022).

5. From voluntary to compulsory?

Perhaps nothing illustrates more aptly the virtues and shortcomings of climate mitigation actions based purely on voluntary measures as the story of GFANZ, which results from a process that began long ago, probably with the endeavour of the World Economic Forum and his

⁸ <https://www.legislation.gov.uk/ukpga/2015/30/contents/enacted>. Accessed on 4-10-2021.

founder, Klaus Schwab, a member of the United Nations' High-Level Advisory Board on Sustainable Development and vice-chairman of the United Nations Committee for Development Planning since 1993, who was one of the inspirators of the protocol adopted by the UN Climate Change Conference in Copenhagen in December 2009 (WEF, 2010) and a long, fervent ensign of *Global Corporate Citizenship*, whereby business leaders should consider “critical to engage with shareholders, the communities in which their companies operate [...] for adequate corporate governance structures to the adoption of environmentally sustainable procedures, and philanthropy (Schwab K., 2008).

GFANZ, in accordance with that philanthropic spirit, had resolved at Glasgow to engage in climate mitigation action spirit with enthusiasm. Nevertheless, after a flamboyant beginning (with the endorsement of over 450 of the largest financial institutions responsible for assets of over \$130 trillion) faced the backlash of the endorsement (under the UN-Net Zero umbrella) of more stringent criteria and clear deadlines when several signatories threatened to leave or even to take legal action. The feud revolved not only around “the pace” of the transition, which most of the companies wanted to be determined internally rather than dictated by third parties, but also on the “direction”, i.e. on investment decisions, which could involve carbon intensive projects -even coal.

The agency to convert goodwill into action, even in the domain of the mercurial financial sector could be, at least partially, under the guidance and control of some public bodies (through regulations). From this point of view, the commitment to sustainable finance began essentially 20 years ago, when the Equator Principles (Equator Principles, 2020) were published, aimed at giving guidelines to development and investment banks to rank the quality of projects financed from an environmental perspective. This was followed by the Principles for Responsible Investment (2006) (UN, 2021), the Principles for Sustainable Stock Exchange (2009) (SSE initiative, 2021), the Principles for Sustainable Insurance (2012) (UNEP Finance Initiative, 2012), and the Principles for Responsible Banking (2019) (UNEP Finance Initiative, 2019). The last of such a stream of initiatives is the UNEP Emissions Gap Report 2022, which, in chapter 7, lists not only the finance flows and mitigation investment needs by sector, type of economy and region, but proposes some regulatory actions and market-based measures, available to national, international, public and private bodies, to align financial system actors with climate change (UNEP, 2022).

The characteristic of these initiatives is that they are voluntary in nature, although there is essentially global pressure for participation from various stakeholders (UNEP, 2022). In recent years, however, there has been a significant change, i.e., a transformation from a voluntary process into a series of compulsory legal and regulatory interventions. Specifically, and to remain in the European context, in 2019 new European regulations were issued on mandatory sustainability disclosures for the financial world, and on transition-related indices. From 2017 to 2019 the European taxonomy was shared as part of the Sustainable Finance Action Plan⁹ with the aim of channelling capital flows towards more sustainable activities, defining “green” and sustainable sectors, and characterising the minimum impacts of activities. In addition, several pieces of legislation were passed, such as the UK Modern Slavery Act¹⁰, the Prudential Regulation Authority on climate change,¹¹ and the French Duty of Care Act.¹²

Moreover, a reform that should affect the income component is the

⁹ <https://www.bankofengland.co.uk/climate-change>. Accessed on 4-10-2021.

¹⁰ <https://www.bankofengland.co.uk/climate-change>. Accessed on 4-10-2021.

¹¹ The ability of agents, public or private, to effectively use investment capital to serve needs.

¹² A new possible avenue for the oil industry of self-financing could be that of converting gas flaring into cryptocurrencies mining facility (Snytnikov and Potemkin, 2022).

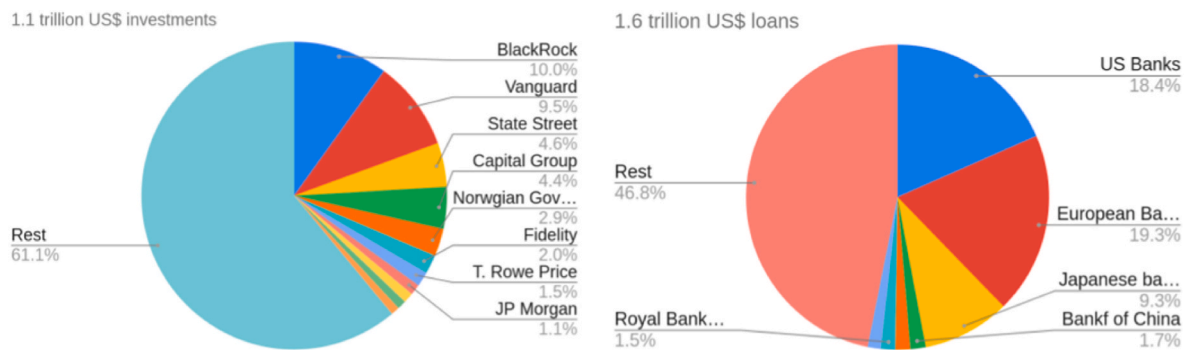


Fig. 2. The 12 projects expected to cause 175 gigatons of additional CO₂ emissions (August 2020) investigated by 18 NGOs (among which, Urgewald and ReclaimFinance). Source: own elaboration on Five Years Lost – How the Finance Industry is Blowing the Paris Carbonbudget (InfluenceMap, 2021).

one that banking and insurance supervisors in Europe are preparing to change the degree of capital absorption¹³ according to the allocation of loans. In other words, if banks orient their investments in sustainable assets according to the taxonomy, they will be able to save in terms of equity. Since the cost of equity is higher than any other source of funding, reducing exposure in particularly polluting sectors such as oil and gas will generate a direct financial benefit.

5.1. The pillars of the next EU regulatory framework

International banking regulators have long recognised the financial stability implications of climate change, as extreme climate change events could generate such negative impacts that ecosystems, infrastructure and supply chains could collapse, affecting human health and mortality itself. In financial terms, extreme climate events could lead to massive devaluations of assets and collateral held by financial institutions, to unexpected price swings and market movements that will affect the entire spectrum of financial risks in our financial system (Jung et al., 2022).

For this reason, the authorities are radically revising the regulatory framework by introducing a set of expectations aimed at making climate risk an urgency in banking risk management and business decisions in general (European Central Bank, 2022). Regulation is designed to model the credit institutions on one side and the financial firms on the other. The former is reforming the Basel framework while the latter is aimed at changing the financial advisory process that has been regulated through the Sustainable Finance Disclosure Regulation (SFDR).

With reference to the Basel framework, there are two pillars of climate risk regulation: pillar one (implied in the EU Action Plan) and pillar two (Kress, 2022).

With reference to the first pillar, the authorities are debating the revision of prudential ratios on bank capital to incentivise behaviour aimed at accelerating the energy transition and minimising negative climate externalities. In this regard, opinions on the most appropriate prudential measures are widely divergent. Several prudential solutions exist to incorporate climate-related financial risks (CRFRs) into existing prudential frameworks and in particular into risk management processes. But such interventions are certainly slower because they require standardised modelling shared by all banking institutions, at least those with international operations (European Banking Authority, 2022).

Quicker to implement would be Pillar II measures whereby banks and insurance companies are obliged to establish risk management processes and assess the adequacy of their capital to cover all risks they may potentially face in the course of their business, including solvency.

¹³ A solution could be that of introducing more diversified sustainable benchmarking consistent with the zero-emissions 2050 targets. This perspective will be treated in section 5 of this article.

Supervisors then conduct a review (SREP) and assess the risk profiles of individual credit institutions from four different perspectives: (i) business model, (ii) governance and risk management, (iii) capital and (iv) liquidity.

None of the Pillar II measures have yet led to the imposition of additional regulatory capital requirements on financial institutions to ensure their resilience to the CRFR. In 2020, supervisors considered that it was too early to impose Pillar II capital requirements due to difficulties in quantifying climate financial risk.

By design, the models and approaches used to assess Pillar II risks and capital adequacy are largely at the discretion of each institution and measurement difficulties are likely to result in heterogeneous results rather than provide a consistent approach to managing climate risk across the financial system.

A more relevant role can be played by stress test exercises aimed at identifying and managing climate risk in the financial system. The results of such exercises offer valuable insights into the climate risks of financial institutions and the potential channels and effects in which they materialise. These insights help shape the actions of supervisory authorities and raise the awareness of financial institutions to improve their risk management practices and adapt business models. However, so-called ‘stress tests’ have significant limitations: (a) most ‘stress test’ exercises have focused on transition risks and have not addressed the physical risks induced by climate change; (b) ‘stress tests’ ignore the dimension of disruption risk, which stems from the unpredictable and non-linear nature of climate-related events and the interconnections between natural systems that can amplify climate impacts, which together make it impossible to model climate risks with any degree of accuracy; (c) the existing scenarios do not take into account the feedback loop, i.e. the impact the financial sector itself has on climate transition and developments.

The ECB has made progress in overcoming some of these challenges in its EU-wide stress test exercise, but also emphasised that significant work still needs to be undertaken on a comprehensive climate stress test framework (Houben et al., 2021).

Albeit the critical issues and the heterogeneous solutions debated, prudential supervision reforms for financial, credit and insurance intermediaries are expected to give a strong impetus to solving the age-old link between finance and oil. Having identified the financial circuit as the driving mechanism, the banking regulators (European Banking Authority and European Central Bank) proposed a number of key performance indicators, in particular the Green Asset Ratio, to guide the process and condition financial intermediaries towards achieving a higher level of sustainability and to finance activities consistent with the Paris Agreement. The European Banking Authority developed this advice in parallel and consistent with its consultation paper on Pillar 3 disclosure on ESG risks, which includes a common Green Asset Ratio (GAR) proposal (European Banking Authority, 2021a).

The GAR identifies the assets of institutions that finance

environmentally sustainable activities according to the EU taxonomy, such as those consistent with the European Green Deal and the objectives of the Paris Agreement. To incentivise sustainable lending and investment, the authorities have anticipated a revision of prudential supervision to calibrate banks' capital ratios based on the weight of GAR. In other words, a bank with greener financial assets (loans and securities) will benefit from an advantageous capital requirement (European Banking Authority, 2022). The European Banking Authority will require around 150 banks to publish the so-called green asset ratio, or GAR, as of 2024, although some data is already available, at least for major European banking groups (Table 1 below).

But the planned mechanism has raised many criticisms. First, substantial amounts of banking assets will not be included in the scope of the upcoming green asset ratio, revealing the metric's shortcomings in accurately comparing the environmental efforts of European credit institutions. For example, assets held for trading and exposures to governments and central banks are completely excluded from the GAR calculation, while loans to small and medium-sized enterprises or non-EU corporate counterparties may never be considered green (UniCredit, 2021). Currently, assets eligible for the taxonomy are largely limited to residential real estate financing by banks and EU companies subject to reporting requirements under the Non-Financial Reporting Directive, a European reporting regulation that applies to certain large companies. Thus, financing of activities that are oriented towards the conversion of energy sources in industry may paradoxically be excluded if they do not fall under the EU taxonomy. Such activities will be excluded from the numerator but not from the denominator of the GAR. In essence, this means that such assets will be considered 0% sustainable in the calculation of the GAR. This puts banks with large exposures to these segments at a structural disadvantage when trying to increase their GAR. Even if every single asset in a bank's banking portfolio were environmentally sustainable, its green asset ratio could never exceed the GAR. A criticism of the GAR indicates that the suitability ratio currently represents more the nature of a bank's business lines rather than its greenness, and its suitability ratio is mainly made up of its mortgage loan portfolio (Wass, 2022).

In a vision to correct this indicator, the EBA calls for banks to provide information on everything from exposure to carbon-intensive companies to the physical risk of climate change. It also proposes a Banking Book Taxonomy Alignment Ratio, or BTAR, which attempts to fill one of the GAR's gaps by extending the numerator to counterparties not covered by the Non-Financial Reporting Directive (European Banking Authority, 2022a). This complementary parameter is intended to help provide a more complete picture of banks' alignment to the taxonomy and to incentivise lenders to provide green finance to SMEs, although institutions still face significant data availability issues and may have to rely on estimates and proxies to calculate the BTAR.

Table 1
Green asset ratio (GAR) coverage and taxonomy eligibility ratio for the largest EU banks.

	Assets in scope of the GAR (% of total assets)	Taxonomy-eligible assets (% in scope of GAR)
BPN Paribas	51.4	25.8
Crédit Agricole	67	46
Banco Santander	90	43
Groupe BPCE	68	54
Société Générale	63	18.4

Data compiled June 6, 2022.

BNP Paribas SA estimated that only about half of its assets will be covered by the report, mainly due to its large trading portfolio and exposures to central banks and governments. For Banco Santander SA, a retail-focused credit institution, 90% of its total assets will be included. Source: Company filings.

5.2. The Sustainable Finance Disclosure Regulation

The EU SFDR¹⁴ aims to help investors distinguish and compare the many sustainable investment strategies available in the European Union. It helps investors by demanding greater transparency on the extent to which financial products consider environmental and/or social issues, are sustainable or have sustainable objectives. This information is now more standardised.

Under the EU SFDR, asset managers and investment advisors will be required to provide company-specific information on how they are responding to two key issues: sustainability risks and material adverse impacts. As far as asset managers are concerned, the EU SFDR also requires transparency on remuneration policies related to integrating sustainability risks. In addition, the EU-SFDR aims to help investors in their choice of products by imposing an increased level of disclosure where sustainability is an issue.

Three different product classifications are foreseen by the EU SFDR.

- Article 6 products integrate environmental, social and governance (ESG) considerations into investment decisions or explain why sustainability risk is not relevant, but do not meet the additional criteria of Article 8 or 9 strategies.
- Article 8 products can promote social and/or environmental characteristics, although they are rarely the primary focus.
- Article 9 products have a sustainable investment target.

The aim of the EU SFDR Regulation is to redirect capital towards sustainable growth and to help customers to make better sustainable investment decisions. Its main objectives are to increase transparency on environmental, social and sustainability issues in financial markets and to establish common standards for the disclosure and dissemination of such information. Two other important considerations are supported by increased transparency and the introduction of standards. First, they make it more difficult for asset managers to engage in 'greenwashing' of their products. In other words, they prevent the application of an ESG or sustainability label to a product if there is no transparency in the process itself to do so. Second, they make it much easier for investors to compare investment options according to the relevance of ESG factors in investment decisions. This helps investors make informed decisions that are consistent with their investment objectives.

The regulation is an important step towards encouraging more sustainable stock selection. However, there is still a long way to go. A number of surveys show that greenwashing is still a widespread practice among investment funds (Busch, 2023). In a pessimistic scenario, the weaker or absent sustainability agenda of other geopolitical powers will give them a competitive advantage at the expense of the EU. In a more positive scenario, the EU will become the global standard in terms of sustainability. Even though there are many signs that the federal line is weakening at the level of the states and individual large investors, the US could follow suit. On 9 December 2022, the UK government announced major financial services regulatory reform "to promote growth and competitiveness in the financial services sector" (the Edinburgh Reform). In doing this, the UK Government is ensuring that the financial system plays a major role in helping the UK to achieve the Net Zero target¹⁵ and is acting to ensure that the UK is the *best place in the world* to invest in a responsible (management) and sustainable (law or net carbon footprint) way.

¹⁴ Regulation (EU) 2019/2088 of the European Parliament and of the Council of 27 November 2019 on sustainability-related disclosures in the financial services sector. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1033990/net-zero-strategy-beis.pdf. Accessed on May 2, 2023.

5.3. Corporate Sustainability Reporting Directive

The [European Banking Authority, 2021b](#) also intends to introduce a measure to capture ESG risks in banks' trading books at a later stage. The regulator has excluded the trading book from the scope of the Pillar 3 standard for the time being because it is a more volatile asset, with assets often remaining on banks' balance sheets for short periods. This makes the measurement of a green asset ratio more complex and increases the risk of banks 'showcasing' their holdings on the day the ratio is calculated. Starting in 2023, the Corporate Sustainability Reporting Directive will also change the current Non-Financial Reporting Directive requirements, extending coverage to all large companies and all companies listed on regulated markets, although unlisted SMEs will still be excluded.

The range of assets eligible for the taxonomy will also increase as the EU plans to release performance criteria covering more sectors and four more environmental objectives, including pollution prevention and biodiversity protection. Moreover, according to the European Central Bank, bank business strategy is crucial. Based on the report published in 2020 (2020a), less than one third of the assessed banks disclose the potential impact of transition risk on their business model in the short and long term. This percentage is even lower when physical risk is taken into account. Only a limited number of institutions disclose a clear mapping of climate-related risks on existing risk categories, impacts on strategy and mitigation actions to be implemented. For this reason, the [European Central Bank \(2020\)](#) published recommendations to refine banks' governance, lending policy and risk management behaviour that are consistent with environmental sustainability objectives. Although the green asset ratio has limitations, together with the new rules on environmental and climate risks, we can expect an improvement in lending and financial policies and ESG disclosure for European banks, as it provides a binding, quantitative and consistent ESG measure that has been missing until now.

The regulatory framework thus described introduces a system of constraints and incentives to complement one of the main pillars of regulation of the banking and insurance markets, namely market discipline.

Market discipline means that banks, financial institutions, sovereign entities and other major players in the financial sector are obliged to conduct their activities taking into account the risks they face. Market discipline is based on market transparency and on disclosing the risks associated with an asset or a counterparty. In the presence of efficient markets, agents who deviate from a sustainable allocation should be penalised in terms of the cost of funding and the cost of equity.

In fact, market discipline did not prevent the accumulation of bank risk that led to the financial crisis and the bank failing in 2023 ([Aldrich, 2023](#)). This failure is thought to be due to structural impediments to effective market discipline - such as misaligned incentives, lack of transparency or moral hazard caused by implicit guarantees.

Therefore, it is believed that the acceleration of the sustainability and energy transition process can be achieved with more robust rules, even with some elements of market pressure.

In this context, it is noteworthy that the European Central Bank recently took a clear stance that banks "will have to comply with all remaining supervisory expectations on climate and environmental risks outlined in 2020 by the end of 2024, including full integration into the Internal Capital Adequacy Assessment Process (ICAAP) and stress testing (ECB, 2022)".

5.4. More regulation?

We have shown here how the EU is trying to move in this direction, issuing sustainability disclosures for the financial world, and on transition-related indices with the Corporate Sustainability Reporting Directive ([European Banking Authority, 2021b](#)). However, there is still

room for improvement, foremost in the direction of.

1	Benchmarking	Science-based benchmarking of performance: how to objectively assess climate-related standards and targets (including the development of a standardised framework for the assessment of carbon offsetting schemes)
2	Indicators	A more diverse set of sustainable metrics/indicators that are consistent with the goal of zero emissions as set out in the Paris Agreement and in line with the International Energy Agency (IEA, 2021) roadmap.
3	Accountability	What are the consequences for breaching the standards or missing target.
4	Auditing	How to ensure the information provided is reliable and true.
5	Control/enforcement	Who is the deputed authority and how can it apply sanctions or incentives.
6	Assessment	Enhanced methodologies to assess (systemic) climate-risks and undertake a comprehensive climate stress test framework.

Essentially, what is still missing after all, as some authors before us have pointed out as much as many practitioners had voiced for, is *more information*, both from financial actors, in the form of disclosure, and from societal actors (prominently scientists), in the form of knowledge ([Scholtens, 2017](#); [Galaz et al., 2018](#); [Bebbington et al., 2020](#)). The need for more accessible and shared constructive information was echoed by financial attendees of the last COP27, who requested scientific base metrics to align portfolios with mitigation goals and standardise intensity targets and carbon compensation schemes. It became apparent that stakeholders were seeking for a more nuanced and critical approach to evaluate corporate environmental policies and financial assets, rather than a binary scheme green-no-green, such as, for example, the green asset ratio. This latter pledge, we believe, begs for extra attention from both the academic world and the policy maker, who hinges still more on the idea that regulation means more stick, rather than more carrot. Perhaps, in a future context where tech-finance will create many of ways to by-pass restrictions and to channel funds to the carbon-intensive industries, it will become more important to actively involve financial actors in an informed (and checked) manner and with persuasive means (such as that, for example, of climate-risks edging), rather than merely with stiffer impositions.

6. Conclusions

Although we are hereby invoking more regulation, we are not undervaluing the contributions of a voluntary nature. A glimpse of how in the future the financial sector could positively stir the policy maker in a good direction has been recently provided by a prompt reaction to the decision of the European Commission to change the taxonomy of "green energy" to include nuclear and gas. In an open letter, the Institutional Investors Group on Climate Change (IIGCC), a powerful coalition of pension funds and asset managers, including the Big Three and Goldman Sachs, has warned that "labelling fossil gas as a sustainable investment risks channelling capital towards activities that are incompatible with Europe's climate ambition" ([Kira T., 2022](#)). It is now interesting to see whether the EU will be willing to pursue its decision against the auspices of investors representing 50 trillion US dollar or abide with the wishes of its constitutive governments.

Nevertheless, as other authors pointed out, the role of capital markets in "saving the planet and (changing capitalism)" ([Grote and Zook, 2022](#)) should not be overstated and, most importantly, could be guided and checked by a well-designed regulatory framework (national and international), aimed at increasing the transparency and accountability of financial actors ([Hourcade et al., 2021](#); [Pauw et al., 2022](#); [Lieberknecht Markus, 2022](#)). Moreover, the application of the precautionary principle to financial policy in a context of radical uncertainty and climate risks suggest the need for a stronger public agency ([Chenet H. et al., 2021](#)).

How the current (and hopefully short lived) war in Ukraine will shape the decoupling path between carbon intensive industries and financial sector, is a further source of major uncertainty and concern, but desirably, and arguably, will only strengthen this foreseeable divorce. Nevertheless, contradictory signals are looming which are yet hard to square and interpret but are not promising. On the one hand, concerns over energy security and high cost of energy are further advocating for a transition away from fossil fuels, on the other hand, the same causes are inflating the value of oil and gas reserves around the world (formerly on the brink of becoming stranded assets) and prompting for a smoother transition, or, with the words of an asset manager of a prominent ESG fund: “highlighting the need for a more orderly transition, for social reasons as much as for environmental reasons” (Flood, C., 2022).

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

No data was used for the research described in the article.

References

- Aldrich, E., 2023. Failed Banks in the U.S. — an Analysis by Year, Size and More. Forbes Advisor.
- Ali, S., 2022. US Republicans Pull \$1bn from BlackRock over ESG Investing Considerations. Financial Times.
- Bebbington, Jan, Osterblom, Henrik, Crona, Beatrice, Jouffray, Jean-Baptiste, Larrinaga, Carlos, Russell, Shona, Scholtens, Bert, 2020. Accounting and accountability in the Anthropocene. *Account Audit. Account. J.* 33 (1), 152–177.
- Berg, F., Fabisiak, K., Sautner, Z., 2020. Rewriting history II: the (un) predictable past of ESG ratings. In: European Corporate Governance Institute–Finance Working Paper, 708, 10–2139.
- Bryan, K., 2022. COP27: Mark Carney Clings to His Dream of a Greener Finance Industry. Financial Times.
- Bryan, K., Dunkely, E., 2022. “HSBC to stop new oil and gas project funding after backlash.”. *Financ. Times*.
- Busch, D., 2023. EU sustainable finance disclosure regulation. *Cap. Mark. Law J.* <https://doi.org/10.1093/cmlj/kmad005>.
- Carbon Brief, 2021. COP26: key outcomes agreed at the UN climate talks in Glasgow. Carbon Brief. <https://www.carbonbrief.org/cop26-key-outcomes-agreed-at-the-un-climate-talks-in-glasgow/>. (Accessed 31 January 2022) (update based on country-level estimates. International Monetary Fund).
- Chenet, H., Ryan-Collins, J., van Lerven, F., 2021. Finance, climate-change and radical uncertainty: towards a precautionary approach to financial policy. *Ecol. Econ.* 183, 106957.
- Chiariucci, R., Loffredo, M.I., Ruzzenenti, F., 2017. Evidences for a structural change in the oil market before a financial crisis: the flat horizon effect. *Res. Int. Bus. Finance* 42, 912–921.
- Coady, M.D., Parry, I., Le, N.P., Shang, B., 2019. Global fossil fuel subsidies remain large: an. Tong, D., Zhang, Q., Zheng, Y. et al. Committed emissions from existing energy infrastructure jeopardize 1.5 °C climate target *Nature* 572 (2019), 373–377.
- Cojoianu, T.F., Ascui, F., Clark, G.L., Hoepner, A.G., Wójcik, D., 2021. Does the fossil fuel divestment movement impact new oil and gas fundraising? *J. Econ. Geogr.* 21 (1), 141–164.
- Comfort, N., Aron, S., 2021. Wall Street holds fast to fossil fuels as climate pressure grows. Bloomberg.
- Commodity Futures Trading Commission U.S., 2019. Impact of Automated Orders in Futures Markets–A Report by Staff of the Market Intelligence Branch Division of Market Oversight.
- Demarais, A., 2022. The end of the age of sanctions? *Foreign Aff.*
- Equator Principles, 2020. EP4. <https://equator-principles.com/wp-content/uploads/2021/02/The-Equator-Principles-July-2020.pdf>. (Accessed 4 January 2021).
- European Banking Authority, 2021a. Mapping Climate Risk: Main Findings from the EU-wide Pilot Exercise. *EBA/Rep/2021/11*, Paris, 21 May 2021.
- European Banking Authority, 2021b. Report on Management and Supervision of ESG Risks for Credit Institutions and Investment Firms. *EBA/REP/2021/18*, Paris, 2021.
- European Banking Authority, 2022a. Final Draft Implementing Technical Standards on Prudential Disclosures on ESG Risks in Accordance with Article 449a CRR. Paris, Final Report *EBA/ITS/2022/01*, 24 January 2022.
- European Banking Authority, 2022b. The Role of Environmental Risks in the Prudential Framework. Discussion Paper *EBA/DP/2022/02*, Paris. (Accessed 2 May 2022).
- European Central Bank, 2020. Guide on Climate-Related and Environmental Risks. Supervisory Expectations Relating to Risk Management and Disclosure. Frankfurt, November 2020.
- European Central Bank, 2022c. Press release: “ECB sets deadlines for banks to deal with climate risks”. <https://www.bankingsupervision.europa.eu/press/pr/date/2022/html/ssm.pr221102~2f7070c567.en.html>. (Accessed 29 December 2022).
- Flood, C., 2022. Energy Crisis Prompts ESG Rethink on Oil and Gas.”. *Financial Times*.
- Galaz, V., Crona, B., Dauriach, A., Scholtens, B., Steffen, W., 2018. Finance and the Earth system—Exploring the links between financial actors and non-linear changes in the climate system. *Global Environ. Change* 53, 296–302.
- Gerig, A., 2015. High-frequency Trading Synchronizes Prices in Financial Markets. *SSRN* 2173247.
- Grote, M.H., Zook, M., 2022. The Role of Capital Markets in Saving the Planet and Changing Capitalism—Just Kidding. *SSRN* 4023071.
- Haynes, R., Roberts, J.S., 2015. Automated Trading in Futures Markets. CFTC White Paper.
- Hodgson, C., Mooney, A., 2021. “Climate funds often fall short of Paris goals, says report.”. *Financ. Times*.
- Houben, S., Schellekens, G., Zander, K., 2021. The Clock Is Ticking for Banks to Manage Climate and Environmental Risks. European Central Bank. <https://www.bankingsupervision.europa.eu/press/publications/newsletter/2021/html/ssm.nl210818.5.en.html>. (Accessed 10 January 2023).
- Hourcade, Jean-Charles, Dasgupta, Dipak, Ghersi, Frédéric, 2021. Accelerating the speed and scale of climate finance in the post-pandemic context. *Clim. Pol.* 21 (10), 1383–1397.
- IEA, 2021. Net zero by 2050: a roadmap for the global energy sector. <https://www.iea.org/reports/net-zero-by-2050>. (Accessed 4 January 2021).
- InfluenceMap, 2021. Vanguard & BlackRock’s ‘net Zero’ Pledges. Report. Available at: [InfluenceMap Vanguard & BlackRock’s ‘net zero’ pledges](https://www.influencemap.com/vanguard-blackrock-net-zero-pledges/). (Accessed 15 January 2022).
- IPCC, 2022. Climate change 2022: mitigation of climate change. In: Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. <https://www.ipcc.ch/report/ar6/wg3/>. (Accessed 2 November 2022).
- King, A.A., Pucker, K.P., 2022. ESG and alpha: sales or substance? *Inst. Invest.* <https://www.institutionalinvestor.com/article/b1wxqznltnqyzj/ESG-and-Alpha-Sales-or-Substance>. (Accessed 21 July 2022).
- Kira, T., 2022. Investors Worth €50 Trillion Call on EU to Exclude Gas from Green Finance Taxonomy. EURACTIV. <https://www.euractiv.com/section/energy-environment/news/investors-worth-e50-trillion-call-on-eu-to-exclude-gas-from-green-finance-taxonomy/>. (Accessed 4 January 2021).
- Kirsch, A., et al., 2022. Banking on Climate Chaos: Fossil Fuel Finance Report 2022, Rainforest Action Alliance. United States of America. Retrieved from: https://policycommons.net/artifacts/3084488/bocc_2022_vspspread/3885301. on 20 Mar 2023. CID: 20.500.12592/5jpn5t.
- Köhler, S., Pizzol, M., 2019. Life cycle assessment of bitcoin mining. *Environ. Sci. Technol.* 53 (23), 13598–13606.
- Krabbe, O., Linthorst, G., Blok, K., Crijns-Graus, W., Van Vuuren, D.P., Höhne, N., et al., 2015. Aligning corporate greenhouse-gas emissions targets with climate goals. *Nat. Clim. Change* 5 (12), 1057–1060.
- Kress, J.C., 2022. Banking’s climate conundrum. *Am. Bus. Law J.* 59 (4), 679–724.
- Kuykendall, T., Whieldon, E., Dholakia, G., 2021. “BlackRock heading to net-zero but holds large fossil fuel investments for now. S&P Market Intelligence. <https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/blackrock-heading-to-net-zero-but-holds-large-fossil-fuel-investments-for-now-62628334-4-10-2022>.
- Laco, K., 2022. 19 States Investigate Major US Banks for Pushing ESG Policies ‘killing’ American Companies. *FoxBusiness*. <https://www.foxbusiness.com/politics/19-states-investigate-major-us-banks-pushing-esg-policies-killing-american-companies>. (Accessed 31 October 2022).
- Le Guenedal, T., Roncalli, T., 2022. Portfolio Construction with Climate Risk Measures. *SSRN* 3999971.
- Lemercier, J., 2021. “NFTs are hot. So is their effect on the earth’s climate.”. *Wired*. <https://www.wired.com/story/nfts-hot-effect-earth-climate/>. (Accessed 21 July 2022).
- Lenaerts, K., Tagliapietra, S., Wolff, G.B., 2021. How Much Investment Do We Need to Reach Net Zero? *Bruegel-Blogs*, NA-NA.
- Lieberknecht, Markus, 2022. “Institutional Investors as Climate Activists: Curb Your Enthusiasm.”. *SSRN* 4198042.
- MacKenzie, D., 2019. Market devices and structural dependency: the origins and development of ‘dark pools’. *Finance. Soc* 5 (1), 1–19.
- Masters, B., Temple-West, P., 2022. Vanguard Quits Climate Alliance in Blow to Net Zero Project. *Financial Times*.
- Mooney, A., Hodgson, C., Temple-West, P., 2023. Royal Bank of Canada Becomes Top Financier for Fossil Fuel Industry’. *Financial Times*.
- OECD, 2022. Press release: support for fossil fuels almost doubled in 2021, slowing progress toward international climate goals, according to new analysis from OECD and IEA. <https://www.oecd.org/environment/support-for-fossil-fuels-almost-doubled-in-2021-slowing-progress-toward-international-climate-goals-according-to-new-analysis-from-oecd-and-iea.htm>. (Accessed 13 January 2022).
- Pauw, W.P., Moslener, U., Zamarioli, L.H., Amerasinghe, N., Atela, J., Affana, J.P.B., Buchner, B., Klein, R.J.T., Mbeva, K.L., Puri, J., Roberts, J.T., 2022. Post-2025 climate finance target: how much more and how much better? *Clim. Pol.* 1–11.
- Peters, G.P., 2018. Beyond carbon budgets. *Nat. Geosci.* 11, 378–380.
- Rekker, S., Ives, M.C., Wade, B., Webb, L., Greig, C., 2022. Measuring corporate Paris Compliance using a strict science-based approach. *Nat. Commun.* 13 (1), 1–11.

- Scholtens, B., 2017. Why finance should care about ecology. *Trends Ecol. Evol.* 32 (7), 500–505.
- Schwab, Klaus, 2008. Global corporate citizenship: working with governments and civil society. *Foreign Aff.* 87 (1), 107–18. <http://www.jstor.org/stable/20020271>.
- Snytnikov, P., Potemkin, D., 2022. Flare gas monetization and greener hydrogen production via combination with crypto currency mining and carbon dioxide capture. *iScience*, 103769.
- SSE initiative, 2021. Action plan to make markets climate resilient: how stock exchanges can integrate the TCFD recommendations. <https://sseinitiative.org/publication/action-plan-to-make-markets-climate-resilient-how-stock-exchanges-can-integrate-the-tcf-d-recommendations/>. (Accessed 4 January 2021).
- Strampelli, G., 2020. Can BlackRock save the planet? The institutional investors' role in stakeholder capitalism. *Harv. Bus. L. Rev. Online* 11, 1.
- Sustainable Views, 2022. What Happened at GFANZ and Why it Matters.". *Financial Times*. <https://www.sustainableviews.com/what-happened-at-GFANZ-and-why-it-matters/>. (Accessed 24 December 2022).
- Tong, Dan, Zhang, Qiang, Zheng, Yixuan, Caldeira, Ken, Shearer, Christine, Hong, Chaopeng, Qin, Yue, Davis, Steven J., 2019. Committed emissions from existing energy infrastructure jeopardize 1.5 C climate target. *Nature* 572 (7769), 373–377.
- UN, 2021. Principles for responsible investment. <https://www.unpri.org/download?ac=10948>. (Accessed 4 January 2021).
- UNEP, 2022. Emissions gap report 2022. <https://www.unep.org/resources/emissions-gap-report-2022>. (Accessed 20 February 2023).
- UNEP Finance Initiative, 2012. PSI-principles for sustainable insurance. https://www.unepfi.org/fileadmin/documents/PSI_document-en.pdf. (Accessed 4 January 2021).
- UNEP Finance Initiative, 2019. PRA-principles for responsible banking. https://www.unepfi.org/wordpress/wp-content/uploads/2019/07/PrinciplesOverview_Infographic.pdf. (Accessed 4 January 2021).
- UniCredit, 2021. EBA advocates for "green asset ratio" for banks based on new EU taxonomy. https://www.research.unicredit.eu/DocsKey/credit_docs_9999_179431.ashx?EXT=pdf&KEY=n03ZZLYZf5miJJA2_uTR8ntEMbYs0mfoyrKefYFWq_s=&T=1. (Accessed 10 January 2023).
- van Steenis, H., 2022. Finance Pivots from Risks to the Opportunities of Energy Transition and Decarbonization at COP27. World Economic Forum. November 18, 2022. <https://www.weforum.org/agenda/2022/11/cop27-finance-energy-security-carbon-markets-transition>. (Accessed 24 December 2022).
- Walker, O., 2021. Does the maths on Mark Carney's \$130tn net zero pledge stack up? *Financ. Times* 4.
- Wass, S., 2022. Bank Disclosures Reveal Limitations of Green Asset Ratio as a Comparable Metric. S&P Global. <https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/bank-disclosures-reveal-limitations-of-green-asset-ratio-as-a-comparable-metric-70544636>. (Accessed 10 January 2023).
- WEF, 2010. A partner shaping history. https://www3.weforum.org/docs/WEF_First40Years_Book_2010.pdf. Accessed on 20-03-2023.
- Zamarioli, L.H., Pauw, P., König, M., Chenet, H., 2021. The climate consistency goal and the transformation of global finance. *Nat. Clim. Change* 11, 578–583. <https://doi.org/10.1038/s41558-021-01083-w>.