



I've got the power! Really?

Assessing the impact potential
of financial products supporting
the energy transition

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List of abbreviations

2DS: 2-Degree Scenario

B2DS: Below 2-Degree Scenario

CBI: Climate Bond Initiative

EC: European Commission

EE: Energy Efficiency

EIB: Environmental Impact Bond

EPC: Energy Performance Contracting

ESCO: Energy Service Company

EU GBS: European Union Green Bond Standard

GBP: Green Bond Principles

GLP: Green Loan Principles

IMP: Impact Management Project

PE: Private Equity

PV: Photovoltaics

RE: Renewable Energy

SIB: Social Impact Bond

SLB: Sustainability-Linked Bond

SLBP: Sustainability-Linked Bond Principles

SLL: Sustainability-Linked Loan

SLLP: Sustainability-Linked Loan Principles

SPT: Sustainability Performance Target

TPF: Third-Party Financing

UoP: Use of Proceeds

VC: Venture Capital

Executive summary

In September 2020, the EC proposed to substantially increase its greenhouse gas (GHG) emissions reduction target from 40% to at least 55% compared to 1990 levels by 2030 as part of its Climate Target Plan and its European Green Deal. A vast reorientation of our economies is needed to reach this crucial goal, including massive investments in renewable energy and energy efficiency.

However, the financing gaps associated with energy efficiency and renewable energy investments are currently immense (but not out-of-reach), at about 340 billion euros per year (EC, 2020).

In parallel, several innovative financial schemes have emerged from the financial sector with the objectives of bridging the financing gaps and serving a growing demand for greener products from investors.

As the pace of green financial innovations is frantic, there is a high need to assess the ability of the proposed financial solutions to support and finance the clean energy transition in Europe. Moreover, the current rise in extra-financial concerns by institutional and retail investors requires tools to help them understand their own environmental contribution.

Accordingly, this report analyses the “climate impact potential” of financial solutions relevant for the financing of the energy transition. For that purpose, we developed a “Climate Impact Potential Assessment Grid” grounded on previous studies on investor impact conducted by the Impact Management Project (IMP) and the University of Zurich (UZH).

The grid is made of four criteria: i) the signalling of a commitment to the green energy transition, ii) the service of new or undersupplied markets, iii) the provision of flexible capital and iv) the pressure on funded organisations to align their climate strategy with a below 2°C scenario.

We apply the grid to a selection of ten green financial products. In addition, we review relevant literature to provide a comprehensive understanding of the current status of research regarding the impact assessment of the different financial schemes.

Our work reveals that green financial products diverge according to their impact mechanisms and that some adjustments are urgently needed to make them reach their full impact potential. In particular, many new financial structures that have gained a large popularity (like green bonds or sustainability-linked bonds) target mature companies that already have a large access to financing. As such, they do not help to address some critical funding gaps observed for small companies or small projects.

Our work also emphasizes that, for all financial products studied, research about their impact in the real economy is largely absent due to a unidimensional focus on financial consequences for investors and investees.

Consequently, we ask for both a significant reorientation of sustainable finance research and for a massive reallocation of private capital.

About 2° Investing Initiative

The 2° Investing Initiative (2DII) is an independent, non-profit think tank working to align financial markets and regulations with the Paris Agreement goals.

Globally focused with offices in Paris, New York, Berlin, London, and Brussels, 2DII coordinates some of the world's largest research projects on sustainable finance. Its team of finance, climate, and risk experts develop research, tools, and policy insights to help financial institutions and regulators hasten and adapt to the energy transition.

In order to ensure its independence and the intellectual integrity of its work, 2DII has a multi-stakeholder governance and funding structure, with representatives from a diverse array of financial institutions, governments, and NGOs.

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Green financial products and the energy transition funding gaps

In September 2020, the EC proposed to substantially increase its greenhouse gas (GHG) emissions reduction target from 40% to at least 55% compared to 1990 levels by 2030 as part of its Climate Target Plan and its European Green Deal. This new ambition has mechanically led to an update in July 2021 of its objectives for 2030 regarding the share of renewable energy¹ resources (from 32% to 40%) and improvement in energy efficiency² (from 32.5% to 36-39% compared to 1990). In order to reach the environmental objectives set by the EC, massive investments in renewable energy (RE) and energy efficiency (EE) are required.

In Europe, prior to the objectives' upgrade, financing gaps related to renewable energy in a below two degrees scenario (B2DS), namely the difference between historical (or committed) investments and estimated needs, had been estimated at €30 billion per year for the 2020-2030 decade by the European Commission in a recent working paper (EC, 2020) and in a range between \$54 and \$75 billion per year until 2050 by researchers (Polzin et al, 2019). This gap implies that current trends should be more than doubled, with a particular emphasis on less mature technologies that require mostly upstream finance (Polzin et al, 2019).

For energy efficiency, the EC estimated the EE funding gap over the next decade to be at €310bn per annum, even before the adoption of the more ambitious 50-55% reduction in GHG emissions. The largest gaps are, by far, in the building and transport sectors.

¹ The European Commission considers as renewable energy “(...) energy that is produced using the earth’s natural resources, like sunlight, wind, water resources (rivers, tides and waves), heat from the earth’s surface, or biomass. The process, by which these renewable resources are converted into energy, emits no net greenhouse gases” (EC, 2020b). We will stick to that definition in the present report.

² The EC defines energy efficiency as “the ratio of output of performance, service, goods or energy to input of energy” and energy efficiency improvement “an increase in energy efficiency as a result of technological, behavioural and/or economic changes” (EC, 2012)

Table 1: Sector breakdown of the EE funding gap in the EU (2020-2030)

Sector	EE funding gap per year
Buildings (residential)	€ 115 bn
Buildings (non-residential)	€ 70 bn
Transport	€ 120 bn
Industry	€ 5 bn

Source: Commission services 2020; Estimate for additional investments based on EUCO32-32.5 scenario. Estimates of additional investment per year over the period 2021-2030 are relative to 2016 Reference, estimates per sector rounded to the nearest €5 bn. Estimates are not updated to include raising the ambition of GHG emission reductions to 50-55%.

When we add investment needs for RE and EE, **the total funding gap amounts to more than 27% of total annual savings by EU households, even before considering the upgraded targets.** Such a funding gap will be filled only if a radical reorientation of private savings is implemented. **Over the next ten years, it is up to €3.4 trillion of savings that needs to be reallocated,** creating a “moving the trillions” challenge (Sirkis et al., 2015).

The financial burden has not to be borne only by households. Most likely, the financing of the green transition will operate through a joint mobilization of public and private funds supported by adequate monetization by the Central Bank and the banking system. The ECB will be required to play a key role, proportional to its firepower. In 2020 only, the ECB increased its balance sheet by € 2.3 trillion to confront the Covid crisis. **The ECB response to the Covid crisis was thus equivalent to 7 years of required additional financing of the green energy transition.**

Table 2: The EE and RE funding gaps put in perspective

	Renewable energy	Energy efficiency	TOTAL
Financing gap per year, 2021-2030, (€ billion)	€30 bn	€310 bn	€340 bn
Financing gap per year, per capita (EU-27 population), (€)	€67	€692	€759
Financing gap per year, as a share of GDP in 2019 (EU-27, %)	0.2%	2.2%	2.4%
Financing gap per year, as a share of annual gross household savings in 2019	2.4%	25%	27.4%

Source: Commission services 2020; Estimate for additional investments needs in the power, construction, industrial and transport (vehicles and rolling stock, excluding infrastructure) sector based on EUCO32-32.5 scenario, <https://ec.europa.eu/energy/en/data-analysis/energy-modelling/euco-scenarios>. Estimates of additional investment per year over the period 2021-2030 are relative to 2016 Reference, estimates per sector rounded to the nearest € 5 bn. Estimates not yet updated to include raising the ambition of GHG emission reductions to 50-55%.

The financing needs are certainly immense and call for the full involvement of the financial sector, mainly private actors as public finance alone will not be sufficient because of limited financial resources and the reluctance to increase even more debt-to-GDP ratios, especially after the massive intake in public debt in relation with the COVID crisis.

As observed by researchers, the required funds (from private sources) for a successful energy transition are already available in Europe (Polzin and Saunders, 2020). But it will be highly challenging to channel them to the right investments.

Indeed, the issue is not only quantitative. Aside from an aggregated funding gap, Europe faces a qualitative mismatch. Most renewable energy investments are allocated towards mature technologies (mostly solar and wind), while other solutions (e.g. geothermal, small hydro, waste-to-energy solutions, marine, biofuels) are witnessing a much slower development (see Appendix 1). Yet, for a complete energy transition, a broad set of solutions needs to be deployed in order to avoid technology lock-in and propose a diversified energy mix. The development of non-established technologies should thus be considered.

Researchers have also documented a lack of private, small-scale equity investment to promote research, development and demonstration (RD&D) for novel technologies, such as energy storage. They also report a lack of low risk but small ticket financing for investments in energy efficiency and decentralized renewable energy projects (Polzin and Sanders, 2020).

Such a diagnosis calls for the creation and deployment of financial solutions that fit with the specificities of the funding of RE and EE investments of different types. The last fifteen years have seen a wave of newly created so-called green financial products in parallel with the emergence of investors (whether institutional or retail) that want to have a real impact on climate change through their investments (2DII, 2020).

In order to create a positive impact in the real economy and claim their contribution, financial products targeting the development of RE or EE measures should provide evidence of their ability to generate a real world positive and long-lasting change. Previous studies revealed that many investing and lending activities have a low likelihood of effectively supporting climate action, while claiming their environmental contributions (Kölbel et al., 2020; 2DII, 2021).

Accordingly, the present document aims at addressing this concern, providing a **Climate Impact Potential Assessment Grid** for financial products designed to support the energy transition. Emphasis is put on the capability of financial solutions to boost energy efficiency and renewable energy investments. While detailed empirical studies should (ideally) be conducted to provide a definite assessment of the real impact of financial products, our study of the different structures can be used as a starting point for future research regarding the impact evaluation of financial schemes.

In the process of applying the Climate Impact Potential Assessment Grid to financial solutions supporting the energy transition, we reviewed scientific literature from academics and other organisations in order to understand what has been done so far to assess the impact of green financial products, and get a clearer view of what is still to be done.

Are existing green financial products really suitable to finance the energy transition and make investors improve their impact on the world?

A method to assess the climate impact potential of financial products

Approaching the financing gaps previously exposed is critical. Hence, we need an overall increase in financial flows directed towards energy efficiency and renewable energy projects across the European continent in order to reach the environmental objectives set by the EC *and* a qualitative reorientation to early-stage technologies and small-scale projects.

With the objective of encouraging capital providers to invest in these sectors and facilitating a reallocation of capital, several financial products and schemes have emerged. These different financing mechanisms have opened up broader sustainable investment opportunities and diversification benefits for capital providers. In addition, they aim at addressing specific investment hurdles associated with the financing of “green” projects and companies.

Accordingly, it is important to assess the ability of green financial products and mechanisms to increase the share of “green” activities in the real economy beyond shallow and misleading marketing claims.

Indeed, prior work by 2DII has shown that green bonds, for instance, do not necessarily change the overall climate strategy of issuers in the power sector (2DII, 2018), and that marketing claims of sustainable mutual funds regarding their real impact are often not backed by convincing evidence and appear to be misleading for investors (2DII, 2021).

In this section, we propose a grid to analyse the impact potential of financial structures to reduce carbon emissions in the real economy and apply the grid to a list of green financial products.

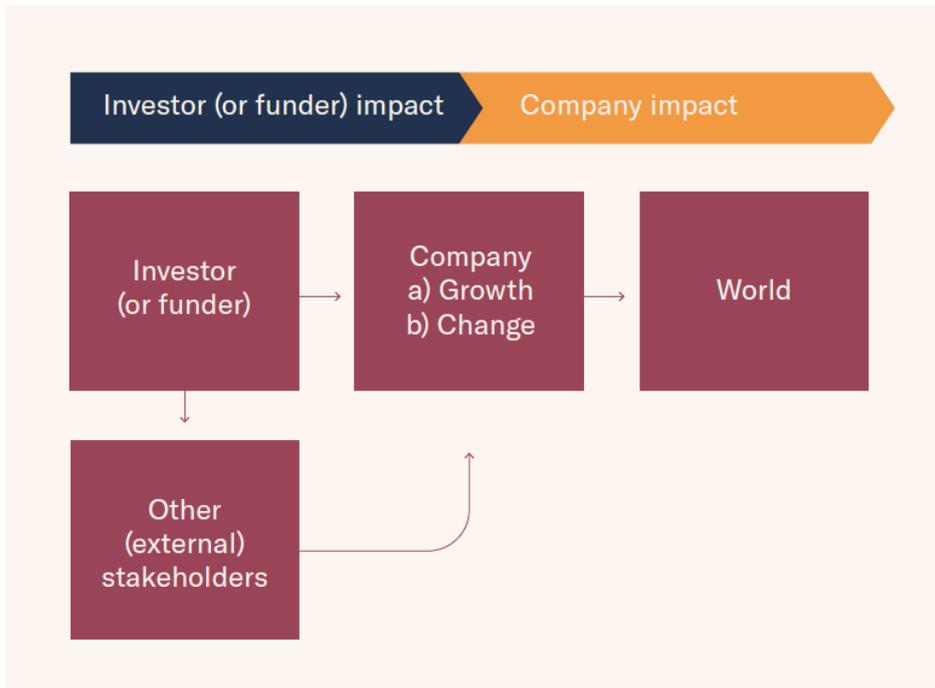
1.1 Distinguishing investor impact from company impact

This work focuses on the ability of financial structures to improve the investor’s own impact on the real economy through their investments in green financial products, beyond the impact of the underlying enterprises and assets.

Investor or funder impact corresponds to the change(s) induced through investing and lending activities in the impact of invested companies as shown in figure 1. Here we take the funder’s point of view, so that the chain of impact is made of two steps: funder impact and company impact.

Of course, aside from funders, other stakeholders (like NGOs, the media, public administrations, consumers...) also have an impact through their actions towards companies. And the impact of funders may be mediated by other stakeholders, for instance when a financial institution lobbies to influence the regulation to which companies must comply

Figure 1: the chain of impact



Source: adapted from Kölbel et al. (2020)

Capital providers have several opportunities to generate a positive impact in the real economy through their investing and lending activities. They can enable “green” companies to grow faster, encourage “brown” enterprises to improve their sustainability performances, and/or influence other investors in their investment decision-making processes (Kölbel et al., 2020).

The IMP developed a taxonomy of the different investors’ strategies to effectively generate an impact and the level of empirical evidence supporting those strategies. The taxonomy includes four main investor impact mechanisms, namely (i) signalling that impact matters, (ii) grow new or undersupplied markets, (iii) provide flexible capital and (iv) engage actively with investees and other relevant stakeholders (IMP, 2019).

All those mechanisms should not be considered as equal. A comprehensive review by Heeb and Kölbel (2020) shows that among the four impact mechanisms, signalling is the one whose capability to create positive change in the real economy is the least supported by empirical evidence. The support for signalling comes from mere narratives or theoretical models, while, in contrast, other mechanisms are backed by real-life observations.

1.2 Introducing a new concept: product impact

In this report, the analysis takes place at product level to assess the ability of several environmental products to actually increase EE and RE activities in the real economy. Consequently, we apply the impact concept for financial products.

In the most general terms, impact is the causal and additional outcome to the world in comparison with a counterfactual baseline scenario. When applied to companies, impact becomes company impact and is the additional outcome to the world caused by the company compared to a counterfactual (and hypothetical) scenario where the company would not exist. Similarly, investor impact is the additional outcome to the world caused by the investor compared to a counterfactual scenario where the investor (or funder in the case of financial institutions providing loans) would not exist.

In a straightforward manner, product impact is the additional outcome to the world caused by the creation and the current use of the financial product compared to a counterfactual scenario where the product would not exist or not be used for funding (for any reason). In such a counterfactual scenario, companies raise capital through other means.

Product impact is, by definition, situation-specific since it depends on the actual use of the product by investors and investees. As such, it has important features:

1. Product impact depends on the deployment of the product and the specific terms associated with the product beyond its general structure (proposed yield, conditions for full repayment, external certification...);
2. Product impact constantly changes (due to a variable deployment);
3. Product impact can be well below the full product impact potential (that is only achieved when the product is widely deployed and the structure used at its best).

It is noteworthy that a product can have an impact while the investor does not increase their own impact by using the product. It occurs when the investment would have been made by another investor and the substitution does not cause any improvement to the world. It only leads to a portfolio reallocation between (two or more) investors, like a zero-sum game.

It especially happens when high impact products are overpurchased. An impact-focused investor would increase his/her own impact by letting regular investors purchase those oversubscribed high-impact products because s/he would reallocate the money to other investments with higher impact compared to those funded by standard investors.

1.3 Evaluating product climate impact potential: a dedicated assessment grid

In this report, we analyse the impact potential of different EE and SE products based on the common features observed in the market.

We base our analysis on an adaptation of the taxonomy of investor impact developed by the Impact Management Project (IMP, 2019) and put to empirical tests by researchers of the University of Zurich (Heeb and Kölbel, 2020). We have adjusted the taxonomy to financial products used for financing renewable energy and energy efficiency solutions.

As introduced before, the taxonomy considered four main impact mechanisms:

- Signalling that impact matters: investors can send market and non-market signals that they are committed to impact. Market signals through investments and divestments based on sustainable screening contribute to change the conditions to access capital in financial markets for companies. Investors can also send signals that do not directly affect financial markets but may influence stakeholders through stigmatization (publicly stating opposition to certain companies or industries), endorsement or benchmarking (passively applying benchmark portfolios of companies with the highest sustainability performance);
- Grow new or undersupplied capital markets: investors can make a difference by enabling the growth of impactful companies whose growth is constrained by limited access to external financing;
- Provide flexible capital: investors can also help impactful companies by offering beneficial financing, for instance by accepting below-market returns, taking subordinated debt or equity or agreeing on custom-made exit terms;
- Engage actively: investors may use their privileged position to influence the companies they are invested in through different means (voting at shareholder meetings, dialoguing with management, asking for board seats, etc.).

We directly derive four criteria for product impact assessment (relative to the green transition) from the taxonomy:

1. The signalling (by the investor or the investee) of a specific commitment to the green energy transition (and not a general commitment to sustainability);
2. The service of new or undersupplied markets (i.e. projects or companies that face a difficult access to funding);
3. The provision of flexible capital (i.e. at a below-market rate or with custom-made features);
4. The engagement (or incentive, pressure, constraint...) with the investee to make it adapt its climate strategy to align to a B2DS.

Within the third criterion, we consider one feature to be particularly relevant for financial products aimed at financing the energy transition: the transfer of project risks to the investor. More specifically, project risk transfer occurs when capital providers are directly engaged with underlying “green” projects and therefore bear financial risks linked with the latter, as opposed to a general risk sharing across funders into a company’s or entity’s balance sheet through conventional financial solutions (equity, bonds, loans). Indeed, energy efficiency and renewable energy investments usually imply significant risks (Polzin, 2017) in multiple forms (especially technology and political) that may be difficult for companies, public agencies or private individuals to bear by themselves. In particular, companies whose core business is not related

to renewable energy and energy efficiency might not wish to increase the risk level of their balance sheet through investments in uncertain green projects. Transferring the specific project risk to counterparts that have the required skills and resources to deal with those hurdles may consequently help remove a significant barrier to investment for project holders.

Consequently, the Climate Impact Potential Assessment Grid is made of four criteria, as summarized in the figure 2.

Figure 2: the Climate Impact Potential Assessment Grid for green financial products



The climate impact potential of financial solutions supporting the energy transition

2.1 Ten green financial products under scrutiny

For the purpose of this report, we identified ten different financial solutions that relate to the financing of the energy transition. They do not represent an exhaustive list of all solutions available for investors as project finance, securitization or blended finance provide many options that could also be relevant. We decided to restrain the report to a shortlist of ten solutions based on their clarity, their novelty and/or their popularity. By their names, they all relate to sustainability or the energy transition.

Those ten solutions can be discriminated whether the capital invested is earmarked to green projects (project financing) or serves to finance the investee's balance sheet with no restriction (corporate financing).

Table 3: the 10 structures assessed in the report

Project financing solutions	Corporate financing solutions
Use-of-proceed green bonds	Sustainability-linked loans
Green loans	Sustainability-linked bonds
Asset-backed green bonds	Low-carbon mutual funds
Environmental Impact Bonds	Green thematic mutual funds
Energy Performance Contracting	Green crowdfunding

For each financial solution, we provide an analysis of their (climate) impact potential based on their activation of the different impact mechanisms proposed and, when possible, on the existing research on the specific effectiveness of those mechanisms when applied to the products.

For simplicity, the results for each product are summarized in a table at the end of the product section and translated into a colour code with favourable conclusions in green, unfavourable in red and mixed in orange.

2.2 Assessing product impact: project financing solutions

For the scope of this report, we consider as project financing financial instruments whose proceeds are earmarked to specific projects. This does not mean that the project is necessary outside the balance sheet of the project originator, as is the case in project finance. Indeed, some financial structures aim at funding specific projects, while investing in the entire balance sheet of the company (e.g. use of proceed green bonds).

2.2.1 Use of proceeds green bonds

Green bonds are fixed-income instruments that raise money specifically earmarked for new or already existing (i.e. finance and refinance) climate and environmental projects. They can be issued by private firms, banks or public entities to support environmental and climate-related activities.

Green bonds are so far the most popular structure within green finance. With a cumulative issuance of more than USD 1 trillion worldwide (Climate Bonds Initiative, 2021) since the first issues (in 2007 for supranational organisations and 2013 for corporates), green bonds have been called “the stars of sustainable finance” by the media (The Economist, 2020). In 2020 only, green bonds raised USD 270 bn worldwide, among which USD 156 bn were due to European issuers (CBI, 2021).

There is no strict regulation of green bonds even if voluntary guidelines have been proposed by business organisations (the Green Bond Principles, or GBP, first established by the International Capital Market Association in 2014) or by the European Union (the EU Green Bond Standard adopted in July 2021) and a certification from the Climate Bonds Initiative is also possible. Consequently, self-labelled green bonds that do not comply to any guideline coexist with compliant or certified green bonds.

What can be said about the climate impact potential of green bonds?

Signal of a green commitment

Green bonds can be used to finance multiple types of projects with positive environmental effects. Renewable energy and energy efficiency represent only two of the ten project categories identified by the GBP. So, on paper, issuers and investors in UoP green bonds send a signal to their stakeholders that they care about the planet, not that they are specifically committed to the green energy transition.

Worldwide, 56% of green bonds that disclose information on the use of proceeds are issued to finance projects with the single objective to mitigate climate change (Fatica and Panzica 2020). These are mostly projects relating to renewable energy and energy-efficient technologies. Including green bonds with several objectives, a total of 74% of all bond contracts are issued for projects with the purpose of climate change mitigation, partly or fully.

It is not clear whether green bond issuances positively affect investment plans of issuers (see general discussion). A major issue concerns additionality in green investment, especially for bonds used for refinancing purposes, which represent 16% of the green bond contracts in place (Fatica and Spanzica, 2020). When they are issued to refinance existing green projects that were previously financed with conventional bonds, green bonds do not generate additional capital for climate action. As such, they would not necessarily be associated with increased volumes of climate-friendly activities (Bongaerts and Schoenmaker, 2020).

Refinancing is certainly crucial for the realization of green projects as there is commonly a mismatch between the maturity of green energy projects and the maturity of their financing sources (which are shorter). But nothing proves that the refinancing would not have taken place without the use of green bonds.

We consequently consider that the signalling that the green transition is important to the issuer is unclear, especially for bonds refinancing old projects. It is more obvious when the bond is certified as a Climate Bond by CBI.

Regarding market signals, several recent empirical studies have observed a “greenium” (green premium) in the bond market, with a discount up to 20 basis points for green bond yields compared to conventional bonds from the same issuer, a premium that applies both in the primary and secondary markets and that is larger for certified green bonds compared to self-labelled green bonds (Gianfrate and Peri, 2019; Zerbib 2019; Fatica, Panzica and Rancan, 2019). Buying green bonds or shares of green bond funds contributes to that greenium in secondary markets.³

Service of undersupplied markets

Green bonds have de facto been so far reserved to large issuers. The international bond markets generally prefer a large minimum issue size, from EUR 300 to 500 million (TEG 2019). While there is no formal minimum issue size mandated by the Green Bond Principles, institutional investors will often look for a size that is big enough to guarantee liquidity and index inclusion. This usually translates to numbers that are simply too big for many companies to dedicate to the types of qualifying projects.

For issuers, certifying that their green bonds adhere to a given set of guidelines, keeping proceeds in separate accounts, establishing the required internal processes for selecting eligible projects, and regular reporting on the use and impact of proceeds makes issuing a green bond more expensive than conventional bonds (Sartzetakis, 2020) and require human resources that may be missing.

Additional costs have been estimated around USD 30,000 (Kaminker et al., 2018) or between 0.3 and 0.6 basis points for a USD 500 million issuance (Hachenberg and Schiereck, 2018). Even if that looks small, it may be particularly challenging for smaller issuers (Forsbacka and Vulturius, 2019).

³ The existence of a *greenium* has not reached a consensus in the academic arena yet. Larcker and Watts (2019) who use a very tight matching methodology, in which they match each green bond to a quasi-identical brown bond of the same issuer, obtained that the green bond premium is essentially zero.

Provision of flexible capital

In the case of use-of-proceeds green bonds, the specific barriers linked to the development and implementation of green energy projects are not transferred to external capital providers, as the payback of capital and interests is backed by the entire balance sheet of the issuers and not by the revenues and assets of the project to which the proceeds are earmarked. There is no additional risk transfer compared with conventional debt financing.

Another impact pathway for green bonds could take place through the cost of capital. As mentioned earlier, evidence points in the direction of a decreased cost of debt at issuance for issuers of green bonds. So buying a green bond at issuance, directly or through a fund, currently implies the provision of capital at concessional terms.

But, as noted before, the yield gap appears to be limited. Even considering the largest estimates, the *greenium* would still appear too small to affect the volume of green investments or the arbitrage between green and brown projects by companies. As a matter of comparison, AAA corporate (standard) bond yields have fluctuated by up to 400 bp in the last decade, between a peak of 4.2% in 2011 to levels as low as 0.2% this year. Lending conditions are currently excellent both for conventional and green bond issuers. Consequently, the *greenium* has far less impact on corporate investment plans than changes in the monetary policy run by major central banks.

Moreover, part of the *greenium* is offset by additional costs associated with green bond issuances, as previously explained.

In short, the *greenium* should be larger to have a significant impact on issuers' investment plans. A key question for the future impact of green bonds is whether the *greenium* can grow even bigger until a point at which it will be large enough to materially influence the WACC of green projects, as well as the issuers' investment decisions.

Pressure to align

Green bond issuers are not obliged to select projects in line with science-based targets. The three main guidelines proposed to the industry are voluntary only and offer different recommendations.

The 2021 edition of the GBP “recommends heightened transparency for issuer-level sustainability strategies and commitments, and encourages information, if relevant, on the degree of alignment of projects with official or market-based taxonomies”. The EU Green Bond Standard (EU GBS) demands that “the funds raised by the bond should be allocated fully to projects aligned with the EU Taxonomy”. Finally, the certification by the Climate Bonds Initiative requires that projects funded by the bonds meet scientific criteria consistent with the 1.5°C target declared in the 2015 Paris Agreement. So the EU GBS and the Certified Climate Bonds set the highest levels of constraint for the issuers.

Past research showed little consistency or connection between green bond frameworks and issuers' climate targets. Based on an analysis of the twenty largest European green bond issuers in 2018, Tuhkanen and Vulturius (2020) found that in most cases there is a disconnect between issuers' climate targets and their green bond frameworks. Their results suggest that, at least until recently, there was little pressure for green bond issuers to use their proceeds to achieve ambitious science-based targets.

Table 4: impact mechanisms used by green bonds

Signal of a commitment to green energy transition		Service of new/undersupplied markets	Provision of flexible capital	Pressure to align climate strategy with a B2DS
Non-market	Market			

Note: Green cells show that the impact mechanism is clearly actioned by the product, red cells that it is clearly not and orange cells that it is uncertain or conditional to product features. Similar tables will be proposed for other products.

2.2.2 Green loans

According to the Green Loan Principles (GLP) published by three recognized industry associations (the Loan Market Association, Asia Pacific Loan Market Association and the Loan Syndications and Trading Association) in March 2018, green loans are “any type of loan instrument made available exclusively to finance or re-finance, in whole or in part, new and/or existing eligible Green Projects”.

The GLP, which build on and refer to the Green Bond Principles (GBP) of the International Capital Market Association with a view to promoting consistency across financial markets, include a non-exhaustive list of green projects towards which the proceeds of the loan could be applied and require that the relevant green project provides clear environmental benefits.

Worldwide, close to 90% of green loans (Nordea, 2020) are raised by only five sectors (renewable energy, power, utilities, real estate and financial services) and 70% by the only renewable energy and power sectors.

Facing competition with other sustainable structures, the popularity of green loans seems to have faded away in the recent years, especially in Europe where it is now outcompeted by sustainability-linked loans (see section below).

The nature of green loans and bonds means that the formats compete over green assets and projects to be financed by green debt. If an asset or project is financed by a green bond, the same asset or project cannot be financed by a green loan. Because green bonds are public instruments, most (large) entities prefer to use their limited amount of green assets and projects for issuing green bonds, with the greater communication opportunities they offer. They can then complement the bond with a sustainability-linked debt instrument (see sections below) to further push the entity’s overall sustainability strategy (Nordea, 2020).

Another limitation to the expansion of green loans is posed by the tendency of banks to use green loans as a basis for their own green borrowing, especially the issues of green bonds. The eligibility of assets and projects included in a green loan will depend on the lender’s scope of eligibility chosen for its green borrowing. Green borrowers are therefore limited by the eligible categories in the GLPs as well as the lender’s own terms (ibid).

Nevertheless, the green loan format is particularly suitable for sectors with assets and projects that are green by nature, such as renewable energy, and for sectors with established and

broadly accepted methods for defining green, such as real estate (ibid). In contrast, other sectors in search of greening their businesses through energy efficiency projects may be limited in their access to those debt instruments by the banks' internal taxonomies.

What can be said about the climate impact potential of green loans?

Signal of a green commitment

For banks, green loans refinanced by the issue of green bonds are an effective tool to communicate a strong commitment to environmental issues in general, not to the energy transition in particular. For issuers the reputational benefits are less obvious as loans are private instruments.

Service of undersupplied markets

Unlike green bonds, green loans are not reserved to the largest companies. Nevertheless, the costs associated to the project evaluation and selection, and to the reporting of the use of proceeds and the outcomes may still act as powerful deterrents for SMEs. In addition, there is no evidence that the access to green loans is easier for issuers compared with conventional loans. Most probably, the access is conditioned the same way to the credit profile and history of the borrower.

Provision of flexible capital

As for use-of-proceeds green bonds, the specific barriers linked to the development and implementation of green energy projects are not transferred to the banks in the case of green loans, as the payback of capital and interests is backed by the entire balance sheet of the issuers and not by the revenues and assets of the project to which the proceeds are earmarked.

Regarding cost of capital, there is currently no evidence that green loans are cheaper for issuers compared with conventional loans. The evaluation of a potential "greenium" in the loan market has not attracted researchers' attention so far.

Interestingly, Giraudet et al. (2021) studied a dataset of posted loan prices scraped from online simulators made available by French credit institutions. They focused on whether "green" projects were offered lower interest rate than conventional ones, in the field of automotive and building retrofits. They found that greener automobile projects carry lower interest rates but building retrofits do not. In addition, they revealed that despite their similar risk, conventional automobiles benefit from lower interest rates than conventional retrofits. The results suggest that "green" loans are priced considering the underlying assets and the apparent capability of borrowers to pay higher yields (assuming that homeowners are wealthier than car purchasers).

If we add the specific costs associated to green loans, we can confidently conclude that green loans do not provide capital at concessional terms.

Pressure to align

According to the guidelines provided by the GLP, there is no obligation for companies that sign green loan contracts to commit to align to a 2DS or B2DS. The GLP only recommend that "*all designated Green Projects should provide clear environmental benefits, which will be assessed, and where feasible, quantified, measured and reported by the borrower*" (GLP, 2018). And there is no evidence that banks proposing green loans engage with the signing companies to make them adjust their climate strategies and endorse more ambitious targets.

Table 5: impact mechanisms used by green loans

Signal of a commitment to green energy transition		Service of new/undersupplied markets	Provision of flexible capital	Pressure to align climate strategy with a B2DS
Non-market	Market			

Note: Green cells show that the impact mechanism is clearly actioned by the product, red cells that it is clearly not and orange cells that it is uncertain or conditional to product features. Similar tables will be proposed for other products

Box 1: Green deposits and green saving accounts

Green deposits are savers’ deposits held at a (commercial or cooperative) bank or other financial institutions and specifically used to fund projects that are considered to generate a positive and long-lasting impact on the environment. Thus, the use of these funds is decided by the financial institution while the savers, who directly own the capital deposited in green saving accounts, often lack control on final investment decisions. In some cases, the depositors decide towards which type of activities, the capital will be channelled, like for La Nef in France where depositors choose between green, social and cultural projects.

Therefore, the impact generated strongly depends on the use of proceeds. Yet, the definition of what is considered “green” varies widely among savings services providers. Some banks refer to green savings accounts when financing the planting of a tree for every account opened to offset residual GHG emissions, while others fund green mortgages (e.g. Ecology Building Society) or green loans (e.g. Tandem Bank). Consequently, transparency regarding capital allocation may sometimes be missing. Nevertheless, some exceptions exist. For instance, Triodos Bank in the UK and La Nef in France publish on their websites details of every organisation funded using deposits.

Interestingly, the Joint Research Center of the European Commission has recently introduced a new proposal to verify the greenness of a deposit account, aiming to test its possible inclusion in the scope of the Ecolabel. According to this, what makes a savings or deposit account ‘green’ is the earmarking of ‘green loans’ to green projects or companies engaged in green economic activities. Not all money in the account is used at all times for loans as there must be some liquidity to cover withdrawals, but a specific percentage of that which is assigned to loans should be used for green projects/activities. The minimum percentage that can be used as the basis for an EU Ecolabel criterion is still to be determined (EACB, 2020).

Additional research should be conducted regarding the recipients of loans associated to green saving accounts. Do they target groups that are known for having a difficult access to funding like SMEs (who represent 78% of loans granted by La Nef) and households? The conditions at which the money is lent should also be investigated.

2.2.3 Asset-backed green bonds

Green bonds do not restrict to use of proceed bonds that are backed by the issuer's entire balance sheet with no transfer of project risk.

Other green bonds are instead backed by green assets separated from the rest of the issuer's balance-sheet. Those include:

- green use of proceed revenue bonds;
- green project bonds;
- green securitised bonds;
- green covered bonds.

The table 6 explains the main differences across the structures and how they depart from the classic use of proceed structure, already presented in a former section.

Table 6: the different types of green bonds

Type of green bond	Use of Proceeds	Debt recourse
Use of proceed bonds	Earmarked for green projects	To the issuer
Use of proceed revenue bonds	Earmarked for green projects	To the project's revenues
Project bonds	Ring-fenced for the specific underlying projects	To the project's assets and balance sheet
Securitised bonds	Earmarked for the financing or refinancing of the underlying pool of projects	To the underlying group of projects (e.g. solar leases or mortgage loans)
Covered bonds	Earmarked for the underlying pool of projects	To the issuer and, in case of default, to the pool of underlying projects

Source: Climate Bonds Initiative

Regarding the energy industry, those financing schemes backed by the assets' revenues are particularly well-suited for power generation plants using renewable energy resources, a sector in which revenue streams are likely to be fixed by a power purchase agreement (PPA) or a feed-in-tariff (FIT).

What can be said about the climate impact potential of asset-backed green bonds?

Signal of a green commitment

Those particular forms of green bonds are subject to the same Green Bond Principles as the more traditional use of proceed bonds. Like use-of-proceed bonds, those asset-backed green

bonds can directly fund energy-related projects designed to address climate change but are not restricted to those projects, sending an unclear message to stakeholders.

Regarding market signals, there is, to our knowledge, no study that specifically addresses the pricing of green asset-backed green bonds. We need evidence to assert that the “greenium” is also found in this smaller, less liquid compartment of the bond markets.

Service of undersupplied markets

In a different manner, by enabling to group together a multitude of small RE or EE projects, green covered or securitized bonds may provide access to funding to energy users (small municipalities, SMEs or households) that would have otherwise faced great difficulty to get financing at a reasonable cost. But they may also be used by large companies that already have good balance sheet financing conditions.

Provision of flexible capital

An important discriminating factor is the direct connection between capital providers and the funded project from a financial perspective. Only collaterals linked to the targeted project can be used and debt payments are solely serviced by the cash flows emanating from the project(s). Accordingly, the financing structure used by capital providers in those project finance solutions is directly linked to the underlying project, most often via a Special Purpose Vehicle off the company’s balance sheet, and the associated risks are transferred to investors in the SPV.

Pressure to align

As for use-of-proceeds green bonds, green asset-backed bonds do not include any obligation for issuers to align with a B2DS, except for those receiving the certification from the Climate Bonds Initiative.

Table 7: impact mechanisms used by asset-backed green bonds

Signal of a commitment to green energy transition		Service of new/undersupplied markets	Provision of flexible capital	Pressure to align climate strategy with a B2DS
Non-market	Market			

Note: Green cells show that the impact mechanism is clearly actioned by the product, red cells that it is clearly not and orange cells that it is uncertain or conditional to product features. Similar tables will be proposed for other products

2.2.4 Environmental impact bonds

Environmental impact bonds (EIBs) are modelled after social impact bonds (SIBs) which are not ‘bonds’ in the traditional sense. In essence, SIBs and EIBs are three-party outcome-based

contracts between a commissioner (that would finally turn into an ‘outcome payer’), a service provider and an investor. The ‘outcome payer’ commissions a purpose-driven delivery organization to achieve a particular social or environmental outcome and the impact-motivated investor provides the funding to deliver the services, which eliminates the commissioner’s financial risk. The investor will then be repaid fully with interests only in case the targeted social or environmental outcome is achieved. As such, SIBs and EIBs use a *pay for success* approach.

Specifically, the sequence in an EIB scheme, is the following:

- (i) bond investors pay up-front costs needed for the deployment of the environmental project;
- (ii) then the environmental solution is deployed;
- (iii) at a pre-fixed date the impact (or more precisely the outcome) of the project is assessed by an external verifier;
- (iv) And finally, if the outcome matches or exceeds the pre-agreed terms, then the commissioner that benefits from the underlying project repays the investors with pre-agreed interests. In case of failure to meet the target, the repayment is reduced.

Figure 3: the Environmental Impact Bond structure



Source: 2DII

The scheme has the potential to help the (often public) commissioners to save money in case of failure. It also fortifies service providers with large amounts of funding upfront and gives them the flexibility to run their interventions according to what will achieve the best outcomes, allowing them to experiment and innovate.

For investors, EIBs (alongside SIBs and Development Impact Bonds) represent new investment opportunities with returns poorly correlated to traditional asset classes.

This financial scheme is relatively recent. The first SIB was issued in 2010 to finance charitable service providers that were working with prisoners at the Peterborough jail in England. Six years later, the first-ever environmental impact bond was issued by DC Water in the US to Goldman Sachs and Calvert Impact Capital, funding a \$25 million infrastructure to relieve the combined sewer overflows the city of Washington DC was facing (CFD, 2019).

There are currently more than a hundred and fifty projects financed using SIBs in the world totalling more than \$1 billion of commitments to pay for successful social outcomes involving children, youth, employment, social welfare, criminal justice, education, healthcare and environment (Cohen, 2020).

What can be said about the climate impact potential of environment impact bonds?

Due to the recency of the structure, track record is still low and literature scarce. Yet, some interesting research has been conducted with a focus on both social (mainly) and environmental impact bonds.

Rizzello et al. (2020) studied several SIB issues and conclude that they provide an interesting tool for private-public partnerships necessary to reach the UN SGDs. Even though similar studies should be conducted for environmental impact bonds specifically, it gives encouraging signals as the underlying structure is similar.

Moreover, O'Flynn et al. (2021) analysed the role of social and environmental impact bonds for implementing terrestrial protected areas. Like many (small-sized) energy efficiency and renewable energy projects, that environmental issue face significant challenges to secure (affordable) funding, being a main obstacle of large-scale deployment and proper management. The paper reviewed the potential applicability of social and environmental impact bonds for terrestrial protected areas and revealed that this type of bond can be a useful financing model for a range of sustainability-related concerns. While the focus is on natural area protection and not on the energy transition, it shows the relevance of this financial scheme for the funding of new and/or undersupplied projects, as well as the advantages of its flexible structure.

Signal of a green commitment

In this three-party contract, both the commissioner and investors show their commitment to projects providing a positive environmental impact. Investors go a step further as they display their confidence in the service provider to attain the environmental target by accepting a potential financial loss in case of failure. The signal could be even stronger if the structure were better known and not diffused within the large category of SIBs.

Service of undersupplied markets

With their long credit history and capability to raise local taxes, local public entities generally have no problem to access financing in the form of standard loans or bonds. They are nevertheless constrained by their debt situations that could prevent them from engaging in long-lasting and uncertain energy projects. But EIBs do not provide any access to new sources of capital.

Provision of flexible capital

By construction, the pay-for-success scheme eliminates the commissioner's financial risk partly or fully. Accordingly, environmental impact bonds allow commissioners to engage into riskier projects than they would have done in a two-party contract with the service provider.

This particular structure is especially adapted to specific projects with revenues streams and/or potential cost savings linked with environmental milestones.

In such a scheme, the effective cost of capital of the bond is directly tied to the environmental performance of the project. The financial terms of the EIB contracts are very different from conventional or other green financial solutions as they permit the commissioner to repay the investors with negative interest rates in case of failure of the service provider to deliver.⁴

In the example of the \$25 million DC Water EIB, investors’ rate of return varies with the water runoff volume reduced by the green infrastructure put in place. In case of underperformance, investors would face a \$3.3 million risk-share payment back to DC Water (which DC Water could then use to mitigate the under-performance with additional stormwater-related projects). In case of overperformance, investors would receive a one-time payment to them of \$3.3 million in addition to the reimbursement of the capital. If the green infrastructure performs as expected, there are no additional payments in either direction (CBF, 2019).

Pressure to align

Like in other project finance solutions, the connection to an overall climate strategy is usually not part of this scheme. The targets agreed by the commissioner and the service provider depend more on the technology deployed than on the overall climate strategy of the commissioner. Finally, it is the investor’s prerogative to decide whether the targets associated to the project are ambitious enough when compared to a 2DS or a B2DS and to incidentally pressure the commissioner to scale up its ambitions through discussion.

Table 8: impact mechanisms used by environmental impact bonds

Signal of a commitment to green energy transition		Service of new/undersupplied markets	Provision of flexible capital	Pressure to align climate strategy with a B2DS
Non-market	Market			

Note: Green cells show that the impact mechanism is clearly actioned by the product, red cells that it is clearly not and orange cells that it is uncertain or conditional to product features. Similar tables will be proposed for other products

⁴ In the case of the Peterborough SIB, the payback was conditioned to the reoffending rate after five to seven years. If the charities had failed to reduce the reoffending rate by 7.5 per cent relative to a control group of released prisoners, no money would have returned to the investors. However, if the rate of reoffending fell by 7.5 per cent or more, the government would repay the initial investment, in addition to a rate of interest that would rise according to the reduction achieved. The cornerstone of this initiative was that, in case of success, the government would be paying out only 30–50 per cent of the money that would be saved on law courts and prisons (Cohen, 2020).

2.2.5 Energy Performance Contracting

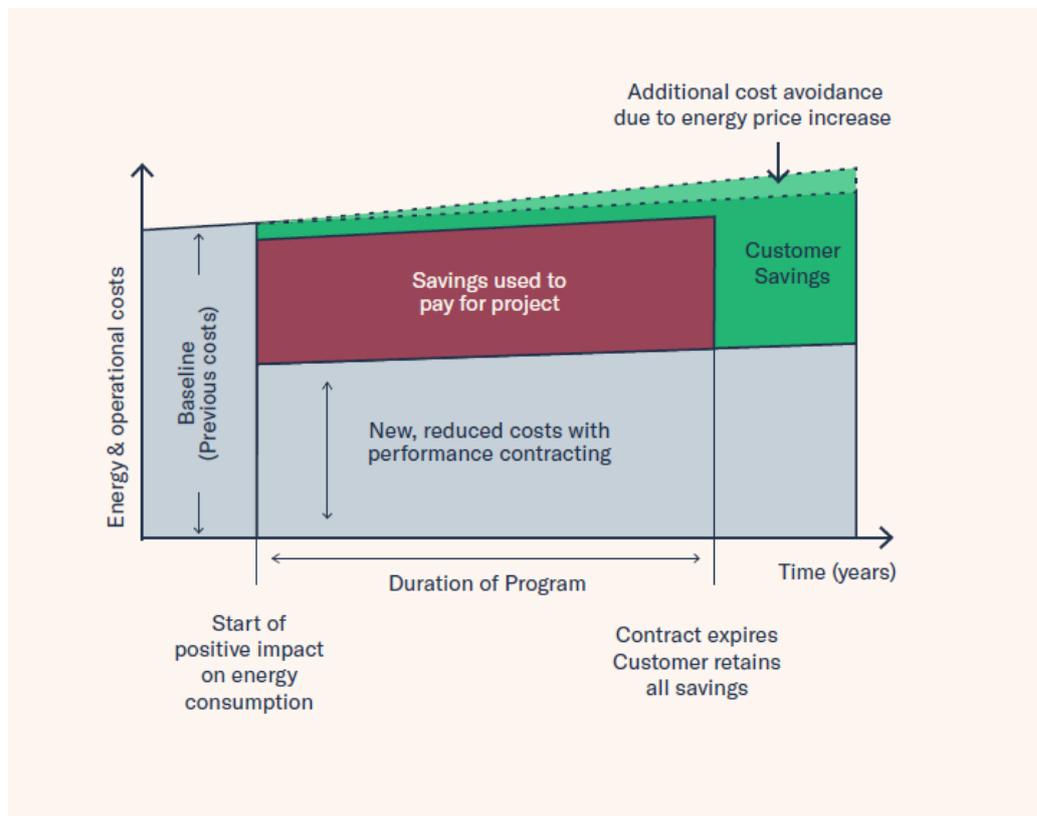
According to the Energy Efficiency Directive 2012/27/EU, the definition of Energy Performance Contracting (EPC) is the following:

“a contractual arrangement between the beneficiary and the provider of an energy efficiency improvement measure, verified and monitored during the whole term of the contract, where investments (work, supply or service) in that measure are paid for in relation to a contractually agreed level of energy efficiency improvement or other agreed energy performance criterion, such as financial savings”.

Energy Performance Contracting is a form of Third-Party Financing (TPF) applied to energy and energy-efficiency equipment. As such, it is an agreement that guarantees the investor to achieve the savings declared by a service provider, these savings are allocated to the repayment of the service provider’s investment costs. Through this financial arrangement, the service provider owns, operates, and maintains an infrastructure while the customer hosts the system on its property. This mechanism has witnessed an important development in the United States in the early 2000s for renewable energy investments, particularly for solar PV projects (Thumann et al., 2008) and is ever since progressively used for energy-efficiency systems.

It allows end-users to benefit from an energy device without supporting its acquisition costs, nor having to maintain the system. Indeed, in this scheme, the service provider pays the up-front costs linked to the deployment of the energy asset, and therefore bears the risks of the investment. In exchange, the customer is committed to abandon the energy savings to the service provider. Depending on the scheme, at contract maturity, the system either becomes the property of the host or can be entirely purchased by the host at a fair market value, or the contract can be renewed.

Figure 4: typical payout structure of an EPC



Source: Pernetta & Bender (2019)

In many cases, the service provider proposing this type of financial mechanism is an Energy Service Company (ESCO), a business providing financial and technical solutions to energy efficiency, retrofitting and energy infrastructure projects. It is important to underline that ESCOs can raise (project) debt to finance working capital linked to specific projects, implying that risks are shared between the service provider and its financial investors.

What can be said about the climate impact potential of energy performance contracts?

Little literature is currently available regarding TPF, especially with a particular focus on the energy sector and environmental impact. De Mot et al. (2016) provided an economic approach to TPF but in a completely different context (TPF for legal litigation), exposing the reasons behind its emergence, namely a remedy for risk-sharing and financing when individuals have limited financial capabilities. In addition, this study highlighted potential downside effects linked to TPF, such as principal-agent problem, information asymmetry and transaction costs, that may jeopardize its effectiveness as a financing option.

Signal of a green commitment

ESCOs and their funders can easily promote their contribution to the collective green energy transition through TPF solutions as they address a major blocker of the transition, namely the funding and expertise gaps of demand-side economic agents.

Service of undersupplied markets

EPC target economic agents (households, SMEs, small municipalities) with limited internal financial resources and restricted access to external funding to fund projects with significant upfront costs.

Provision of flexible capital

TPF is particularly well-suited for organizations and retail customers that do not have sufficient initial investment capital to purchase the energy systems or energy-efficiency devices and/or do not want to deal with the operational part and risks of the project. It is usually within the terms of a third-party financing contract that the service provider assumes all responsibilities linked to ownership (Thumann et al., 2009). Therefore, the direct risks associated with the energy devices are transferred from end-users to the service providers and their external funders. Consequently, TPF is well adapted to bridge the financing and technical gaps of energy efficiency and renewable energy investments, in particular for end-users whose personal skills are not related to those activities.

Li et al. (2019) studied TPF in a low-income context in China and showed that it allows investments in clean energy device – in this case small-scale solar PV projects that otherwise may have not existed, given the barriers the customers would have faced such as high up-front costs, long payback periods and technical maintenance.

While European contexts are different, similar investment hurdles are often faced by private individuals, SMEs or small municipalities. In addition, TPF contracts may be set up with competitive electricity prices for end-users, usually associated with tax breaks.

Accordingly, TPF provides tailored financing for energy-related projects, generally focusing on small-scale projects for households or SMEs.

Pressure to align

By facilitating the financing of energy efficiency activities and the use of renewable energy resources, TPF appears to be a relevant solution to allow businesses and individuals to support the advancement towards the EU’s environmental objectives.

Nevertheless, based on the structure and current available literature, it is difficult to identify a link between TPF and the alignment of users’ climate strategies and investment plans with a 2DS or B2DS.

Table 9: impact mechanisms used by energy performance contracts

Signal of a commitment to green energy transition		Service of new /undersupplied markets	Provision of flexible capital	Pressure to align climate strategy with a B2DS
Non-market	Market			

Note: Green cells show that the impact mechanism is clearly actioned by the product, red cells that it is clearly not and orange cells that it is uncertain or conditional to product features. Similar tables will be proposed for other products

2.3 Assessing product impact: corporate financing solutions

As opposed to project financing, corporate financing focuses on the funding of an entire organisation without targeting specific “green” projects. Therefore, the financial products and mechanisms selected here directly fund entities running projects related to the green energy transition.

In this report, the corporate financing category includes the following financial products and structures: sustainability-linked loans, sustainability-linked bonds, low-carbon mutual funds, green thematic funds, and green crowdfunding.

2.3.1 Sustainability-linked loans

According to the Sustainability Linked Loan Principles published by industry organisations in March 2019, sustainability linked loans “are any types of loan instruments and/or contingent facilities (such as bonding lines, guarantee lines or letters of credit) which incentivise the borrower’s achievement of ambitious, predetermined sustainability performance objectives”.

The borrower’s sustainability performance is measured using sustainability performance targets (SPTs), which include key performance indicators, external ratings and/or equivalent metrics and which measure improvements in the borrower’s sustainability profile. The suggested criteria listed in the Sustainability Linked Loan Principles are indicative only – the critical factor is that the criteria chosen are ambitious and meaningful to the borrower’s business.

The use of proceeds in relation to a sustainability linked loan is not reserved to certain projects and, in most instances, sustainability linked loans will be used for general corporate purposes.

Instead of determining specific uses of proceeds, sustainability linked loans look to improve the borrower's sustainability profile by aligning loan terms to the borrower's performance against the relevant predetermined SPTs.

While it long stayed in the shadow of green loans, the sustainability-linked loan market has picked up at an impressive pace since 2018 and especially following the publication of the SLLPs in 2019, surpassing green loan volumes in 2019 (Nordea 2020).

The sectors covered by SLLs are more diverse than the ones using green loans. Worldwide, the top five sectors represent 40% of the funding (vs 90% for green loans). The structure does not require a definition of green assets and projects to be financed but instead allows all types of entities to commit to sustainability targets. Thus, SLLs provide an alternative for borrowers in sectors that lack clear definitions of green or companies within sectors that may not have green assets and projects but can decrease their overall environmental footprint through the replacement of existing devices.

What can be said about the climate impact potential of sustainability-linked loans?

Signal of a green commitment

The structure clearly helps borrowers signal to their stakeholders they are committed to improving their sustainability profile.

Nevertheless, compared with other green debt instruments, it suffers two pitfalls that could prevent it from being considered as a credible signalling device of a strong commitment to the green energy transition.

First, it is a private debt instrument less easily usable for marketing compared to public bonds. Second, SLLs are not green by nature. Market participants can use a large variety of environmental or social KPIs provided that the criteria chosen are meaningful to the borrower's business and the target ambitious. Companies are not tied to using only the criteria listed in the Sustainability Linked Loan Principles.

Regarding climate metrics, target CO₂ emissions are common, but there are examples of other criteria relevant to the borrower's business (like the proportion of electric vehicles in a company's fleet, or improvements in uptake of energy consumption monitoring tools among customers of a utility company). The borrower's overall ESG rating (typically expressed on a scale of 0 to 100) is also largely used.

Service of undersupplied markets

Like green loans, SLLs are not reserved to the largest companies. Nevertheless, the costs associated to the SPT selection, potentially in coordination with a "Sustainability Coordinator" or a "Sustainability Structuring Agent", and the (external or internal) review of the actual performance vs the target may still dissuade SMEs to use such an alternative structure. In addition, there is no evidence that the access to SLLs is easier for companies compared with conventional loans.

Provision of flexible capital

The SLL contract does not include any form of risk transfer to the bank. Depending on the terms of the debt contract, a failure to meet the target for the relevant KPI (due to a technological issue for instance) would lead to no consequence for the bank or even, more rarely, to an

increased payment. Most often, SLLs only imply a step-down in the interests to be paid to the bank, allowing for reduction in case of sustainability appropriate performance.

Indeed, early financings were structured such that if the borrower satisfied its sustainability criteria, the margin on the loan was reduced. The size of that reduction varied between loans and markets but might typically be in the range of 2 to 4 bp on a general corporate financing. For some issuers with poor credit ratings, the discount might be higher – as much as 10 to 20 bp. In case of failure to meet the target, most contracts did not include any penalty for the borrowing company. Instead, the margin reduction would simply not apply.

More recently, two-way pricing mechanisms have been introduced on some deals. Two-way pricing mechanisms probably better incentivise performance by providing for an interest reduction if sustainability criteria are met, and applying an interest increase in case of underperformance (Nordea 2020b).

The underlying objective of incentivising borrowers to make improvements to their sustainability profile is probably more likely to be achieved through two-way pricing mechanisms, but it is possible that they could be viewed in a less positive way since they result in lenders making greater returns on loans from borrowers who are not meeting their sustainability targets.

There are examples of alternative structures being considered, which could mitigate that concern. One idea replaces increases in pricing with a requirement to make additional payments into a separate bank account should sustainability targets not be met. Those amounts could then be used only for reinvestments into solutions helping to meet the sustainability target of the borrower (Nordea 2020b).

Finally, there is currently no evidence that SLLs are cheaper for borrowers (before the step-up or step-down) compared with conventional loans. The evaluation of a potential “sustainability” in the loan market has not attracted researchers’ attention so far.

If we add the specific costs associated to SLLs, we can confidently conclude that they do not provide capital at concessional terms.

Pressure to align

According to the SLLP, there is no obligation for companies that sign SLL contracts to commit to align to a 2DS or B2DS.

Whether the choice of issuing a SLL will lead or not the issuer to adopt a climate strategy closer to scenario-alignment finally depends on the KPI and target chosen in accordance with the lender and the structuring agent. The role of banks in their attribution of SLLs to borrowing companies is thus crucial.

Financial and reputational risks associated with missing the target do not appear as strong incentives to perform. The financial penalty or reward seems often to be small compared to the overall borrowing costs and the reputation risk of failing the target is limited as SLLs are private contracts.

Table 10: impact mechanisms used by sustainability-linked loans

Signal of a commitment to green energy transition		Service of new/undersupplied markets	Provision of flexible capital	Pressure to align climate strategy with a B2DS
Non-market	Market			

Note: Green cells show that the impact mechanism is clearly actioned by the product, red cells that it is clearly not and orange cells that it is uncertain or conditional to product features. Similar tables will be proposed for other products

2.3.2 Sustainability-linked bonds

Sustainability-linked bonds (SLBs) are performance-based public debt instruments where the issuer commits to achieve pre-defined sustainability-related objectives within a given timeline, while the proceeds are intended to be used for general purposes (Giráldez et al., 2021). As for SLLs, the financial terms of a SLB can vary depending on whether the issuer reaches the pre-defined key performance indicators (KPIs). Unlike SLLs, the change in the repayment conditions most often take the form of a one-way step-up. If the issuer fails to achieve its target at the observation date, then it faces an increase in the following coupons to be paid to the bond holders.

Since the first issue of a SLB by Enel in September 2019, the structure has rapidly gained popularity. According to the ICMA Sustainable Bonds Database, by July 2021 already 35 deals had been set at the global level, with half of them involving European issuers. All of the existing deals except two use environmental KPIs.

The success of the structure can be related to its simplicity for the issuer. Sustainability-linked bonds appeal to companies that want to offer “sustainable bonds” with fewer financial restrictions. Companies issuing SLBs expect lower staffing and administrative costs compared with other types of sustainable bonds (green or social bonds). And they claim it is simpler for them not to have to isolate green or social projects that would often be too small to justify an issue of several hundreds of millions of euros. Consequently, large issuers like Novartis or Enel have claimed their intention to use SLBs instead of green bonds in the future (Wall Street Journal, 2020). Oil majors, who have difficulty issuing green bonds, have also claimed their interest for the structure. As an example, Total Energies announced in February 2021 its commitment to only issue sustainability-linked bonds in the future.

The structure gathered more momentum thanks to the publication of the Sustainability-linked Bond Principles (SLBPs) by the ICMA in June 2020 and the announcement by the ECB in September 2020 that it would accept bonds with coupon structures linked to certain sustainability performance targets as eligible collateral for Eurosystem credit operations and for outright purchases in Eurosystem monetary policy operations.

What can be said about the climate impact potential of SLBs?

Because the first issue took place only two years ago, SLBs' track record is by definition very limited. For instance, the reaction of the market to success or failure at the observation date is still unknown as the first test will occur in December 2021 for the Enel issue. For the same reason, academic literature dealing with the outcomes of SLBs is quasi absent. At present, available information mainly focus on how SLBs were structured, in particular what are the underlying KPIs fixed by issuers and the (independent) verifiers. Yet, it would be interesting to analyse the real-life consequences of the emergence of SLBs.

Signal of a green commitment

Giráldez et al. (2021) recently published an article describing the main characteristics of SLBs as well as their functioning. In addition, they analysed potential risks and structural consequences for KPI-linked bond issuances. More specifically, they underlined concerns linked to (i) the selection of KPIs, (ii) the target ambitions and (iii) the necessity to create a framework for a credible and market-accepted verification process of issuer's performance.

Indeed, as for SLLs, there is currently no standards regarding the definition of KPIs linked to SLBs. They range from CO₂ emission reduction targets and renewable energy installed capacity, to gender equality and social inclusion. Therefore, the outcomes are dependent to the underlying objectives. Moreover, an important question may be raised regarding the materiality of these KPIs for issuers and the society as a whole. Consequently, the signal sent to stakeholders appears to be unclear as many different types of KPIs can be chosen by issuers. It is less obvious the issuer commits to fighting climate change by issuing a SLB compared to a green bond.

Service of undersupplied markets

Considering the administrative and financial hurdles to issue such bond, preliminary conclusions lead to well-established companies as main issuers. As such, SLBs do not serve undersupplied markets.

Provision of flexible capital

In their current form, most SLBs distinguish themselves from other green debt structures regarding the consequences for the issuer and investor in case of environmental failure. While for other structures the investor would face no (green bonds) or negative (EIBs, green project bonds...) financial consequence, the SLB investor is actually rewarded in case of such an adverse scenario.

This financial scheme raises ethical questions since it creates a moral hazard for investors, as they will benefit from the issuer's failure to deliver on its sustainability ambitions and goals. With the existing terms, investing in a SLB with green KPIs can be considered as "betting against climate". For the SLB issuer, there is consequently no transfer of project risk to the investor whatsoever. There could even be an amplification of the green project risks, the financial penalty adding to the costs associated to the failing projects.

Regarding the provision of cheaper capital, there is unfortunately no academic work dealing with this topic so far. But research from the industry suggests that the SLB market is moving towards a "sustainability". Inaugural issuances in 2021 were all "awarded" by negative yield premiums compared to past issues around 5-7 bp (Natixis, 2021). In all cases, the premium seems too small to influence the investment plans of the issuers.

Pressure to align

As highlighted by Giráldez et al. (2021), the level at which issuers set their environmental and social objectives is of significant importance and will affect the overall sustainability performance of the issuer. The SLB principles framework states that sustainability performance targets should be “ambitious” and “beyond a business-as-usual trajectory”. Unfortunately, these requirements are qualitative only.

Whether the choice of issuing a SLB will lead the issuer to adopt a climate strategy closer to scenario-alignment finally depends on the KPI and target chosen. Additionally, its resolution to stick to the objectives would correlate with the financial and reputational risks associated with failing the target. The financial penalty (the step-up) often seems to be small compared with the overall borrowing costs (less than 10% or even 5% of the yield for issuers with degraded credit ratings) and their natural variability. It is interesting to note that the first three issuers of SLBs used the same structure (with a step-up of a mere 25 bps), which was almost becoming market practice at this early stage. In a few cases, the coupon variation only applies to the final year of the SLB’s life, making the overall potential financial cost even less significant. There are also other examples where the measurement of KPIs coincide with times when the bonds are callable. This gives the issuer an option to redeem the bonds early and avoid paying the financial penalty (Lukaszewski, 2021). According to the SLB principles, the variation from original terms in case of failure to meet the target should be “meaningful,” which leaves much room for convenient interpretation by issuers and bond originators.

Beside the financial risk, the reputation risk of failing the target appears unclear. We still need empirical evidence to understand the market and media reaction to such adverse information at observation dates.

Table 11: impact mechanisms used by sustainability-linked bonds

Signal of a commitment to green energy transition		Service of new/undersupplied markets	Provision of flexible capital	Pressure to align climate strategy with a B2DS
Non-market	Market			

Note: Green cells show that the impact mechanism is clearly actioned by the product, red cells that it is clearly not and orange cells that it is uncertain or conditional to product features. Similar tables will be proposed for other products

2.3.3 Low-carbon mutual funds

An increasing number of investors are publicly reporting on the alignment of their portfolio with temperature trajectories, increasingly expressed by an aggregated and synthetic temperature metric (such as 2°C or 2,5°C).

In parallel, many funds invested in listed assets proposing to fight against climate change have been launched in the most recent years. They propose portfolios aligned with a 2°C scenario or the Paris Agreement. For delivering that promise, they adapt asset allocations compared to standard portfolios, using some or all of the following techniques:

The exclusion of the most carbon-intensive sectors (especially fossil fuel producers);

- A best-in-class approach to select companies that are the least carbon-intensive within their sectors;
- An overweighting of companies that generate products and services that enable to decrease collective carbon emissions (avoided emissions), mostly companies producing renewable energies or energy efficiency solutions.

There are currently 101 funds in Europe following a low-carbon approach that cumulate €26 billions of assets under management (Novethic, 2021). Among those funds, only 44% have a target for emission reduction.

Low-carbon mutual funds now benefit from multiple adequate indices (including MSCI Low Carbon Indices or Euronext Low Carbon 100 Europe) and a certification, the Morningstar's "Low Carbon Designation", that has been shown to affect investors' capital flows and mutual funds' asset allocations (Ceccarelli et al. 2021). Investors redirected their flows towards funds that received the LCD label. Second, the investment funds that did not obtain the label responded by shifting their holdings to more climate-friendly securities.

The claim of low-carbon mutual funds to contribute to mitigate climate change is often supported by portfolio temperature scores that appear to be much lower than the ones of relevant benchmarks which are often above 3°C or even 4°C.

Even if most companies are misaligned with the 2DS, it is actually easy to build portfolios that are aligned without incurring a significant increase in risk or a strong deviation in return versus traditional benchmarks. Analysing SBTI database, Mercereau et al. (2020) obtain that average temperature for global equities is about 3°C. Only 6% of firms within the MSCI ACWI Index are below 2°C and 4% below 1.5°C. Nevertheless, they show that it is feasible to reach the 2°C target by building an equally-weighted portfolio made of 500 stocks (out of more than 2600) covering 78% of all sectors. Such a portfolio would suffer a marginal increase in volatility (of 0,4 pp) and a small tracking error (2%). An optimized (i.e. not equally-weighted) portfolio would attain the target with even less increase in risk and tracking error.

What can be said about the climate impact potential of low carbon mutual funds?

Signal of a green commitment

For investors and asset management firms, low carbon mutual funds are an easy and effective tool to show a commitment to the green transition, even if the actual contribution to climate change mitigation is doubtful.

Temperature metrics may give the (false) impression that investing in the temperature-aligned portfolio may lead the world to this specific climate future. If companies in a portfolio have, in the aggregate, a lower carbon intensity or a better climate trajectory than companies in another portfolio, it does not mean this is because of investors' actions. It is, as often, crucial to separate between investor impact and corporate impact.

Investing in listed stocks or bonds of temperature-aligned companies does neither make them mechanically commit to new green investments nor improve even more their climate strategy.

Nevertheless, the existence of low carbon funds and indices may provide an incentive for companies to compete for being part of those portfolios, leading to a collective acceleration in transition.

Low carbon funds also send market signals through their use of different screening approaches. On the one hand, theoretical models show that screenings run by sustainable investors affect asset prices (Pastor et al. 2021; Pedersen et al. 2021). On the other hand, we do have ample

empirical evidence that carbon emissions are negatively related to company's value (Griffin et al. 2017; Garzón-Jiménez and Zorio-Grima 2021). It is also clear that carbon emissions are negatively connected to the cost of debt (Pizzutelo et al. 2020; Palea and Drogo, 2020; Caragnano et al. 2020). Thus companies with low carbon emissions enjoy a valuation premium in both equity and bond markets without one can say whether it is due to the specific portfolio decisions of low carbon funds.⁵

There is also uncertainty regarding the effect of those market signals on corporate emissions. As noted by Kölbl et al. (2020), if there is some evidence that screening approaches affect asset prices, and theoretical models that predict a further effect on ESG practices, *“there is no empirical evidence that explicitly links sustainable investors’ screening approaches to changes in ESG practices”*.

Service of undersupplied markets

Low carbon mutual funds do not bring additional capital to companies in desperate search for funders as they target large listed firms that face no restricted access to funding.

Provision of flexible capital

The purchase of stocks and bonds based on companies' temperature scores is not related to any specific green project for which the risk could be redistributed. And, by definition, investments in secondary markets do not provide capital to issuers in a direct way.

Pressure to align

Passively investing in companies that are already aligned seems to be counter-intuitive if an investor wants to actively contribute to the overall alignment of the economy. There is no evidence showing that the positive screening of the most-aligned companies leads them to accelerate even more in their green transition.

Other approaches, for instance investing in and engaging with highly emitting companies, divesting from these once they make the necessary transition to a low-carbon business model, and reinvesting in highly-emitting companies could be, at least on paper, considered more impactful. Yet, its “alignment” performance would most likely be worse using the currently available temperature alignment methodologies.

⁵ Research also shows that the extent of carbon disclosure helps reduce the yield premium required by investors to compensate for poor carbon performance (Bui et al. 2019).

Table 12: impact mechanisms used by low-carbon mutual funds

Signal of a commitment to green energy transition		Service of new/undersupplied markets	Provision of flexible capital	Pressure to align climate strategy with a B2DS
Non-market	Market			

Note: Green cells show that the impact mechanism is clearly actioned by the product, red cells that it is clearly not and orange cells that it is uncertain or conditional to product features. Similar tables will be proposed for other products

2.3.4 Green thematic funds

Green thematic funds are mutual or private funds that have specialized in investments in companies serving the green transition. They mostly use conventional assets (equity, bonds) to support their thematic investment strategy.

Thematic funds in general focus on powerful, long-term global trends based on macro imbalances (between populations and resources, supply and demand, etc.) which create huge investment opportunities.

Thematic investing is currently one of the hottest trends in asset management and cover a very broad set of investment themes, within the environmental domain (water, forestry, agriculture, energy efficiency, biodiversity...) or outside (AI, digital, silver economy, blockchain, etc.).

The latest research by Novethic obtains that there are currently 238 mutual funds available to European individual investors dedicated to a green theme, for a total of €128 billion of assets under management (Novethic, 2021). Those figures include funds with a general environmental scope and those with a more specific focus.

Beside mutual funds, private equity funds have also been endorsing environmental themes, especially renewable energy, in the recent years. New funds are created, new fundraising rounds are announced as well as the opening of those green private equity funds to retail investors through partnerships between PE firms and insurance companies. Consequently, new investments in renewable energy by VC/PE seem to reaccelerate after a significant fall in the aftermath of the Great Financial Crisis, both worldwide and in Europe (see Appendix 2).

What can be said about the climate impact potential of green thematic funds?

As for low carbon mutual funds, investing in companies that produce solutions that mitigate climate change is not a sure way to have an impact as an investor. If it ensures that the investee has a positive climate-related impact, it says nothing of the investor impact. The investor impact will depend on the ability of the investor to boost the production of the investee through his investment. Consequently, we will repeat below the same analysis as for low carbon mutual funds.

Signal of a green commitment

Buying shares of a fund that only invests in secondary markets in stocks or bonds of companies operating in the RE or EE sectors implies a clear signal of a commitment to the green energy transition with no insurance that it will positively affect the investees' investment plans and lead to a real change in overall emissions.

Thematic funds also send market signals by contributing to increasing the valuations of green companies in primary and secondary markets. Since (young) companies in those sectors enjoy a very rapid growth, the capital surplus raised during (relatively frequent) seasoned offerings thanks to the higher valuations will probably fuel an activity increase that will be beneficial for climate change mitigation.

Service of undersupplied markets

Listed companies operating in EE and RE sectors have no problem to attract investors, as proven by their high valuation metrics. The investment serves undersupplied markets only when the funds target small companies that are loosely connected to financial markets, especially private equity funds.

Provision of flexible capital

The purchase of stocks and bonds of companies operating in the RE or EE sectors is not related to any specific green project for which the risk could be redistributed.

At initial and seasoned offerings, there is risk sharing between company owners and investors as with any equity or bond investment. Nevertheless, if the technology used by the investee fails or is outcompeted by another technology, then the company fails and the investors will suffer a significant loss, in a much larger extent than for equity or bond investments in aligned companies operating in more mature sectors. So issuers do not give up additional risk when they attract green investors through thematic funds compared to standard investors but green investors take additional risks by concentrating their portfolios on a few, potentially non-mature, sectors.

The provision of flexible capital depends on the financial terms of the investments by the fund, whether they are done at market or concessional terms. In primary markets, it would happen only if thematic VC/PE funds finance companies operating in the EE and RE sectors at higher valuation metrics compared to standard VC/PE funds. In secondary markets, thematic mutual funds do not provide capital to issuers and de facto restrict themselves to sending price signals.

Pressure to align

The investment in the thematic funds does not lead the investees to converge to a B2DS-alignment since the investees are... already aligned.

Table 13: impact mechanisms used by green thematic funds

Signal of a commitment to green energy transition		Service of new/undersupplied markets	Provision of flexible capital	Pressure to align climate strategy with a B2DS
Non-market	Market			

Note: Green cells show that the impact mechanism is clearly actioned by the product, red cells that it is clearly not and orange cells that it is uncertain or conditional to product features. Similar tables will be proposed for other products

2.3.5 Green crowdfunding

Crowdfunding platforms have experienced a rapid growth and surge in popularity in recent years, principally after the 2008 financial crisis in response to the difficulties faced by many enterprises attempting to raise private capital. They cluster a large number of investors to finance businesses through digital platforms that connect the supply and demand of capital.

Broadly speaking, crowdfunding appears in two forms: donation-based crowdfunding (referring to funding driven by donations and rewards, excluding financial return expectations), and investment crowdfunding (including both debt and equity financing).

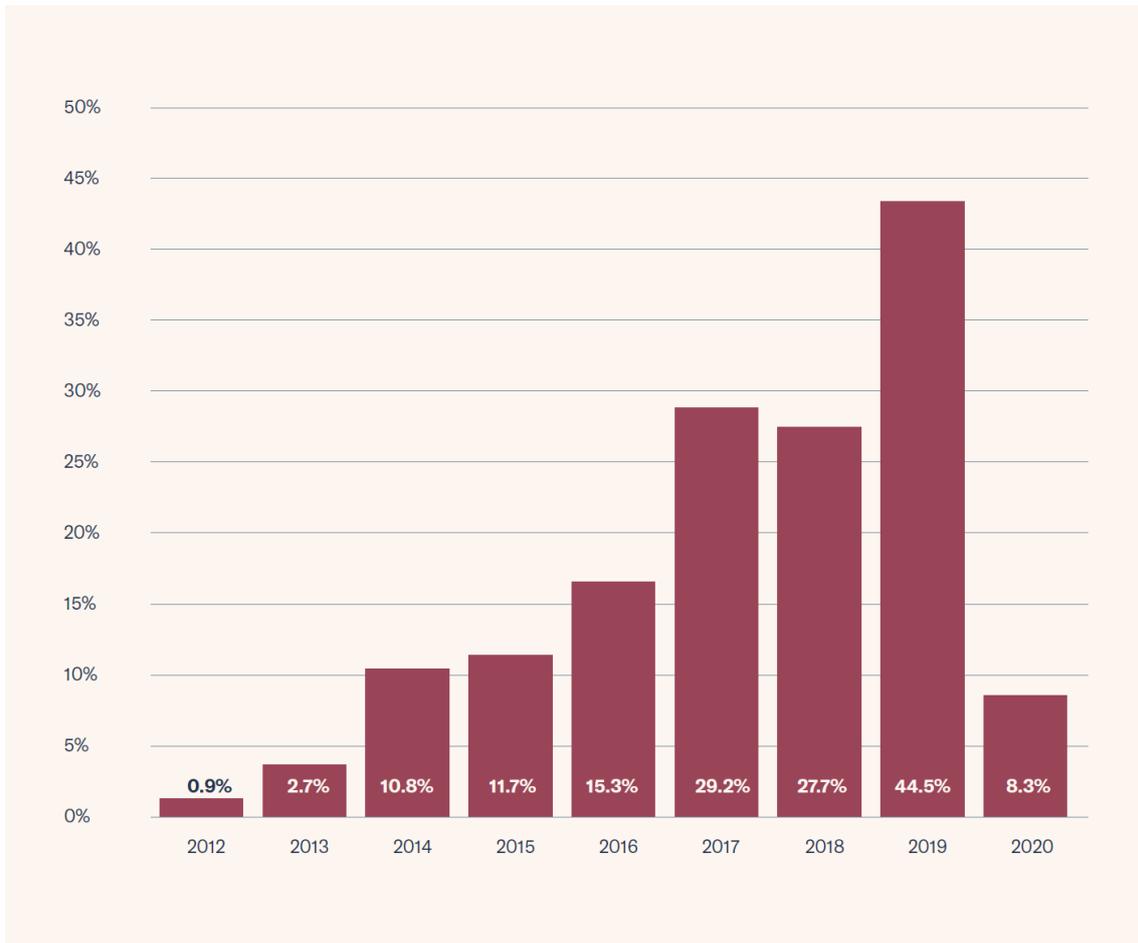
Crowdfunding platforms are more and more used as an alternative funding options in different sectors, including the energy industry. They are particularly well-adapted to bridge the early-stage financing gaps of investments that do not require large ticket sizes and complex due diligence processes, and that may lack collaterals to get debt financing from banks or VC/PE. In addition, crowdfunding also may open doors for further venture capital investments (ibid).

Numerous platforms focusing on green projects have emerged in Europe in the last ten years. We have identified more than thirty green platforms in the continent.

So far, the overall volumes of transactions of all (both green and general) crowdfunding platforms are limited in continental Europe compared to UK and US, with a total of only \$5.2 billion raised through P2P lending in 2020 (mostly in the form of consumer lending) and \$1.7 billion through real estate, equity, donation or reward crowdfunding (see Appendix 3).

But the potential of crowdfunding platforms to complement or even replace traditional funding channels is not negligible as shown by the example of UK, the most advanced country for alternative finance in Europe. There, P2P lending accounted for 44% of total loans to small businesses (i.e. with revenues below £ 2 million) in 2019 while equity crowdfunding represented the equivalent of 15% of the VC activity (Cambridge Center for Alternative Finance, 2021)

Figure 5: P2P lending as a percentage of new loans to small businesses in the UK (2012-2020)



Source: The Global Alternative Finance Market Benchmarking Report 2021, CCAF

What can be said about the climate impact potential of green crowdfunding?

Literature regarding the impact generated by crowdfunding is limited, since most papers focus on specific techniques to successfully raise capital and the role of crowdfunding as a viable option to avoid financial intermediaries. Yet, interesting aspects of crowdfunding have been studied by various scholars, including their ability to foster investments in specific sectors and industries.

Signal of a green commitment

Crowdfunding campaigns are good communication tools for companies, especially those in B-to-C sectors. Using a sample of 345 initial offerings on UK platforms, Vismara (2018) showed that although sustainability orientation does not increase the chance of attracting capital from professional capital providers, it helps to mobilise a higher number of individual investors.

Service of undersupplied markets

Startups are famously limited in their capability to get funding from banks because of the lack of credit history and assets and they cannot tap financial markets. Thus, crowdfunding offers a key

option to directly finance green businesses and projects that otherwise would have faced difficulties to raise capital

Provision of flexible capital

In startups, project risk and company risk are confused. Thus, raising capital through equity or debt issues on platforms implies a project risk transfer to investors that is crucial for project holders. But the project risk transfer is not specific to green investors met through green platforms.

With donation or reward crowdfunding, the funders provide concessional capital while for debt and equity it is harder to say; empirical studies need to be conducted. Early evidence points in the direction of a potential increase in cost-of-capital for project holders. Gierczak et al. (2017) noted that crowdfunding imposes a high cost of capital on companies, as platforms collect around 5% of the capital raised on average (fees have been reduced ever since) and frequently charge additional fees for providing due diligence for projects, or insurance for project funders.

Furthermore, project owners need to take into account the cost and time necessary for the (video) ‘pitch’, the updates and the day-to-day management of the fundraising campaign (feedback), and the post-investment efforts towards investors (Delivorias, 2017).

Pressure to align

The companies that raise capital through green crowdfunding platforms tend to propose goods and services that are solutions to environmental issues. As such, they probably are already on a scenario-aligned trajectory before raising additional capital.

Through crowdfunding, we can expect the *distance* between entrepreneurs and capital providers to be reduced compared to conventional investments, raising the chance to influence the strategy of businesses. Depending on the type of crowdfunding used, the climate strategy may be affected, but usually only to a limited extent. Donation-based structures or P2P lending do not encompass the involvement of funders in the governance of companies. Voting rights in equity-based crowdfunding may be limited as well, owing to the small tickets and the significant numbers of crowdfunders.

Table 14: impact mechanisms used by green crowdfunding

Signal of a commitment to green energy transition		Service of new/undersupplied markets	Provision of flexible capital	Pressure to align climate strategy with a B2DS
Non-market	Market			

Note: Green cells show that the impact mechanism is clearly actioned by the product, red cells that it is clearly not and orange cells that it is uncertain or conditional to product features. Similar tables will be proposed for other products

2.4 Climate impact potential of green financial products: a summary

The following tables provide a summary of the project and corporate financing solutions considered in the present report, in relation with their ability to support the funding of energy efficiency activities and renewable energy projects and, consequently, their potential to give investors the possibility to have a positive contribution on climate change.

They show that the financial products greatly diverge in their impact mechanisms. The products that operate the most levers simultaneously (green crowdfunding, Energy Performance Contracts, asset-backed green bonds) are the not the ones that have attracted the largest flows of capital so far. Oppositely, the very popular green and sustainability-linked debt instruments fail to be much more than vague signalling devices in their current terms.

Table 15: climate impact potential assessment of project financing solutions

Financial products	Signal of a commitment to green energy transition		Service of new / undersupplied markets	Provision of flexible capital	Pressure to align climate strategy with a B2DS
	Non-market	Market			
Green bonds	Orange	Green	Red	Red	Orange
Green loans	Orange	Red	Red	Red	Red
Asset-backed green bonds	Orange	Orange	Orange	Green	Orange
Environmental impact bonds	Orange	Red	Red	Green	Red
Energy Performance Contracting	Green	Red	Green	Green	Red

Table 16: climate impact potential assessment of corporate financing solutions

Financial products	Signal of a commitment to green energy transition		Service of new / undersupplied markets	Provision of flexible capital	Pressure to align climate strategy with a B2DS
	Non-market	Market			
Sustainability-linked loans	Orange	Orange	Red	Red	Red
Sustainability-linked bonds	Orange	Orange	Red	Red	Red
Low-carbon mutual funds	Green	Green	Red	Red	Red
Green thematic funds	Green	Green	Orange	Orange	Red
Green crowdfunding	Green	Red	Green	Orange	Red

General discussion

In this section, the objective is to discuss transversal issues that concern the impact assessment of the different financial schemes previously presented.

3.1 A required reorientation of research

A first aspect that is common to all financial products previously discussed is that research covering them is mainly focused on the effects of those products on financial metrics relevant for issuers (cost of capital) or investors (financial return). So far, research on the observed outcomes of green financial products at the investee level is particularly limited. Apart from the study of impact mechanisms, we conducted a literature review on product outcomes based on keywords (e.g. carbon emissions, carbon intensity, avoided emissions, climate strategy, carbon footprint, temperature score...) to link financial products to observable climatic outcomes.

We could identify only ten papers dealing with this issue, and more than two-thirds of them focus on one single structure: green bonds (see table summary in appendix 4).

It was particularly obvious for green bonds where the discussion of the “greenium” has captured a lot of attention and fuelled extensive research while the sensitivity of green investments to that premium was almost completely neglected by researchers. If we assume that one pathway to investor impact is through investments that decrease the investees’ cost of capital, then the process involves two steps: i) from investment to cost of capital and ii) from cost of capital to green physical investments. So far research is mobilized to test the first step only. A more balanced split of research work across the two steps would be profitable.

Accordingly, **we advocate for a clear reorientation of sustainable finance research in direction of the study of the impact of green financial products, at micro (the behaviour of issuers) and macro (the path of collective carbon emissions) levels.**

The two levels are both necessary since we can take a narrow or broad view on additionality. Indeed, “green” financial products may be used by an issuer/investor to signal its commitment to issues related to climate change, even though the financial schemes used have no significant impact by themselves.

For instance, empirical data could obtain that the same issuer would have get financed through other means without any difficulty or that there was no change in its climate strategy after issuing the green security. But the choice of a green structure participates to entrench its commitment to green transition as well as its climate strategy. Bundled with other signals, such a decision could finally transform behaviours of other stakeholders (especially competitors).

Other valuable research would analyse the financing needs of RE and EE solution providers or users and their current blockers. Which frictions in current financing solutions limit the most their investments? Is it the cost of capital, the technology or political risk, the maturity mismatch between financing solutions and green projects, etc.? Financing barriers should be properly understood, especially in new and undersupplied markets. For that purpose, **surveys and interviews seem to be relevant tools.**

3.2 Measuring product impact: an impossible task?

Measuring the actual impact of financial products is most probably impossible as it implies a counterfactual scenario (i.e. what would have happened if the product had not been created or used) that cannot be known.

Observing that issuers that use those green financial products tend to decarbonize their business models faster than other issuers (as observed for green bonds) does not prove causality nor additionality. The same outcome might have happened without the green products, for instance if those green financial products are used by companies that are particularly highly committed to the green transition (whatever the financial solutions at their disposal).

To isolate the effect of financial products on GHG emission reductions, we need an experimental context where actual green issuers are compared to a control group made of companies similar in all features (including the commitment to the green transition to avoid a selection bias) that would have no access to the green product.

Such a controlled experiment cannot be run in real-life. As a consequence, impact research can only go for second-best options. Such a conclusion has been reached by another 2DII report focusing on the (investor) impact of financial institutions (2DII, 2021b). For investor impact, the recommended strategy was to measure outcomes on investees and simultaneously assess investor contributions using the investor impact taxonomy proposed by IMP.

In accordance, we can think of two different second-best research strategies on product impact. The first is to assess and discuss product impact potential on logical ground by observing whether the structures use relevant impact mechanisms, as we did in this report. The logical evaluation would benefit being supported by empirical analysis. For instance, researchers could question the yield premium on all types of green financial products vs conventional financing means following what has already been abundantly done for green bonds. They could also check whether there is addition or substitution between green financial products and conventional products via econometric models (e.g. green bonds vs conventional bonds).

But research can also take another (second-best) pathway. Researchers could compile empirical indirect (and imperfect) evidence of impact. It means testing whether the adoption of green financial innovations has so far been matched with real improvements by investees in their transition to greener business models by observing different relevant outcome metrics, namely the longitudinal (across time) and relative (vs peers) change in climate strategy, green investments, carbon intensity, total GHG emissions, alignment scores with a B2DS, etc.

The econometric approach known as the difference-in-difference method seems to be an appropriate tool to evaluate the improvements at the investee level. The idea is to compare the difference in climate-relevant outcomes between users (the treatment group) and non-users (the control group) of green financial products before and after the adoption of green financial products by the first group. The difference-in-difference is a quasi-experimental technique that measures the causal effect of some non-random intervention. It is commonly used in many branches of economics, to test the effectiveness of various policy interventions (e.g. see Stock and Watson (2011)).

Therefore, **we call for two different streams of impact research on green and sustainable financial products: a “discussion of impact potential” stream and an “indirect evidence for impact” stream.**

3.3 Impact, scenario-alignment and decarbonization strategies

It is important to note that correlational studies that search for a relation between the use of green financial solutions and companies' GHG emissions or carbon intensity cannot be considered in isolation as a gold standard for product impact or investor impact research. They are surely informative, but they are not conclusive.

First, as we already said, correlation does not mean causality, nor additionality. The reduction in carbon emissions or intensity might have occurred without the recourse to the green financial products. The improvement might be the only reflection of an increased awareness of the need to transition fast by some corporate managements, not a consequence of the availability and use of the green financial products.

Even more, **green product overlap could become a new concern** as use-of-proceeds and KPI-linked structures now plainly coexist. A company could issue a green bond or loan to finance new green investments and a sustainability-linked instrument based on targets achieved thanks to the green investments. The two instruments will complement each other in advancing the communication of the company's sustainable strategy without summing effects on the company's environmental performance. The investors' impact in both structures will be mechanically reduced while it won't be captured by a correlational analysis focusing on one green product only.

Second, impact does not mean scenario-alignment. Investors should not self-congratulate for having a (difficult-to-prove) positive impact on their investees if investees are still below their contribution to the collective switch to a below 2°C trajectory. Oppositely, financing or investing in companies aligned with a B2DS does not ensure the investor has a positive impact on the companies. Impact and scenario-alignment are two different and complementary concepts.

The Climate Transition Finance Handbook published by the ICMA in December 2020 puts a science-based Paris-aligned climate strategy at the heart of its recommendations to issuers of debt instruments with climate transition-related purposes (including use of proceeds and asset-backed green bonds, SLBs and by extension, transition bonds). Such an initiative has the potential to foster a harmonization of issuers' practices that would be highly profitable for investors in search of "scenario-aligned impact".

Third, individual scenario-alignment does not equal individual contribution to collective scenario-alignment. While the assessment of financial products' impact on individual companies' GHG emissions is highly relevant, it does not necessarily guarantee a positive environmental effect at a global scale.

Indeed, the overall climatic consequences are totally different whether a company divests from its most carbon-intensive activities, transforms its business model, decreases its total output or launch specific initiatives and partnerships with relevant stakeholders aimed at strengthening its climate strategy. In the former case, GHG emissions are only displaced from one investor's portfolio to another.

As an example, the giant oil company BP announced its willingness to go for net-zero by 2050 in 2020 and decreased its scope 1 and 2 emissions by 16% in 2020 according to its sustainability report. However, most of the reduction was achieved by divesting from fossil fuel assets, which ownership moved to other operators that may face less scrutiny from investors and stakeholders. Accordingly, BP's divestment potentially frees up capital for "greener" investments and support the achievement of its own environmental objectives, yet GHG emissions at a global level may not have decreased.

Following this example, a company can potentially sell its most carbon-intensive activities to other organisations in order to reach its climate objectives. As a result, the total GHG emissions will not decrease. They might even increase, depending on the strategic orientation of the buyer. Identically, if a company closes down some carbon-intensive activities, its output (and associated carbon emissions) might be taken over by a (more or less climate-concerned) competitor.

If they actually reduce net total emissions, investments in renewable energy and offsetting strategies also have adverse effects in the form of land use. It is important to highlight the fundamental difference between net zero emissions for the planet or for a single corporation. It is not certain that a climate-neutral company corresponds to what it should look like to achieve net zero emissions worldwide. Indeed, carbon sinks and land are limited in a closed system like planet Earth.

Finally, the use of the carbon intensity metric to assess the transition path of an investee can be highly misleading since a firm might improve such a metric by investing more into activities that are the least carbon-intensive within its portfolio. That apparent decarbonization strategy would actually lead to an increase in net total emissions at both individual and collective levels.

In summary, the assessment should go beyond the micro-level environmental impact on borrowers and investees, and also encompass the effects at a macro level. Research should then be conducted on the decarbonisation plans of companies and organisations.

A relevant impact research would then **analyse the link between the use of green financial structures and the adoption by investees of decarbonization strategies aligned with a B2DS (at a macro level).**

For impact-aware investors, the practical consequence is to assess their investments in financial products across two dimensions, as shown in table 18:

Table 18: the impact / scenario-alignment investment matrix

		The investment in the financial product contributes to an investee’s climate strategy aligned with a B2DS at micro AND macro levels	
		YES	NO
The investor improves his/her own impact through his/her investment in the financial product	YES		
	NO		

3.4 Leveraging impact

If all products studied have in common to be signalling devices of a commitment to the green transition or to sustainability in general, some of them need adjustments in their structures to reach their full potential to shift our economies to a B2DS and strengthen their capacity to contribute to the financing of activities in the clean energy sector.

We do not argue here that environmental financial products and mechanisms should “tick all the boxes” of the proposed *Climate Impact Potential Assessment Grid* to prove they have a real impact on the energy transition. Yet, they should go way beyond the signalling of a superficial commitment to the green transition, or a mere association with green companies, especially if environmental contribution is claimed by financial institutions.

A major adjustment is to **open the most popular green structures** (especially green bonds) to the segments that need the most an increased and eased access to capital to engage into small-scale RE and EE projects, especially households, small municipalities and SMEs. There is a clear need to bring smaller and risky projects to the green market.

This can be done by **pooling risk through securitisation** (i.e. issuing green “asset backed securities” to finance a pool of small low-carbon projects). Securitization is the transformation of illiquid assets (typically loans) into liquid assets. In practice, securitization moves assets off-the balance sheet of lending institutions together with their underlying risks. Securitization provides access to debt markets to small-scale actors previously excluded from them. This market widening both improves the access to capital and, potentially, lowers the cost of capital, in particular when comparing with usual bank lending (Kidney et al. 2017).

Green securitization has a huge potential (green ABS issuance on all segments could amount to 280 to 380 billion dollars a year in the period 2031-2035; OECD, 2017), as a multitude of green assets could apply as collaterals: mortgages on certified buildings or for energy efficiency home retrofits; loans/leases on electric vehicles or EV charging stations; loans/leases on solar or wind assets; loans to green SMEs; Energy Performance Contracts, etc.

Green securitization aggregates micro projects into instruments of a critical size to qualify for acquisition by institutional investors who are constantly on a frantic search for green finance opportunities. As such, green securitization would contribute to solve the most urgent problem with green finance: the lack of green assets to be invested in by green institutional investors. It would also help the European Central Bank to deploy a green quantitative easing by providing highly liquid tradable securities covering a large number of sectors.

Unfortunately, green securitization suffers from the reminiscence of the subprime crisis. And it is perceived by market players as riskier because of the lack of credit rating history (Petit and Schlosser, 2020), without available data on default rates and loss given default for the new green asset classes. It means that the new securities would most probably not reach the AAA/AA/BBB tranches preferred by institutional investors, at least not in their first issuances.

To confront market timidity, the EU and Member States could encourage securitization by providing tax incentives or public guarantees to this type of structures. The use of green loans as collaterals would also require to create public or subsidized services to help small-scale borrowers to finance the extra costs associated to verification and reporting.

In the same vein, green crowdfunding could be scaled-up by the introduction of mutual funds specialized in investing in small-scale projects through platforms. Those funds would provide diversification benefits and act as **risk management tools for crowd investors**. They could be financially supported by public agencies to account for the extra-costs associated to micro due diligence.

Another required adjustment is to **reduce informational gaps** regarding the different green financial solutions among potential project developers and investors. Some promising structures like Environmental Impact Bonds, Energy Performance Contracting or green crowdfunding are still massively unknown by their potential beneficiaries. Public campaigns to raise the awareness of those solutions seem essential.

Conclusion

This report has analysed various encouraging financing options that are expected to help financial markets contribute more to the financing of the energy transition and close the different funding gaps.

Those different structures are complementary rather than competing since they serve different types of investors (regarding their risk preferences, return expectations and investment horizons) and investees (according to their capability to raise capital through conventional means and to hold the project risk).

In follow-up work, we plan to extend the Climate Impact Potential Assessment Grid to new solutions (infrastructure funds, transition bonds, micro-loans, blended finance, white certificates, etc.) and to push it to a higher level, for instance by developing a Financial Product Carbon Impact Score that would be supported by (hopefully growing) empirical evidence of the efficiency of the different impact mechanisms and the actual positive outcomes on funded organisations⁶. Such a score would be particularly helpful for investors to identify within the multitude of green financial innovations which ones really serve the green transition cause.

Even if the financial innovations exposed in the report are private initiatives by the financial sector designed for private investors, their success to address the energy transition funding gaps will depend on an adequate and multiform institutional support by public authorities (through labels, tax incentives, subventions, guarantees...). Product impact is not set in stone. Instead, it is fundamentally policy dependent.

⁶ In France, 2DII participates in a working group gathering financial institutions and NGOs to develop a scale to assess the potential of mutual funds to contribute to the sustainable transition (beyond the sole impact on carbon emissions).

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Appendix

Appendix 1: Renewable energy investments⁷ and total installed capacity⁸ in EU-27, 2015-2019

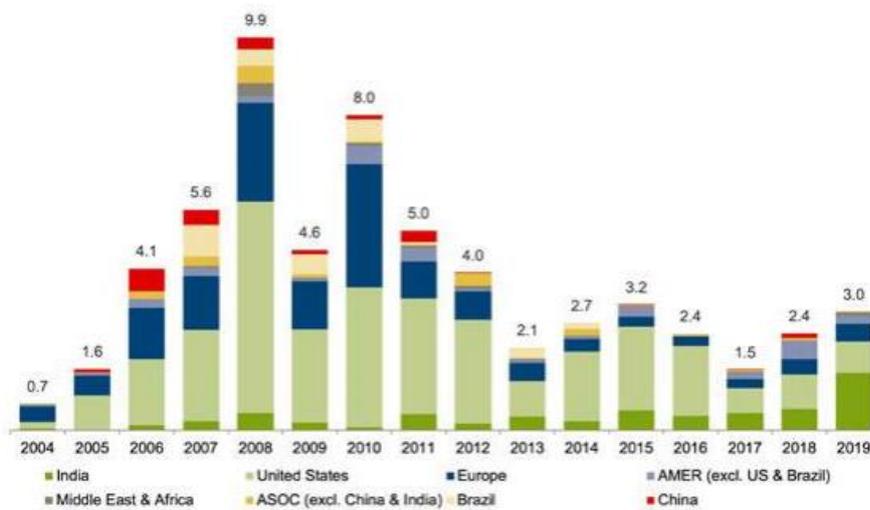
Energy	2015	2016	2017	2018	2019
Solar (PV & thermal) (USD bn)	15.8	10.2	10.8	19.2	24.6
Solar PV (MW)	85,371	89,104	93,013	101,586	
Wind (onshore & offshore) (USD bn)	28.4	43.8	28	36.7	26.4
Wind (MW)	127,171	137,998	148,930	157,292	
Hydro (USD bn)	0.1	0.1	0	0.1	0
Hydro (MW)	148,311	149,838	150,483	150,826	
Biomass (USD bn)	2.5	4.2	1	3.2	3.1
Biomass (MT)	20,500	21,950	22,860	23,350	24,000
Geothermal (USD bn)	1.2	0.8	0.2	0.6	0.5
Geothermal (MW)	839	841	848	862	
Biofuels (USD bn)	0.7	0.6	0.6	0.6	0
Biofuels (mil. litres)	33,853	33,401	32,769	33,549	35,319
Marine (USD bn)	0.1	0.1	0.1	0	0
Marine (MW)	223	225	224	223	

Source: Authors' elaboration based on Frankfurt School et al. (2020)

⁷ Source: Global Trends in Renewable Energy Investments (UNEP, Frankfurt School, BNEF)

⁸ For power generation only (source: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Electricity_and_heat_statistics#Installed_electrical_capacity)

Appendix 2: VC/PE new investment in renewable energy by region (\$ bn)



Buy-outs are not included as new investment. Total values include estimates for undisclosed deals.
 Source: UNEP, Frankfurt School-UNEP Centre, BloombergNEF

Appendix 3: alternative finance volume by model in Europe (excluding UK), in USD

	2020	2019	2018	2017	2016	2015
P2P/Marketplace Consumer Lending	\$2901m	\$4183m	\$2889m	\$1570m	\$771m	\$406m
Invoice Trading	\$2016m	\$1809m	\$803m	\$604m	\$279m	\$89m
P2P/Marketplace Business Lending	\$1844m	\$1481m	\$997m	\$526m	\$388m	\$235m
Real Estate Crowdfunding	\$822m	\$733m	\$600m	\$292m	\$121m	\$30m
Balance Sheet Consumer Lending	\$657m	\$608m	\$100m	\$3m	\$19m	\$0m
P2P/Marketplace Property Lending	\$500m	\$375m	\$145m	\$75m	\$105m	\$0m
Donation-based Crowdfunding	\$296m	\$112m	\$62m	\$107m	\$65m	\$3m
Equity-based Crowdfunding	\$280m	\$224m	\$278m	\$238m	\$242m	\$177m
Reward-based Crowdfunding	\$262m	\$195m	\$175m	\$179m	\$211m	\$155m
Debt-based Securities	\$130m	\$112m	\$168m	\$85m	\$25m	\$12m
Balance Sheet Business Lending	\$105m	\$33m	\$81m	\$24m	\$0m	\$0m
Consumer Purchase Finance/BNPL	\$57m	\$80m				
Revenue/Profit Sharing	\$26m	\$11m	\$4m	\$2m	\$9m	\$1m
Crowd-led Microfinance	\$18m	\$22m				
Mini Bonds	\$14m	\$6m	\$43m	\$60m	\$36m	\$24m
Balance Sheet Property Lending	\$10m	\$2250m	\$1378m	\$0m	\$0m	\$0m
Other	\$3m	\$0m	\$6m	\$33m	\$11m	\$0m
Community Shares	\$0m	\$0m	\$2m	\$0m	\$0m	\$0m
Total	\$9941m	\$12233m	\$7731m	\$3799m	\$2283m	\$1132m

Source: The Global Alternative Finance Market Benchmarking Report 2021

Appendix 4: Studies on the real-life outcomes of green financial solutions

Financial solutions	Study	Zone	Sector	Evaluation method	KPI	Effect on KPIs
Green Bond	Flammer (2021)	World	All	Quantitative comparison (change)	Carbon emission	Positive
					Environmental rating	Positive
	Maltais & Nykvist (2020)	Sweden	All	Interview	Ratio of green-to-brown investments	Null
					Climate targets	Positive
	Gibon et al. (2020)	Europe	Renewable energy	Quantitative comparison (level)	Carbon emissions	Positive
	Fatica and Panzica (2020)	World	All	Quantitative comparison (change)	Carbon intensity (book value)	Positive
	Fatica et al. (2021)	Europe	Banks	Econometric modelling	Lending to carbon-intensive sectors (as lead bank)	Positive
					Lending to carbon-intensive sectors (as participant bank)	Null
	Ehlers et al. (2020)	World	All	Quantitative comparison (level)	Carbon intensity (revenues)	Null
			Industry / real estate	Quantitative comparison (change)		Positive
			Utilities	Quantitative comparison (change)		Negative
	2DII (2018)	World	Power	Quantitative comparison (level)	Share of renewables	Null
					Share of hydro	Positive
				Quantitative comparison (change)	Share of renewables	Null

	Schmittmann and Chua (2021)	World	All		Share of hydro	Positive
				Quantitative comparison (level)	Carbon intensity (revenues)	Positive
				Quantitative comparison (level)	Carbon intensity (assets)	Positive
				Quantitative comparison (change)	Carbon intensity (revenues)	Positive
				Quantitative comparison (change)	Carbon intensity (assets)	Positive
Green loans	Schmittmann and Chua (2021)	World	All	Quantitative comparison (level)	Carbon intensity (revenues)	Null
				Quantitative comparison (level)	Carbon intensity (assets)	Null
				Quantitative comparison (change)	Carbon intensity (revenues)	Positive
				Quantitative comparison (change)	Carbon intensity (assets)	Positive
Sustainability-linked loans	Schmittmann and Chua (2021)	World	All	Quantitative comparison (level)	Carbon intensity (revenues)	Null
				Quantitative comparison (level)	Carbon intensity (assets)	Null
				Quantitative comparison (change)	Carbon intensity (revenues)	Positive
				Quantitative comparison (change)	Carbon intensity (assets)	Positive
Green mutual funds	De Angelis et al. (2021)	US	All	Econometric modelling	Carbon intensity (revenues)	Positive
Green crowdfunding	Adhami et al. (2017)	Europe	Renewable energy	Econometric modelling	Environmental Performance Index (regional district)	Positive (money raised) / Null (# of campaigns)