



Tracking investment into energy transition in Germany and France: a comparison of methodologies and selected results

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Abstract

The paper aims to provide a brief insight into domestic tracking of investment into energy transition and climate actions in EU countries. Doing so, we are drawing parallels between the German and French methodologies and results, given that these are the only two countries, which have conducted this exercise in the EU for more than just one year and gained the most experience so far. We discuss main similarities and differences in the two tracking methodologies, the status quo of available information and various methodological and data challenges encountered throughout two approaches. These analyses provide an important starting point for understanding the investment challenges associated with the climate and energy objectives. Building on this, Member States could develop strategies to mobilise (mainly private) capital for the climate and energy transition, in line with investment need estimates as supplied by National Energy and Climate Plans (NECPs).

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Summary

The method of climate finance landscape or climate and energy investment mapping at country level can be a useful tool to understand how investment and investment patterns address domestic climate-related commitments. They may help understand a deficit or an excess of investment in sectors of the economy or in specific technologies. While data related to greenhouse gas (GHG) emissions and energy consumption, is available to measure the progress towards national and international climate targets, a differentiated assessment of the actual investments provides important additional information for decision making. As key economic variable and important element of the national accounts, investment data and the related mapping of financial flows could inform our understanding of climate-related economic activity and the functioning of the institutional framework in incentivising adequate levels of investment. Therefore, these diagrams could serve as a guidance for an effective shift of financial incentives and an efficient policy instrument design.

In Germany, neither a common methodology nor a tracking system have been legally established yet. Climate-specific finance expenditure is not a part of reporting in public budget at any level of government nor in public financial intermediaries. Furthermore, the information on private investment is fragmented and insufficient.

In France, the tracking definitions and methodology are established by law, whereas the data is provided by targeted regular surveys conducted by public agencies. Still, certain areas of investment remain challenging to reflect precisely in the landscape. This is particularly the case with investments to reduce GHG emissions not related to energy combustion, such as agriculture and forestry.

This paper is the result of a cooperation between the Franco-German Office for the Energy Transition (DFBEW/OFATE), the Institute for Climate Protection, Energy and Mobility (*Institut für Klimaschutz, Energie und Mobilität*, IKEM) and the Institute for Climate Economics (I4CE). It presents the detailed climate finance landscape produced by IKEM for Germany and I4CE for France and discusses the main results and methodological challenges related to this instrument.

The comparative analysis reveals some similarities, such as the difficulty in tracking the private component of climate finance, resulting in an underestimation of the total investment. Nonetheless, the climate-specific investment flow for the year 2016 was estimated by IKEM at EUR 42.7 billion for Germany and by I4CE at EUR 38.6 billion for France. A further similarity lies in the predominance of the building and energy generation segments: they accounted for close to two thirds of the investment tracked in both countries. The analysis includes the other strongly emitting sectors such as transport, industry and agriculture and reveals some differences between the two countries.

Aside from aspects of methodological nature, the paper highlights other differences regarding the source of investment or the preferred financial instruments. For instance, Germany relies more heavily on the private sector than France. The German climate and energy investment map insists on the central role of the KfW, the main public financial institution, in structuring the 'onlending' (intermediated lending) model through the local branches of private banks, resulting in a far greater significance of low-interest concessional loans in this country.



Glossary

Term	Definition	Source
Balance Sheet	A balance sheet is a statement, drawn up at a particular point in time, of the values of assets owned and of liabilities outstanding.	(OECD 2007)
Concessional debt	These are loans that are extended on terms substantially more generous than market loans. The concessionality is achieved either through interest rates below those available on the market or by grace periods, or a combination of these. Concessional loans typically have long grace periods.	(OECD 2019)
Debt finance	Lending money to a company, government, or project in the form of a loan or bond.	(Reyes 2012)
Emissions trading	A trading system through which countries may buy or sell units of greenhouse-gas emissions in an effort to meet their national limits on emissions, either under the Kyoto Protocol or under other agreements, such as that among member states of the European Union.	(UNFCCC n.d.)
Equity	A stock or any other security representing an ownership interest or partial ownership of a company. The value of the investment is related to the success, rather than the interest payments accrued by debt finance.	(Reyes 2012)
Feed-in tariffs	Feed-in tariffs are fixed electricity prices that are paid to renewable energy producers for each unit of energy produced and injected into the electricity grid. The payment of the feed-in-tariffs is guaranteed for a certain period of time that is often related to the economic lifetime of the respective renewable project. Feed-in-tariffs are usually paid by electricity grid, system or market operators, often in the context of power purchasing agreements.	(Energylopedia n.d.)
Guarantee	A financial guarantee is a contract by a third party (guarantor) to back the debt of a second party (the creditor) for its payments to the ultimate debtholder (investor).	(Investopedia 2019)
Grant	Transfers made in goods, cash, or services from a government or other organisation to an eligible recipient for a specified purpose, with no repayment required.	(OECD 2019)
Gross fixed capital formation	Defined by the European System of Accounts (ESA), gross fixed capital formation consists of resident producers' acquisitions, less disposals, of fixed assets during a given period plus certain additions to the value of non-produced assets realized by the productive activity of producer or institutional units.	(OECD 2019)
Institutional investor	An institution that manages and invests other people's money. Examples: pension funds, insurance funds, investment funds, and other entities on the capital market.	(OECD 2019)
Loan (credit)	A loan is money, property, or other material goods given to another party in exchange for future repayment of the loan value or principal amount, along with interest or finance charges.	(Investopedia 2019)
Onlending	Lending money by an organization that they have borrowed from another organization or person.	(FT n.d.)

Acronyms

BAFA	Federal Office for Economic Affairs and Export	LTECV	French Energy Transition and Green Growth Act
ADEME	French Environment & Energy Management Agency	NECP	National Energy and Climate Plan
CO₂	Carbon Dioxide	NKI	National Climate Initiative
CPI	Climate Policy Initiative	ODA	Official Development Assistance
DFBEW	Deutsch-französisches Büro für die Energiewende (Franco-German Office for the Energy Transition)	OECD	Organisation for Economic Co-operation and Development
EC	European Commission	OECD DAC	Development Assistance Committee of the Organisation for Economic Co-operation and Development
ECA	European Court of Auditors	OFATE	Office Franco-Allemand pour la Transition Énergétique
EEA	European Environmental Agency	PPE	French Multiannual Energy Plan
FIT	Feed-in Tariff	R&D	Research and Development
GDP	Gross Domestic Product	SME	Small and Medium-sized enterprises
GFCF	Gross Fixed Capital Formation	TEG	Technical Expert Group
GHG	Greenhouse Gas	UNFCCC	United Nations Framework Convention on Climate Change
KfW	Credit Institution for Reconstruction		



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Introduction: why track investment into energy transition?

The tracking and assessment of finance provided for climate actions traces back to the end of the 2000s. The aim was to understand the financing and investment flows emerging as a response to climate change with a particular focus on the needs of developing countries (UNEP, 2010; UNFCCC, 2007). The interest particularly grew after the adoption of the **Copenhagen agreement** (UNFCCC, 2010), in which **developed countries committed to jointly mobilize USD 100 billion in climate finance annually by 2020 to address the needs of the developing world**. This commitment triggered the development of dedicated assessment methodologies as well as their use to track cross-regional climate finance flows (Brown et al., 2011; Buchner et al., 2011a, 2011b). The latter study (Buchner et al., 2011b) introduced a method of climate finance landscape, which allowed tracking climate finance flows along their lifecycle, starting from the source of money and the relevant intermediaries, through instruments used, towards the channels and uses.

A year later, tracking climate finance flows using the landscape method was replicated in the national context. Here, the purpose was to understand how investment and investment patterns addressed climate-related commitments at a domestic level. The pioneering study here focused on investment into the German energy transition for the year 2010 (Juergens et al., 2012a). This country-level landscape aimed at analysing the sources of investment, intermediaries involved, financial instruments used, sums and measures they flow to.

After the first publication of the German climate finance landscape, analysts of several EU countries prepared similar landscapes. I4CE – Institute for Climate Economics - adopted the landscape of climate finance for France and updated it every year since then (Hainaut et al., 2018a, 2018b, 2016a, 2015, Hainaut and Cochran, 2018, 2017; Morel et al., 2014). In 2016, Rademaekers et al. published a similar climate finance landscape for Belgium. Recently, Novikova et al. updated the assessment for Germany publishing the map of climate and energy investment for the buildings sector (2018) and then for the whole economy (2019).

In 2018, the European Union adopted the **Regulation on the Energy Union Governance** (REGULATION (EU) 2018/1999). One of its goals is to ensure that the 2030 EU energy and climate targets are met. The Regulation requires EU Member States to submit **national energy and climate plans** (NECPs) based on a common template. Among other issues, it asks to provide analytical details on current investment flows into decarbonisation of their economy. The ultimate goal of the latter requirement is to be able to analyse the gap between current investment and investment needed to meet the EU 2030 energy and climate targets. It could also help understand the investment patterns and ways to improve them. The overall **investment challenge for achieving the targets tops to EUR 11.2 trillion** of largely private capital to be raised until 2030 (EC, 2016b). The country-level landscapes of climate finance could serve as a possible tool to address this Regulation's requirement.

The country-level landscapes of climate finance are also useful to meet international climate-related commitment. The Article 2.1c of the Paris Agreement (UNFCCC, 2015) requires “making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development”. These landscapes could reflect the flows into domestic climate actions and help align them better.

The paper aims to provide a brief insight into tracking investment for energy transition and climate actions at different government scales. In **Section 1**, we define climate finance and explore its tracking practices at global, EU and national level. In **Section 2**, we describe and compare the methodologies of tracking climate finance in Germany and France. In **Section 3**, we provide an analysis of the landscape published for these two countries. Doing so, we are drawing parallels between the German and French methodologies and results. The choice of these two countries is particularly relevant as they are the only ones at EU-level having conducted this exercise several years in a row. They have thus gained the most experience so far.

I. Tracking investment at country, EU and global level

While the term “climate finance” sounds self-explanatory, it may cover different expenditures depending on the context (Caruso and Ellis, 2013; Clapp, et al., 2012). The overall central aspect is the act of spending money on either climate mitigation or climate adaptation actions. However, given the political commitment of developed countries towards developing countries, as well as domestic commitments of the EU and individual countries to spend a particular amount of money or a particular budget share on climate actions, the exact definition became a political question, rather than a purely technical one (GIZ, 2014).

I.1. Climate finance in the international context

In the international context, **climate finance usually refers to the financial support of developed countries towards developing countries**, in the frame of the UNFCCC negotiations. Interestingly, in spite of the significance of the USD 100 billion commitment as part of the Copenhagen agreement, **no universal definition of climate finance has been adopted** (Caruso and Ellis, 2013; UNFCCC, 2016).

Focus: the international climate negotiation process

International negotiations on climate change take place within the frame of the United Nations, based on the so-called United Nations Framework Convention on Climate Change (UNFCCC). The greenhouse gases (GHG) reductions goals for 2050 or the support allocated to developing countries are some examples of the topics being covered during those negotiations. Various technical committees, such as the Standing Committee on Finance mentioned above, decide on methodologies and guidelines, for instance on the GHG accounting, on annual reporting and on finance.

The UNFCCC Standing Committee on Finance (UNFCCC, 2014) conducted a review of climate finance definitions adopted by international institutions. It concluded that these organizations usually provide the definitions of mitigation and adaptation finance and refer to climate finance as a cumulative of these two. Therefore, in its 2014 Biennial Assessment Report, the Committee adopted a similar definition. It framed climate finance as “finance that aims at reducing emissions, and enhancing sinks of GHG [*climate mitigation*] and aims at reducing vulnerability of, and maintaining and increasing the resilience of, human and ecological systems to negative climate change impacts” [*climate adaptation*] (UNFCCC, 2014).

The next important questions besides the definition of climate finance are 1) how to measure progress towards the delivery of the climate finance volume committed in the Copenhagen agreement and 2) how to check whether the impact needed to meet the climate targets is delivered.

A common reporting format was adopted by the UNFCCC in 2018¹ to facilitate the provision - and later analysis - of information related to climate policy. The format consists in tables including key indicators (GHG emission trends, emission reduction targets and progress towards achievement of these targets, etc.). However, the only financial aspect covered by these tables concern the support provided by the reporting country to developing countries either through multilateral channels such as the World Bank or through direct bilateral channels. This format does not address the financial flows allocated to the climate mitigation and adaptation efforts at the domestic level.

The discussion of climate finance in the OECD context had a similar focus to the UNFCCC, namely to measure the bilateral financial aid and track the progress towards “mobilising” USD 100 billion annually until 2020 (GIZ, 2014).

¹ The “common tabular format (BR CTF) for biennial reporting guidelines for developed country Parties” under the UNFCCC Decision 19/CP.18 and Decision 9/CP.21 (UNFCCC, 2018).

After a first reporting wave to the UNFCCC in 2014 (biennial reports 2010-2012), the OECD stated that climate finance accounting standards in the context of development aid significantly improved (OECD and CPI, 2015). Despite this progress, the broad definition of climate finance still leads to unclear reporting practices, which are most likely inconsistent across donors (Clapp, et al., 2012). Tracking methodologies and definitions are still undergoing changes, especially in the private finance sector (OECD and CPI, 2015).

In 2011, the think tank Climate Policy Initiative (CPI) developed a methodological approach to the tracking of international climate finance using the landscape method described in the introduction. Since then, the CPI publishes such global landscapes annually (Buchner et al. 2017a). In contrast to the UNFCCC and the OECD, CPI does not have its own reporting and statistics platform, but uses “empirical data drawn from a wide range of primary and secondary sources” to produce the landscapes (Buchner et al., 2017b). Whereas the CPI’s definition of climate finance is similar to that of the UNFCCC and the OECD, with a focus on bi- and multilateral finance, the methods are clearly outlined, assuring transparent and comparable results.

One of the most ambitious current international projects aiming to standardize the definition of climate finance is the work of the Technical Expert Group (TEG) "Sustainable Finance" of the European Commission. In June 2019, the TEG submitted a draft report (EU TEG 2019) for public consultation. The report defines sustainable finance in the form of a taxonomy for the area of climate finance. It defines sectoral threshold values, which a financed project (e.g. in the aluminum or steel sector) must comply with in order for the corresponding financing to be considered "sustainable finance". According to the proposals of the European Commission, it is planned to establish a "Sustainable Finance Platform", which will continuously develop and adapt this taxonomy in the coming years, also beyond climate financing for other important sustainability dimensions.

1.2. Financing climate actions by the EU budget

In response to the climate change challenge, **the EU committed to dedicate at least 20% of its 2014-2020 budget² to climate actions.** The EU official documents do not provide a specific definition of climate finance. However, several regulations have been adopted in an attempt to harmonise and strengthen climate finance reporting under UNFCCC amongst its Member States.

In 2014, the European Commission adopted an approach based on the Rio Markers (see focus below) to identify the climate-relevant share of the 2014-2020 disbursement within the European Structural and Investment Funds³. Climate mitigation can either be a “principal”, “significant” or “untargeted” objective of a policy action. Accordingly, the spending will be accounted for as 100%, 40% or 0% climate-relevant. A descriptive table with sectorial examples has been published by the EU Commission and the OECD-DAC (EC 2014, pp. 29–30; OECD 2016, pp. 61–81).

Discussions are currently ongoing about the integration of such a climate dimension in the EU budget past 2020. The climate target and tracking approach will need to be either confirmed or refined. The European Court of Auditors (EuCA) provided a detailed assessment to improve the current approach (EuCA, 2016). This discussion also takes place in the frame of the preparation of NECPs at EU-level and within individual Member States.

² The EU long-term budget are referred to as the EU multiannual financial framework (MFF).

³ The European Structural and Investment Funds (ESIF) represent over half of the EU budget. They are composed of five funds: the European regional development fund, the European social fund, Cohesion fund, the European agricultural fund for rural development and the European maritime and fisheries fund ([EU Commission](#)).

Focus: the Rio markers and the OECD Development Assistance Committee (OECD DAC)

For tracking climate finance, the OECD database on official development assistance (ODA) finance could be filtered by climate change markers introduced at the 1992 Rio Earth Summit and often referred to Rio markers. These markers were later split into climate mitigation and adaptation (ibid.). There are three levels to the climate mitigation Rio markers depending on the intention of a given project: the reduction of GHG emissions as principal objective (score 2), emission reduction is a significant objective (score 1) or climate mitigation is not the target at all (score 0). Different members of the OECD Development Assistance Committee (DAC) accounted climate expenditure with different shares following this scoring system (OECD, 2016).

1.3. Investment relevant to climate commitment of individual Member States

In the context of the EU commitment to dedicate 20% of its budget for climate actions as mentioned above, the EU Member States are required to provide information on their financial and technology support to developing countries as well as on their use of emission allowance auctioning revenue. At least 50 % of the latter is required to be spent on climate and energy related purposes (ETS-Directive 2009/29/EC, Article 10). However, defining climate finance is still left to the Member States (EC, 2016).

The Regulation on the Energy Union Governance (REGULATION (EU) 2018/1999) makes it mandatory for Member States to deliver information on investment flows aimed at meeting the EU 2030 energy and climate targets. This should be mentioned in an analytical annex to their NECPs. Similarly, it is up to Member States to decide how these investment flows will be assessed and presented.

Commissioned by the European Environmental Agency (EEA), Trinomics (2017) provided a comprehensive assessment of the state-of-play of tracking climate finance across Europe. The study points to the still existing lack of common definitions, scope and tracking methodologies, as well as multiple gaps in data and knowledge at EU and Member State level, especially on private sources of finance.

To our knowledge, only three countries in Europe have comprehensively tracked climate finance at the domestic level following the climate finance landscape method: Germany (Juergens et al., 2012; Novikova et al., 2019), France (Hainaut et al., 2015, 2016, 2018a, 2018b, Hainaut and Cochran, 2018, 2017; Morel et al., 2014), and Belgium (Rademaekers et al., 2016). Furthermore, works are currently ongoing in three countries to replicate this analysis: Poland (I4CE, WiseEurope, and NewClimate Institute), the Czech Republic (Michaelova et al., forthcoming) and Latvia (Kamenders et al., forthcoming).

The rest of the paper focuses on tracking investment into energy transition and decarbonisation in Germany and in France. As Figure 1 illustrates, Germany committed to achieve at least a 55% reduction in its emissions by 2030 versus 1990 and a 80-95% reduction by 2050. France committed to a 40% GHG emissions reduction by 2030 and to reach climate neutrality by 2050 versus 1990 (Figure 2). It is noteworthy that France furthermore sets specific sector-based strategies necessary to reduce GHG emissions based on “carbon budgets”, specifying the sectoral mitigation caps that must not be exceeded over five-year periods.

In spite their leadership in the global energy transition, achieving the targets is a challenge for both countries. As the figures attest, both countries had reached significant reductions in emissions before 2014. The emissions barely changed between 2014 and 2017, while declining again in 2018. However, a much steeper decline is needed to achieve the targets. In that perspective, the results of climate finance tracking and the analysis of the investment gap to reach the targets are a crucial contributor to the discussion on whether and why the countries are on track or not towards their climate policy targets.

million tCO₂-eq.

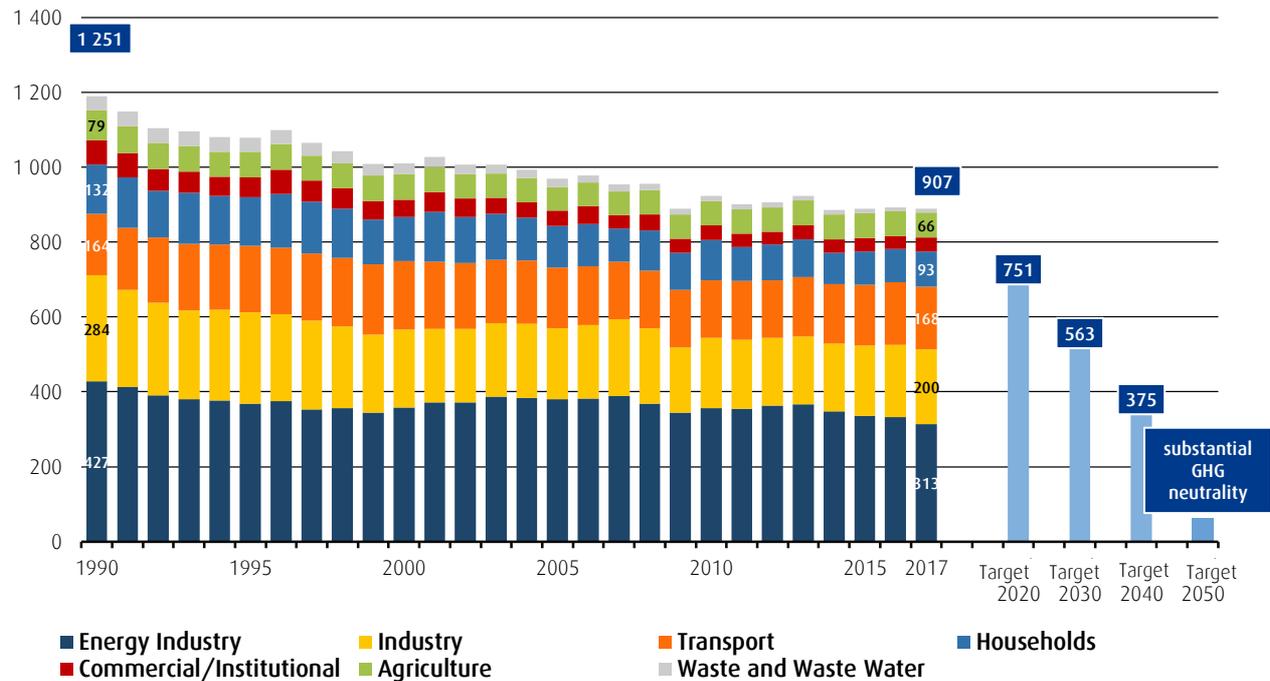


Figure 1 - GHG emissions trends in Germany, excluding land use, land use change and forestry, as well as emissions reduction targets Source: UBA, 2018a.

million tCO₂-eq.

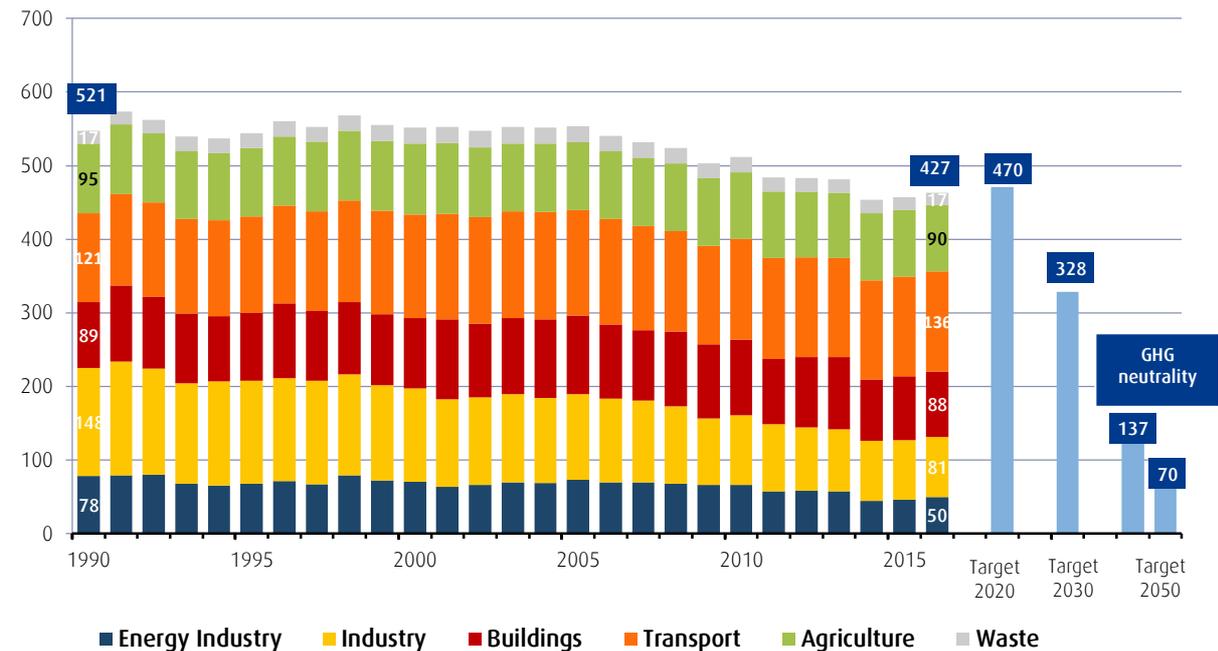


Figure 2 - GHG emissions trends in France, excluding land use, land use change, and forestry as well as emissions reduction targets, Source: CITEPA, 2017.

II. Methodological comparison of tracking in Germany and France

As mentioned, the French climate landscape adopted the tracking methodology developed at a domestic level in Germany in 2012. It has further improved and tailored it to French national specific climate challenges and situation. It has been since published on an annual basis. The German assessment of 2018-2019 was to the largest extent an update of its 2012 methodology with a few exceptions. In this section, we review and compare these case studies in terms of the analytical frameworks, their key elements, their definitions and scopes, as well as differences in data availability.

II.1. Analytical frameworks

The principal outputs of tracking investment flows to combat the climate challenge and enable energy transition is **a substantial database on national climate finance. It can be summarized in diagrams visualizing these flows through the financial value chain.** They are referred to the landscape of domestic climate finance in France over all years when they were available, the German landscape of climate finance for 2012, and the German climate and energy investment map for 2016. The German output was renamed to better reflect the nature of flows tracked, i.e. investment of all actors rather than the financing support only. Further, we will refer to these products as diagrams to avoid confusion.

In both countries, climate and energy investment is **defined as the spending of public and private actors for gross fixed capital formation (GFCF) leading to a GHG emissions reduction.** Adaptation measures in both assessments are excluded, due to missing definitions or lists of project categories that might be applicable to the national context. Furthermore, data on the resilience and suitability of infrastructures and facilities is patchy. According to the EUROSTAT guidelines (ESA 2010), GFCF **covers expenditure to acquire physical assets, such as buildings, transport infrastructure, and others.** On top, the diagrams also **track expenditure for durable goods acquired by households** such as **individual vehicles** that is not covered by GFCF. Furthermore, expenditure of public actors to support climate-friendly activities is also included (for example, **climate friendly land-management**).

The definitions of climate finance used by these countries are different from the definitions of climate finance used in international negotiations. This is because national definitions arise from national climate-related priorities and strategies. For instance, in France the definition of climate finance (Hainaut et al. 2016b) was developed in relation to the priorities of the French National Low-Carbon Strategy (MTES 2017). In Germany, climate finance definition was aligned to the emissions reductions goals and measures as defined by the Climate Action Plan 2050 (BMU 2016a).

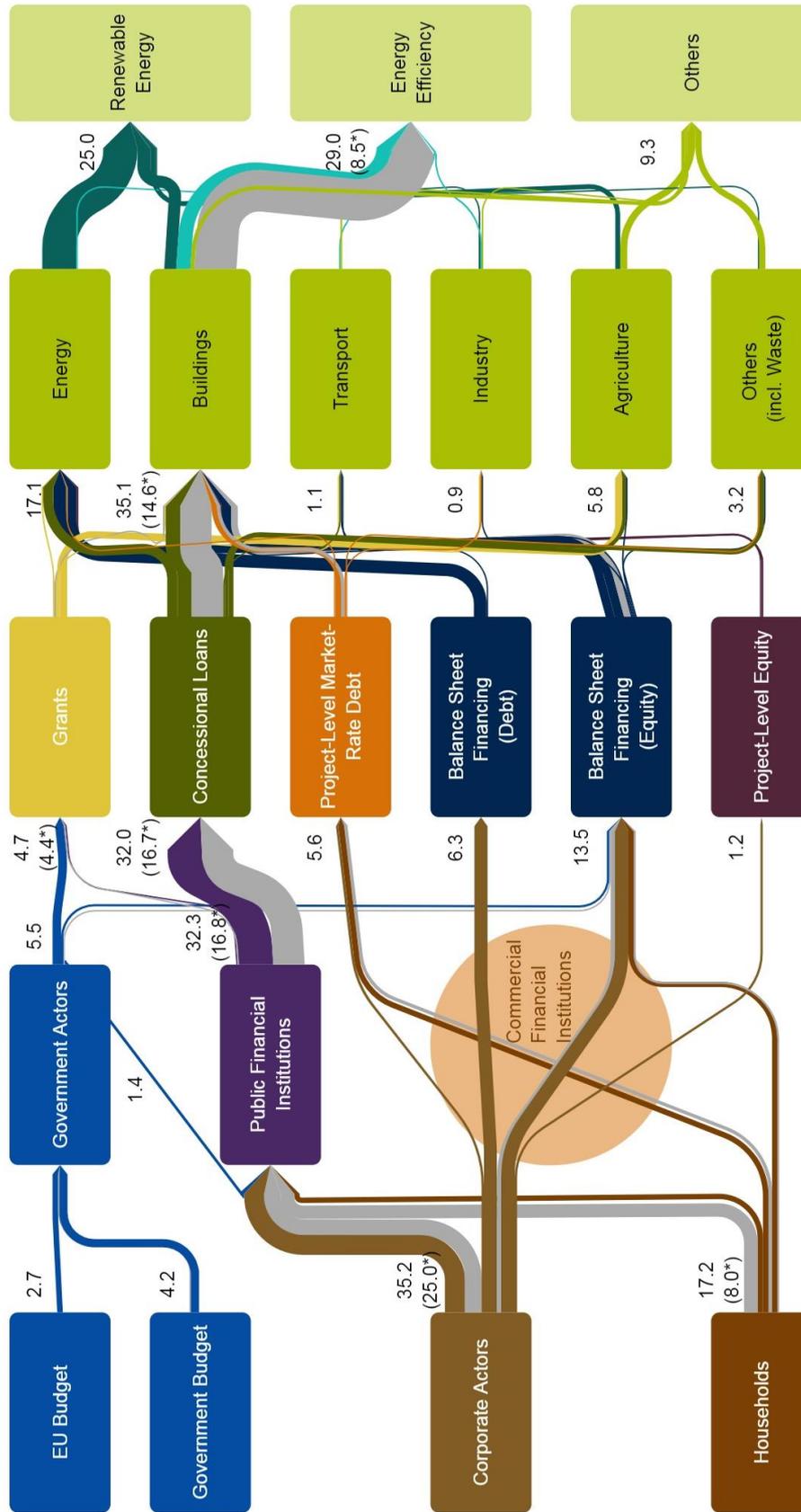
The diagrams present the flows passing through several dimensions of the financial value chain:

1. starting from the **sources of capital, either public or private** (EU budget, government budget, corporate actors or households)
2. through **the intermediaries** who facilitate these flows (government actors, public financial institutions or commercial financial institutions)
3. through the **financial instruments** used (grants, loans, debt or equity), and
4. the **recipient sectors** of the capital (energy, buildings, transport, industry, agriculture or others).

The diagrams are presented at Figure 3 for the 2016 German climate and energy investment map and Figure 4 for the French landscape of domestic climate finance 2016. In France, the authors additionally introduced a dimension of project developers following the dimension of intermediaries.

Figure 3- The 2016 Climate and Energy Investment Map, Source: Novikova et al., 2019

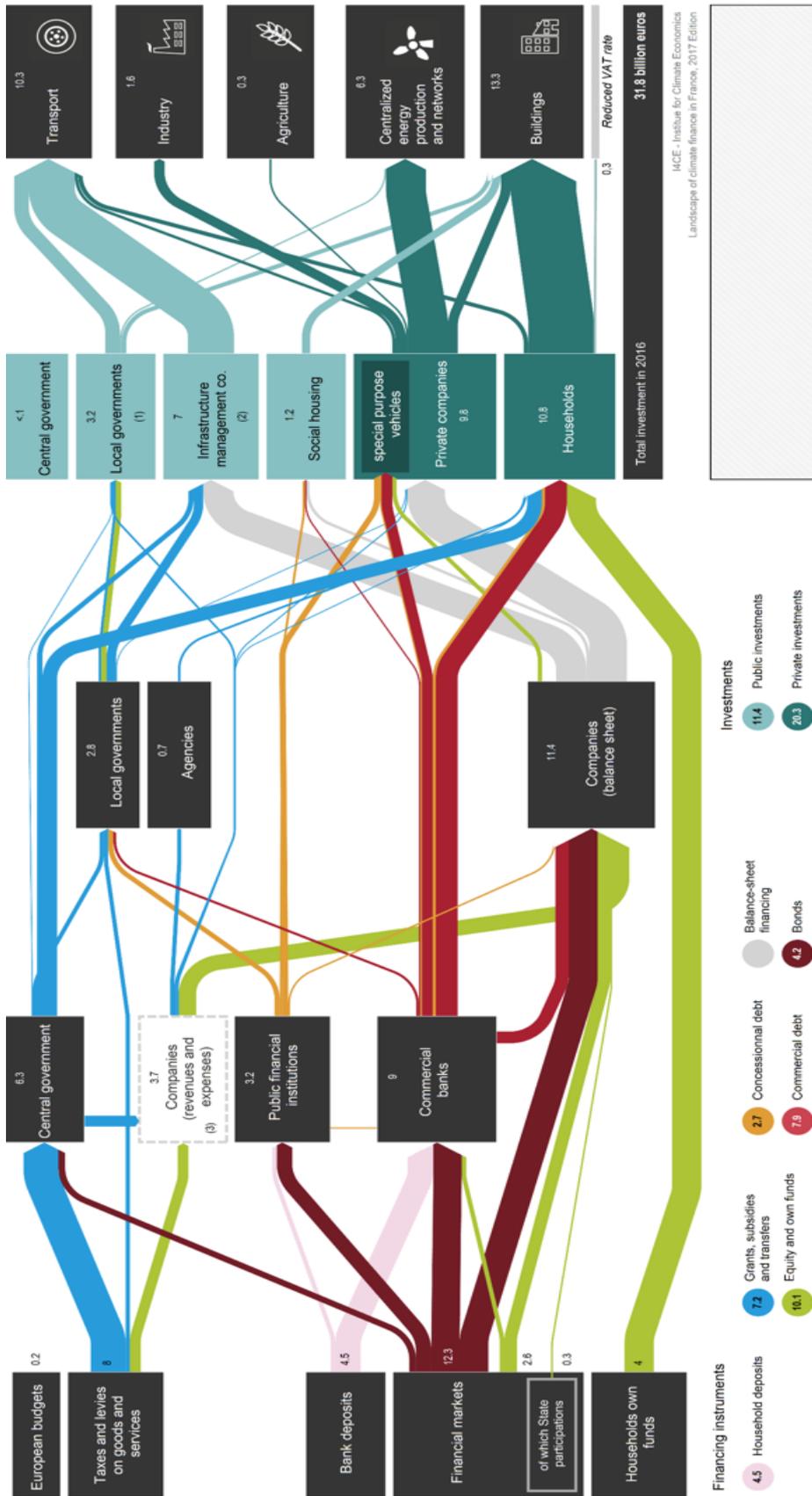
The 2016 Climate and Energy Investment Map for Germany (EUR billions)



Notes:

- a) All financial flows except for the grey ones and the figures expect for those with stars represent total tangible investment including public support into the reduction of GHG emissions and increase of carbon sinks with two exceptions, namely electrical appliances in the buildings sector, as well as blast furnaces and newly built power plants in manufacturing. The grey flows and the numbers marked with stars represent incremental investment into energy efficiency of buildings. Financing of intangible measures is excluded.
- b) The government budget includes federal budget disbursements and co-financing of EU funds to support the investment in 2016, but it excludes public procurement and administrative costs. Regional and municipal investments are not covered, except when reported in the EU/ federal budget or under KfW and BAFA programmes.
- c) Debt owed does not represent the actual finance flows (e.g. debt repayment), but it is shown to highlight the original investors or asset owners who make use of public and commercial financial institutions as financial intermediaries. The map includes only primary investment flows, e.g. the resources available to investors at the time they had to cover for their capital expenses. It does not cover therefore such financial instruments as guarantees, green bonds, the cost of capital or debt repayment by investors, the compensation payments from the public budget to energy generators supplying renewable electricity under the feed-in tariff, and others.

Figure 4 - The French Landscape of Domestic Climate Finance 2016, Source: Hainaut et al., 2018a



Notes: The Landscape of Climate Finance maps investment in tangible (physical) assets securing reduction of GHG emissions in France. This includes construction and equipment acquisition costs and some durable goods as used in national accounts (e.g. vehicles). This excludes the costs of, preparatory studies, operating costs, administrative costs and public procurement costs. Debt represented on the flowchart includes loans and bonds issued by or to project developers, but does not include the reimbursement of previously borrowed funds.

Acronyms:

NE = not estimated

<.1 = amounts of less than €100 million. To maintain clarity, these amounts are not represented graphically but are still included in the total of each box.

- (1) As project developers, i.e. investing in their own buildings or durable goods. Local governments include public transport authorities ("autorités organisatrices des transports", or AOT).
- (2) Public infrastructure management companies include SNCF Réseau (known up to 2014 as RFF), Voies Navigables de France (VNF) and RATP for investment in public transport infrastructure in the Ile de France region.
- (3) Consumption of goods and services on which levies are raised. Proceeds from these levies are dedicated to the financing of low-carbon investment. This includes the transport levy ("versement transport"), carbon auction revenues and the value of white certificates (CEE).

II.2. Dimensions of the assessments

While the core dimensions of the diagrams, i.e. sources, intermediaries, instruments and recipients, except for the one reflecting project developers, are the same, there are certain differences in their definitions. Their detailed comparison is presented in Table 1 and below we discuss the key differences.

One difference is how the **diagrams define the sources**. The German landscape calculates the sources as spending from the public budgets or private sources such as households and corporations. Public spending could either be provided as direct investment into assets, e.g. on construction of efficient public buildings, or as public finance provided to private and public actors, e.g. grants to purchase electric cars. The French landscape defines these as expenditure from the EU budget and public tax revenues directed to the national and local governments, revenue and savings of households, and capital derived from financial markets; these capital flow to public and private intermediaries or directly to project promoters.

As said in the previous section, the other difference is an introduction of a dimension of project developers by the French diagram. They are defined as entities actually making an investment and who are also often the owner of the physical capital generated. These could be central government, local governments, infrastructure management companies, social housing companies, private companies, or households. This captures how different types of project developers (households, companies) who conduct the end investment have different ways of financing their projects and accessing capital.

Commercial financial institutions represent different actors such as commercial banks, pension funds, investment funds, and others. Although they play an important role in financing climate mitigation, in the **German diagram did not quantify investment flows supported by them**. Included by it commercial loans could be attributed either to public budgets or to commercial financial instruments by relying on co-financing data at the scale of the subsidy or loan program. **The French diagram reflected these flows** to the extent to which existing sector-focused studies reported them.

Finally, the German diagram has one more category in the **recipient dimension – the “other” sector**. This covers expenditure into technologies and practices that cannot be clearly attributed to any of the other sectors as well as expenditure into water supply, sewage and waste disposal and removal of environmental pollution.

Both diagrams track only primary investment flows, e.g. the resources available to investors at the time they had to cover for their capital expenses or that they could reliably call in to cover their expenses right after the expenses occurred (Hainaut, H., Cochran, I. 2018). Therefore, such instruments risk management instruments (e. g. guarantees), repayment grants, and feed-in tariffs were excluded. **Accounting for these flows would lead to an overestimation of climate and energy investments** and may result in double-counting.

Table 1 - Comparison of elements and their scope of the analytical frameworks

German climate and energy investment map		French landscape of domestic climate finance	
Sources of investment	<p>Public sources are</p> <ul style="list-style-type: none"> • EU budget, as well as • Federal, regional, and local public budgets, which spending could either be provided as direct investment (e.g. construction of efficient public buildings), or as public finance provided to private and public actors (e.g. grants to purchase electric cars). <p>Private sources cover</p> <ul style="list-style-type: none"> • Households, and • Corporate actors. 	<ul style="list-style-type: none"> • Public tax revenue and service charges mainly directed to the national and local governments. <p>Private/public sources cover</p> <ul style="list-style-type: none"> • Financial markets providing capital in the form of debt or equity to public and private intermediaries or directly to project promoters. <p>Private sources cover</p> <ul style="list-style-type: none"> • Self-financing of projects by households. 	Sources of investment
Intermediaries	<p>The intermediaries include:</p> <ul style="list-style-type: none"> • Ministries and agencies • Public financial institutions, • Commercial financial institutions, and <ul style="list-style-type: none"> • N/a 	<ul style="list-style-type: none"> • Local governments, • Private companies. 	Intermediaries
No such element	<ul style="list-style-type: none"> • N/a 	<p>Project developers:</p> <ul style="list-style-type: none"> • Central and local governments, • Infrastructure management companies, • Social housing companies, • Private companies, and • Households. 	Project developers
Financial instruments	<p>Financial instrument covered:</p> <ul style="list-style-type: none"> • Grants, subsidies, transfers, concessional debt, • Project-level market-rate debt, • Balance sheet financing (debt and equity), and • Project-level equity. <p>Green bonds were excluded as they were identified as secondary investment flows.</p>	<p>Green bonds are generally excluded, but bonds issued by the railway management company SNCF Réseau to cover company's annual investments were included. The bonds were attached to the company's balance sheet and could be labelled as form of balance-sheet financing.</p>	Financial instruments
Recipients	<p>Sectors covered:</p> <ul style="list-style-type: none"> • Centralized energy generation and infrastructure (networks), • Industry, • Buildings, • Transportation, • Agriculture, and <ul style="list-style-type: none"> • Others, including waste 	n/a	Recipients
	<p>Technology breakdown:</p> <ul style="list-style-type: none"> • Renewable energy, • Energy efficiency, and <ul style="list-style-type: none"> • Others. 	<ul style="list-style-type: none"> • Sustainable infrastructure (e.g. transport), • Nuclear. • Emission reductions outside of energy combustion (eg. agriculture, forestry) 	



Source: (Hainaut et al., 2018, Novikova et al. 2019).

II.3. Definitions and scopes of investment tracked

The tracking of financial flows contributing to the national climate targets is a legal obligation in France. The law therefore gives some clarity about what kind of investment shall be tracked. Article 174 of the French Energy transition and green growth act (LTECV) requires the government to present **an annual report to the Parliament** which **“quantifies and analyses public finance, assesses private finance, and measures their adequacy with the financial requirements to achieve the objective and transition pace of the law”** [Hainaut et al 2017].

To select which projects count towards achieving national climate objectives, the French landscape uses a combination of international guidelines, standards, and taxonomies (such as developed by Climate Bonds Initiative (CBI, 2017), the Global Landscape of Climate Finance (CPI, 2015), and the EU TEG on Sustainable Finance) and national strategies and plans (the national low-carbon strategy and multiannual energy plan). The annual survey of domestic energy efficiency and renewable energy markets of the French Environment & Energy Management Agency (ADEME) also contributed to defining some specific threshold for eligibility (e.g. criteria for energy efficiency in the building sector). In most sectors, all these documents converge on what should count as climate-friendly projects.

In Germany, tracking of these flows is not required by regulatory documents. Systematic tracking of public finance supporting climate actions and private investment into these purposes is not established. The identification of climate specific assets is based on the methodology developed by Juergens et al. (2013a) that built on the methodology of CPI's work.

The authors created three dimensions to categorise end-use investments: 1) climate-specific versus climate-related; 2) tangible versus intangible; and 3) incremental cost versus total capital investment. First, climate mitigation can either be a “principal”, or “untargeted” objective of a policy action, which will then be accounted for as climate specific or related. Second, investment into tangible assets is that which count towards the gross fixed capital formation. Intangible assets are indirect investments, e.g. information campaigns, training, and R&D activities. Third, the incremental cost reflects the additional expenditure necessary to invest in a low-carbon technology instead of a business-as-usual practice, while total capital investment reflect the full cost of a technology or practice.

The most recent, i.e. 2016, German diagram reflects climate-specific tangible flows. It covers total capital investment for all investment flows as opposed to incremental cost, with two exceptions. The flows, for which the diagram tracked only the incremental cost, were investment into energy efficient electric appliances used in the buildings sector as well as energy efficient blast furnaces and newly built power plants in the industry sector. **The diagram also provides the flows of incremental investment into energy efficiency in buildings.** These flows were calculated because the construction of new buildings and retrofit of existing buildings imply the use of many non-energy-related technologies and practices and therefore the total investment cost of building construction and retrofits will overestimate actual efforts towards energy transition.

Similar to the German diagram, **the French landscape includes only tangible investment. It also tracks the total investment cost. In the case of new energy-efficient buildings, it was defined as the difference between the project's total cost and the average cost of the same building under the energy standard in effect in France in 2005.**

One difference between the two countries is that nuclear energy is included in the aggregated investment volumes in the French landscape, whereas this is not the case for Germany. Indeed, nuclear power is a possible source of decarbonized electricity, along renewables, in the French low-carbon strategy while the draft multiannual energy plan (PPE) issued in 2019 considers the extension of many reactor's operating lifetime beyond 40 years.

Data availability is a prevailing bottleneck in both countries, but through the legal obligation in France reporting on climate relevant financial flows by public actors is made easier. In France, an annex to the annual budget law covers climate public spending (PLF, 2017). In Germany the national budget has to be analysed line by line and climate specific budget lines have to be extracted and judged after a self-developed methodology, following the CPIs approach.

Table 2 compares the scopes and results of the French and German diagrams.

Table 2 – Comparison of the scopes and results of landscapes of domestic finance in Europe

	Germany	France		
Authors	CPI (2010); IKEM (2016)	I4CE (CDC Climat, 2014; I4CE)		
Partners		MEEM, ADEME		
Year Covered	2010, 2016	2011 to 2017		
Scope				
Mitigation	Covered	Covered		
Adaption	Not covered	Not covered		
Sectors				
Buildings	New	yes	New	yes
	Renovation	yes	Renovation	yes
Transport	Vehicles	yes	Vehicles	yes
	Infrastructure	yes	Infrastructure	yes
Agriculture	Energy	yes	Energy	yes
	Other GHGs	yes	Other GHGs	partial
Industry		yes		yes
Energy	Fossil	partial	Fossil	yes
	Nuclear	no	Nuclear	yes
	Renewable	yes	Renewable	yes
	Networks	yes	Networks	partial
R&D		partial		partial
Investment				
Amount	EUR 43 billion (in 2016)	EUR 32 billion (in 2016)		
% of GDP	1,36%	1,43%		
% of GFCF	6,7%	6,6%		

II.4. Data availability and limitations

The investment flows in both diagrams were conducted by either disaggregating national budget reports to sectoral or technology level or by aggregating disbursements at project level to investment at sectoral and technological level. The data availability is setting the limitations of both studies scope. In both countries tracking private climate finance is the prevailing challenge. Therefore, the columns should be treated with caution as **they reflect only the low estimate of the actual investment.**

The 2016 climate and energy investment for Germany relied on similar data sources as used by Jürgens et al. (2012). Although the 2016 update benefited from new climate finance tracking methods, e.g. the climate markers as applied to the spending of the EU budget. Some key data sources are not available anymore, e.g. data on finance from the National Climate Initiative (NKI) and data on private fuel switch investment in the energy sector.

Overall, the key challenges in identifying and tracking climate and energy investment in Germany that the authors concluded on 2016 remained the same as in 2010, namely:

- Data on national budget contributions to climate specific actions are not systematically tracked in the annual budget reports. Identification and accounting of climate-specific expenses from the public budget at national, regional and local level is therefore a challenge.
- Although there are a few surveys on annual climate investment volumes of corporate actors for some sectors, quantifying the investment of the whole private sector is not possible. This is also due to the limited reporting on climate measures of private financial intermediaries and private enterprises.
- The extent to which climate related measures such as infrastructure projects can be accounted is challenging to define. The EU climate markers are a first step into the direction of standardizing this process, but at national level there is no marker approach in place, which leads to the full exclusion of budget lines where the climate specific share is unknown.
- While this is only the share of incremental cost in the total investment especially in the building sector, that could provide a clear picture of the progress towards addressing the investment need of energy transition, the data available does not allow its calculating of the incremental cost of climate investment.
- The data available does not allow a reliable understanding of the breakdown of investment volume by financial instrument.
- The disaggregation of investment flowing into adaptation or climate protection is not possible to conduct, because expenditure for climate change adaptation is often reported as into climate protection expenditure, without sufficient detail.

Also in France, the authors faced a number of challenges:

- Data on investment and finance is abundant in sectors where there are a few large projects (such as transport infrastructure), where public support is extended to each project (such as renewables), or where all project managers have to register their equipment in a registry with energy and climate indicators (such as car sales). On the contrary, data is scarce in sectors where projects are small and heterogeneous (such as the retrofitting of private dwellings) or when corporations receive little public support (such as industry). Many sectors lack a comprehensive annual survey of actions undertaken for climate purposes.
- Data about financial instruments (loans, bonds and credit lines) is often expressed differently according to financial institutions and their counterparts. For example, financial institutions may report on the amounts of loans signed, or the outstanding loans to a certain sector, while the data relevant to match with investment would be the actual disbursement of the funds by the counterpart.
- Companies tend to “self-finance” a lot of their climate-friendly projects. In practice, this means that they use the same instruments to fund all their investments, whether climate-friendly or not. In this situation, there is no obvious method to match investments with a particular set of instruments. The French landscape assumed all funds raised during the year contributed, in proportion, to the company’s end-use investment.
- Data on climate change adaptation could not be easily gathered.

III. Results of tracking investments in Germany and France

As said, there have been two diagrams issued to assess investment for Germany: these are a 2012 study of CPI assessing the 2010 investment and a 2019 study of IKEM assessing the 2016 investment. **The 2016 update estimates the climate-specific investment flows that were able to be traced to amount EUR 42.7 billion, which is a 16% increase compared to 2010 (EUR 36.7 billion).** The French landscape has been conducted in a yearly term since 2011. While climate relevant investments increased from 2011 to 2013 by EUR 2.3 billion, **the yearly amount of EUR 32 billion climate-specific investment flows has been stable since then.** Nevertheless, this stability masks contrasting trends among the principal areas of the transition: energy efficiency, renewable energy, infrastructure investment and others.

In France, **in the area of energy efficiency**, which mainly concerns the building and industry sectors, **annual investments have increased since 2011 and are provisionally estimated to reach EUR 14.6 billion in 2016.** This increase reflects several trends, including gradual recovery in new building construction, strengthening of incentives for the renovation of private housing units, and the targeted programmes for the refurbishment of social housing units.

In Germany **the incremental share in energy efficiency investment increased by 18% since 2010, totalling to EUR 8.5 billion climate specific investments in 2016.** As compared to France, the German study covers a smaller portion of investment into the buildings sector than that used in the French Landscape. The main difference in accounting is given by the use of gross capital formation in the French landscape and incremental investment shares for energy efficient building construction and retrofits in Germany. **Total investment in energy efficiency in Germany totals to EUR 37.5 billion in 2016** including the incremental share in investment cost reflected in comparison above (EUR 8.5 billion).

Focus: investment into renewable energy in Germany and France

Following the sharp increase during 2009 and 2011, investment into renewable energy installations in France significantly decreased between 2011 and 2013. This was caused by the four months moratorium on photovoltaic systems, the introduction of auction systems and the related lack of trust of foreign stakeholders. From 2013 to 2016, investments were stable in the range of EUR 3.5 billion to EUR 4.2 billion. Companies are the main investors, using mainly special purpose vehicles relying on bank lending to finance projects.

In 2016, investment into renewable energy installations in Germany was EUR 8.5 billion, also decreasing by 6% from 2010 to 2016. This trend could be explained by the decline in investment costs for renewable energy installations, especially photovoltaics, as well as a decline in new installed renewable energy capacity between 2012 and 2016 (May et al. 2017). The investment is largely made by the private sector, however around EUR 4.9 billion of it was supported by through KfW concessional loans.

As discussed in the previous section, **it is tricky to compare sources of investment in German and French landscapes because they are defined differently.** Therefore, the numbers below could not be directly compared to each other.

In Germany, private actors and in particular corporations are the largest sources of investment. Thus, the private sector provided 83% of the total investment (EUR 52.3 billion), the remaining 17% originated from the public sector (EUR 10.9 billion). Corporate actors remain by far the largest private investors (EUR 35.2 billion), followed by households (EUR 17.2). In the public sector, the German government budget played the largest role (EUR 4.2), followed by the EU budget (EUR 2.7 billion).

The French landscape considers the role of the public sector not only as a provider of funds, but also as a possible driver of private funding. For example, public companies launching rail or urban transport infrastructure through raising commercial or market debt still count as publicly-driven finance. According to this definition, in France, public and private actors provide almost equal volumes of investment. **Public-driven finance in France has increased from 2011 to 2015, both in absolute value (from EUR 14.3 to EUR 17 billion) and in proportion to total investments (from 48 to 52%). Private project developers conducted 64% of this investment, public project developers contributed 32%, and public-private project developers addressed the rest of the volume. These figures could not be compared to the German results due to different definitions of investment sources**

In France, subsidies and equity play a larger role in funding climate projects than in Germany. This could be the result of a higher share of investments in transport infrastructure in the overall totals (as transport infrastructure relies mostly on subsidies), or a signal that French project managers face a riskier investment environment, resulting in a lower debt to equity ratio in their funding models:

- subsidies to and equity of public project managers amounts to EUR 3.8 billion
- debt raised by public project managers is EUR 7.6 billion
- grants provided to households and private companies from public budgets totals to EUR 4.9 billion
- organized transfers between private sector institutions amounts to 0.4 billion.

Private finance in France has a share of 48% and is driven by commercial debt and own funds by households and companies. Households as project developers in France invested in total EUR 10.3 billion followed by private companies with EUR 6.2 billion.

In terms of financial instruments, **the German assessment highlighted the central role played by KfW**, the country's main public financial institution. Results from the study indicate that KfW played a main role **in structuring the 'onlending' (intermediated lending model) through the local branches of private banks. Around EUR 32.0 billion in concessional loans for private individuals and businesses for energy efficient renovations of buildings and renewable energy installations were made available through this model.** In Germany, commercial banks are the primary financial intermediary for loans to project developers.

Comparatively in France, the major part of concessional debt totalling EUR 3.5 billion was issued directly by the government-owned financial institutions such as the Caisse des Dépôts. The practice of "onlending" seems less developed, especially towards private individuals. While large companies and infrastructure managers in France used bonds to finance their investments households relied mainly on equity. In terms of project size, small projects (less than EUR 100,000), particularly developed by households (construction, retrofit, vehicle acquisition) as well as infrastructure projects (more than EUR 100 million) were financed mainly by grants, subsidies and payments. Concessional loans were mainly used to finance medium sized projects (between EUR 100,00 and EUR 100 million), such as public building renovation and renewable energy generation. Large companies, infrastructure managers and commercial banks used bonds to finance large projects (more than EUR 100 million). The high share in diffuse investments mirrors the difficulty of attracting private investment for smaller projects.

In both studies the sectors, which attracted the largest share of climate-specific investment were the building sector (France: total EUR 13.3 billion; Germany: total - EUR 35.1 billion, incremental – EUR 14.6 billion) and the energy generation and transmission sector (France: total - EUR 6.3 billion; Germany: total - EUR 17.1 billion). These sectors also underlie the highest sector-specific targets for greenhouse gas emissions (GHG) reductions by 2030.

The French assessment builds upon yearly historical data from the previous conducted assessments. Therefore, being able to develop growth patterns for different used financial instruments and recipient sector volumes. The change over time analysis leads to deeper results in terms of progress towards closing the gap to the calculated investment needs and furthermore gives insights about the progress in terms of shifting financial flows towards climate resilient projects. The increasing investment volumes since 2014 lead to a reduced gap between actual and needed investments, which are calculated based on the 2015 National Low Carbon Strategy (SNBC) and the 2016 Multiannual Energy Plan (PPE). However, as visualized in Figure 5 a deficit of EUR 10 to 30 billion in annual

investments remain to achieve the national climate objectives. In Germany Juergens et al. (2019) reviewed different studies for investment needs to reach the national climate targets in 2030 and conclude on a range from EUR 24.9 to 58.5 billion. The wide range of the different studies lead to a gap between EUR 0 and 16 billion.

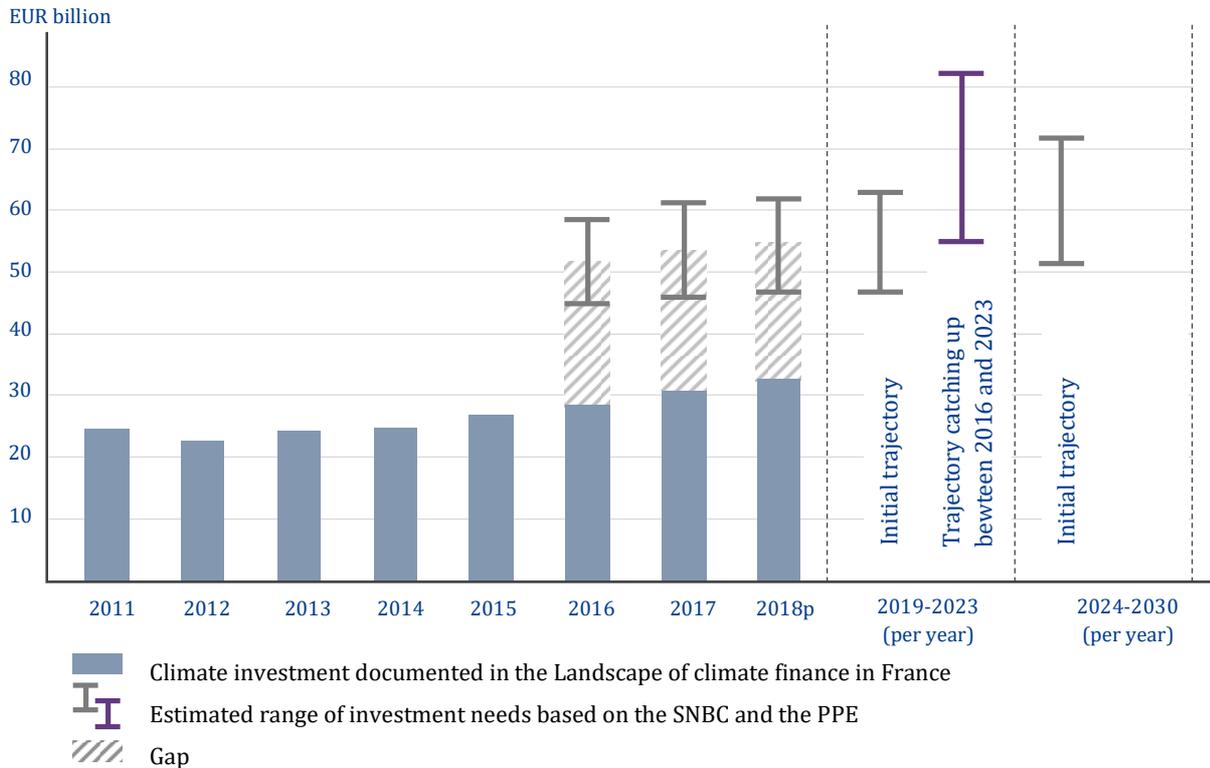


Figure 5: Comparison of calculated investments in the French landscape and investment needs after SNBC and PPE, Source: (Hainaut et al., 2018b)

Note: The total of tracked climate investments from 2011-2018 is less than the totals mentioned previously in this brief, as I4CE was unable to quantify future investment needs in sectors such as agriculture, industry and nuclear based on the SNBC and the PPE. Therefore, these sectors are excluded from the comparative assessment.

Conclusions and discussion

In summary, the methodologies to track investment into energy transition in Germany and France have similarities and differences. Therefore, their results could not be directly compared, and such analysis should be conducted with caution.

This brings us to the conclusion that common definitions as well as methods to track these flows would be important to facilitate comparability of results. Mutual learning could help hereby to establish a holistic tracking approach, given the challenge of lacking the official tracking methodology in Germany. The expert group of the European commission on a taxonomy for sustainable finance as well as a review of the climate tracking approach applied to the EU budget's 20% climate action target could take this into consideration. Both processes have the potential to significantly contribute to common definitions to be used across public and private finance instruments, funds, programmes and incentives.

Despite different methodologies, still interesting observations could be made on how France and Germany finance their energy transitions. Concessionary debt plays a large role in financing energy transition in Germany whereas diffuse instruments are used in France. The German state-owned development bank, KfW, plays a vital role in financing energy transition, disbursing EUR 32 million of concessional loans to households, enterprises and public actors through local branches of private banks making the capital easily accessible for projects of various size. In France, this practice of “onlending” is less developed. Different actors rely on different financial instruments, including bonds, concessional loans directly disbursed by government-owned financial institutions, subsidies, commercial debt, balance sheet financing, and others. The high share in diffuse investments mirrors the difficulty of attracting private investment for smaller projects in France.

In both countries, the buildings sector attracts the largest share of investment. This sector is however the largest challenge for both countries and neither of them is on tracking meeting sector-specific targets. Investment into transport sector, flowing largely from public sources, ranks second in France, but it is not ranked high in Germany. The lower share of transport investment in Germany is not however its pattern, but the consequence of lacking the methodology of how to account climate-specific investment of transport infrastructure. Investment into the energy generation and transmission sector ranks second in Germany and third in France, with the investment into renewable energy installations having declined since 2010 in both countries. Investment into the decarbonisation of the industry sector does not play a big role, probably due to low prices of EU ETS allowances. From the GHG emission reduction trends, it is apparent that much larger efforts are required to meet 2050 targets in both countries.

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