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Tracking finance flows towards assessing their consistency with climate objectives

PROPOSED SCOPE, KNOWNS AND UNKNOWNS

Raphaël Jachnik, Mariana Mirabile, Alexander Dobrinevski

Research Collaborative
Tracking Private Climate Finance

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By Raphaël Jachnik, Mariana Mirabile, Alexander Dobrinevski (1)

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Abstract

Achieving a low-greenhouse gas (GHG) development requires making finance flows consistent with this objective. In order to measure progress to date as well as inform future public action in this area, this paper calls for further efforts to track gross primary investments flows in new infrastructure and equipment and the refurbishment of such assets, as well underlying sources of finance. The proposed scope focuses on tangible fixed assets with a direct and significant impact on GHG emissions. It complements existing finance tracking initiatives, which mostly cover secondary transactions relating to stocks of publicly-traded financial assets (equities and bonds). Tracking investments and sources of finance and assessing their consistency with climate mitigation objectives require the availability of comprehensive and granular data. This is currently only the case for a very small sub-set of the targeted scope: project finance schemes and international development finance, which represent less than 2% of gross-fixed capital formation (GFCF). As a first step to better cover the targeted scope, countries could undertake pilot studies on an ad-hoc basis, making use of a range of official, commercial and country-specific data sources as well as estimation methodologies. Such pilots may inform both domestic policy action as well as the future design of international-level indicators of progress. While the focus is here on climate mitigation, resilience is an essential component for achieving climate objectives, and requires complementary tracking efforts.

Résumé

La réalisation d'un développement à faible émission de gaz à effet de serre (GES) nécessite de rendre les flux financiers compatibles avec cet objectif. Afin de mesurer les progrès à ce jour et d'informer l'action publique future dans ce domaine, ce rapport appelle à des efforts supplémentaires pour mesurer les flux d'investissements dans les nouvelles infrastructures et nouveaux équipements et la rénovation de ce type d'actifs, ainsi que les sources de financement sous-jacentes. Le périmètre proposé se concentre sur les actifs corporels immobilisés ayant un impact direct et significatif sur les émissions de GES. Il est complémentaire aux efforts en cours sur le suivi de la finance qui se concentrent principalement sur les transactions secondaires liées aux stocks d'actifs financiers (actions et obligations) sur les marchés financiers. La mesure des investissements et sources de financement ainsi que l'évaluation de leur compatibilité avec les objectifs d'atténuations nécessitent la disponibilité de données exhaustives et granulaires. Ce n'est actuellement le cas que pour un très petit sous-ensemble du périmètre visé : les mécanismes de financement de projet et la finance de développement internationale, qui représentent moins de 2% de la formation brute de capital fixe (FBCF). Afin de mieux couvrir le périmètre visé, les pays pourraient, dans un premier temps, entreprendre des études pilotes se basant sur un éventail de sources officielles, commerciales et spécifiques au pays, ainsi que sur des méthodes d'estimations. De telles études pilotes pourraient informer l'action publique nationale ainsi que la mise en place d'indicateurs de progrès à un niveau international. Bien que l'accent soit ici mis sur l'atténuation, la résilience est un élément essentiel dans la réalisation des objectifs climatiques, et nécessite des efforts de mesure complémentaires.

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Acknowledgments

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The paper is a contribution to the body of work of the Research Collaborative on Tracking Private Climate Finance. The Research Collaborative is a technical research network and platform to advance and share knowledge for improving the tracking of climate-relevant private finance in particular towards addressing and informing finance-related discussions under the UNFCCC. This is done on the basis of dedicated work by Research Collaborative staff as well as through joint initiatives and co-operation with other parts of the OECD, external analytical partners, financial institutions, and countries.

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Executive summary

Most activities undertaken by households, companies, and governments involve financial transactions. Hence, as called for in Article 2.1c of the Paris Agreement, meeting climate objectives requires "*making finance flows consistent with a pathway towards low greenhouse gas emissions* (GHG) *and climate-resilient development*". Doing so implies implementing and monitoring public actions and privately-led initiatives that have an effect on investment and financing patterns and decisions.

In contrast to only looking at investments for activities that contribute to climate objectives, measuring progress towards Article 2.1c also requires tracking activities that undermine or do not impact these objectives, which goes beyond what is currently done under the UNFCCC. Further, while estimates of climate finance (domestic or international) are often aggregated to a headline number, the consistency of investment and finance flows may be assessed through a series of indicators e.g. for different sectors, financial instruments, asset classes, types of investors or financers.

In this context, the objective of this paper is to suggest a scope for further finance tracking in relation to Article 2.1c and to assess corresponding data availability. The emphasis is on activities with direct climate impacts, focusing on information that may be most useful to inform both the design of indicators of progress and public action. The aim is also to complement existing finance tracking efforts, which typically focus on secondary investments in and stocks of publicly-traded financial assets (equities and bonds), often to raise awareness of the climate impacts and risks associated with investors' allocation decisions. Such analyses may result in behavioural changes that can indirectly support climate action and are, therefore, important elements for measuring the overall consistency of the financial system with climate objectives.

The proposed scope for further tracking efforts focuses on gross primary investment in new infrastructure and equipment (tangible fixed assets in national accounts terms) and the refurbishment of such assets, as well the underlying sources of finance. The rationale for this proposal is that:

- The production and use of infrastructure and equipment account for a very large share of future GHG emissions;
- The year-on-year tracking of gross flows (rather than stocks or net flows) provides critical information for analysing the total value of investments;
- Tracking sources of finance can inform consistency assessments for specific finance providers and instruments, and subsequent design of targeted policy action.

While the focus is here on climate mitigation, resilience is essential for achieving Article 2.1c. It, however, requires a complementary tracking effort to address specific data and methodological challenges. For instance, the mainstreaming of resilience into investments and business decisions makes it difficult to identify relevant activities within datasets. Adaptation activities are also project- and location-specific as they respond to local climate vulnerabilities. This means that defining a meaningful, standardised list of adaptation activities is not possible.

A general challenge to tracking the consistency of finance with climate objectives is the absence of internationally-agreed approaches for classifying activities as contributing to, undermining, or having no impact on such objectives. It is outside the scope of this paper

to propose such classification, especially as there are a number of existing initiatives to do so. The paper, however, highlights that tracking needs to be conducted at a level of disaggregation (ideally individual activities, at least sub-sectors) that will allow to apply available working definitions, criteria and classifications.

There are limitations associated with the proposed scope. It does not capture operational expenditures, which leads to underestimating finance flows and may bias results since the distribution of capital and operational costs is uneven across sectors and technologies. Further, investments in intangible assets (intellectual property products in national accounts terms) and household consumption of non-durable goods and services also have an impact on climate objectives. Finally, tracking investments alone does not address the fact that a given investment volume will have different outcomes depending on technology costs and contexts. Over time, the scope of tracking could be expanded to address these elements.

There are, however, already significant data gaps to overcome before being able to comprehensively cover the initial scope proposed:

- Gross fixed capital formation (GFCF) can be considered as an approximate benchmark for the order of magnitude of investment flows to be tracked (though GFCF also covers intangible assets, which represents 1% to 30% of the total depending on the country, but excludes a large share of household spending on equipment). In 2016, GFCF flows in OECD countries and major non-OECD economies accounted for about USD 21 trillion. However, the usefulness of official statistics on GFCF is limited due to the level of aggregation of publicly-available data (no sub-sector break downs) and lack of links to sources of finance.
- Alternative data sources and analytical initiatives each provide relevant parts of the desired scope. But their coverage is often limited to a specific sector and geography, type of investment flow, asset, or actor. When it comes to tracking sources of financing that underpin investments, data gaps are even more acute, notably for corporate investments and individual loans from commercial banks.
- Data availability is significantly better for investments in activities that contribute to climate objectives than for investments that do not impact or undermine these. Accessing data about the latter is typically more difficult as investors and finance providers have no incentive to disclose such information on a voluntary basis.
- Based on current data availability, it is only for a very small sub-set of investments in new infrastructure and equipment that sources of finance can be comprehensively tracked and consistency with climate objectives could be assessed: project finance schemes and international development finance, which represent less than 2% of GFCF.

A number of steps can be taken to test and improve data availability as well as tracking frameworks. Countries could first undertake pilot studies on an ad-hoc basis, making use of a range of official, commercial and country-specific data sources as well as estimation methodologies based on e.g. physical capacities or sales data. Such pilots could then go on to compare tracked volumes of investments and financing with those that would be required to meet climate objectives, thereby informing the assessment and design of public action.

In addition, building on country pilots, governmental and research institutions could put together aggregate-level indicators of investments and financing, here again making use of best-available data and estimation methods. Such estimates and indicators could substitute official statistics where adjustments in data collection processes (e.g. disaggregated GFCF data) are either very lengthy or unable to fulfil Article 2.1c-related information needs.

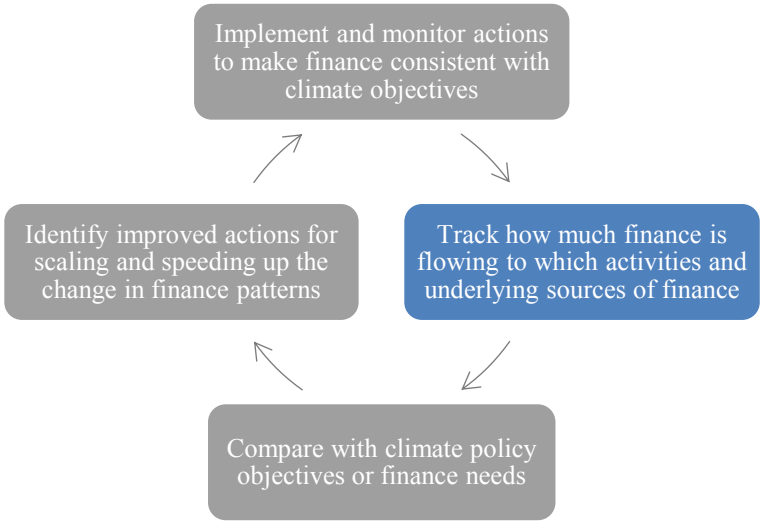
1. Introduction

Parties to the United Nations Framework Convention on Climate Change (UNFCCC) agreed, with the 2015 Paris Agreement, to aims of "*holding the increase in global average temperature to well below 2°C above pre-industrial levels*", (Article 2.1a) and to "*increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience*" (Article 2.1b) (UNFCCC, 2015). The 2018 report from the Intergovernmental Panel on Climate Change (IPCC) stresses both the need to act fast to have a chance of achieving the first objective, as well as the decreasing ability to achieve the second objective should the temperature increase surpass 1.5°C (IPCC, 2018).

Most activities undertaken by households, companies, and governments involve financial transactions in one way or another. Hence, as called for in Article 2.1c of the Paris Agreement, meeting climate objectives requires *"making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development"*, (see Box 1.1). Doing so implies identifying, implementing and monitoring public actions as well as privately-led initiatives for mobilising finance towards activities that contribute to climate objectives, and for shifting finance away from activities that undermine these objectives. There are a number of frameworks being developed to scope and monitor such actions and initiatives e.g. (OECD/The World Bank/UN Environment, 2018), (ODI/WRI/RMI/E3G, 2018)) and (Climate Transparency, 2018).

Estimates of how much is invested in which activities, as well as of who the main underlying financers are, is a necessary input for measuring progress towards the aims of Article 2.1c. It is further needed to assess whether existing public actions and privately-led initiatives are having the desired effects on finance and at what scale, compared to climate policy objectives and related investment needs. As illustrated in Figure 1.1, this in turn is critical to inform improved or new actions and initiatives towards scaling and speeding up the desired shift in financing patterns.

Figure 1.1. Schematic view of Article 2.1c-related analytical needs



Source: Authors.

In this context, the objective of this paper is to suggest a possible scope of Article 2.1-related tracking of "finance flows" with a focus on what may be most useful to inform public action for making finance consistent with climate objectives, while trying to avoid duplication with on-going tracking initiatives. To this end, the paper clarifies a number of key finance-related concepts (e.g. stocks versus flows), and maps the extent to which existing data sources and analytical initiatives address the proposed scope of tracking. The outcome of this analysis is intended to help identify priority areas for further finance tracking efforts by countries, researchers as well as producers of primary and secondary data (both public and private, including investors and finance providers themselves).

It is important to note that assessing the consistency of investments and financing (observed through tracking) with climate policy objectives, eventually requires classifying activities as contributing to, undermining or not impacting such objectives. Defining criteria for doing so is a complex endeavour that has to take into account changing technological specifications and abilities as well as dynamic policy pathways, in the context of which activities are implemented. Tackling this issue is outside the scope this paper, which rather focuses on scoping and identifying investment- and financing-related data needs in order to then apply available classifications of activities (see Section 2. for more on this).

The paper is structured as follows:

- Section 2 outlines the main differences and common challenges between (only) tracking finance that contributes to climate objectives and (more broadly) tracking finance in the context of Article 2.1c.
- Section 3 explains the rationale for the proposed scope for further Article 2.1c-related finance tracking efforts, as well as its limitations, based on discussing key concepts that underpin any finance tracking work.
- Section 4 maps current data availability for the proposed scope of tracking.
- Sections 5 and 6 conclude and suggest possible next steps.
- Finally, an Annex provides a more comprehensive overview of all data sources and analytical initiatives reviewed while preparing this paper.

While the focus is here placed on climate mitigation, resilience is essential for achieving Article 2.1c. However, measuring the consistency of financial flows with climate-resilient development involves specific data gaps and methodological challenges. The mainstreaming of resilience into investments and business decisions (Averchenkova, Crick, Kocornik-Mina, Leck, & Surminski, 2015), (Agrawala, et al., 2011)) makes it difficult to identify relevant activities within financial datasets. Adaptation activities are also project and location specific as they respond to specific climate vulnerabilities. This means that defining a meaningful standardised list of adaptation activities is not possible. Tracking investment and financing in relation to climate resilience, therefore, requires a complementary mapping effort.

Box 1.1. Article 2 of the Paris Agreement

1. "This Agreement, in enhancing the implementation of the Convention, including its objective, aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by:

a. Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change;
b. Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production; and
c. Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development.

2. This Agreement will be implemented to reflect equity and the principle of common but differentiated responsibilities and respective capabilities, in the light of different national circumstances."

Source: (UNFCCC, 2015).

2. Tracking Article 2.1c-related and climate finance: differences and common challenges

Information about the extent to which finance flows (past and present) are consistent with climate objectives is needed in the short term to inform rapid changes in public policy that will, in turn, trigger shifts in future investment and financing patterns. Under the UNFCCC, information on progress towards Article 2.1c is one of the elements that can inform the first Global Stocktake in 2023 (as well as the following ones), which will assess collective progress towards achieving the purpose and long-term goals of the Paris Agreement.

Article 2.1c implies tracking finance more broadly than currently done under the UNFCCC. Finance-related reporting requirements for Parties to the Convention focus on finance in support of climate mitigation and adaptation activities (understood by the international community as "climate finance"), with a focus on developing countries. This is particularly relevant in the context of the commitment made by developed countries to mobilise USD 100 billion annually by 2020 for climate action in developing countries from a "*wide variety of sources, public and private, bilateral and multilateral, including alternative sources of finance*" (UNFCCC, 2009). However, climate finance can be tracked in all geographical contexts, whether domestic or cross border between any countries.

Building on a number of complementary data sources, the UNFCCC *Biennial Assessment and Overview of Climate Finance Flows* prepared by the Standing Committee on Finance (SCF) presents an as comprehensive as possible global picture of climate finance ((UNFCCC, 2018 Biennial Assessment and Overview of Climate Finance Flows, 2018), (UNFCCC, 2016 Biennial Assessment and Overview of Climate Finance Flows Report, 2016), (UNFCCC, 2014)). The scope of the Biennial Assessment is currently limited to tracking activities contributing to a low-GHG and climate-resilient development. It aims to

capture international and national (domestic) as well as public and private finance. In practice, due to UNFCCC context as well as the availability of data sources, it has a strong focus on finance flows from developed to developing countries.

In contrast, as highlighted in Figure 2.1, measuring progress towards Article 2.1c requires looking at the consistency of all finance flows with climate objectives, including finance for activities that undermine or do not impact climate objectives. As such, the scope of tracking finance in relation to Article 2.1c goes beyond the current scope of the Biennial Assessment.

Figure 2.1. Respective scopes of Article 2.1c-related and climate finance tracking

<table>
<tr><td rowspan="4">Scope of climate finance tracking</td><td>Finance to activities aimed to contribute to climate objectives</td><td rowspan="4">Scope of Article 2.1c-related finance tracking</td></tr>
<tr><td>Finance to activities with climate-related co-benefits</td></tr>
<tr><td>Finance to activities with no particular climate-related impact</td></tr>
<tr><td>Finance to activities that undermine climate objectives</td></tr>
</table>

Source: Authors.

Further, while estimates of climate finance are typically aggregated to a headline number, whether global ((UNFCCC, 2018 Biennial Assessment and Overview of Climate Finance Flows, 2018), (CPI, Global Landscape of Climate Finance 2017 - Climate investment analysis, 2017)) or from developed to developing countries ((OECD, Climate finance from developed to developing countries: Public flows in 2013-17, 2018), (OECD, 2015)), Article 2.1c does not imply a need for such a single estimate. Tracking finance flows in the context of assessing their consistency with climate objectives can involve a series of parallel estimates for different economic sectors, finance instruments or asset classes, categories of investors or financers, etc. The consistency of finance relating to each of these elements can be assessed without necessarily, in the course of that process, attempting to further aggregate estimates.

There are, however, at least two common challenges to climate finance- and Article 2.1c-related tracking. The first one is limited data availability on finance flows. Limitations related to climate finance have been previously analysed and are summarised by the UNFCCC's Biennial Assessment. Data constraints related to Article 2.1c are discussed in Section 4 and Annex A. Overall, as highlighted by earlier research there is, especially for private finance, a combination of constraints related to confidentiality and difficulties in identifying relevant activities within financial datasets (Caruso & Jachnik, 2014).

The second common challenge is the absence of an internationally-agreed approach for defining activities as contributing to or undermining a low GHG and climate-resilient development, which in turn constrains data collection efforts. Multiple initiatives are working towards defining criteria for classifying activities, some of which aim to specifically shed light on which activities to consider as climate finance (e.g. (Joint-MDB, 2018), (CBI, 2018)), as green (EIB and China Green Finance Committee, 2017), as being consistent with the Paris agreement (e.g. (CICERO, 2016)), or more broadly as sustainable (e.g. (Technical Expert Group on Sustainable Finance, 2019) (European Commission, 2018)).

This paper does not aim at proposing a criteria for activities' classification, but rather focuses on the availability of the information to which any criteria for classification could

be eventually applied. The paper suggests a scope of tracking to observe investments made in the past, which can then be labelled as contributing, undermining or not impacting climate objectives based on e.g. available classifications of activities, forward-looking national mitigation objectives and strategies, as well as sector-specific emission and transition pathways at national and international levels.

To this end, finance flows need to be tracked at the highest possible level of disaggregation. Some systems provide a classification of activities such the International Standard Industrial Classification of All Economic Activities (ISIC), and are designed to compile economic data. As such, they allow to present data at the level of subsectors e.g. coal and solar within the electricity sector, road and rail within the transport sector. Some other systems provide a classification of products (and services) such as the European Union's statistical classification of products (CPA). They are designed to categorise products that have common characteristics and allow to collect statistics on the production, distribution, international trade and consumption of such products.

3. Tracking finance flows: proposed scope

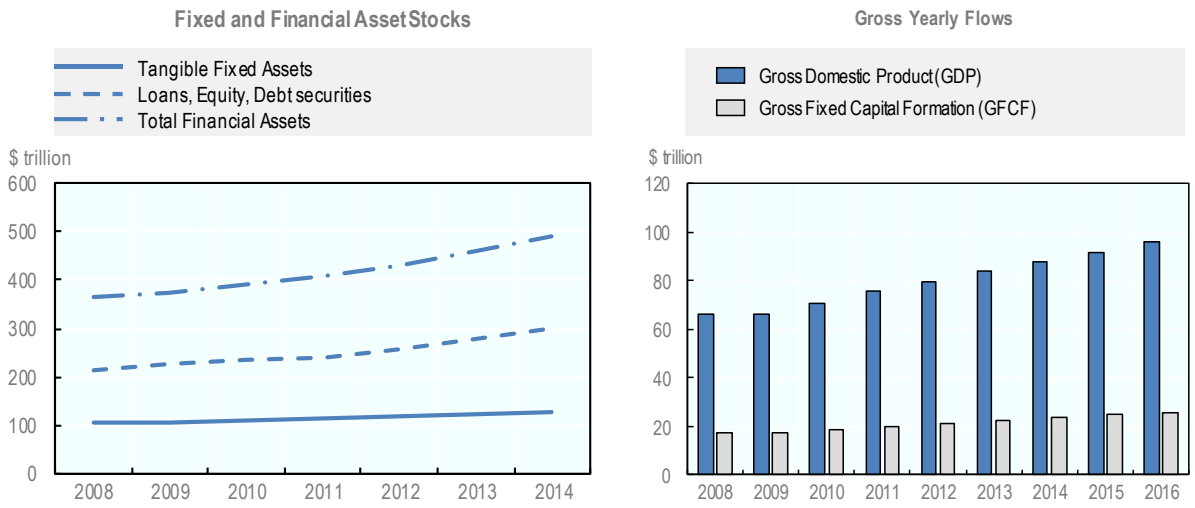
The term "finance flows" referred to in the Article 2.1c of the Paris Agreement is all encompassing and may include any economic transaction. Figure 3.1 plots four metrics relating to the financial markets and the economy: stocks of financial assets and of tangible fixed assets on the one hand, gross domestic product (GDP) and gross fixed capital formation (GFCF) on the other hand.

Financial markets are often cited as a source for financing the transition to a low-GHG and climate-resilient development. More specifically, assets under management by institutional investors are regularly quoted to illustrate that the issue is not a lack of available capital, but rather a lack of projects with attractive-enough risk-return profiles. Stocks of tangible fixed assets are several times smaller than stocks of financial assets, with growing divergence between the two. Loosely speaking, this illustrates the financialisation of the economy, i.e. a significant amount of financial intermediation activity linked, on average, to each tangible fixed asset. In addition, the valuation of financial assets is influenced by secondary markets and their supply and demand dynamics.

GDP and GFCF are widely-used metrics of economic activity. GDP refers to the monetary value of final goods and services produced in an economy, including public services such as defence or education. From the perspective of expenditures, GDP is equal to the sum of all final uses of goods and services (final consumption, exports, and gross capital formation), less the value of imports. GFCF consists of net acquisitions of assets intended for production. It includes both tangible fixed assets and so-called intellectual property products (the latter including, for instance, research and development).[1] As one of the expenditure components of GDP, GFCF is significantly lower than GDP.

[1] According to the System of National Accounts, Tangible fixed assets include Dwellings, Other buildings and structures, Machinery and equipment, Weapons systems, Cultivated biological resources; Intellectual property products include Research and development, Mineral exploration and evaluation, Computer software and databases, Entertainment, literary or artistic originals and Other intellectual property products

Figure 3.1. Differences in orders of magnitude depending on the scope of finance considered



Note: Total financial asset stocks include loans, equity and debt securities outstanding and, in addition: financial derivatives, insurance pension and standardised guarantees, currency and deposits, monetary gold and SDRs and other accounts receivable. Data on stocks of tangible fixed assets and financial assets covers most OECD countries (with the exceptions of Australia, Chile, Iceland, Israel, Mexico, Spain, Switzerland, and Turkey). The coverage of GDP and GFCF includes all OECD member countries as well as Brazil, China, Colombia, Costa Rica, India, Indonesia, Russia and South Africa (more than 75% of world GDP). Amounts are reported in current prices, converted to international dollar with current PPP rates.
Source: System of National Accounts, Table 1, Table 9B and Table 720R (OECD, 1. Gross domestic product, 2018), (OECD, 9B. Balance sheets for non-financial assets, 2018), (OECD, 720R. Financial balance sheets - non consolidated - SNA 2008, 2018). Accessed from OECD.STAT, January 2019.

Specifying which types of economic transactions to include when tracking "finance flows" is a necessary first step to measure progress towards Article 2.1c. For the reasons explained in the next sub-sections, and in particular the need to address activities with a direct climate impact, it is proposed that further tracking efforts in relation to Article 2.1c focus on the following scope: gross primary investment in new infrastructure and equipment[2] (tangible fixed assets in System of National Accounts (SNA) terms) and the refurbishment of existing ones. It is further proposed that both the amounts invested as well as the underlying sources of finance are tracked. Previous studies recognised the relationship between infrastructure investment and GHG emissions (Kennedy & Corfee-Morlot, 2013). Analysing investments in tangible fixed assets is also relevant from a general macroeconomic perspective (for example, infrastructure investment has been linked to long-term economic growth (Gramlich, 1994), (Canning & Pedroni, 2008)).

The proposed scope also makes it possible to complement and avoid duplication with existing tracking and disclosure initiatives. These typically focus on secondary investments in and stocks of publicly-traded financial assets (equities and bonds), often to raise awareness of the climate impacts and risks associated with investors' allocation decisions (e.g. (2degrees-investing, 2017), (TCFD, 2017)). Such analyses may result in behavioural changes that can indirectly support climate action e.g. investors may become more active in their shareholding. Further, secondary investments as well as refinancing play an

[2] Economic transactions relating to equipment are often referred to as investments, but may sometimes be labelled as consumption in official statistics e.g. e.g washing machines are consumer durable for households but an investment for dry cleaning service companies.

important role in freeing up financial resources for new projects. As a result, these elements are, along with the scope of tracking proposed here, necessary components for measuring the overall consistency of the financial system with climate objectives (as for instance argued in (Robins, 2018)).

With this in mind, Sections 3.1 to 3.5 aim to define the respective terms used and explain the rationale for, as well as the limitations of, the proposed scope. To this end, the section is structured according to the following five questions:

- Why tangible fixed assets rather than intangible or financial assets?
- Why primary investments rather than secondary transactions?
- Why investment flows rather than stocks?
- Why gross flows rather than net flows?
- Why track both investment flows and underlying sources of finance?

3.1. Why tangible fixed assets rather than intangible or financial assets?

A large share of current and future emissions is embedded in the use of existing and new tangible fixed assets, primarily infrastructure and equipment.

Economic transactions can relate to purchases of goods and services, financial assets or non-financial assets. Financial assets include bonds, stocks, as well as savings accounts. Non-financial assets include, as a subset, tangible fixed assets (residential and non-residential infrastructure as well as equipment), which are the focus of the proposed tracking effort. All other categories of non-financial assets are outside of the scope of the proposed tracking effort, such as assets which are not tangible[3] (e.g. software, research and development), inventories, valuables, and natural resources.

Investments in tangible fixed assets are particularly relevant to measure progress towards reducing emissions in both the short- and long-term. While GHG emissions are entwined in most economic transactions, some transactions are more GHG-intensive than others. It is estimated that over 60% of GHG emissions are embedded in the stock and use of infrastructure systems (New Climate Economy, 2016), a sub-set of total tangible fixed assets. Further, many tangible fixed assets have long lifespans. The environmental impact and monetary costs of replacing them before the end of their lifespan imply that future GHG emissions associated with their use are locked in by investment choices made in the past and in the present.

The suggestion to focus efforts on tangible fixed assets does not imply that investments in financial and intangible assets, as well as the consumption of non-durable goods and services do not play a role in a low-GHG transition:

- Investments in intangible assets (intellectual property products in the SNA), as well as the consumption of non-durable goods and services play an important role in reducing emissions. They are further of primary importance for achieving climate change adaptation and increasing resilience. Intellectual property products (which represent 1% to 30% of the GFCF depending on the country) include investments in information technology, and research and development. Information

[3] Assets which are, broadly speaking, intangible, may fall in different categories under the SNA (software is considered an intellectual property product, licenses are considered non-produced non-financial assets). Some of these categories are included in the scope of GFCF according to the SNA and others are not. However, all of them are excluded from the proposed tracking scope which focuses on tangible fixed assets only.

technologies play an increasing important role in influencing the GHG-intensity of economic activities, while research and development provides innovations that underpin future emission pathways. Consumption patterns also play a key role e.g. purchasing and eating less meat can have a significant impact on meat production and thus on both emissions from agriculture and the availability of natural carbon sinks. A fully-comprehensive analysis of the climate consistency of finance flows to the real economy requires looking into both tangible and intangible assets, and the consumption of non-durable goods and services by all economic actors.

- Investments in financial assets, in particular stocks and bonds, are fundamental to influence the decision-making of project owners. The behaviour of investors on financial markets affects the volume and nature of investments in tangible fixed assets. For instance, divestment from fossil-intensive companies has the potential to increase financing costs for these companies and to encourage them to reduce their own investments in new fossil-fuel infrastructure. Active shareholding, on the other hand, may also be a way to influence strategic priorities of companies. Climate-related aspects of investment in financial assets are increasingly researched by academics (e.g. (Battiston, Mandel, Monasterolo, Schütze, & Visentin, 2017)) as well as by other organisations (e.g. (Banktrack, 2017), (2degrees-investing, 2017)). The tracking scope proposed here is complementary to such efforts.

3.2. Why primary investments rather than secondary transactions?

Investments in new infrastructure and equipment and the refurbishment of such assets define future GHG emissions.

Capital expenditures for the creation of new assets from scratch and to the extension or refurbishment of existing ones all contribute significantly to defining future GHG emissions levels and pathways. In the system of national accounts, GFCF includes both investments in new assets, as well as "*major improvements, additions or extensions to fixed assets, both machinery and structures, which improve their performance, increase their capacity or prolong their expected working lives*". Ordinary maintenance and repairs to keep existing fixed assets in good working order are, however, not included in GFCF, as considered as "intermediary consumption" (UN, 2008).

Hence, a limitation associated with a focus on investment (capital expenditures) is the non-coverage of ordinary operational expenditures, while a significant share of GHG emissions is associated with the operation of tangible fixed assets. In terms of finance tracking, this leads to an underestimation of total finance flows relating to these assets. It may further bias results, as the distribution of capital and operational expenditures is uneven across sectors and technologies. For example, solar and gas power plants have a different distribution of costs over time. While construction (capital) represents 83% of the cost of producing one MWh of electricity for solar PV, the share for gas is only 18% (Dressler, Hanappi, & Van Dender, 2018). Estimating past and future operational expenditures would, therefore, be a complementary analytical step.

Capital expenditure results in new tangible fixed assets, or in existing assets being refurbished. On the other hand, secondary transactions (mergers, acquisitions, refinancing, trading of already issued securities, or other financial transactions) result in property (or debt) related to existing assets changing hands. However, the nature of the tangible fixed asset does not change. In the context of measuring progress towards Article 2.1c, which

relates to impacts in terms of climate mitigation and resilience, it is, therefore, particularly relevant to track capital expenditures in tangible fixed assets since these are directly related to the climate impacts of these assets. Where capital expenditures are financed on primary markets through the offering of new securities (e.g. initial public offering of stocks or issuance of bonds), such primary financing transactions provide information on the sources of financial flows into new tangible fixed assets.

Acquisitions and refinancing, on the other hand, create exit opportunities for first round investors and, as such, free up financial resources for further investments in new tangible fixed assets. For instance, the purchase (typically at a premium price) of an operational renewable energy power plant by an equity fund from a project developer will provide the developer with funds to develop and (at least partly) finance further capital expenditures. As such, the tracking of mergers, acquisitions and refinancing is relevant in the context of analysing the range of factors that impact the availability as well as the terms and conditions of finance for investments in new tangible fixed assets, which in turn influences the relative attractiveness of low-GHG and GHG-intensive activities for investor and financiers. Refinancing may, however, fall within the proposed scope of tracking where, together with primary financing, it contributes to the refurbishment of existing assets.

3.3. Why investment flows rather than stocks?

The year-on-year tracking of flows provides critical information for analysing the consistency over time of investments in new assets with climate objectives.

Economic transactions can be analysed by looking at flows and stocks. Flows correspond to monetary transactions within a given period of time. Stocks result from cumulative flows at the end of a given period of time.[4]

Flows and stocks are complementary measures and commonly-used concepts in accounting and statistical systems. Foreign Direct Investment (FDI) statistics, which include both greenfield investments as well as mergers and acquisitions (see Section 3.2), illustrate the usefulness of looking at both side by side. While Germany does not appear in the top ten countries for FDI flows to France in 2016, it is within the top five countries for FDI stocks (OECD, 2018), thereby highlighting a strong relationship between the two economies though mostly based on past FDI flows. Hence, flows appear more useful to analyse recent developments (for FDI, such developments would include for many countries, the increasing share represented by China in terms of inflows) while stocks are more appropriate for structural analyses because they represent accumulation over time.

The text of Article 2.1c itself refers to "flows". Indeed, the regular (most often year-on-year) tracking of past and present flows provides critical information for assessing the consistency of economic transactions with climate objectives. Finance flows result in new physical assets being built and purchased, which, due to their long lifespan (see Section 3.1), define a large portion of future GHG emission levels for decades. In sectors and countries where refurbishment of existing physical assets plays a particularly important role in achieving climate objectives (e.g. the building sector in developed countries), it will, however, be relevant to take as a benchmark the existing stock of tangible fixed assets. This will allow to compare investment flows for the refurbishment of some of the existing assets with the remaining stock of non-refurbished assets.

[4] In the SNA, stocks are defined as "a position in, or holdings of, assets and liabilities at a point in time" (UN, 2008[10])

Stocks of finance themselves also provide useful information in relation to Article 2.1c. Measured at a given point in time, they can for instance shed light on the GHG entanglement and climate vulnerability of portfolios, and thus on the potential for stranded assets[5]. A better understanding of the financial risk represented by the latter may lead to changes in investment patterns on stock and bond markets, which is the rationale for the multiple on-going initiatives launched to improve climate-related risk assessment and disclosure, notably the Task Force on Climate-related Financial Disclosures (TCFD, 2017).

3.4. Why gross flows rather than net flows?

Gross flows allow to identify the total value of investments contributing or undermining climate objectives.

The distinction between gross and net is relevant to analysing any economic transaction. When referring to stocks, the meaning of gross and net typically refers to the value of assets taking into account depreciation (net) or not (gross). In contrast, the difference between gross and net flows relates to whether reflows are accounted for (net) or not (gross).

As an example, official development assistance (ODA) statistics cover both gross and net flows: for instance, gross debt-related ODA is the amount that a donor spends in a given year, which becomes a net measure once repayments of the loans (as well as forgiven or unrecoverable debt) are taken into account. In contrast, international statistics on FDI flows are typically recorded on a net basis i.e. equity and debt transaction debits between direct investors and their foreign affiliates subtracted from equity and debt credits between the same entities. As a result, FDI net flows reported for a given country in a given period may be close to zero, not necessarily due to an absence of transactions, but based on significant volumes of both gross inflows and outflows offsetting each other.

While net flows are a useful measure in certain contexts (e.g. balance of payments, development finance), from the perspective of Article 2.1c it is more relevant to focus on gross flows. Gross flows capture the full value of investments in assets that contribute to or undermine climate objectives. Due to the above-mentioned offsetting mechanism between inflows and outflows, this would not be possible if only looking at net flows.

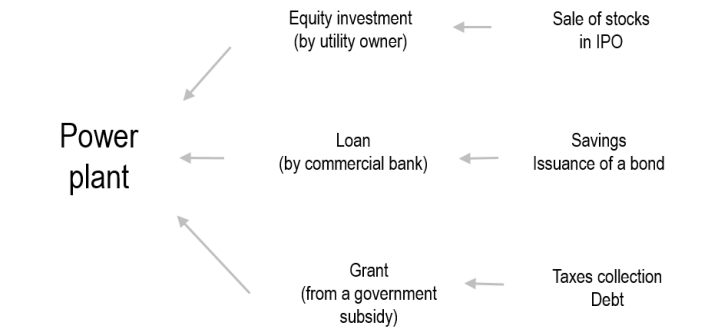
A general limitation associated with tracking investment and finance flows is that they do not make it possible to, on their own, address the fact that a given volume of investment may correspond to different levels of outcomes depending on different and varying costs and prices of technology. For example, unit capital costs for solar photovoltaic projects fell by 15% during the year 2017 alone (IEA, 2018), leading to larger installed electricity production capacity per dollar invested. Also, the average costs of onshore wind installations in 2016-2017 differed by up to a factor of 2-3 depending on the geographic region (IRENA, 2018). These are important elements to qualify estimates of investment and financing flows before drawing policy conclusions and recommendations (see Section 6.

[5] Resources which, at some time prior to the end of their economic life (as assumed at the investment decision point), are no longer able to earn an economic return (i.e. meet the company's internal rate of return), as a result of changes associated with the transition to a low-carbon economy (www.carbontracker.org/terms/stranded-assets).

Box 3.1. The importance of a clear point of measurement

Investments in physical assets are usually financed by a number of different actors. For example, financing the construction of a power plant may include equity by the project owner(s), debt from a commercial bank, and a government subsidy (Figure below). Each actor involved in the financing of the investment relies in turn on a range of upstream sources of financing. The utility company's equity investment may have been financed from retained earnings, the issuance of stocks in an Initial Public Offering (IPO), or a bond issuance. The bank having lent the resources may be both relying on savings of its customers as well as the issuance of a corporate bond to increase its lending capacity. Similarly, the government providing the subsidy typically obtains its resources from household and corporate tax collection as well as borrowing.

Illustrative example of possible points of measurement



Source: Authors.

The example above also goes back to the distinction between primary and secondary financing described in Section 3.2. The ownership of each financier can change over time, through mergers and acquisitions and the trading of stocks in secondary markets. The debt-related portion of project may also be refinanced at different stages. For instance, once the tangible fixed asset is in operation, the utility company may issue bonds and pay back the loan from the commercial bank (having financed the construction stage).

The complexity resulting from the above-described financial intermediation and secondary financing is a challenge for any finance tracking exercise. It can be addressed by defining a clear point of measurement. As per the scope proposed in this paper, the point of measurement is here set at the level of the initial (primary) investment in new tangible fixed assets.

3.5. Why track both investment flows and underlying sources of finance?

Tracking the sources of finance that underpin investments that contribute to or undermine climate objectives is needed to inform the design of targeted policy action.

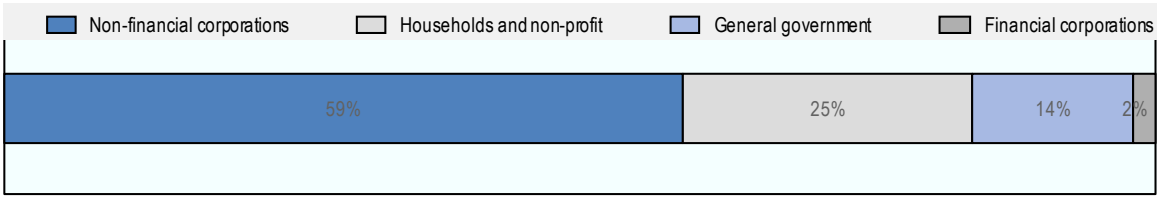
The term investment refers to the total value of the expenditure[6] incurred for building a given tangible fixed asset or purchasing an equipment. The term financing refers to the underlying sources of finance that make such an investment possible.

The SNA classification provides the following grouping and classification of so-called "institutional sectors"[7], which, as illustrated in Figure 3.2, can be used to split GFCF flows by categories of investors (owners of the project):

- Non-financial corporations e.g. utility company;
- Financial institutions ("financial corporations" in the SNA) e.g. banks;
- General government e.g. central and local authorities;
- Non-profit institutions serving households e.g. trade unions; and
- Households.

Figure 3.2 underlines that the majority of investments (as recorded by GFCF) is carried out by non-financial corporations, with households and governments also playing a sizeable role. The share of financial institutions is minimal as they often provide financing to the investor, rather than invest in the physical asset as such. For instance, a household typically invests in a dwelling partly with its own resources based on savings (for this part, investment and financing are one and same process), with the remainder financed by a bank loan (financial institution). In the SNA, the entire amount of the expenditure would be allocated to households. As further detailed in Section 4. and in Annex, most data sources, including GFCF statistics, do not make it possible to systematically track the sources of financing behind investments.

Figure 3.2. Gross fixed capital formation per institutional sector (% total, 2013-2015 average)



Note: Data refers to GFCF in OECD member countries as well as Brazil, China, Colombia, Costa Rica, India, Indonesia, Russia and South Africa.

Source: System of National Accounts, Table 14A and Table 4 (OECD, 2018). Accessed from OECD.STAT, July 2018.

Financing can be provided by both private and public entities through a wide variety of grant, debt-, equity- and guarantee-related instruments.[8] Tracking sources of finance (actors and instruments) is fundamental to understand who finances which activities. This is

[6] The System of National accounts defines expenditures (in goods and services) as "the values of the amounts that buyers pay, or agree to pay, to sellers in exchange for goods or services that sellers provide to them or to other institutional units designated by the buyers (UN, 2008).

[7] An institutional unit is "an economic entity that is capable, in its own right, of owning assets, incurring liabilities and engaging in economic activities and in transactions with other entities."

[8] There are a number of classifications (e.g. for the purpose of the balance of payment, FDI and development finance statistics, ISO 10962), which break down financial instruments in sub- and hybrid categories. Such level of detail may not be required nor particularly relevant to tracking expenditures for capital expenditures in tangible fixed assets.

needed to assess the consistency of financing provided by specific actors and, as outlined in Section 1. , is a necessary input for assessing whether public actions and privately-led initiatives have the desired effects on finance and at what scale. This in turn is critical to inform improved actions and initiatives towards scaling and speeding up the desired shift in financing patterns.

For instance, granular data on debt financing extended by commercial banks' would contribute to an assessment of the current degree of consistency of the banking sector with climate objectives.[9] Such assessment could inform the design of targeted public policies to encourage a shift of banks' financing away from investments in tangible fixed assets that further undermine climate objectives and towards assets that contribute to achieving these objectives.

Guarantees play an important role to help mitigate risks (e.g. of default or in relation to the political context) and as such, in mobilising funds in various contexts (including in developing countries as highlighted in (Benn, Sangaré, & Hos, 2017)). They, however, pose a specific tracking challenge. While providers of guarantees typically value this instrument (e.g. based on a combination of total exposure and probability of the guarantee being called upon), this information is not systematically recorded in official statistics and commercial databases.

4. Mapping data availability for the proposed scope of tracking

This section maps a selection of data sources and analytical initiatives (hereafter "data sources") that fit the scope of tracking proposed in Section 3. : gross investment flows for new infrastructure and equipment and the refurbishment of existing such assets. Annex I provides a more comprehensive overview of data sources reviewed for this exercise, including those that could contribute to Article 2.1c-related finance tracking beyond the scope proposed here.

To inform the proposed scope of tracking, data sources need to cover:

- all countries (ideally allowing country-level analysis);
- flows from all actors or "institutional units" (as defined in Section 3.5);
- both domestic and international flows;
- both infrastructure and equipment; and
- all sectors.

Further, in terms of the level of data disaggregation, data sources should provide:

- information on the underlying sources of finance for the investment at entity level;
- granular-enough information (at least sub-sectors) to make it possible to apply working definitions of activities that respectively contribute to or undermine climate objectives (as discussed in Section 2.).

Table 4.1 illustrates the total volume of finance tracked by each data source considered. It also indicates whether its level of disaggregation allows for analyses of sources of finance and consistency. The table is illustrative, data sources are not comparable due to different scopes and definitions. Among them, information on Gross Fixed Capital Formation

[9] Importantly when analysing financing provided by commercial banks, a difference needs to be made between direct lending and underwriting (see for instance (Banktrack, 2017)). Counting the latter implies significant risks of double counting with other sources of financing.

(GFCF) is the closest to matching the suggested scope of tracking in relation to Article 2.1c. The geographical coverage, even if not global, includes major countries (representing over 70% of global GDP). Flows are collected for all actors (institutional units), and cover investments in both infrastructure and equipment.

The coverage of GFCF is in line with the suggested scope of tracking, noting that GFCF also covers investments in intellectual property products, which represents 1% to 30% of the total depending on the country. The usefulness of GFCF to assess progress towards Article 2.1c is, however, currently limited due to the level of aggregation at which data are collected (see for instance (Fay, Han, Il Lee, Mastruzzi, & Cho, 2019)). GFCF statistics are aggregated at the actor (institutional sector) level and do not provide information on the underlying sources of finance of the investment flows tracked. A second limitation lies in the sectoral classification, which is too aggregated to allow separating out activities that respectively contribute to or undermine climate objectives, e.g. investments in "energy" are recorded without indication on the technology.

As a result of these limitations, and pending possible adjustments to existing measurement frameworks to allow such analyses, it is necessary to look into alternative data sources. A selection of such alternatives are outlined in the next pages. None of these individual sources of data fulfil all the aforementioned conditions to meet Article 2.1c finance tracking needs. Each of them, however, provides a partial picture of the volume of financial activities, sources of finance and/or of consistency with climate objectives.

Table 4.1 summarises the characteristics of data sources and analytical initiatives described above. A number of conclusions can be drawn. The coverage of the data sources analysed is often limited to a specific geographical coverage, type of flow or asset, actor or sector. For most data sources, the level of data disaggregation would not necessarily be sufficient, except for project finance and official development finance. However, both only represent a very small share (less than 2% each) of GFCF.

In terms of geographical coverage and flows, data availability and coverage is better for international finance flows, and in particular between developed and developing countries. The mapping highlights very limited availability of data at a disaggregated level on domestic investments (and underlying sources of financing) as a significant limitation for tracking progress on Article 2.1c. Comprehensive data on investment in a national context are typically only available based on dedicated ad hoc research efforts (see section 6. for possible next steps).

When it comes to the type of tangible fixed assets, data is more widely available for infrastructure than for equipment. Project finance databases provide activity-level data on infrastructure investments and financing but represents a small share of total investments in tangible fixed assets. Finally, sectoral coverage of most data sources focus on tracking finance for activities contributing to climate objectives, with only rarely equivalent data availability and tracking efforts for investments in activities undermining these objectives, thereby hindering consistency analyses.

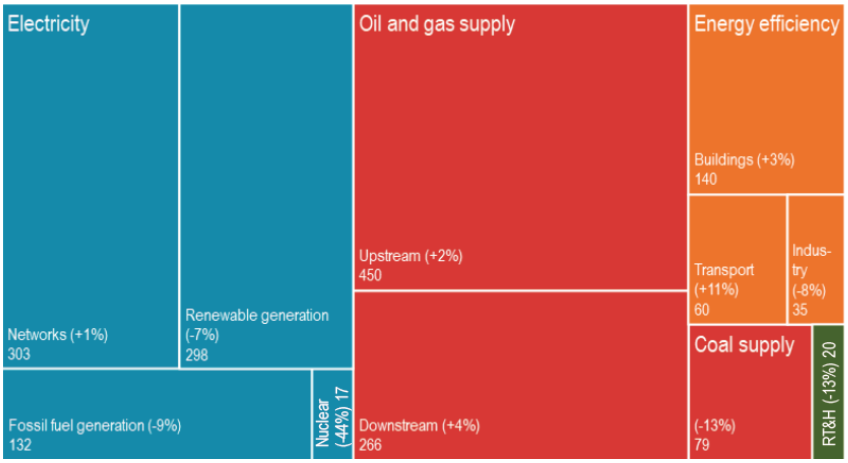
Table 4.1. Sources and initiatives to track investment and financing to new tangible fixed assets

Indicator	Volume (USD trillion)	Reference	Type	Coverage (origin)	Coverage (destination)	Coverage of assets	Coverage of refurbishment	Sectoral coverage	Sources of finance	Level of disaggregation
Gross fixed capital formation	21	OECD	Data source	All contributions to GFCF (domestic and international)	OECD + selected countries*	Infrastructure & equipment	Yes	All	No	Sectors
Energy investments	1.8	IEA	Analytical initiative	Global (international and domestic)	Global	Infrastructure & equipment	Yes	Energy	Partially	Sub-sectors
Climate finance	0.7	UNFCCC	Analytical initiative	Global (international and domestic)	Global	Unclear	Unclear	Contributing to climate objectives	Yes	Sub-sectors
Project finance	0.3	IJ Global	Data source	Global (international and domestic)	Global	Infrastructure	Unclear	All	Yes	Projects
Commercial banks finance to fossil fuel	0.2	BankTrack	Analytical initiative	Major banks (domestic and international)	Global	Infrastructure & equipment	Unclear	Fossil fuel industry	Yes	Sub-sectors
International development finance	0.2	OECD	Data source	Bilateral and multilateral providers (international)	Developing countries	Infrastructure & equipment	Unclear	All	Yes	Projects
Export credits	0.1	OECD	Data source	Members of the export credit group (international)	Global	Infrastructure & equipment	Unclear	All	Yes	Sub-sectors
French domestic climate finance	0.03	I4CE	Analytical initiative	All actors investing in France (domestic and international)	France	Infrastructure & equipment	Yes	Contributing to climate objectives	Yes	Sub-sectors

Note: Amounts are illustrative are not directly comparable to each other due to differences in coverage (geography, years) and definitions. * Brazil, China, Colombia, Costa Rica, India, Indonesia, Russia and South Africa. *Sources*: (OECD, 2018); (IEA, 2018); (UNFCCC, 2018 Biennial Assessment and Overview of Climate Finance Flows, 2018); (IJGlobal, 2018); (Banktrack, 2017); (OECD, 2018); (OECD, 2018); (I4CE, 2018).

The IEA World Energy Investment (WEI) estimates annual investments, mainly by applying unitary costs (per type of asset and per country) to observed new installed capacity in a year (e.g. gigawatts of electricity production capacity, kilometres of pipeline) (IEA, 2018). It provides estimates of energy investments at a level of detail that can provide a basis for a consistency analysis (Figure 4.1). There are, however, limitations in terms of Article 2.1c-related finance tracking. Sectoral coverage is limited to the energy sector. Further, publicly-available data are aggregated at global level rather than provided per country. Finally, being mostly based on a constructed estimate of total investment values rather than on finance flows data, the WEI does not provide information on the sources of finance, except for investments structured as project finance (7% of total energy investments), which are tracked based on the IJ Global commercial project finance database. Combining estimates based on newly installed capacity with investment data based on financial commitments (or announcements) leads to difficulties in terms of methodological consistency.

Figure 4.1. Global energy investment in 2017 (USD billion) and percent change from 2016



Note: RT&H = renewable transport and heat. Networks includes electricity storage.
Source: (IEA, 2018).

The UNFCCC Biennial Assessment and Overview of Climate Finance Flows (BA) (UNFCCC, 2018 Biennial Assessment and Overview of Climate Finance Flows, 2018) provides a global picture of global climate finance based on best-available data. As introduced in Section 2. the Biennial Assessment includes international and domestic as well as public and private finance, building on a number of complementary data sources. Here again, there are limitations in terms of Article 2.1c tracking. While, in theory, estimates include both domestic and international flows, in practice, due to data limitations, the coverage of domestic flows is very limited. Further, the scope of the Biennial Assessment is limited to activities contributing to a low GHG and climate-resilient development, and does not cover finance to activities that undermine climate objectives.

Finally, the information as compiled and presented in the Biennial Assessment does not allow for an analysis of sources of finance.[10]

Commercial databases such as IJGlobal, Thomson ONE and Dealogic, as well as the publicly-available World Bank Private Participation in Infrastructure (PPI) database, provide project-level data on a specific financing mechanism: project finance[11]. Such data typically covers global investment flows towards infrastructure projects for all sectors. It allows to carry out country-specific analyses, assess the sources of finance and can provide a basis for separating out investments in activities that respectively contribute to or undermine climate objectives. As a result, project finance data underpin many finance tracking initiatives. There are, however, limitations in using these data for assessing progress towards Article 2.1c:

- Investments through project finance arrangements only represent a small share of total investments in tangible fixed assets. As indicated in Table 4.1, the volume of finance invested through project finance (assuming a good coverage from data sources) is less than 2% of the volumes of finance tracked under GFCF. According to the IEA, project finance only accounts for about 7% of total investments in tangible fixed assets in the energy sector (IEA, 2018).
- Second, a comparison of investment in activities that respectively contribute to and undermine climate objectives based solely on project finance data may provide biased results as the use of project finance is uneven across sectors and technologies. For instance, incumbent companies in the energy sector, most of which are fossil-intensive, may finance a large share of their investments through corporate (rather than project) financing. In contrast, project finance is very frequently used for renewable energy projects. Thus, an analysis based on project finance data only could overestimate the relative scale of renewable energy compared to fossil fuel-related investments.

A consortium of civil society organisations regularly carries out in-depth research to understand the scale of fossil fuel-related financing provided by commercial banks. For coal, the starting point of the research is a list of the major 120 coal plant developers (provided by Urgewald in their Global Coal Exit List (Urgewald, Global Coal Exist List - New Database Reveals World's Biggest Coal Plant Developers, 2017)), and corresponding corporate groups (56 companies planning to build more than 3 GW of new coal capacity). Data on financial transactions are extracted from commercial databases (Bloomberg, Thomson Reuters Eikon, and IJGlobal) and analysed to identify which commercial banks financed these companies and how i.e. through direct loans or underwriting services allowing companies to issue bonds and shares (Banktrack, 2017). When combined with a similar tracking for renewable energy, this allows for an indicative (partial) comparison of commercial banks' financing for activities that respectively undermine or contribute to climate objectives (Fair Finance Guide International, 2015).

The OECD Development Assistance Committee hosts the most comprehensive data source for international development finance, based on reporting from DAC members (developed

[10] The Climate Policy Initiative's (CPI) Global Landscapes of Climate Finance (CPI, Global Landscape of Climate Finance 2017 - Climate investment analysis, 2017)is another well-known source of climate finance. Data from the CPI Landscape is included in the UNFCCC BA.

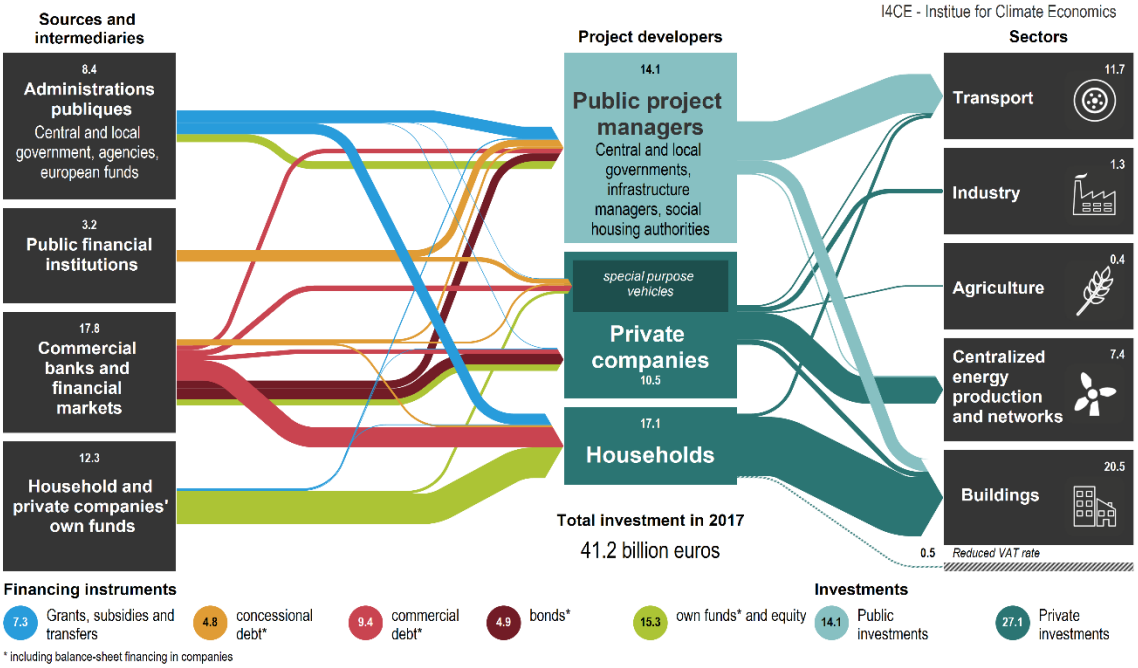
[11] Project finance is a financing mechanism based typically upon a special purpose vehicle, acting as a limited recourse financial structure. Project debt and equity financing a project through project finance are paid back from the cash flow generated by the project itself (OECD, 2015).

countries) and multilateral development banks and funds. DAC data is available at the activity-level. Financing for tangible fixed assets can be identified through DAC sectoral classification. Data allows for consistency analyses through sub-sectoral classifications, as well as through the Rio markers for activities contributing to climate objectives. Analyses of sources of finance are also possible. One major limitation of the DAC data lies on its coverage, which is, by nature, limited to international flows from specific countries and development institutions to developing countries only.

The OECD Export Credit Group (ECG) collects (at activity level) and publishes (at aggregate level) data on export credits extended by its members. Export credits are government financial support (loans, guarantees, insurance or interest rate support) to buyers abroad to purchase goods from national exporters (OECD). On the provider side, the geographical scope is limited to ECG members. All economic sectors are covered, with so-called sector understandings e.g. for Coal-Fired Electricity Generation Projects, for Renewable Energy and Water Projects. In practice, however, commercial confidentiality restrictions prevent access to disaggregated data and, as a result, limits the possibility to conduct analyses of the consistency of export credits with climate objectives.

The Landscape of Climate Finance in France produced each year since 2014 by the Institute for Climate Economics (I4CE) is an example of a country-level in-depth analytical initiative to gather comprehensive information on investments in tangible fixed assets that contribute to domestic climate objectives. I4CE collects data on investments for projects contributing to climate mitigation objectives, and estimates the underlying sources of finance (Figure 4.2). The analysis is based on a combination of primary data, ad-hoc surveys, and estimation techniques ((I4CE, 2018) (Hainaut & Cochran, 2018)). Besides being limited to a single country, the main limitation of the I4CE analysis in relation to Article 2.1c is that it only partially, and for the first time in 2018 (2017 data) covers investments in and underlying financing for activities that undermine climate objectives.

Figure 4.2. I4CE Landscape of Climate Finance in France in 2017 (EUR billion current)



Source: (I4CE, 2018).

5. Conclusions

The all-encompassing nature of Article 2.1c implies a need to structure and prioritise which parts and components of the financial value chain are to be looked at and for what purpose. In this context, the aim of the paper is to help identify priority areas for further finance tracking efforts by countries, researchers and producers of primary and secondary data (both public and private, including investors and finance providers themselves). For instance, tracking stocks of shares and bonds on public financial markets on the one hand, and, on the other hand, tracking investment flows in new tangible fixed assets are very different types of analyses. The nature and lifespan of tangible fixed assets has a direct effect on GHG emissions, from which transactions on financial markets are at least one step upstream.

As a result, it is suggested that tracking investment for new infrastructure and equipment and the refurbishment of such assets, as well as underlying sources of finance, is of particular relevance from the perspective of assessing progress and to inform public action towards achieving the objective of Article 2.1c. This focus further makes it possible to complement and avoid duplication with existing tracking and disclosure initiatives, which mostly focus on secondary investments in and stocks of publicly-traded financial assets (equities and bonds). The aim of such initiatives is most often to estimate the climate-related risk exposures of investors' portfolios as a means to influence investment decisions and encourage active shareholding to change companies' strategies.

In terms of data availability, current gaps are significant and do not allow to comprehensively assess the consistency of investments in new infrastructure and equipment and in the refurbishment of such assets with low-GHG development. Existing finance tracking efforts typically focus on specific financial asset classes (i.e. group of financial instruments with similar characteristics such as bonds), actors (e.g. development finance institutions), and geographies (e.g. single-country). When it comes to tracking sources of finance that underpin investments, gaps are even more acute, in particular in relation to domestic public finance at a disaggregated level, corporate investments and financing, and financing provided by commercial banks.

Further, most initiatives focus on tracking finance for low-GHG activities only, whereas assessing progress towards Article 2.1c requires covering all investments, and in particular the ones that undermine climate mitigation objectives. Accessing data about these is typically more difficult as, in contrast to investments that support climate objectives, investors and underlying finance providers have no incentive to disclose such information on a voluntary basis. With the data at hand, the consistency of only a small sub-set of investments in new tangible fixed assets and of underlying sources of finance, mainly project finance schemes and cross-border official development finance, could be assessed.

6. Possible next steps

As highlighted in the previous section there are many outstanding data and analytical gaps in terms of tracking finance flows in relation to Article 2.1c. A number of available data sources and on-going analytical initiatives aim to analyse the consistency of investment stocks and behaviour on financial markets (e.g. (2degrees-investing, 2017), (TCFD, 2017)).

Data and efforts to track the consistency of investment in the real economy and of underlying sources of finance, which are needed to inform public policy making, are scarce. There is, therefore, a need for additional and dedicated data collection and analytical efforts to start addressing this gap. The following next steps could be considered.

- Individual investors and finance providers could increase and unify the scope of their reporting on finance flows that they initiate. Some actors already report on financing for activities that contribute to climate objectives. However, the coverage does not extend to the full portfolio of financial transactions. Reporting all types of investments, categorised with a granularity sufficient to infer the climate impact of the activities, would allow a comprehensive assessment and comparison to climate objectives.
- Countries could undertake pilot studies on an ad-hoc basis, making use of a range of official, commercial and country-specific data sources as well as estimation methodologies e.g. physical capacities or sales data. Such pilots would ideally be initiated and supported by public authorities, but can be conducted jointly with or by expert analytical bodies. The example of the annual Landscape of Climate Finance in France (I4CE, 2018) and the methodology that underpins it (Hainaut & Cochran, 2018), provides a potential reference point. Any 2.1c-related tracking, however, requires to also comprehensively cover activities that undermine or do not impact climate objectives.
- In addition, building on country pilots, analytical bodies could put together aggregate-level indicators of investments and financing, here again making use of best-available data and estimation methods. Such estimates and indicators could substitute official statistics where adjustments in data collection processes are expected to be either very lengthy or not able to address growing limitations of traditional official statistics in the context of globalised economies ((Linsi & Mügge, 2019)). The work of the IEA to estimate energy investments provides a reference point that could be deepened as well replicated in other sectors (IEA, 2018). While not necessarily granular enough to inform targeted policy actions at the country level, such aggregate indicators could contribute to measuring collective progress e.g. under the UNFCCC's Global Stocktakes. They may also be of relevance to on-going OECD work to identify and develop green growth indicators, where investment and finance are currently only very partially covered.
- Countries and producers of official statistics could explore options for more systematic data collection at a level of disaggregation that would allow a granular analysis of investments and financing for new tangible fixed assets. In the context of national accounts statistics, this could take the form of improved linkages between GFCF and underlying sources of finance. There are a number of on-going streams of work in the context of the G20 Data Gaps Initiative (DGI) to provide more granular institutional sectors and to improve the tracking of relationships between the different sectors of an economy and the rest of the world. Such initiatives may improve the ability to track sources of finance that underpin investments in new assets. However, standard sectoral classifications used in economic classification systems cannot provide the necessary level of granularity to be able to then apply available working definitions or taxonomies of activities that contribute to or undermine climate objectives.

There are, in addition to tracking investment and finance flows, a number of complementary areas of analytical work that underpin the implementation of Article 2.1c, in particular:

- Comparing tracked volumes of finance with those that would be required to meet low GHG and climate-resilient development objectives and needs. Such comparisons could be done with different scopes e.g. at a global or country level for a given sector/sub-sector, for a given category of investors and financiers. In any case, it requires translating climate objectives into corresponding volumes of investment and financing needed. Mitigation objectives of countries are, for instance, outlined in Nationally Determined Contributions submitted to the UNFCCC, which, if aggregated, have, however, been assessed as insufficient to meet the objectives of the Paris Agreement (UNEP, 2018).
- Evaluating factors having led to past volumes of finance having contributed to or undermined climate mitigation and adaptation objectives. This area of work can build upon existing efforts to analyse the role of public regulation, policies and support in affecting investment and financing in relevant sectors. In doing so, care needs to be taken to take into account the fact that volumes of investments and financing may in turn affect public policies and support, as well as the role of political economy factors (Röttgers & Anderson, 2018).
- Identifying, implementing and monitoring short-, medium- and long-term public actions and privately-led initiatives for making finance flows more consistent with climate objectives. Such actions and initiatives will necessarily vary depending on which part of the financial chain is targeted. The finance tracking scope proposed in the present paper aims to foster better-informed (and thus, ideally, more effective) policies targeted at influencing investment and financing decisions for new tangible fixed assets the refurbishment of such assets, which have a direct impact on GHG-emission trajectories. Analyses of financial markets, or of climate-related risk exposure of institutional investors' portfolios have the potential to trigger a different type of action. They may encourage investors to more actively and better integrate climate considerations into their investment decisions and portfolio management activities.

Annex A. Overview of data sources and initiatives reviewed

A number of data sources and analytical initiatives relevant to the tracking of finance were looked at in the context of researching for and drafting this paper. Those of most relevance to the proposed scope of tracking (gross investment flows for new infrastructure and equipment and underlying sources of finance) are featured in Section 4. The purpose of this Annex is to more comprehensively summarise the coverage of data sources and analytical initiative reviewed, including beyond this proposed scope e.g. to track finance stocks.

Data sources and analytical initiatives reviewed

Table A.1 lists and partly characterises the initiatives and sources of data reviewed. A selected number of them are briefly described below in addition to those already introduced in Section 3. (e.g. SNA, FDI and DAC statistics) and Section 4. (e.g. BankTrack, IEA). The distinction between a data source and an analytical initiative (which makes use of data sources) it not straightforward. Both labels could be applied to some entries.

The Bank for International Settlements (BIS) international banking statistics provide balance sheet information from banks with the aim to monitor the capital flows between countries, and to measure the banks' risk exposure. Data are aggregated rather than published at the level of individual banks. Further, there is no information on the types of projects being financed. As such, the potential use of BIS data in the context of Article 2.1c-related finance tracking appears very limited.

Bloomberg New Energy Finance (BNEF) hosts a proprietary database of renewable energy investments based on market announcements, active monitoring and industry contacts. The database mostly relates to asset finance and, to a lesser extent, corporate debt, venture capital and private equity. While the most comprehensive data source in its field, BNEF limitations include no coverage below certain thresholds, and default assumptions for filling missing deal values. BNEF aims to expand coverage to clean energy-connected sectors such as energy efficiency and smart grids, although activity-level investment tracking is more difficult than for renewable energy (BNEF, 2017). Overall, BNEF allows for a granular but partial (in terms of sectoral coverage) tracking of investments in activities that contribute to climate objectives.

Climate Policy Initiative's (CPI) Global Landscapes of Climate Finance provide an annual overview of climate finance flows since 2012. The 2017 publication provides a five-year trend analysis on the how, where, and from whom finance is flowing toward low-carbon and climate-resilient actions. The Landscape relies mostly on development finance data as well as the BNEF commercial database. Its coverage is, by nature, limited to investments (and underlying sources of finance) in projects contributing to climate objectives (CPI, Global Landscape of Climate Finance 2017 - Climate investment analysis, 2017). It is, as such, similar in scope to the UNFCCC Biennial Assessment.

Table A.1. List of data sources and analytical initiatives analysed

	Initiative	Coverage of tangible fixed assets	Stock or flow	Primary or secondary finance	Coverage of financial instruments	Climate beneficial, detrimental or both		Reference
						Coverage	Distinction	
Data sources	Bank for International Settlements (BIS)	Unclear [a]	Stocks, net flows, partially gross flows	Both	Loans, Bonds	Both	No	(BIS, 2012)
	Bloomberg New Energy Finance (BNEF)	Infrastructure [d]	Gross flows	Both	Loans, Equity, Bonds	Beneficial	n.a.	(BNEF, 2017)
	Bloomberg Terminal (Bloomberg)	Unclear [a]	Stocks, net and gross flows	Both	Loans, Equity, Bonds [c]	Both	No	(Bloomberg, 2018)
	Dealogic	Infrastructure [d]	Gross flows	Both	Loans, Equity, Bonds	Both	Yes	(Dealogic, 2018)
	Expenditures by function of Government (COFOG)	Infrastructure & equipment	Gross flows	Primary	Direct Expenditure	Both	No	(OECD, Government expenditure by function (COFOG), 2018)
	IJGlobal - Transactions module (IJGlobal)	Infrastructure [d]	Gross flows	Both	Loans, Equity, Bonds	Both	Yes	(IJGlobal, 2018)
	Institutional investors survey - Ernst & Young	Unclear [a]	Stocks	Both	Loans, Equity, Bonds	Both	No	(EY, 2013)
	MDB Joint Climate Finance report (MDB Climate Finance)	Infrastructure & equipment [b d]	Gross flows	Primary	Grants, Loans, Equity	Beneficial	n.a.	(Joint-MDB, 2018)

Initiative	Coverage of tangible fixed assets	Stock or flow	Primary or secondary finance	Coverage of financial instruments	Climate beneficial, detrimental or both		Reference
					Coverage	Distinction	
OECD Annual Survey of Large Pension funds (OECD Pension Funds)	Unclear [a]	Stocks, net flows (partially)	Both	Loans, Equity, Bonds	Both	No	(OECD, 2015)
OECD DAC Creditor Reporting System (OECD DAC)	Infrastructure & equipment [b d]	Net and gross flows	Primary	Loans, Equity	Both	Yes	(OECD, DAC Creditor Reporting System, 2018)
OECD Export Credit Group Statistics (OECD Export credits)	Infrastructure & equipment [b d]	Gross flows	Primary	Loans	Both	Yes	(OECD, 2018)
OECD and UNCTAD Foreign Direct Investment (FDI)	Unclear [a]	Stocks, net flows	Primary	Loans, Equity, Bonds	Both	No	(OECD, 2018); (UNCTAD, 2018)
OECD Inventory of Fossil-fuel subsidies (OECD FF subsidies)	Unclear [a]	Flows (various)	Unclear	Subsidies (various)	Detrimental	n.a.	(OECD, 2015)
OECD System of National Accounts - Gross Fixed Capital Formation (GFCF)	Infrastructure & equipment	Gross flows	Primary	Direct expenditure	Both	No	(OECD, 2018)
Bureau van Dijk Orbis	Unclear [a]	Stocks, net flows, partially gross flows	Both	Equity	Both	Unclear	(Orbis)
Thomson Reuters[12] EIKON/ONE (Thomson)	Unclear [a]	Stocks, net and gross flows	Both	Loans, Equity, Bonds [c]	Both	Yes	(Thomson, 2018)
World Bank Private Participation in Infrastructure (WB PPI)	Infrastructure [d]	Gross flows	Primary	Loans, Equity	Both	Yes	(World Bank, 2018)
World Federation of Exchanges (WFE)	Unclear [a]	Stocks, net and gross flows	Both	Equity, Bonds [c]	Both	No	(WFE, 2018)

[12] Since October 2018 rebranded as Refinitiv

	Initiative	Coverage of tangible fixed assets	Stock or flow	Primary or secondary finance	Coverage of financial instruments	Climate beneficial, detrimental or both		Reference
						Coverage	Distinction	
Analytical initiatives	2 degree investment initiative (2DI)	Infrastructure & equipment [e]	Stocks	Secondary	Equity, Bonds [c]	Both	Yes	(2degrees-investing, 2017)
	Banking on reform: Aligning the development banks with the Paris Climate Agreement (E3G)	Unclear [a]	Gross flows	Primary	Grants, Loans, Equity, Bonds	Both	Yes	(Wright, et al., 2018)
	Banks vs. Paris agreement (BankTrack - Banks)	Infrastructure & equipment [e]	Gross flows	Primary	Loans, Equity, Bonds	Detrimental	n.a.	(Banktrack, 2017)
	Carbon Tracker Initiative (Carbon Tracker)	Unclear	Stocks	Both		Both	Unclear	(CTI, 2018)
	Climate Bonds Initiative (CBI)	Unclear [a]	Stocks, gross flows	Primary	Bonds	Beneficial	n.a.	(Climate Bonds Initiative, 2017)
	Climate Public Expenditures and Institutional Review (Country initiative)	Unclear [a]	Gross flows	Primary	Unclear (mostly gov. expenditure)	Both	No	(ODI, 2011)
	Colombia MRV system (Country initiative)	Unclear	Gross flows	Primary	Unclear	Beneficial	n.a.	*Forthcoming*
	Global landscape of climate finance (CPI)	Infrastructure & equipment [b c]	Gross flows	Primary	Grants, Loans, Equity	Beneficial	n.a.	(CPI, Global Landscape of Climate Finance 2017 - Climate investment analysis, 2017)
	Global trends in renewable energy investment (UNEP)	Infrastructure [d]	Gross flows	Both	Loans, Equity, Bonds	Beneficial	n.a.	(UNEP B. , 2016)
	I4CE Landscape for France (Country initiative)	Infrastructure & equipment	Gross flows	Primary	Grants, Loans, Equity, Bonds	Beneficial	n.a.	(I4CE, 2018)

Initiative	Coverage of tangible fixed assets	Stock or flow	Primary or secondary finance	Coverage of financial instruments	Climate beneficial, detrimental or both		Reference
					Coverage	Distinction	
IEA World Energy Investment (IEA WEI)	Infrastructure & equipment	Gross flows	Primary	Loans, Equity, Bonds	Both	Yes	(IEA, 2018)
Institutional investors vs. Paris agreement (BankTrack – Inst. Inv.)	Unclear [a]	Stocks	Secondary	Equity, Bonds	Detrimental	n.a.	(Urgewald, Investors vs. The Paris climate agreement, 2016)
Long-term Finance and Economic Growth (Group of Thirty)	Infrastructure & equipment	Stocks, net and gross flows	Both	Loans, Equity, Bonds	Both	No	(Group of Thirty, 2013)
Mapping the World's Financial Markets 2014 (Deutsche Bank)	Unclear [a]	Stocks, net flows, partially gross flows	Both	Loans, Equity, Bonds	Both	No	(Deutsche Bank, 2014)
McKinsey Global Institute	Infrastructure	Stocks, net and gross flows	Both	Unclear	Both	Unclear	(McKinsey Global Institute, 2016)
RAN Fossil Fuel Report Card (RAN FF)	Unclear [d]	Gross flows	Primary	Loans, Equity, Bonds	Detrimental	n.a.	(Rainforest Action Network, 2018)
The Landscape of climate finance in Germany (Country initiative)	Infrastructure & equipment	Gross flows	Unclear	Unclear	Beneficial	n.a.	(CPI, 2012)
UNFCCC Biennial Assessment (UNFCCC BA)	Unclear [a]	Gross flows	Unclear	Grants, Loans, Equity, Bonds	Beneficial	n.a.	(UNFCCC, 2018 Biennial Assessment and Overview of Climate Finance Flows, 2018)
Global Shadow Banking Monitoring Report 2017 (FSB – Shadow Banking)	Unclear [a]	Stocks	Both	Loans	Both	No	(FSB, 2017)

a: Insufficient granularity to map from financial assets/transactions to tangible fixed assets
b: Identification of investment in tangible fixed assets only possible indirectly, e.g. via sector classification and/or project description
c: Limited coverage of unlisted financial instruments, such as loans or unlisted equity (e.g. limited to project finance or to syndicated loans)
d: Limited coverage (only projects involving specific types of financing such as project finance, export credits)
e: Limited to specific classes of fixed assets

The Climate Bonds State of the Market Report, commissioned by HSBC and produced by the Climate Bonds Initiative (CBI), quantifies the volume of issuances of green and "climate-aligned" bonds. The analysis provides information about the bond issuers (recipients), rather than the financial actors investing in these bonds (providers). Data collection for labelled green bonds is based on press releases and announcements, while unlabelled climate-aligned bonds are identified through a screening of the Bloomberg and Thomson Reuters databases (Climate Bonds Initiative, 2017). More generally, bond-related data are of most relevance to tracking investments in financial assets, but can also provide a basis for tracking investment and finance flows to tangible fixed assets e.g. project-level bonds, issuance of corporate bond with the funds then used to invest in tangible fixed assets.

The OECD Annual Survey of Large Pension funds and public pension reserve funds (OECD, 2015) monitors and compares the investment behaviours and performance of large institutional investors. It is a measure of stocks of financial assets. It covers ninety nine Large Pension Funds (LPFs) and Public Pension Reserve Funds (PPRFs) in selected OECD countries, IOPS countries, and member countries of the G20, based on data gathered from 2014 and 2015. The level of disaggregation of data overall does not allow to track and analyse whether investment positions (stocks) of pension funds relate to activities that contribute to undermine climate objectives.

The OECD's inventory of fossil fuel subsidies encompasses direct budgetary transfers and tax expenditures that provide a benefit or preference for fossil-fuel production or consumption, either in absolute terms or relative to other activities or products. Estimates are generally based on budgetary and tax-expenditure estimates published or otherwise provided by the responsible governments (OECD, 2015).

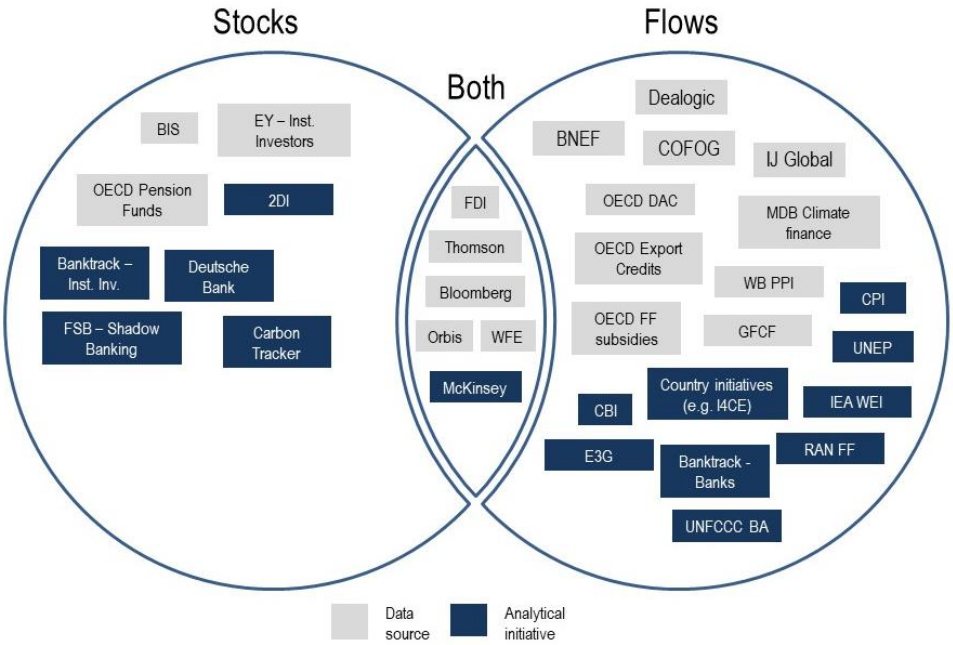
Coverage of stocks versus flows

As introduced in Section 3.3, investments and the underlying sources of finance can be analysed from a flow or a stock perspective. Figure A.1 clusters data sources and analytical initiatives depending on whether they look into stocks, flows, or both.

2 Degrees Investing Initiative (2ii) is an example of an analytical initiative focusing on stocks. 2ii tracks the consistency of institutional investors' portfolios (holdings on the equity and corporate bonds markets) with climate goals. By shedding light on the climate-related risks embedded in their portfolios, the exercise aims to encourage institutional actors to invest in entities active in sectors that contribute to - rather than undermine - climate mitigation objectives. A similar analysis for the banking sector has also been published (Battiston, Mandel, Monasterolo, Schütze, & Visentin, 2017).

Most data on flows are expressed in gross terms, with a few exceptions e.g. FDI data is most often expressed in net terms for both stocks and flows, thus potentially "hiding" relevant transactions (as explained in Section 3.4). The OECD DAC data allows for analyses of both gross and net flows. The SNA financial accounts are expressed in both gross and net terms. The SNA non-financial account data is expressed in net terms for stocks of non-financial assets (i.e. including depreciation), and in gross terms of GFCF (flows).

Figure A.1. Existing data sources and initiatives tracking stocks and flows



Source: Authors.

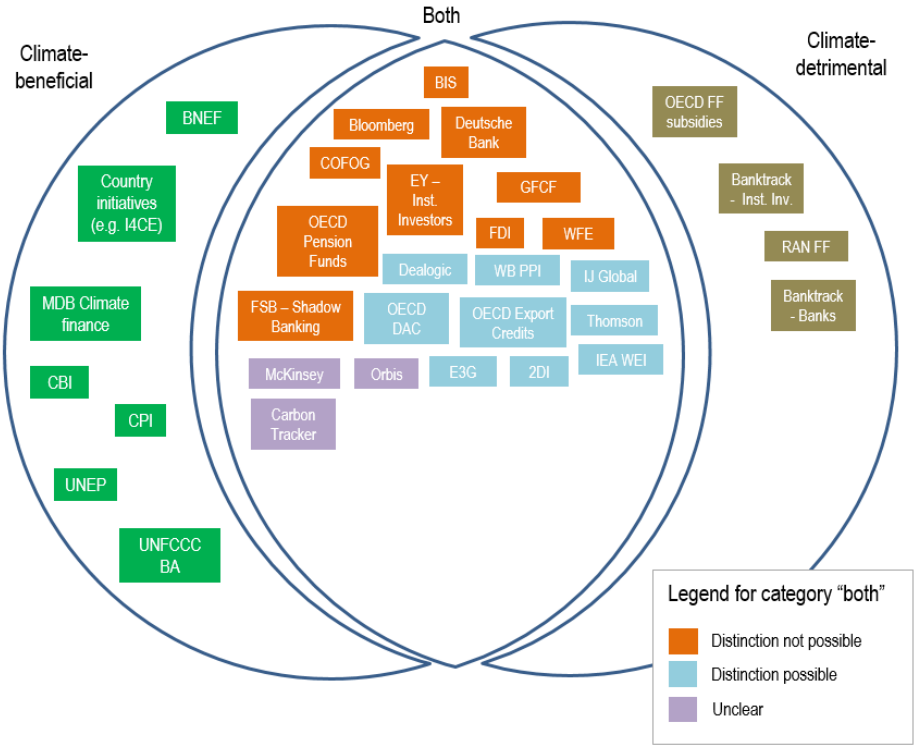
Many finance tracking initiatives do not specifically address the difference between primary finance, refinancing and mergers and acquisitions (M&A) when putting forward estimates, despite the fact that most commercial databases do allow for such distinction. The Climate Bonds Initiative is, however, an example of an initiative clearly focusing on primary finance (new bond issuances in a specific year).

Coverage of finance that contributes to and undermines climate objectives

Figure A.2 presents the data sources and initiatives based on whether the scope of their tracking efforts covers finance that contributes to or undermines climate mitigation objectives. Initiatives tracking both and, as a result, potentially allowing for a consistency analysis are showed in the intersection of the two circles.

UNFCCC biennial reports (reporting by Parties), BNEF, Climate Policy Initiative and I4CE cover finance flows contributing to climate mitigation objectives, while the OECD inventory of Fossil Fuel subsidies focuses on support to projects undermining these objectives. The OECD DAC database, the WB PPI database, commercial databases (IJGlobal, Thomson One, Dealogic) as well as the export credits' group statistics provide information for all sectors. However, except for the OECD DAC, the level of disaggregation or of publicly-available data does not allow to distinguish finance for activities that respectively contribute or undermine climate mitigation objectives.

Figure A.2. Tracking finance contributing or undermining mitigation objectives



Source: Authors.

In commercial databases such as Thomson EIKON or Bloomberg, companies are classified through sectoral classifications (GIS, TRBC, NAICS) that are not broken down to a level that can match existing working definitions of climate mitigation activities (see (Caruso & Jachnik, 2014)). Any consistency analysis is further limited by the fact that only one sector is assigned per firm, based on the major activity of the company. Thus, for example, the progressive shift of a fossil-fuel intensive power company towards renewable sources would not be visible until renewable energy becomes the companies' main activity. This could, however, be addressed by applying so-called "segment adjusters" as done by BankTrack in their publications.

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