



Finance sector alignment
with international climate goals
Reviewing options and obstacles



ABOUT THE REPORT

Authors: 2° Investing Initiative: Hugues Chenet, Anuschka Hilke, Wei Duan

Project: This reports was written as part of the GREEN-WIN project.

The GREEN-WIN project is a major international transdisciplinary research collaboration applying a solution-oriented approach targeted at increasing the understanding of links between climate action and sustainability and overcoming implementation barriers through win-win strategies. The project critically assesses where and under which conditions win-win and, in particular, green growth strategies work in practice and where fundamental trade-offs must be faced. The project team is focusing on four critical barriers that have been identified by practitioners and policymakers. These include:

- Develop transformative narratives highlighting opportunities in climate and sustainability action in order to contribute to overcoming cognitive barriers and empowering people.
- Examine climate and sustainability finance policies and governance arrangements in order to contribute to overcoming financial barriers to mitigation and adaptation.
- Substantiate the economics of green growth in order to contribute to overcoming economic and collective action barriers to de-carbonisation. Towards this end we introduce major innovations into the GEM-E3 computable general equilibrium model required to discover green growth strategies. These include developing a network-based model of technological diffusion and introducing financial market constraints and adaptive expectations of agents.
- Contribute to overcoming economic and institutional barriers through identifying win-win strategies, sustainable business models and enabling environments in three action fields of coastal zone flood risk management, urban transformations and energy poverty eradication and resilience.

All these activities are embedded within a sustained international dialogue involving stakeholders from policy, research, civil society and the private sector, and an open knowledge management and capacity building strategy to promote knowledge transfer and learning beyond the project lifespan.

More information: <http://green-win-project.eu>



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 642018.



ACKNOWLEDGMENTS

This report benefitted from the review and comments of Green-Win project consortium members, in particular Brendan Burke (2dii), Nadia Ameli (UCL), Leonidas Paroussos (E3M), Antoine Mandel (EEP-PSE) and Jochen Hinkel & Alexander Bisaro (GCF).

The authors would like to thank the 24 participants of the workshop “Aligning finance with climate goals” organized by 2° Investing Initiative in partnership with University College London (UCL) in London on July 11, 2016, with the help and contribution from Heloise Lammens (2°ii), Nadia Ameli, Michael Grubb and Paul Drummond (UCL).

CONTACT

Hugues Chenet, hugueschenet@2degrees-investing.org

Anuschka Hilke, anuschka@2degrees-investing.org, +33 1 4281 1997

Copyright 2° Investing Initiative (February 2017).

The views expressed in this report are the sole responsibility of the authors and do not necessarily reflect those of the 2° Investing Initiative members nor those of the persons and organisations who have been solicited or interviewed as part of the project. The authors are solely responsible for any errors. The Executive Agency for Small and Medium-sized Enterprises (EASME) funding the Green-Win project under the EU Horizon 2020 programme is not responsible for any use that may be made of the information it contains.

TABLE OF CONTENTS

EXECUTIVE SUMMARY	4
A- INTRODUCTION – AIM OF THE REPORT AND METHODS APPLIED	7
B- MEASURING THE ALIGNMENT OF THE FINANCE SECTOR WITH CLIMATE GOALS	9
1. Why measure the alignment of the finance sector with climate goals	9
1.1 Investment and mitigation	9
1.2 The role of the finance sector in meeting the climate targets	11
2. How to measure alignment	13
2.1 Breaking down the climate target into an economic vision	13
2.2 Translating economic roadmaps into finance metrics	16
2.3 The missing link: climate performance metrics	18
2.4 Existing indicators	19
3. Summary	21
C- APPROACHES FOR IMPROVING ALIGNMENT	22
1. Obstacles for the integration of climate considerations in finance	22
1.1. Understanding the general mechanisms of finance	22
1.2 Specific barriers to the integration of climate considerations	24
2. Review of existing and potential approaches for improving alignment	26
2.1 Introduction	26
2.2 Green Bonds	27
2.3 China green credit policies	30
2.4 Low carbon indices and mainstream indices	32
2.5 Greening banking regulation	34
2.6 Consistency issues and trade offs and complementary approaches	37
D. CONCLUSION	39
BIBLIOGRAPHY	40

EXECUTIVE SUMMARY

INTRODUCTION

The landmark Paris Agreement adopted in 2015 established a clear objective for the fight against climate change: limiting global warming to well below +2°C (<<2°C) above preindustrial levels. Furthermore, the agreement also specifies the need to make finance flows consistent with this goal. This amounts to a fundamental paradigm shift, scaling up climate finance from a niche of the finance sector to a mainstream alignment of finance flows with climate goals.

The report aims to increase the understanding of the impact of this paradigm shift, specifically regarding two issues:

- 1) What are options and obstacles to measuring the alignment of financial flows with climate goals?
- 2) How do different approaches aiming to improve such an alignment fare in terms of their feasibility, acceptability, impacts well as trade-offs and inconsistencies?

The report combines information from multiple disciplines and sources in order to provide a comprehensive overview of the challenges and a critical discussion of selected options. It is based on literature review, data analysis and benefited from feedback from an expert workshop held as well as informal expert feedback.

This report is a contribution to the Green-Win project which is supported by the European Horizon 2020 Research and Innovation Programme and seeks to identify the win-win tools and strategies that can help to overcome barriers to the implementation of sustainability and climate action. The finance sector can be a stumbling block or an enabling factor to this end. By examining factors that bias finance towards short-termism and perpetuation of existing production and consumption patterns as well as market and policy responses to overcome such existing bias, the report aims to increase the knowledge base of stakeholders and develop solutions to overcome financial barriers to upscaling of identified win-win solutions. The report also contributes to the overall project aim of developing coherent global narratives for linking climate change and sustainable development goals.

MEASURING ALIGNMENT

Achieving the climate target means our economies have to reach a global net-zero GHG emission level during the second half of the century. The International Energy Agency estimates that shifting to a +2°C pathway can be achieved at only slightly increased investment levels, typically ~3% more than the investments needed in a business-as-usual trajectory leading up to +6°C. One of the main challenges is that this requires a capital reallocation, shifting the capital flows from high-carbon to low-carbon assets, in order to stay within the limits of the carbon budget.

The call for the finance sector to contribute to the fight against climate change clearly emerged in the last five years. The expected contribution of the finance sector is nothing less than its alignment with climate target (<<2°C aligned). This emphasizes the challenge of being climate-friendly as a whole (i.e. financing the complete decarbonisation pathway), and not only creating green niches.

However, even assessing the current state of (non-) alignment of finance to the climate goals is not a simple task. On the one hand, the climate goal itself is complex and multi-dimensional. On the other hand, finance is an aggregation of multiple tools and regulations that are not designed to integrate factors such as climate change.

There are countless ways to convert the climate target – a single temperature number – into an economic pathway according to the possible mixes of technology development, policy and lifestyle preferences. At the national level, such preferences are represented in governmental decarbonisation roadmaps and strategies. These provide a good illustration of the diversity of approaches and ambitions, as well as the difficulty to solve the <<2°C equation globally.

At the international level one approach consists of translating the climate target into trajectories of energy and technology change, distributing the decarbonisation effort across sectors and regions while fitting the increasing energy needs. The IEA publishes such technology roadmaps for key sectors. This approach constitutes the primary material that can be used to develop indicators for the finance sector by translating them into investment roadmaps and defining financing needs.

A number of indicators currently exist aiming to assess climate-friendliness. Two complementary families of approaches co-exist: emission-based indicators (easier to aggregate, but very difficult to benchmark with the 2°C goal) and activity-based indicators (comparable with energy technology roadmaps, but limited to some sectors). Carbon footprinting is still the most commonly used metric and contributed recently to the substantial capacity building on climate change mitigation issues in finance. Yet, sector- and technology-specific metrics based on corporate production and capacity forecasts have become available, and have opened the way to operational metrics that are more compatible with financial institutions’ usual practices.

Better climate assessment of the finance sector shall have a key role to play in improving the climate impact of financial products and regulations, tracking progress in financing the transition and helping policy makers to set up the relevant incentives. It is crucial that financial institutions meet the challenge of climate change, in the right direction and at the right pace.

IMPROVING ALIGNMENT

While climate policies currently still fail to set a clear framework for investors, barriers for climate-alignment also exist within the sector itself. Mainstream finance is structurally built, managed, regulated and supervised in a way that makes integration of climate change difficult. Time horizons used for financial analysis as well as strategic asset allocation strategies currently do not allow to take future developments related to climate change into account.

The climate challenge has so far mainly been addressed through an additional layer of dedicated financial products and regulations on top of the existing system, even though some have the potential to become mainstream over time. Only few approaches even attempt to directly integrate low-carbon constraints into mainstream financial activity. A large variety of approaches to improve alignment has been developed. This report discusses a subset of these covering a variety of aspects, from classic financial products with a green label (e.g. green bonds), to investment management tools with a green subset (e.g. low-carbon indices), to national policies targeting the finance sector (e.g. green credit policies). A new approach currently under discussion is to directly green mainstream financial regulations (e.g. Basel rules for banks).

SELECTED APPROACHES FOR IMPROVING ALIGNMENT DISCUSSED IN THE REPORT

	Green bonds	Green credit policy	Market indices	Basel regulation
Market initiatives	✓		✓	
Regulation		✓		✓
Product specific	✓	✓		
Wider framework			✓	✓
Existing	✓	✓	✓	
Under discussion				✓

Green Bond have shown impressive growth rates over the last years and are a well accepted approach by investors and policymakers alike. However, the market needs to continue to grow exponentially to achieve a relevant size according to first estimates. At the same time there are major concerns about greenwashing in the absence of agreed definitions. There also remains some uncertainty about the real impact of green bonds in terms of additionality.

China's Green credit policy guidelines have the potential to integrate a climate constraint into lending activity in general. However, the way they are currently implemented in China leave a number of questions open, given that they only apply to domestic lending. Also capacity constraints reduce the potential impact of the approach.

Low carbon indices have great potential to reorient financial flows given the importance of indices for financial decision-making in general. However, they currently suffer from methodological drawbacks and the fact that they rarely include the climate goals as a constraint. While they have a strong impact on the secondary market, their impact on the real economy is less clear. In addition, their uptake is currently marginal and it remains to be seen if they will become widely used by the finance sector.

Greening regulatory frameworks such as Basel regulation, as currently discussed, would potentially have strong impacts on improving alignment depending on the approach taken. While there are at the same time supporters and opponents of the approach it is clear that such an approach would need a strong political will to materialize.

For all approaches the question of the definition of what is climate-friendly and linking them more clearly with the climate goals is a key precondition of increased impact in the quest towards improving the alignment of financial flows with climate goals.

CONCLUSION

The finance sector is now expected to contribute to the fight against climate change, which represents a turning point. It appears to have recently grasped the issue, especially with the sudden entry of financial policymakers and central banks in the conversation. But it is not clear yet if it has the capacity to reorient finance flows in the right direction and at the right pace in order to shift investments towards a low-carbon economy compatible with the well below 2°C limit.

Monitoring the contribution of financial flows to climate goals is essential to be able to design and adjust policy responses aiming to improve and ultimately achieve the alignment of financial flows with climate targets. This requires better metrics able to clearly link the climate goals with financial activity. Established indicators are not sufficient in this regard, but new approaches are currently being developed and refined.

A - INTRODUCTION: AIM OF THE REPORT AND METHODS APPLIED

Background and aim of the report

This report is a contribution to the Green-Win project which is supported by the European Horizon 2020 Research and Innovation Programme and seeks to identify the win-win tools and strategies that can help to overcome barriers to the implementation of sustainability and climate action. The finance sector can be a stumbling block or an enabling factor to this end. By examining factors that bias finance towards short-termism and perpetuation of existing production and consumption patterns as well as market and policy responses to overcome such existing bias, the report aims to increase the knowledge base of stakeholders and develop solutions to overcome financial barriers to upscaling of identified win-win solutions. The report also contributes to the overall project aim of developing coherent global narratives for linking climate change and sustainable development goals.

The decision to achieve alignment: The 2015 Paris Agreement has set the internationally agreed goal to hold the increase in the global average temperature to well below 2°C above pre-industrial levels. Furthermore, the agreement also specifies the need to make finance flows consistent with this goal. Indeed, the main role of finance is to fuel the real economy and it thus has a significant influence on economic decision-making. Financial markets, through their global nature and supposed high adaptive capacity, are now expected to act as a key player in the decarbonisation of the economy and the fight against climate change. In a broader context, after the failure of financial markets during the recent financial crisis, many hope that finance may eventually become a tool in the service of sustainability. It could thus not only get closer again to its original purpose of servicing the needs of the real economy but also regain trust and acknowledgement for this vital role, much of which has been lost during the crisis.

A fundamental change: The idea of aligning financial flows with climate goals may sound convincing and even a win-win situation itself: the financial sector winning back trust and purpose, the real economy winning from a reorientation of financial innovation with their services and society winning from reduced damages through climate change as well as potentially reduced costs of mitigating climate change.

However, one should not underestimate the fundamental character of such a request. Aligning financial flows to climate goals means establishing a constraint applicable to the financial sector as a whole. Climate change is thus put on a similar level with other general constraints such as financial stability and consumer protection. This shows the acceptance of the universal character of climate change. However, it is also a fundamental change away from a paradigm that has characterised climate change negotiations and research alike for years: the idea of scaling up dedicated climate finance which has effectively created two parallel systems: climate finance and mainstream finance.

A challenge to implement: However, the complexity of the finance system is not always well understood among the different stakeholders who are involved discussions around climate change. Moreover, the actual capacity of the financial sector to address the issue of climate change and respond adequately to the challenge is not guaranteed. In particular, many questions remain on how to determine to what extent the finance sector is on track with respect to the international climate objective of keeping global warming well below 2°C and what are the most promising approaches to the alignment.

The present report: This report's objective is to increase the general understanding of how the financial sector interacts with climate goals. In particular, the report provides answers to the following questions:

- Comparing financial portfolios with climate goal (Section B):
 - ✓ What are options and obstacles to measuring the alignment of finance to climate goals?
- Comparing different approaches to improve alignment (Section C):
 - ✓ what are important issues regarding their feasibility (e.g. technical and regulatory issues) as well as acceptability (e.g. for political, social and private sector stakeholders)?
 - ✓ what can be expected in terms of potential climate impact?
 - ✓ What trade offs and inconsistencies may exist between the different approaches?

This report aims to be a reference document for those interested in the contribution of the finance sector towards climate goals, whether from policymakers and governments, climate change community, financial sector, industry, international organisations, or civil society.

Methodology of the report

It is worth noting that the broad topic itself (finance sector and climate change) is still young: it is only since the Paris Agreement in December 2015, that the notion of “aligning the financial sector with climate goals” has become a widely agreed and communicated concept. In addition, the aforementioned questions lie at the intersection of multiple disciplines and approaches such as climate science, economic and energy technology modelling, climate policy, industrial and energy policy, financial regulation, behavioural finance, investment strategy, risk management, responsible investment, and governance of climate actions.

Due to the novelty of the concept and probably also because of its inherent multidisciplinary core, it is so far barely addressed by academic publications. Most existing academic publications are focused on dedicated climate finance, which represents only a very small part of finance overall. In addition the approach of increasing climate finance is fundamentally different from trying to move the whole of the finance sector towards “climate compliance.”

The present report thus reunites documents from a large range of sources. A literature review was done based on different types of material covering the multiple disciplines mentioned, including from the professional and policy domains. The value added by this report is to combine various sources of information to give an in-depth overview of the main barriers and the current state of the art in relation to the research questions outlined above. The following describes the main types of sources that were used for the report:

- **Academic papers and media/data releases** on climate science, carbon budget and climate scenarios, from researchers, research organisations, and bodies involved in climate negotiation (e.g. Allen [2015]; Meinshausen [2015]; IPCC [2013]; NASA [2016]; Stern [2006]; Rogelj et al. [2016]; UNFCCC [2016]);
- **Papers, studies, models and data from economic and climate think tanks** (e.g. Climate Bonds Initiative [2016]; CDP [2015]; Carbon Tracker Initiative [2011]; New Climate Economy [2014]);
- **Publications and data from national and international organisations** (e.g. EIA [2016]; IEA [2016]; IMF [2011]; Japan Ministry of Environment [2016]; OECD [2016]; UN SG [2015]; UNFCCC [2015]; UNEP [2015]; UNEP FI [2014]; World Bank [2016]);
- **Publications or official speeches from financial institutions or policy makers** on mainstream financial regulation, and how climate change is connected with finance sector; those can come either from
 - regulatory bodies (e.g. BIS [2016]; Boissinot et al. [2016]; Carney [2015, 2016]; CBRC [2012]; EC [2015]),
 - government members (e.g. G7 [2015]; G20 [2016]; Hollande [2016]; Royal & Sapin [2016]),
 - banks, investors and financial services (e.g. BoAML [2016]; EIB [2015]; FBF [2016]; S&P/Trucost [2016]);
- **Studies, methodological reports and commercial documents from private companies and consultancies** (e.g. Cicero [2016]; Mercer [2011]; MSCI [2015]; KPMG [2012]; PwC&IETA [2016]; Shell [2016]);
- **News articles and reviews from general and expert media** (e.g. Carbon Brief [2016]; The Guardian [2014]; Novethic [2015, 2016]; CGIRC [2016]; Responsible Investor [2016], Risk Magazine [2015]);
- **Data from financial and sectoral information providers** (e.g. Bloomberg, Global Data, Thomson Reuters, WardsAuto).

The report has also benefitted from expert inputs through bilateral discussions as well as through a dedicated workshop on “Aligning finance with climate goals” held on 11 July in London and hosted by UCL. The workshop convened 20 participants representing research organisations, public administrations, banks, investors and NGOs.

B - MEASURING THE ALIGNMENT OF THE FINANCE SECTOR WITH CLIMATE GOALS

1. Why measure the alignment of finance sector with climate goals

1.1 Investment and mitigation

A clear climate goal

There is now a strong evidence of global warming: the Earth has already heated up +0.87°C (annual mean) above the 1951-80 average (NASA, 2016a) and 2016 was the third year in a row to break the record of the warmest year since the beginning of measurement over a century ago (NASA, 2016b). It is equally clear that human activity is largely responsible for this climate change (e.g. IPCC 2014), and that the Earth will continue to warm for decades regardless of mitigation measures, as the climate system is not stabilised (e.g. MetOffice, 2016).

In 2015, the 21st Conference of the Parties — COP21 — clearly redefined the target of the fight against Climate Change, which is now set in the Paris Agreement that came into force on November 4, 2016 (UNFCCC, 2015; UN, 2016). The goal is to hold the increase in the global average temperature to well below 2°C (<<2°C) above pre-industrial levels, and pursuing efforts to limit the temperature increase to 1.5°C, recognizing that this would significantly reduce the risks and impacts of climate change (UNFCCC, 2015). Achieving this comes with drastically limiting GHG emissions, down to a “net-zero” level (Allen, 2015): at one point in the second half of the century, anthropogenic GHG emissions will have to be zero, or balanced by sinks of GHG that would remove the remaining emissions (Fig.1), in order to stabilize the climate. The sooner we reach zero, the closer we will be to the +1.5°C limit. Net-zero CO₂ from energy and industry by 2050 can leave us at +1.5°C, but will lead us closer to +2°C if reached only by 2070 (Rogelj et al., 2015).

FIG. 1: THE PARIS AGREEMENT IN 2 GRAPHS (SOURCE: MEINSHAUSEN 2015)

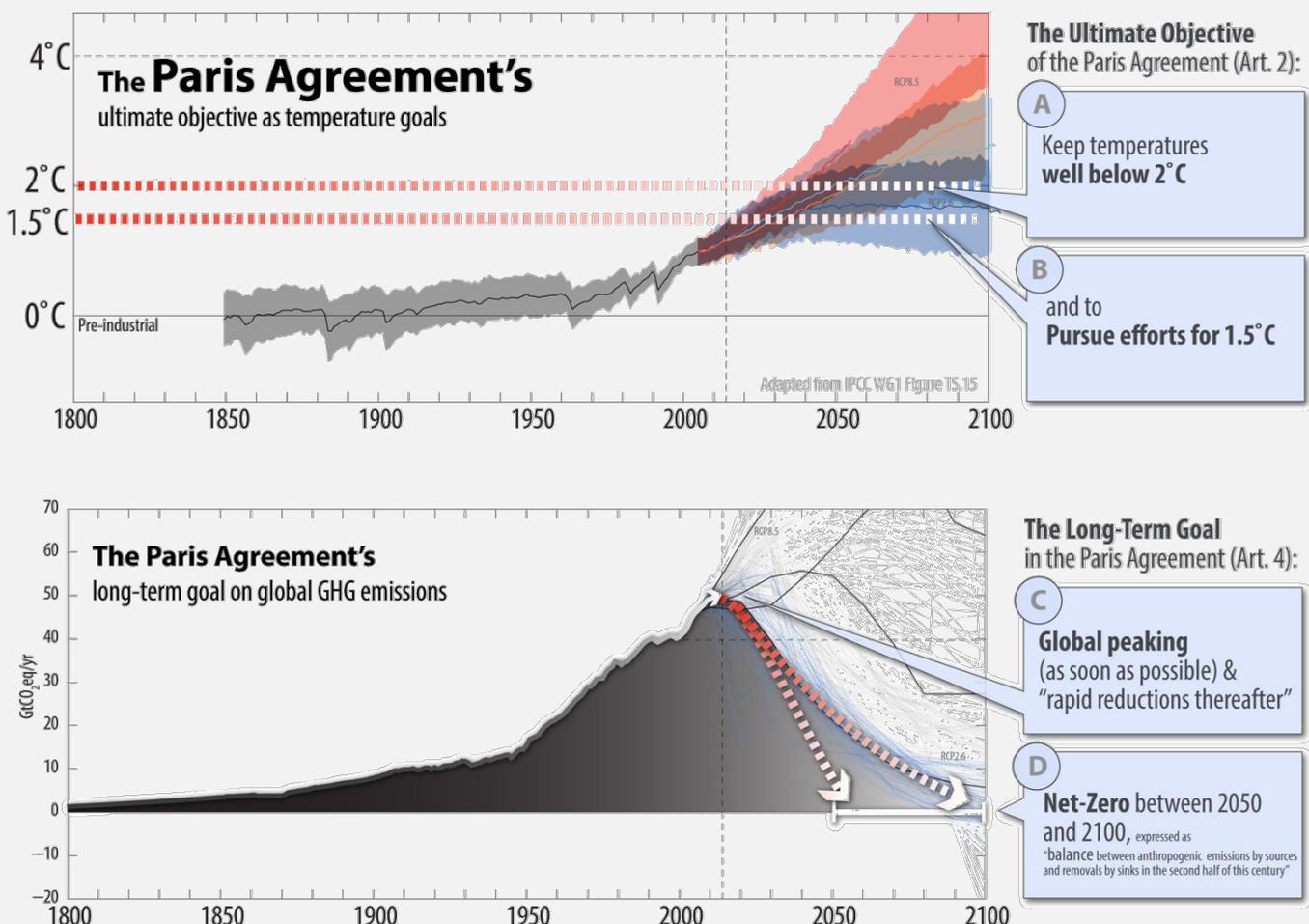


FIG. 2: INVESTMENT NEEDS IN BUILDING, INDUSTRY, TRANSPORT AND POWER SECTOR FROM 2016 TO 2050 (SOURCE: ADAPTED FROM IEA 2016a)

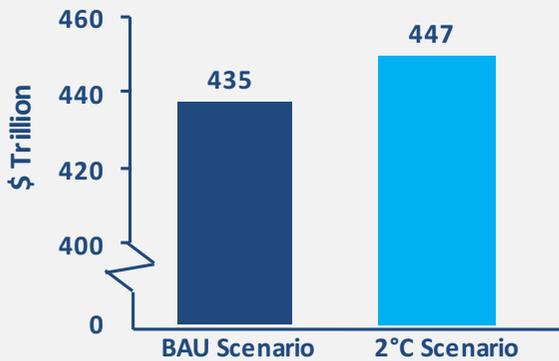


FIG. 3: CARBON BUDGET AND POTENTIAL EMISSIONS FROM FOSSIL FUEL RESERVES (SOURCE: CARBON BRIEF 2016)

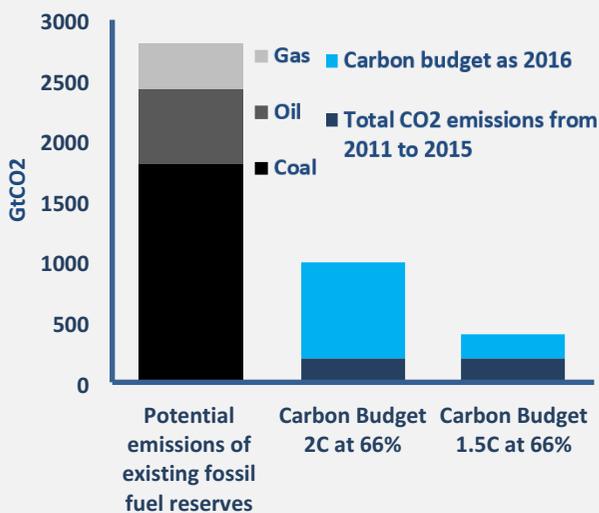
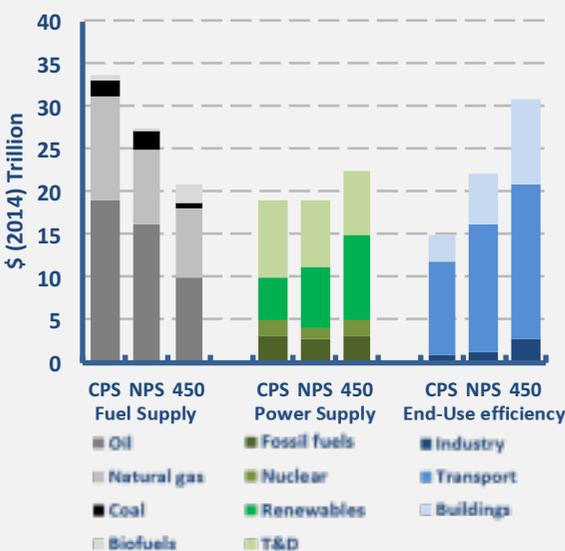


FIG. 4: CUMULATIVE WORLD ENERGY SECTOR INVESTMENT BY SECTOR AND SCENARIO 2015-2040 (SOURCE: IEA 2015)



CPS: Current policies scenario
 NPS: New policies scenario
 450: 2° aligned scenario
 See p. 14 for further discussion on IEA scenarios

A clear need for money

Marginally increased investment needs. To achieve a net-zero carbon economy before breaking the 2°C limit, massive changes in the overall industry and infrastructure systems at global scales are needed. While the overall investment needs are large they need to be compared to investments that are needed even in a business as usual (BAU) scenario. According to the International Energy Agency (IEA), about \$12 trillion additional investment will be needed between 2016 and 2050 to transition to a global low-carbon energy system compatible with a +2°C world, relative to a ~\$435 trillion BAU current policies scenario leading (CPS) to a +6°C world (ETP 2016a). From these estimates, limiting global warming to +2°C would thus ‘only’ imply ~3% more investments. A major part of this additional investment needs to be directed to building and power sectors. It is important to note that such estimates may vary significantly depending on authors and modelling hypotheses. Using IEA ETP 2015 instead would have shown a \$40 trillion (~13% more) additional investment between +2°C and +6°C scenarios, the differences being mainly due to different assumptions for the transport sector.

Investment of a different kind: capital reallocation. Financing the low-carbon economy transition does not only require mobilising more capital, but also ensuring the overall capital allocation is thoroughly consistent with this transition (Boissinot et al., 2016). Indeed the main challenge is not primarily about the scale of investments needed, but rather the shift across industries: capital reallocation from high-carbon (‘brown’) to low-carbon (‘green’) assets and technologies.

The potential emissions of currently known fossil fuel reserves are estimated 2795 GT CO₂, whereas the carbon budget for a 66% chance of staying below 2°C is limited to about 805 GT CO₂ (or to 205 GT CO₂ for a limitation to 1.5°C) (Carbon Brief, 2016). The potential use of carbon capture and storage (CCS) to extend this carbon budget appears limited, as forecasts estimate only 120-240 GT CO₂ could possibly be captured and stored between 2015-2050 (IEA 2013).

This focus on reserves gave rise to the “unburnable carbon” and “leave it the ground” campaigns (CTI, 2011; LINGO, 2015). These campaigns emphasize not only that no investments should be made to explore new fossil fuels reserves, but also that investments in the exploitation of proven reserves as well as in CO₂-intensive equipment using fossil fuels need to be drastically reduced. Hence, while more capital must flow to the low-carbon economy, it is indispensable that reallocation shifts capital away from high-carbon assets.

Defining reallocation needs. According to the IEA, over \$10 trillion need to be redirected from fuel supply to renewable and end-use efficiency sectors between 2015 and 2040. The investment in the oil supply would then decrease by almost half (IEA, 2015). Other research (e.g. NCE, 2014; CPI, 2014a) propose comparable figures.

1.2 The role of the finance sector in meeting the climate targets

Increasing climate finance versus greening mainstream finance

\$100 billion promise. Increasing climate finance has been specifically in the focus after the 2009 and 2010 COPs, where developed countries committed to mobilising US\$100 billion per year by 2020 to help developing countries handle climate change, from a diversity of sources including bilateral, multilateral, public or private (IMF, 2011). It has to be noted that this target is the result of international negotiations and is not related to a specific needs assessment. It also covers finance for mitigation and adaptation action alike. The target is only related to climate-related investments from developed countries to developing countries and its purpose is to share the burden more justly between developed and developing countries. The UNFCCC Standing Committee for Finance publishes a biannual overview of financial flows tracked against the \$100bn goal (UNFCCC, 2016).

Tracking global climate finance. In addition there are also efforts to track climate finance globally in developed and developing countries alike. The aim is to get a better understanding of overall size, dynamics and intermediaries used as well as the final destination of financial flows. A well known example is the climate finance landscape of the Climate Policy Initiative, who are combining information from a number of sources and who have notably found that almost 75% of climate finance identified has been raised and invested domestically (CPI, 2016). Similar initiatives exist on national levels, e.g. the landscape of climate finance in France by I4CE (I4CE, 2016b).

Taking a broader perspective. However, in line with the discussion in chapter 1.1, simply increasing dedicated climate finance is not considered sufficient anymore to reach the climate goals (see box 1). The necessary reallocation and the carbon budget constraint mean that finance needs to drive more money to low-carbon assets but also less to high-carbon assets, so that the overall economy effectively shifts to a decarbonised pathway compatible with the <<+2°C target. Indeed, building significant renewable energy supply does not prevent the economy from a +6°C pathway, if GHG emissions continue to grow and energy demand is not controlled by energy efficiency. In the same way, it is important to not only focus on the most intuitive sectors and assets that are particularly energy intensive or hold a great green potential (e.g. power utilities, vehicles), but also to consider the more diffuse challenges across sectors, such as consumer demand or urbanism, which ultimately have a major impact on GHG emissions.

It should be underlined that the \$100 billion promise is not affected by this change in perspective and both will co-exist in parallel as they have different purposes.

BOX 1: RECOGNITION OF THE NEED TO ALIGN FINANCIAL FLOWS MORE GENERALLY

Paris Agreement (UNFCCC, 2015): *“making finance flows consistent with a pathway towards low GHG emissions and climate-resilient development”.*

OECD (2015c): *“The low-carbon transition investment challenge is two-fold: (1) Scaling up finance for long-term investment in infrastructure. (2) Shifting investments towards sustainable low-carbon alternatives. [...] Policy makers need to address a range of policy misalignments in the overall investment framework that collectively favour investment in fossil-fuel intensive activities.”*

UNEP Inquiry (2015): *“to achieve the sustainable development we want will require a realignment of the financial system with the goals of sustainable development”.*

European Commission (2016a): *“Shifting and rapidly scaling up private investment is essential to support the transition to a low emission and climate resilient economy, and for avoiding the “lock-in” of high emissions infrastructure and assets.”*

European Commission (2016): *“in the EU, efforts have already started to align private investments with climate and resource-efficiency objectives both through policies and by strategic public investments”.*

G20 (2016): *“governments must ensure that policies are aligned across a diverse range of non-climate areas (e.g. tax, investment, electricity markets, land-use and innovation) to support the transition to a low-carbon and climate-resilient economy”*

“In order to support environmentally sustainable growth globally, it is necessary to scale up green financing”

China (2016): *China adopts national policy package for transformation “Guidelines for establishing a green finance system” (Unep Inquiry, 2016)*

The alignment concept

The current call for alignment attempts to make a clear link between scientifically established goals– reducing global temperature warming to well below 2°C – and day-to-day investment decision-making in a general sense.

The alignment concept can be broken down in three pillars (2°ii, 2012):

1. **Assessment:** Development of performance indicators to define the contribution of financial portfolios to achieve climate goals.
2. **Disclosure:** Introduction of reporting requirements for investors to publish how their investment decisions align with climate goals
3. **Incentives:** “Greening” incentives to improve alignment including e.g. incentive schemes across the investment chain of intermediaries, tax schemes on savings and rules on the calculation of capital requirements.

The first two pillars are essential to understand the state of play, to get a solid understanding of how misaligned financial flows are in relation to climate goals and to define to what extent corrective action is needed. Based on this assessment, the third pillar then defines action to overcome barriers to alignment and to adjust the existing incentive system to improve alignment. Measuring alignment is thus a precondition of improving and eventually achieving alignment.

Governments and civil society now emphasize the need to track progress, identify gaps, and avoid locked-in GHG emissions (e.g. G20 (2016a), EC (2016a)). The French government has taken ambitious steps ahead of COP 21 to lead the way and encourage methodological developments in the field (see box 2).

Alignment versus risk perspective. Current discussions around climate assessments and climate disclosure for the financial sector not only relate to the measurement of the alignment with climate goals. Often they are also and sometimes even primarily motivated by a risk perspective, e.g. the Task Force on Climate Related Financial Disclosures of the Financial Stability Board (TCFD/FSB, 2016) and new French disclosure requirements (see box 2). Risk assessments may include the risks related to impacts of climate change (physical climate risk) as well as risks associated with the transition towards a low carbon economy (carbon or transition risks). It needs to be underlined that assessments of alignment on the one hand and risk on the other hand need very different metrics and approaches and they are analysing very different questions (see 2dii, 2013, 2014, 2015b and 2015c).

BOX 2: ART.173 OF FRENCH LAW ON THE ENERGY TRANSITION AND GREEN GROWTH

The French Law on the Energy Transition and Green Growth, adopted in 2015, aims at reducing French GHG emissions, capping fossil fuel and nuclear production, and increasing renewable energy usage (2°ii, 2015d). Its Article 173 on mandatory climate disclosure came into force on Jan. 2016, including the following provisions:

Companies:

- ✓ Listed companies and/or large non-listed firms shall disclose their climate-related financial risks, the measures adopted to reduce the risks.
- ✓ Companies shall report the consequences on climate change of their activities including the supply chain and the use of their products.

Institutional Investors:

- ✓ Institutional investors shall disclose how their decisions align with national energy transition strategy, the international climate goals and the measures taken to contribute to the energy and ecological transition as well as how environmental, social and governance (ESG) criteria are considered in their investment decisions.

Article 173 plays a pioneering role in promoting climate disclosure and pushing the development of adequate indicators and has already attracted worldwide attention from investors and governments alike.

In 2016 the French Environment Ministry in collaboration with 2°ii has organised an international award ceremony to showcase good disclosure practices and stimulate innovation in the field. A special award was dedicated to assessments of the alignment with climate goals (For more information visit http://2degrees-investing.org/#!/page_Award).

2. How to measure the alignment?

Making the link between the global climate goals and the finance sector and more specifically investor portfolios is not a straightforward task. In the following one approach is detailed highlighting the steps necessary (see Fig. 5) and outlining challenges and drawbacks of each step.

2.1 Breaking down the climate goal into an economic vision

Defining the climate target and the carbon budget

The climate target. The decision of setting 2°C as a threshold, can be seen as the result of a compromise between science, policy, politics, and economic development. Considering the catastrophic consequences of climate change, negotiation thus converged on this challenging, feasible, and “affordable” target, in that +2°C warming should be bearable while not negatively impacting economic welfare (Edenhofer et al., 2009). Some researchers and negotiators have proposed a lower target: 1.5°C, pushed in particular by countries such as low-lying islands that are extremely exposed to sea level rise, and for which even a +2°C world would be catastrophic. In an effort to create a goal acceptable to all, both numbers are explicitly mentioned together in the Paris Agreement as potential upper limits for global warming (UNFCCC, 2015; cf. p.6). Indeed, the 0.5°C difference is substantial, both in terms of the effects of global warming, and the necessary pace of decarbonisation it involves (see Fig. 7). On the economic, social, and technology effort side, while +2°C is still achievable, it may be too late to remain below 1.5°C. According to carbon budget data updates in 2016, we only have about years to stay under 1.5°C with a probability of 66% (Fig. 6).

The carbon budget. The implications of this goal on the ground are actually highly intricate. Indeed, the full response of the climate system to GHG concentrations relies on complex physics, and climate modelling comes with many uncertainties. Furthermore, the precise interaction of these dynamics with economic fundamentals is deeply non-linear and non-unique. Therefore, translating the <<+2°C climate target into a single economic pathway is unrealistic, as it comes with a series of difficulties, uncertainties, and choices. On the climate side, many parameters are involved, including: type of carbon budget, underlying data and modelling, scenario selection, temperature response timescales, CO₂ and non-CO₂ respective pathways, etc. (Rogelj et al., 2016). Any difference among these key drivers could produce different estimates of carbon budget.

FIG. 5: PROPOSED LINKAGE OF CLIMATE GOALS AND INVESTMENT PORTFOLIOS (SOURCE: 2dii 2015a)



FIG. 6: CARBON COUNTDOWN (SOURCE: CARBON BRIEF 2016)

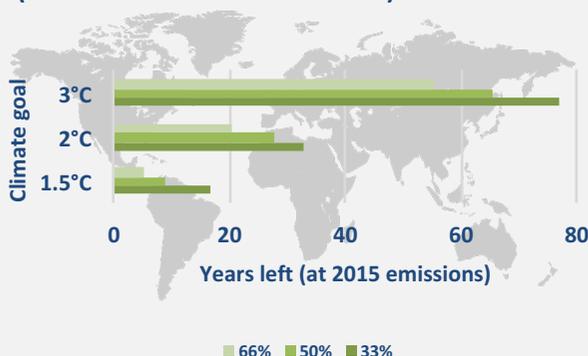


FIG. 7: THE COMPARISON BETWEEN 1.5°C AND 2°C (SOURCE: CARBON BRIEF 2016)

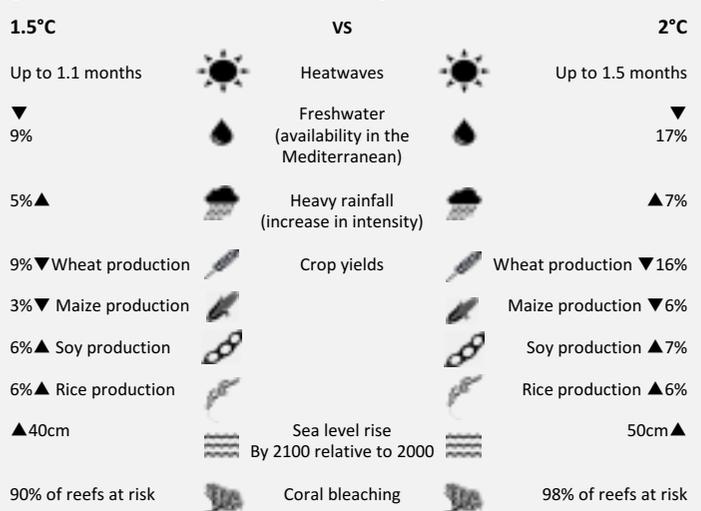
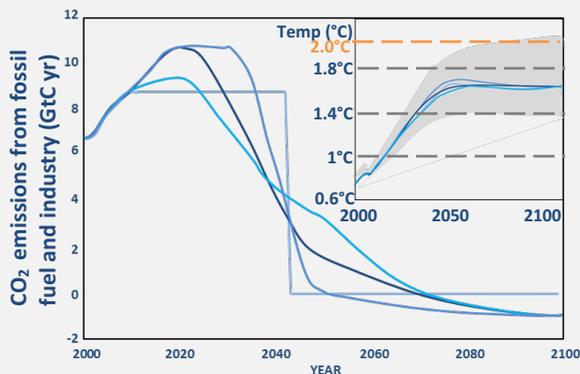


FIG. 8: CARBON COUNTDOWN

(SOURCE: IPCC 2013)

Different emission pathways leading to the same warming (IPCC, 2013):

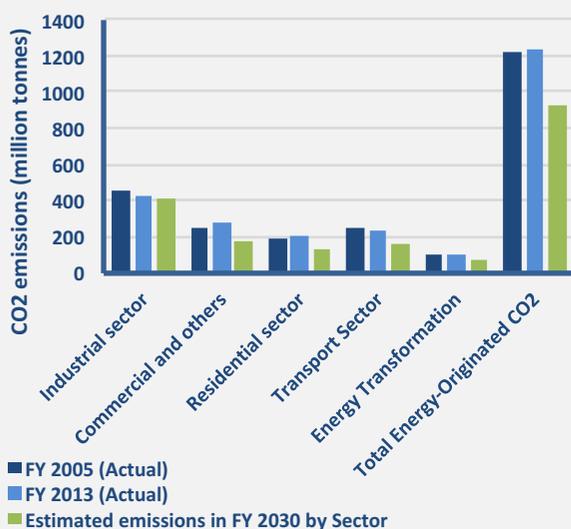
The 4 different illustrative CO₂ pathways below would all deliver the same +2°C climate outcome by 2100 (inside graph). These pathways differ in terms of the time and level of CO₂ emissions peak, which will also decide how rapidly we need to reduce the emissions to achieve the same climate goal. The later the CO₂ emissions peak, the steeper the emission reduction will need to be, including the need for negative emissions.



TAB. 1: FRANCE NATIONAL LOW-CARBON STRATEGY (SOURCE: S. ROYAL, 2015)

Sector	Target by the 3 rd carbon budget period (2024-2028, compared with 2013)	Target of emissions between now and 2050
Transport	-29%	at least -66%
Building	-54%	at least -87%
Agri./Forestry	at least -13%	-50%
Industry	-24%	-75%
Energy	keep below 2013 level	-96% (ref. 1990)
Waste	-33%	-

FIG. 9: JAPAN PLAN FOR GLOBAL WARMING COUNTERMEASURES (SOURCE: JMoE, 2016)



Defining economic roadmaps

The economic pathways. Having a carbon budget gives a single global number – a single global limit. This single number is not usable as such by policymakers in the designing of climate policies, laws and rules, nor by citizens when they make their individual decisions, therefore climate goal and carbon budget need to be translated into more material and specific economic and technology targets. But there are multiple ways of doing this. GHG emission pathways indeed rely on the global mix of technologies, industries, consumption patterns, energy sources, etc. that feed economic activity. Consequently, one can imagine as many pathways (and associated costs) as there are political and social visions of the future. The quantity of GHG emissions over time can be released smoothly with a continuous decrease, or oppositely with an abrupt peak and a subsequent sharp drop, or delayed in time but compensated by negative emissions (via capture and storage) later in the century (Fig. 8). As for time options, the burden sharing has many geographical options. A similar reduction pattern in all countries simultaneously could be naively proposed, but obviously the specificities of local economies, development, energy mixes, technology advances, etc., make such an option unrealistic, and call for country-specific pathways (e.g. DDPP, 2015).

National strategies. Many countries and parties have announced their intended nationally determined contribution (INDCs) to achieve the 2°C target. The EU and its Member States are committed to the target of at least 40% domestic reduction in GHG emissions by 2030 compared to 1990. The United States announced to achieve GHG emissions reduction of 26-28% in 2025 compared with its 2005 level. China commits to lower CO₂ emissions per unit of GDP by 60-65% from the 2005 level. Some countries give details on their targeted national carbon budget, such as France in its national low-carbon strategy, which details how the country can achieve its 2030 and 2050 targets (respectively -40% and -75% of its emissions relative to 1990). France adopted strategic recommendations and associated carbon budgets up to 2028 for 6 macro sectors (transport, building, agriculture and forestry, industry, energy, and waste) (Tab. 1). Japan also recently published its work plan on “Global Warming Countermeasures” (JMoE, 2016), setting an emission reduction target of 26% by 2030 compared to 2013, consistent with Japan’s INDC announcement, on the road to a 80% reduction level by 2050. It provides detailed reduction targets in 5 key sectors (see fig. 9).

Regardless of their level of ambition, these national climate strategies and goals are very diverse and difficult to assess individually versus the 2°C goal, which is global and extends until 2100.

Energy technology roadmaps

Another approach attempting to fit the economic future into climate constraints consists of starting from the global carbon budget, and ‘allocating’ this budget to the key technologies and industries that are expected to drive the energy demand and production over the course of the century. The IEA is conducting such an assessment since 2008 in its annual World Energy Outlook and Energy Technology Perspectives series. The climate goal is translated into two main scenarios, in comparison with ‘Current Policy Scenario’ (CPS) and ‘New Policy Scenario’ (NPS):

- ‘450 Scenario’ — World Energy Outlook [WEO] (IEA, 2015): the main constraint is to limit CO₂ concentration to 450ppm, consistent with the +2°C goal.
- 2°C Scenario (‘2DS’) — Energy Technology Perspective [ETP] (IEA, 2016a): the energy system deployment pathway is consistent with a 50% chance to stay below +2°C. The 2DS limits the total remaining cumulative energy-related CO₂ emissions between 2013 and 2050 to 1000 GtCO₂.

IEA provides roadmaps covering about 20 technologies that are based on the 2DS scenario, with different geographic focus. They include both the GHG emission and related production characteristics (passenger-km, MWh, km, EJ, ...) for each technology, but do not cover sectors such as agriculture and forestry. IEA 2°C scenario is the most complete energy technology worldwide scenario available and considered as the reference by market players. However, it also suffers from a number of critiques. It appears that IEA somehow missed the growth trend of renewable electric capacity since 2000, as it missed the recent shale gas upheaval that notably revolutionized the energy equation in the USA. For example, Fig. 11 shows that the current renewable deployment planned in the US for 2020 is significantly higher than IEA expectations. The other major critique comes from the substantial reliance of the scenario on nuclear power and CCS, which of course are strongly dependent on political preference and technological development. It is emphasized that relying substantially on CCS allows forecasting of global negative emissions, typically after 2070, which automatically reduces emission reduction ambition before then. If CCS is not deployed at the level forecasted, it has strong consequence on the capacity to limit global warming to +2°C. Other organizations work on producing similar types of technological roadmaps, especially for the energy sector (e.g. Greenpeace, 2015).

No such global economic / energy scenario is currently available for the +1.5°C target; the IPCC is preparing a +1.5°C Special Report for Sept. 2018 (IPCC, 2016) and prominent modelling providers are also likely to adjust their models in the near future (e.g. IEA).

FIG. 10: GLOBAL CO₂ REDUCTIONS BY TECHNOLOGY AREA 2013-50
(SOURCE: IEA, 2016a)

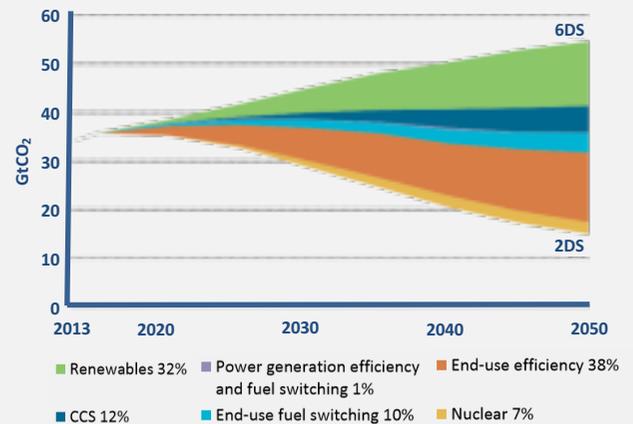
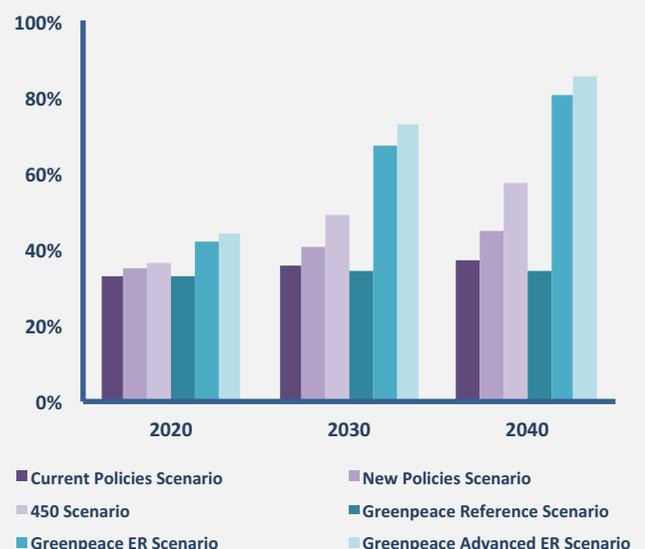


FIG. 11: FORECASTED DEPLOYMENT (IEA) AND CURRENT DEPLOYMENT PLANS FOR U.S.
(SOURCE: 2°II BASED ON IEA 2015 AND GLOBALDATA 2015)



FIG. 12: SHARE OF RENEWABLES IN GLOBAL ELECTRIC CAPACITY IN IEA AND GREENPEACE SCENARIO
(SOURCE: IEA 2015, GREENPEACE 2015)



2.2 Translating economic roadmaps into finance metrics

Defining investment roadmaps

The next step of this approach is to define investment roadmaps that correspond to the economic vision that has been chosen. Investment roadmaps define the level of capital expenditures needed to follow the selected economic transition path.

Existing Investment Roadmaps. The most prominent organizations currently publishing investment roadmaps are the IEA in the World Energy Investment Outlook (IEA 2014) and the annual ETP publications (e.g. IEA 2016a) as well as the OECD for infrastructure investment (OECD, 2012 and updated numbers are forthcoming), and Bloomberg New Energy Finance for low-carbon energy investments (BNEF 2016).

It should be highlighted that, even in the IEA 2°C aligned scenario, the total amount of investment in oil & gas is still higher than in energy efficiency (Fig.13). From a 2°C investment criteria perspective, this suggests that even if some types of oil & gas investment may not contribute to 2°C climate goals, these types of investments need not systematically be misaligned with these climate goals. Obviously, this is all the more relevant for mainstream investors and financial institutions seeking to achieve a diversified portfolio. This illustrates however also a general caveat of such scenarios, which postpone the bulk of the transition to later in the century. Combined with the relatively short time frame that is taken into account when describing investment needs, the long term trends remain invisible.

Investment by whom? Investment roadmaps sometimes inform not only on the levels of investment, but also the expected sources of those investments. The IEA broke down investment by governments, businesses and households for industry, buildings, and transport (Fig. 14).

Shortcomings and next steps. Beyond the issues related to economic roadmaps, most investment roadmaps do not distinguish different types of capital. For instance, translating the energy roadmap for air transport into implications for debt financing requires distinguishing development capital in aircraft manufacturing and low-carbon jet fuel, procurement capital for airlines, and investment in airport infrastructures. This distinction is not clear in capital expenditure roadmaps, in particular with regard to R&D financing needs.

An additional challenge for capital expenditure roadmaps is the high degree of uncertainty associated with issues such as the changes in capital costs and technology. For a detailed analysis on the impact on investment needs of uncertainties around dynamics of globalisation, oil prices and the availability of low-carbon technologies, see SMASH/CIREC, 2016.

FIG 13: INVESTMENT NEEDS 2011-2035 UNDER VARIOUS IEA SCENARIOS (SOURCE: IEA WEIO 2014)

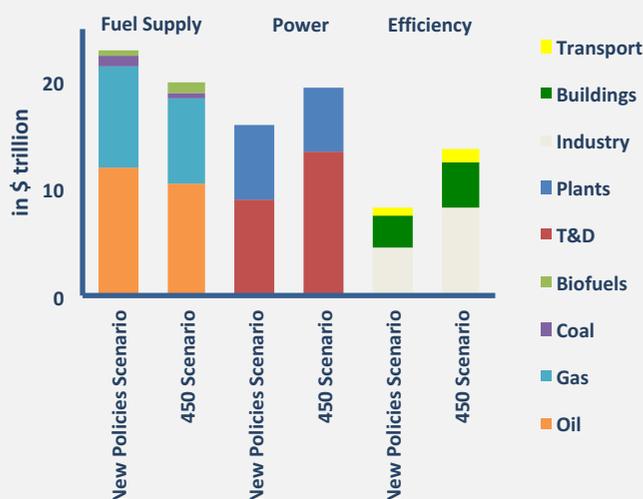
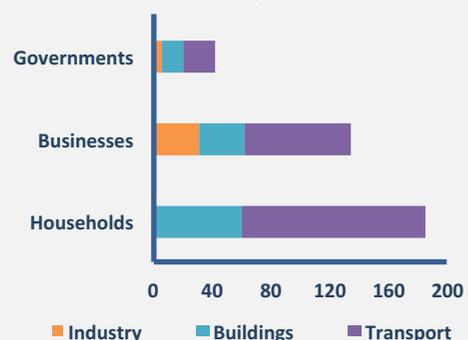


FIG 14: AVERAGE INVESTMENT NEEDS BY INDUSTRY AND SOURCE IN NEW POLICIES SCENARIO \$ BILLIONS (SOURCE: IEA ETP 2012)



Defining financing needs

Roadmaps for the finance sector. Capital expenditure roadmaps, although usually labelled investment roadmaps, provide little guidance for the financing and investment decisions of financial institutions. Turning capital expenditure roadmaps into financing needs roadmaps requires two further steps. First, capital expenditure volumes need to be broken down by type of capital based on the different stages of technology development. Second, the associated capital needs to be connected to an ownership (e.g. companies, households, governments) and financing structure (e.g. equity issuance, loan, retained earnings, etc.). The ownership structure has begun to be addressed in IEA scenarios (cf. previous section). In the IEA 2014 World Energy Investment Outlook, the IEA, in partnership with the 2^o Investing Initiative, began to explore the financing structure of power companies, oil & gas, and coal companies (IEA, 2014). The ‘sources of financing’ analysis broken down by equity issuance, bond issuance, and internal financing for major companies may provide the first step in translating investment roadmaps for the energy sector into financing roadmaps for the finance sector.

First initiatives. Research by Accenture/Barclays (2011) provides the only true role model in this regard. They developed a European scenario for dealing with the financing of a sample of technologies in power production, road transport, and buildings efficiency until 2020. The scenario is based on the analysis and extrapolation of past transactions on these technologies. In 2011, the authors identified cumulated financing needs of €350 billion in technology development and €1.65 trillion in technology procurement. Equity issuance plays a key role in financing development, while retained earnings, loans, and bonds are the primary sources of financing for procurement (Fig. 15 & Fig. 16). To deliver, the finance sector is expected to develop green seed capital, venture capital, and private equity funds to finance innovation, mobilize equity and bonds underwriting businesses to provide expansion and procurement capital, and develop the capacity to originate loans for small-scale projects. Credit Suisse / WWF estimated that the related business opportunities for banks amount to \$25-\$30 billion per annum by 2020 (Credit Suisse/WWF, 2011).

Next steps. A research consortium under the H2020 SEI metrics project (seimetrics.org) is working to further develop insights on financing needs. The research is focused on developing a broad methodology to enable a translation process of investment roadmaps from the IEA and other organisations into financing needs. The translation of investment roadmaps into financing needs is a key piece of the puzzle for developing 2°C investment metrics and criteria for the finance sector. It makes investment roadmaps usable for financial institutions, can help inform portfolio allocation decisions, and financing priorities for public financial institutions.

FIG 15: CUMULATIVE DEVELOPMENT CAPITAL (2011-2020) NEEDS IN EU 25 BY SOURCES OF FINANCING (SOURCE: BARCLAYS/ ACCENTURE 2011)

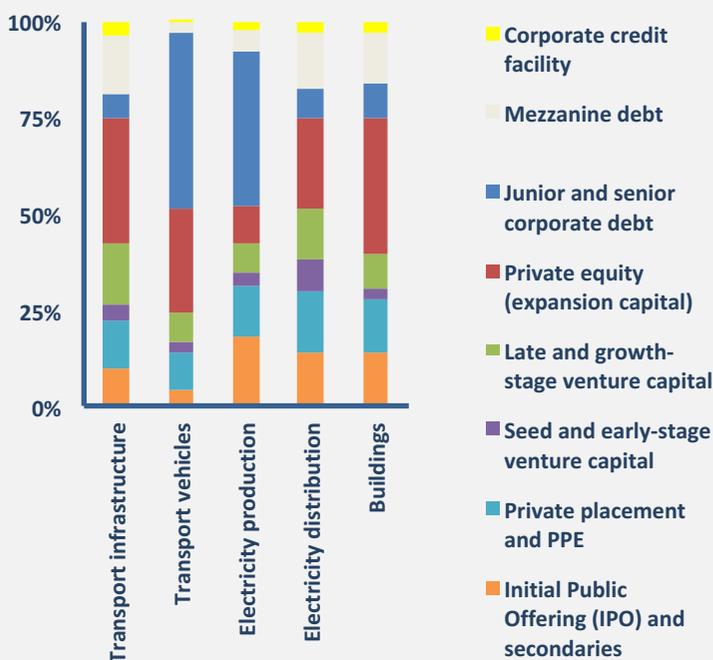
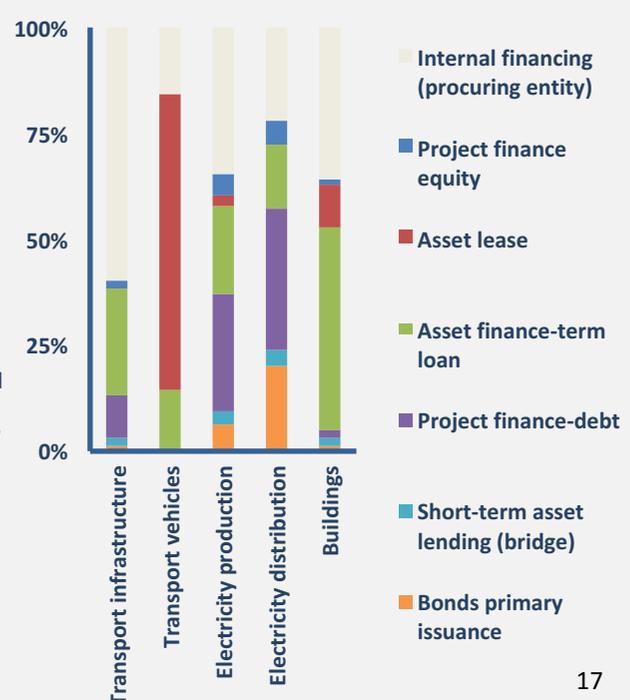


FIG 16: CUMULATIVE PROCUREMENT CAPITAL (2011-2020) NEEDS IN EU 25 BY SOURCES OF FINANCING (SOURCE: BARCLAYS/ ACCENTURE 2011)



2.3 The missing link: Climate-performance assessment

Clear financing roadmaps once established could be used as a benchmark against which to assess the investment behavior of financial institutions. This however still needs a methodology in order to compare investment portfolios against the identified financing targets. Despite the absence of a clear benchmark usable for the financial sector, a number of approaches have flourished using different methodologies to assess the climate-friendliness of investments. The following proposes a brief review of the main methodological challenges faced by those tools, and the main existing indicators that currently used to assess their climate performance.

Translation obstacles

Qualitative question — Definition of climate-friendliness. Many current approaches trying to mobilize new capital flows are about labelling or defining what is ‘climate-friendly,’ given that there is no commonly agreed definition to date. This is the case for almost any type of approach based on an eligibility criteria: green bonds, low-carbon indices, green fiscal or credit policy, issuance of carbon certificates and credits, green collateralization, green quantitative easing, etc.

Some initiatives are developing green taxonomies, such as the Climate Bonds Initiative (CBI, 2016; Tab. 2) for climate-aligned green bonds. Such approaches can potentially serve other purposes than what they have been designed for. For instance, the French label TEEC/EETC (Energy and Ecological Transition for the Climate) for investment funds is based on the CBI taxonomy, whereas the label target is much wider than bonds. Indeed, for the same reasons mentioned above, a specific technology can be considered climate-friendly in a particular region and context, and not elsewhere. The core question behind ‘climate-friendliness’ definition can probably be assimilated to the 2°C-compatible constraint. And therefore ‘climate-friendly’ could mean “+2°C aligned.” In response to this issue, the International Organisation for Standardisation has agreed to the development of an ISO standard with the aim of designing a common framework and principles for assessing and reporting investments and financing activities regarding climate change (future ISO 14097).

TAB. 2a: CLIMATE BOND TAXONOMY (CBI, 2016)

Energy	Solar	Wind	Geothermal	Hydropower	Bioenergy	Wave and Tidal	Energy distribution & management	Dedicated transmission
Low carbon buildings	New residential	New commercial	Retrofit	Products for building carbon efficiency				
Industry & energy-intensive commercial	Manufacturing	Energy efficiency processes	Energy efficiency products	Retail and wholesale	Data centres	Process & fugit. emissions	Energy efficient appliances	Combined heat & power
Waste & pollution control	Recycling facilities	Recycled products & circular economy	Waste to energy	Methane management	Geo-sequestration			
Transport	Rail	Vehicles	Mass transit	Bus rapid transport	Waterborne transport	Altern.fuel infrastr.		
Information tech. Communications	Power management	Broadband	Resources efficiency	Tele-conferencing				
Nature based assets	Agricultural land	Forests (un/managed)	Wetlands	Degraded lands	Other land uses	Fisheries and aquaculture	Coastal infrast.	
Water	Flood defences	Water distribution infrastructure	Water capt.&stor. infrastructure	Water treatm. plants	Assets in energy & production			

Certification Criteria approved
 Criteria under development
 Due to commence

TAB. 2b: EXAMPLE OF DETAILS FROM THE CLIMATE BOND TAXONOMY (CBI, 2016)

Area	Explanation/restrictions/consistency
Green buildings	Commercial New & existing builds- demonstrates top percentile of the local market average in regards to carbon performance with an annual M+V for performance
	Residential New & existing builds - demonstrates top percentile of the local market average and meets the requirements of recognised building standards and/or rating schemes (e.g. high-level building codes or LEED Gold)
	Upgrades / retrofits Buildings that qualify for special purpose government energy efficiency funding programmes, such as US PACE, Australian Environmental Upgrades, UK Green Deal that can demonstrate a significant carbon saving post upgrade

Quantitative question — Reference and benchmark. As discussed above, at this stage, none of the wide scale financial products and regulation practices analysed above actually refer to the actual climate goal. Except for a couple of cases having to date a limited impact (e.g. the Climate Bonds Standard, the Euronext Low Carbon 100 index) the <<2°C goal is never concretely used in the constraints used for building the instrument or regulation, nor even explicitly mentioned in the specifications of the tools or products. In order to address the question “how much is needed to be on track for <<+2°C?”, one of the core issues is to determine the precise economic reference to be benchmarked against. This benchmark will be different depending on the geographic boundary of the financial portfolio/institution, as the financing needs will be different across countries and regions. Similarly, the benchmark shall depend on the financial assets at stake: sovereign bonds, corporate bonds, stocks, private equity etc. will not serve the same purpose in the financial chain and owning such assets will not have the same ‘financing impact’ on the end product (e.g. a wind farm) or activity (renewable energy production). While climate and macroeconomic references are available, a complete set of benchmarks translating them into investing and financing roadmaps and covering all asset classes and geographies are still missing. The EC funded research project Sustainable Energy Investment (SEI) Metrics is currently addressing this gap for listed equities and bonds (2°ii, 2015a).

Relativity question— Additionality. In the question of aligning finance with climate goals, it appears that some types of projects, technologies, activities or assets do not sufficiently attract capital flows. This drives debates on schemes to incentivize investors (e.g. green labels and potential subsequent tax rebates, liquidity and capital requirements adjustment for green assets). Such incentives would certainly need to be based on additionality criteria — especially when public subsidies are to be involved — demonstrating that those investments would not have occurred anyway. This discussion goes beyond the sole challenge of relevant metrics and indicators of whether an investment is green or 2°C-aligned: it opens the questions of its risk-return level, the sufficiency of existing/planned investments, and the ways to compensate potential lower profitability or higher risk profile. Therefore, such a characteristic would necessary move in time and by region, which would somehow modulate the criteria compared to a purely ‘green’ or ‘climate-friendly’ indicator. This would certainly require the establishment of a system to monitor capital allocation, in order to identify the potential gaps – or bubbles – on <<+2°C economic pathways, and adjust the incentives accordingly (2°ii, 2016c). Currently there is little consensus on what qualifies as “additional” (Venugopal and Patel, 2013).

2.4 Existing indicators

Various approaches are being developed that can contribute to assess whether investment and financing decisions are consistent with the <<+2°C target, global carbon budget, or national strategies. We highlight hereafter the respective benefits and limitations of the main indicators discussed today by the financial institutions, policy makers, and research organisations.

Carbon intensities. Carbon footprint is probably the most well-known metric when it comes to measuring the impact an activity has on climate. Many methodological developments occurred in the last decade to apply such an approach to financial products and portfolios via carbon intensities (emissions/€ invested), that are now the basic metrics for investor pledges (e.g. Montreal Pledge, 2014). However, the advantages of this type of metric (easy to communicate, allows cross-sector comparison) also play against it: it is impossible to directly assess the performance of a financial portfolio against a climate target, nor to distinguish whether a decrease in carbon intensity at portfolio level actually makes progress towards achieving the +2°C target. It mixes together the different sectoral specificities to make one single indicator. However, while investing less in public transport infrastructure and more on media sector will certainly decrease the carbon footprint of the financial portfolio, it will also contribute less to financing the energy transition. Another issue is that “over-investment” on one sector cannot offset “under-investment” in another sector, i.e. investing only in renewables and not at all in low carbon transport or industrial processes is not making the transition happen neither. Moreover, footprinting is essentially limited today to backward-looking assessment, which gives low or no indication of future emission patterns. Nevertheless, methodologies in progress attempt to capture both the direct and indirect emissions resulting from e.g. the use phase of products, and to estimate the emissions avoided or reduced in-line with these limitations. The use of carbon intensities for portfolio construction, engagement with companies and communication should be combined with other metrics (e.g. green-brown metrics) and must meet a certain number of conditions if the goal is to improve alignment with climate goals (2°ii, UNEP FI and WRI, 2015). Also, more precise carbon emissions roadmaps by sector at the national level could help to make the connection with sectoral emissions from portfolios.

Climate scoring. Another category of indicators is based on qualitative scores, belonging to the broader ESG scoring family. Climate scores for companies rely on climate-related products, strategies and commitments, which can be individually scored using qualitative or quantitative specific indicators based on footprinting, emission targets, electricity mix, carbon reserves, disclosure practice, engagement strategies, etc. Climate scores provide a good picture of the overall climate features of companies, and allow for rankings inside a sector. But they are very provider-dependent (i.e. non-comparable), cannot be aggregated at portfolio level, and do not give much insight on the alignment with climate goals. (2°ii, UNEP FI and WRI, 2015)

Green/brown metrics. Another approach consists in assessing how green/brown is a portfolio or financial institution, based on the climate-friendliness of the underlying activities invested in. The key ingredient here is the classification that allows to determine whether a technology or activity is 'green' / 'climate-friendly' or not. Then, it is possible to assess the green/brown share at company or portfolio level. Some stock and bond indices are currently based on such metrics, where investors can appreciate, for instance, the green share or renewable share of the index. While such metrics can clearly provide useful and pragmatic quantitative information, they are not designed to address a number of sectors / technologies that matter in the transition, but which do not fit easily in 'green' classifications. Moreover, they do not consist in a single indicator but rather a broad family of specific indicators that cannot be easily cross-compared nor aggregated at portfolio level. Nevertheless, some of the underlying indicators are directly comparable with some of the explicit targets from 2°C policies and strategies, such as the renewable electricity share in the energy mix. (2°ii, UNEP FI and WRI, 2015)

Technology targets are an example of green/brown metrics. As seen p.15, roadmaps such as those of the IEA or Greenpeace provide production targets for a number of key sectors and technologies, so that they fit both the energy demand in the next decades and a carbon budget consistent with the +2°C goal. Depending on technologies and regions, these targets imply either increases or decreases of production levels. Such production levels over time can be compared with those associated with the corporate financial assets (equity, bonds...) constituting a financial portfolio, based on the planned capacity of physical assets (factories, power plants...) owned by those companies. Hence, it is possible to assess the alignment of the portfolio with the equivalent exposure needed to achieve the +2°C goal (2°ii, 2015a). While this approach allows tracking of investments against roadmaps and gives an overall picture of capital mis-/allocation, it is not *per se* useful for sectors and asset classes for which no such roadmaps are available. Moreover, the benefit of having dedicated indicators, units and metrics per sector and technology does not allow a single representative indicator at the portfolio level (2°ii, 2015a). Nevertheless, forward-looking metrics directly based on activity data (e.g. production, capacity, sales, etc.) are more appropriate to be integrated by financial institution professionals – such as financial analysts and credit analysts – in their everyday operations.

TABLE 3: EXAMPLES OF TECHNOLOGY EXPOSURE METRICS BY SECTOR (SOURCE: 2°ii, UNEP FI and WRI, 2015)

	Brown	Green
Oil & Gas & Coal	<ul style="list-style-type: none"> Share of high-cost capital expenditure Share of unconventional (e.g. tar sands, deep water) oil in production mix 	<ul style="list-style-type: none"> Share of carbon capture and storage Share of renewables in R&D and capital expenditure
Power	<ul style="list-style-type: none"> Share of high-carbon electricity generation Est. remaining lifetime of power plants 	<ul style="list-style-type: none"> Share of renewables in electricity generation, installed capacity, and capital expenditure
Automobile	<ul style="list-style-type: none"> Average miles per gallon (MPG) of car fleet 	<ul style="list-style-type: none"> Share of sustainable propulsion technologies in sales
Industry	<ul style="list-style-type: none"> Energy and carbon intensities 	<ul style="list-style-type: none"> Share of zero-carbon manufacturing Relative investment levels in green manufacturing R&D or deployment
Cross-sector	<ul style="list-style-type: none"> Share of oil & gas in sales / revenue Share of coal in revenues 	<ul style="list-style-type: none"> Share of 'green' (e.g. low-carbon economy) in sales / revenue

3. Summary

As a summary of the previous pages, it appears that it is not straightforward to translate the climate target into maneuverable objectives for the finance sector. The translation process is a multistage operation where each step comes with specific obstacles: uncertainty, multiplicity, lack of consistency, lack of comprehensiveness, lack of usability.

If finance has to integrate a new constraint, namely the decarbonisation of the economy compatible with the <<2°C limit, financial players need specific targets, adapted to their own activities, financial rules, and financial asset type specificities. Finance can be considered as a global sector, which therefore fits with the global scale mentioned above. But at this stage, the main references are either at national scale, or are energy technology oriented. National strategies have the advantage of being relevant and hopefully credible from a policy perspective, but suffer the disadvantage of not being consistent across countries and so far not shaped in a way that is directly useful from a finance perspective. Not to mention the fact that NDCs taken together are currently not consistent with the <<2°C goal. On the other hand, energy technology roadmaps such as the IEA scenarios benefit from a certain credibility in terms of technological feasibility and constitute very useful benchmarks for a wide range of stakeholders. The downsides are that they do not cover the full panel of emission challenges (e.g. agriculture, forestry and other land use are excluded) and that they are so far not systematically translated into concrete financing and investing roadmaps.

Three challenges need to be addressed by climate performance assessments, summarized in the following questions:

- “What is 2°C?”: qualitative definitions – useful for labelling, selection processes, eligibility criteria for incentives, etc.
- “How much is 2°C?”: quantitative benchmarks – useful for assessing alignment with climate goal;
- “Under which conditions is it 2°C?”: relative rules, evolving with time and by region – useful to determine when an investment is additional.

Climate-performance assessments need indicators that can help tracking the progress and gaps of investments contributing to the decarbonisation of the economy, as well as avoiding locking-in GHG emissions (2°ii, 2013). It was shown that while there are multiple approaches, there is still much room for improvement with regard to existing metrics. At this stage, because of this challenging background, one of the most important aspects for 2°C compatible metrics is therefore not only to overcome the translation challenge in the best possible way, but also to be explicit about the scenarios and assumptions used and to openly discuss the shortcomings of the approaches.

TABLE 4: PROS AND CONS OF DIFFERENT TYPES OF INDICATORS (SOURCE: 2°ii, UNEP FI and WRI, 2015)

	Pros	Cons
CARBON FOOTPRINT	<ul style="list-style-type: none"> • Broad information on climate intensity of sectors • Prominence among corporates and experience • Standardization of corporate reporting across sectors enables portfolio reporting 	<ul style="list-style-type: none"> • High uncertainty associated with data at financial asset level • Incomplete coverage • Lack of accounting standard • Data volatility associated with external factors when normalizing
CLIMATE (ESG) SCORES	<ul style="list-style-type: none"> • Summary indicators capturing a range of different factors • Established frameworks 	<ul style="list-style-type: none"> • Black box • Risk of greenwashing • Not directly linked to a specific strategy
GREEN/BROWN METRICS	<ul style="list-style-type: none"> • Quantitative indicator with high data transparency • Relevant indicator for corporate management 	<ul style="list-style-type: none"> • Only applicable for a number of key sectors • Challenge of distinguishing relative climate friendliness within categories (e.g., gas vs. coal) • Currently no format to aggregate data across sectors

C – APPROACHES FOR IMPROVING ALIGNMENT

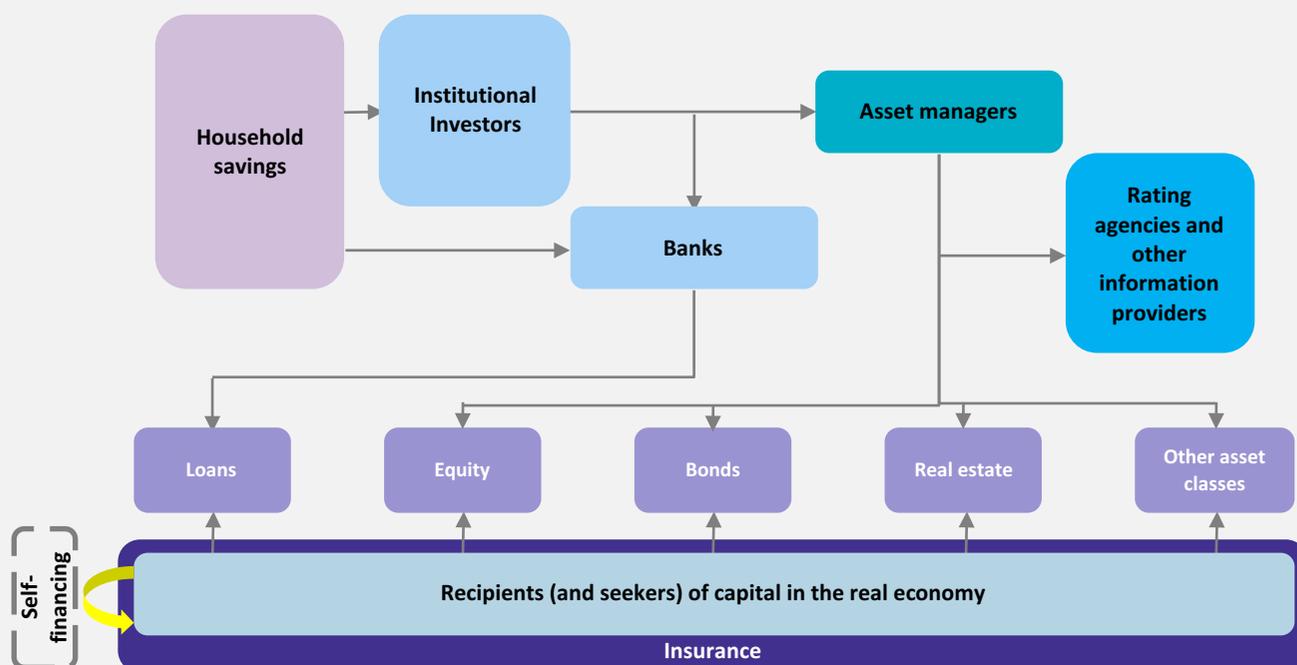
1. Obstacles to the integration of climate considerations in finance

1.1 Understanding the general mechanisms of the finance sector

A diversity of actors. The shift towards a net-zero carbon economy requires a major reallocation of investment. This global reorientation can only materialize if the financial ecosystem as a whole changes the way it mobilizes and allocates capital (UN SG, 2015). The net-zero carbon energy transition being a global challenge affecting all the economic domains, the financing challenge is shared between the multiple sources of the financial system (cf. Fig. 17 for a simplified overview of private financial flows and Box 1). Public sector finance has taken an important role so far and will probably continue catalysing private sector investments, but most of the effort has to come from the private sector. Internal investments from households and firms will constitute a key parameter to decarbonise the economy. But a massive part of the reorientation will rely on the capacity of the finance sector and its many intermediaries, including institutional investors, banks and asset managers, to grasp the challenge and take into account climate goals in their investment practices. The complexity behind the diversity of types of entities and asset classes, clearly results in different constraints and requirements for each. Nevertheless, in order to get a better understanding at the system level, it is worth considering an aggregate finance sector.

The role of finance in the economy. Following John Kay (2015), a well-functioning economy needs the financial system for several basic functions, such as financing, housing, infrastructure, helping individuals manage their savings over lifetime and managing the allocation of both capital and risk. It then sounds logical that the finance sector can contribute to the climate change challenge, acting as a significant mechanism to orient and distribute capital flows to the relevant parts of the economy (UNEP FI, 2014). Moreover, the finance sector indeed drives a huge pool of capital: assets of financial intermediaries in 2014 reached around \$239 trillion (FSB, 2015), which is very substantial in comparison to the amounts at stake for financing the decarbonisation of the economy. But, for different reasons, climate change related issues are still not completely captured by the financial system, which appeared to be rather inefficient so far to accept the challenge. Typically, most Large Pension Funds and Public Pension Reserve Funds allocate little to nothing in renewable energy even though non-renewable energy is a major component of most funds (OECD, 2015).

FIG. 17: INVESTMENT AND FINANCING ECOSYSTEM MOBILIZED TO SUPPORT THE LOW-CARBON CLIMATE-RESILIENT TRANSITION (SOURCE: VIVID ECONOMICS in UN SG, 2015)



A non-natural capital reallocation

Capital (re)allocation decisions are based on risk-adjusted returns, which in turn depend on market factors and industrial policies and financial policies (FtFC, 2014). One can imagine that investors today could anticipate evolutions in these fields and act accordingly on their portfolio. But this is so far not the case: the capital reallocation is virtually not happening, and this dimension is currently underappreciated, essentially because of a lack of materiality of both stringent climate policies and climate risks (2°ii, 2015c; Boissinot et al., 2016). It is difficult to say if climate risk is currently valued by markets, maybe it is, but has effectively no impact (Thomae and Chenet, 2016).

Actually, with few laudable exceptions, the finance sector only started ahead of COP21 to mobilize capacities on climate change and to identify the relevant issues to be tackled (e.g. 2°ii, UNEP FI and WRI, 2015; 2°ii, 2016b; FSB/TCFD, 2016; Novethic, 2016). Its main responses so far can be summarized by the following keywords: disclosure, decarbonisation, green bonds and engagement.

Looking at the numbers, the IEA (2016b) recently showed a 8% decrease in global energy investment in 2015 due to declining energy prices and cuts in oil & gas spending. Fossil fuels still lead energy investments, accounting for 55% (incl. power generation and supply), but it has dropped from 61% in 2014. Comparatively, renewable energy investment increased from 16% to 17%, with \$290 billion of investment in renewable power. Although investment in renewable energy has been quite stable since 2011, the capacity generated by investment increased rapidly because of technological progress and decreasing costs (Fig. 19). These recent figures show that capital reallocation may have started for real; nevertheless it is still far from enough. IEA has warned that we still need to triple efforts to be in line with the climate target set at COP21 (IEA 2016b, FT 2016).

FIG. 18: GLOBAL ENERGY INVESTMENT 2015 \$1.8 TRILLION (SOURCE: IEA 2016b)

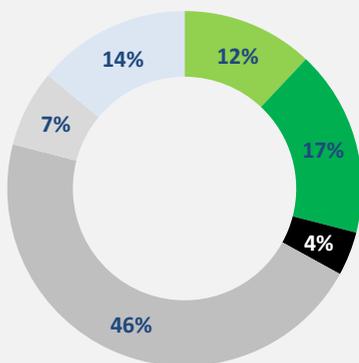
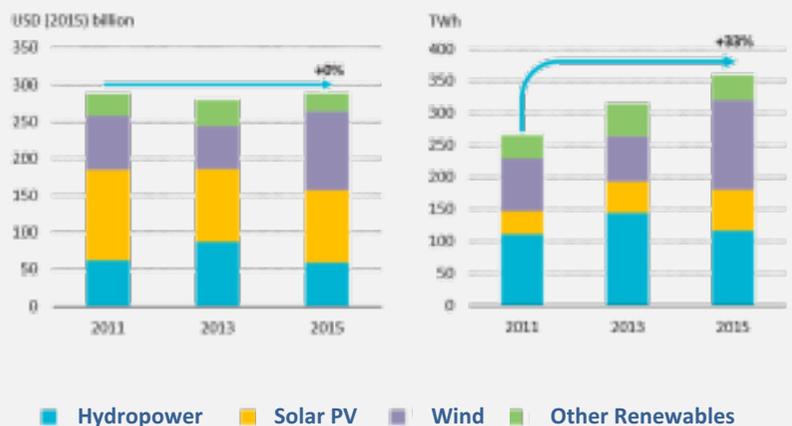


FIG. 19: GLOBAL RENEWABLE POWER INVESTMENT AND THE GENERATION FROM INVESTMENT IN CAPACITY (SOURCE: IEA 2016b)



1.2 Specific barriers to the integration of climate considerations

The existence of climate policies, their stringency as well as uncertainties around them do have significant impact on relative prices and investor behaviour and so have intrinsic market developments such as price declines through technological progress and economies of scale (e.g. IEA 2007 and 2016). However, the focus here is to discuss barriers specific to the finance sector, which may be impeding the integration of climate considerations even if perfect climate policies were in place.

Desynchronized time horizons. Beyond current (carbon) prices, even the general capacity of the financial sector to capture any credible long-term policy signal can be questioned. The extent to which significant future price signals (e.g. €100/ton of carbon in 2030 as suggested by France (MEEM, 2016)) can be taken into account today in financial decision-making is a decisive factor in order to leverage the role of the finance sector in the low-carbon energy transition.

Finance is mainly driven by time horizons that are short term, i.e. (often much) shorter than 5 years. In contrast, combating climate change requires to deal with challenges over decades and centuries. This time horizon question is perfectly illustrated by the “tragedy of the horizon” concept, popularized by Mark Carney, Governor of Bank of England and Chairman of the Financial Stability Board (see quote below). It can be synthesized as the fundamental opposition between a short-term oriented finance sector and long-term challenges related to climate change. This statement therefore highlights the difficulty of relying on the finance sector to address global warming (2nd Generation, 2015).

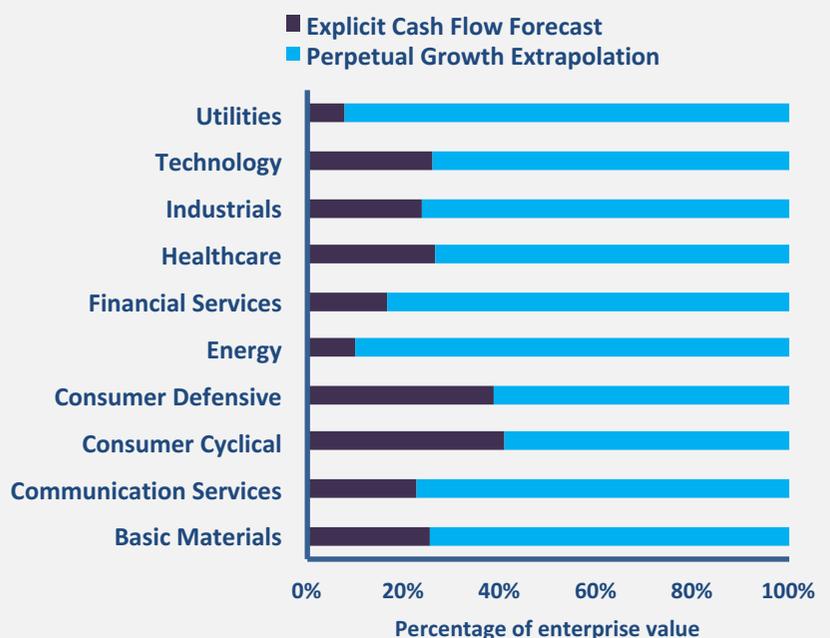
The short-termism of the financial sector can be illustrated by the example of financial analysis. Financial analysis assesses the future profits and losses of companies to inform investors of potential risks (and opportunities). However, this analysis is only done for a few (generally up to five) years forward and is essentially blind for what happens after. It is especially true in the equity research industry, where a company’s net present value calculation relies on perpetual growth extrapolation of its cash flows (see Fig. 20). While this prediction is highly unlikely to correspond to reality especially in the longer term, very few analysts actually use long term forecasts or sensitivity analysis to inform their valuations.

BOX 3: MARK CARNEY ON “BREAKING THE TRAGEDY OF THE HORIZON”

Bank of England Governor, *“Breaking the Tragedy of the Horizon - climate change and financial stability”*, Sept. 2015

“We don’t need an army of actuaries to tell us that the catastrophic impacts of climate change will be felt beyond the traditional horizons of most actors – imposing a cost on future generations that the current generation has no direct incentive to fix.”

FIG. 20: PERCENTAGE OF ENTERPRISE VALUE FROM EXPLICIT CASH FLOW FORECASTS AND PERPETUAL GROWTH EXTRAPOLATION (SOURCE: 2ndII, 2017 USING MORNINGSTAR DATA)



This situation can be symmetrically explained by a lack of demand for such long-term risk assessment. Also there may be a constraint coming from prudential rules that tends to restrain financial institutions from investing in long-term assets (see page 34). In addition, a majority of asset owners, despite their long-term investment horizons (from their liabilities that can extend several decades), actually tend to have shorter holding periods of their assets and higher turnover rates of their (Fig. 21-22-23). This “artificial shortening” of time horizons is expressed in the relative short-term mandates (typically 3 years) asset owners give to their asset managers.

Such analysis is thus not done as there is currently no demand, however if there was demand new data would need to be made available by companies in order to feed the analysis. Hardly any company reports on time horizons that are consistent with the lifetime of their physical assets. While some companies, notably energy utilities, do work on long-term forecasts and use scenario analysis (on climate but also regulation, geopolitics, technology, etc.), none of this information is currently required to be published by mandatory risk reporting.

Strategic asset allocation. Another significant obstacle comes from the asset allocation strategies that investors follow as a very stringent rule to manage their investments and their clients’ interests. Based on Mercer’s research (2011), more than 90% of the variation in portfolio returns over time is attributable to strategic asset allocation (SAA). In current SAA standard approaches the weighting of asset classes (listed equity, fixed-income, private equity, real estate, etc.) in the ‘ideal’ diversified portfolio relies heavily on historical risk-adjusted return profiles. It does not take into account potential changes of those profiles, which can result from major economic shifts. Climate change is undoubtedly one of the ‘events’ that may alter the characteristics of asset classes, as the exposure to carbon risk is not equally distributed across asset classes, e.g. infrastructure investments will be more heavily affected than sovereign bonds. Taking climate change factors into account will not only alter strategic portfolio allocation choices but also potentially vary a lot depending on the possible policy scenario that will take place. Mercer (2011) clearly demonstrated this effect on SAA (Fig. 23); nevertheless, current practices still largely ignore it.

FIG. 21: AVERAGE LIABILITY LENGTHS OF LEADING ASSET OWNERS (SOURCE: 2nd I 2017, FROM MFS 2016)

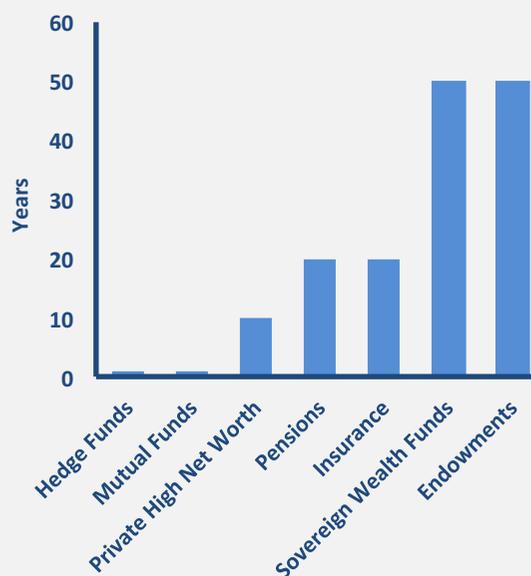


FIG. 22: MEAN DOLLAR-WEIGHTED HOLDING PERIOD OF INSTITUTIONAL INVESTORS (SOURCE: 2nd I 2017, SAUTNER 2013)

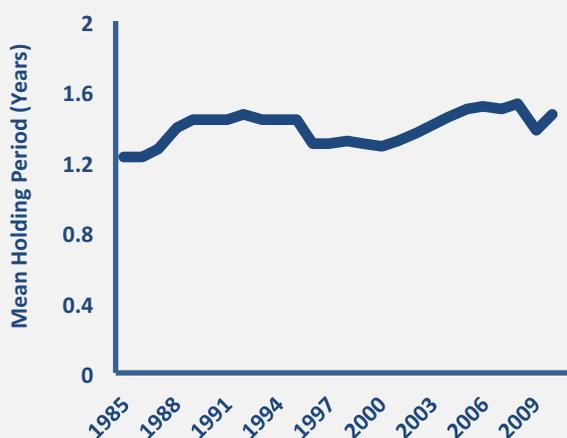
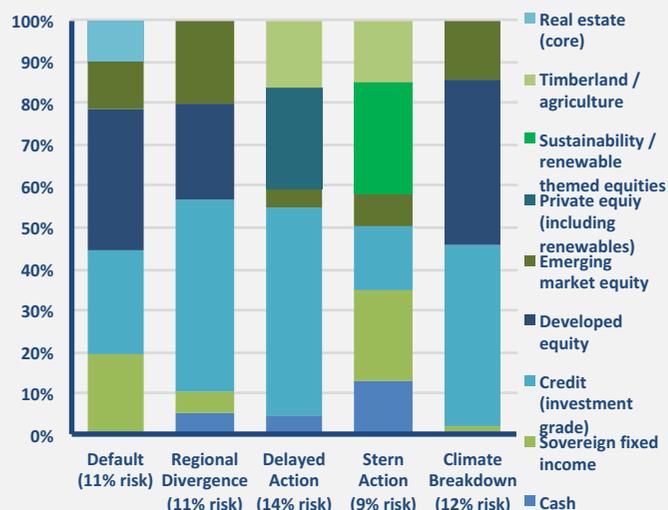


FIG. 23: EXAMPLES OF PORTFOLIO MIX (ALL ACHIEVING 7% RETURN) ACROSS SCENARIOS (SOURCE: MERCER 2011)



2. Review of existing and potential approaches for achieving alignment

2.1 Introduction

In the previous sections, we analyzed how far climate change represents a fundamental challenge for the financial sector as a whole. We saw that if the core climate target is clear, it is still difficult to translate it into clear targets for finance institutions. Certain barriers inherent to the financial system that make the integration of climate aspects into financial decision-making difficult were also discussed. Nevertheless, during the last decade new approaches have been introduced to financial markets to tackle climate change, including new financial products, new benchmarks and changes in regulation. Tremendous progress has been made especially in the last 5 years in the run-up to COP 21. Some observers even find that a “quiet revolution” is underway, slowly building a financial system that can integrate sustainability challenges, notably climate change, in its functioning (UNEP Inquiry, 2015).

In 2015, UNEP Inquiry published a broad overview of the variety of emerging practices globally (UNEP Inquiry, 2015). Current approaches can be seen as a new “layer” of climate-friendly tools on top of existing traditional mainstream finance as parallel climate-friendly versions of mainstream instruments have been developed (e.g. green bonds and indices), even though they may have the potential to become the preferred mainstream approach themselves. This section proposes to see how the challenges highlighted in previous pages materialize across four very different approaches:

1. A green variation of a classic financial product – Green bonds
2. A green financial policy at national level – Chinese green credit policy
3. A potential green benchmark for asset management – Market indices
4. A core mainstream regulation with a green potential – Basel prudential regulation

The four instruments have been chosen to cover a wide range of aspects: market initiatives as well as regulatory approaches; product specific approaches and those concerning the wider framework conditions; approaches that add a low-carbon layer on existing practices and those that integrate low-carbon constraints into mainstream practice. The focus is on existing instruments, however one example – the Basel prudential regulation – is only at the stage of first expert discussions (see table 5).

TABLE 5: COMPARATIVE OVERVIEW OF APPROACHES PRESENTED (2°II)

	Green bonds	Green credit policy	Market indices	Basel regulation
Market initiatives	✓		✓	
Regulation		✓		✓
Product specific	✓	✓		
Wider framework			✓	✓
Existing	✓	✓	✓	
Under discussion				✓

2.2 Green bonds

“Green bonds are standard bonds with a green as a bonus feature” (CBI, 2016). They were created to channel debt investors to environmentally friendly projects, in particular with respect to climate change issues. Green bonds are priced the same way as standard bonds under similar market conditions for the same issuer.

Market dynamics. The green bond market is quite recent and dynamic: before 2010, the annual amount issued was below the \$1 billion threshold. It rose significantly above \$10 billion in 2013 with the first corporate green bond. The 2015 issuance reached about \$42-48 billion (depending on taxonomy) for a global market accumulating \$118 billion outstanding as of May 2016 (CBI, 2016). Growth rates of the market are still high, especially with a significant contribution of the new green bond activity in China. In the first 7 months of 2016, 41% of total green bonds worldwide were issued by companies and banks in China, reaching \$17.4 billion (Langner, 2016). It is not a final number as the Chinese government has announced it will issue RMB300bn (\$46bn) of labelled green bonds over 2016 (CBI, 2016). An interesting feature is that those numbers stand for the “labelled” market, but many bonds are not labelled nor identified as green whereas they do support green projects — the most intuitive example is for renewable energy producers issuing traditional unlabelled bonds. Hence, the global “climate-aligned” bond market is estimated at \$694 billion, including \$118 billion (17%) labelled green bond (CBI, 2016). Despite its rapid growth, the green bond market is still a rather small market compared to both the overall bond market and the needs in low-carbon investments (Fig. 24).

Issuer characteristics. Another interesting characteristic is the source of green bonds: initially driven by development banks, the market is now also composed of corporate, bank and municipal issuers. Also geographically the market is diversifying and now covers many countries across the world, the USA, France, and China being the three leaders (Fig. 25).

FIG. 24: LOW-CARBON INVESTMENT NEEDS, NEW BOND ISSUANCE AND GREEN BOND ISSUANCE (SOURCE: MODIFIED FROM OECD, 2016)

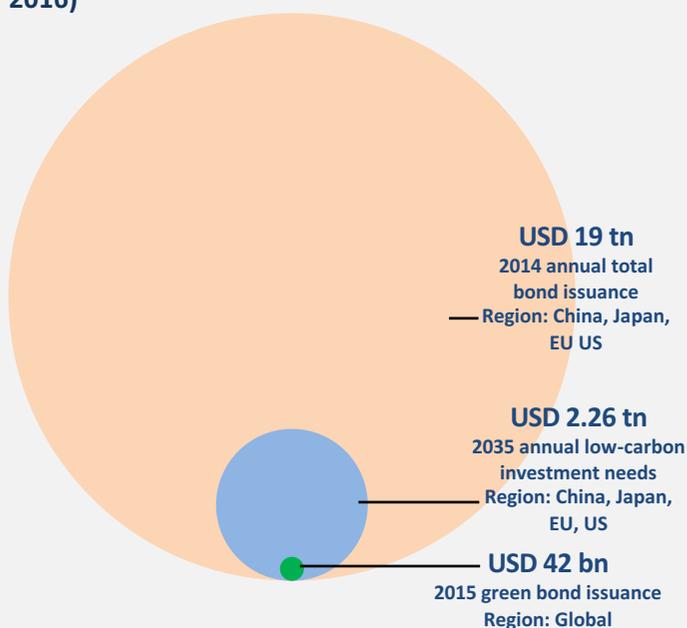
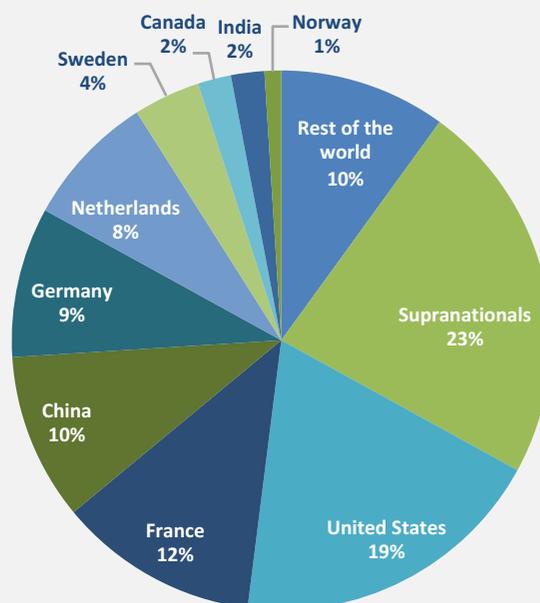


FIG. 25: OUTSTANDING GREEN BONDS BY ISSUING COUNTRY AS OF 30 AUGUST 2016 (SOURCE: CBI 2016)



Feasibility

Unclear definitions. Today, no standard definition of green bonds exists. The most common approach relies on 'second opinion'. For instance, the second opinion framework developed by CICERO provides a "shades of green" scale to the green bonds it evaluates, based on a classification of sectors and technologies contributing to reduce GHG emissions, with a specific assessment on possible emission lock-in in the long term (CICERO, 2016). In terms of standardization and certification, the main scheme is developed by the Climate Bonds Initiative, which sets more detailed criteria and requirements than the broader Green Bond Principles governed by investors, issuers and underwriters (ICMA, 2016). The Climate Bonds Standard is explicitly using the <<+2°C climate goal to define the eligibility of projects and assets, on the basis of IPCC and IEA publications (CBI, 2015). However, only 25 bonds have been certified as of November 2016 for a total issuance equivalent to about \$8.5 billion.

Well known approach – less known projects. Green bonds use exactly the same technical and regulatory framework than regular bonds, which enables them to integrate easily into the existing market structure and facilitates their uptake as all market actors are already familiar with the general features of the debt instrument and the usual regulation applies. The main difference stems from the sub-sectors or types of projects which are financed through green bonds. By definition, the projects/technologies should be new and need to build a track record of performance and analysts may lack specific knowledge needed to appraise projects. In the case of labelled green bonds some additional costs also exist to undergo the labelling procedure.

Acceptability

Widespread enthusiasm. Green bonds have benefited so far from widespread enthusiasm, both from issuers, investors, and policy makers. Green bonds are even one of the only concrete low-carbon financing instruments that are seized by mainstream financial regulations or policies. For instance, the European Capital Market Union (CMU) Action Plan explicitly references European Commission support for the green bond market as a tool to contribute towards delivering the EU 2030 climate and energy policy objectives and the EU's commitments on the Sustainable Development Goals (EC, 2015). Mark Carney, Bank of England Governor and Chair of the Financial Stability Board, makes a strong case for green bonds in the vision he developed to resolve the "Climate Paradox" and the "Tragedy of the Horizon" (M. Carney, 2016). In France, President Hollande announced the issuance of the first sovereign green bonds by France to come in 2017, to support the national low-carbon strategy and finance its new Investment for the Future (PIA3) programme (F. Hollande, 2016; S. Royal & M. Sapin, 2016). In China as well, green bonds benefit from government support and are included in the priority financial tools to be developed, through a series of proposed measures including tax incentives and preferential risk weighting in bank capital requirements (PBC, 2015).

Severe greenwashing criticism. However, despite this fervour for green bonds from some actors, a number of less enthusiastic voices are rising with some severe criticism. The current lack of consensus standards for defining green bonds provides an open door for greenwashing of all kinds. While standardisation efforts are under way, there is a long way to go to arrive at commonly agreed definitions and large scale labelling of the market. Besides the certification challenges, controversies around the 'greenness' of bonds have already emerged in the past few years. These concern for example the inclusion of infrastructure that may be relevant from a strict GHG perspective but cause negative impacts on biodiversity and local societies (e.g. S&P DJI and Trucost, 2016). Another issue is that official green bond taxonomies can include heavy emitting technologies such as clean coal (Langner, 2016). For example, clean coal power stations met the green requirements for some of Chinese green bond issuance in 2016, which is not common practice among green bond issuers, not to mention environmental NGOs (e.g. CTI, 2011; Greenpeace, 2015).

Also the broader nature of issuers' activities is itself put in question, e.g. should it be possible for an airport, a tobacco producer or a major oil company to issue green bonds (e.g. Global Capital, 2016)? And along the same lines, what credibility has a sovereign green bond issued by country that is commonly seen as a laggard in terms of climate policies (Climate Bonds Initiative, 2016b)? As the actual climate impact of green bonds can be questioned (see next section), they can enable heavy polluters to get positive press coverage diverting attention away from their core business model.

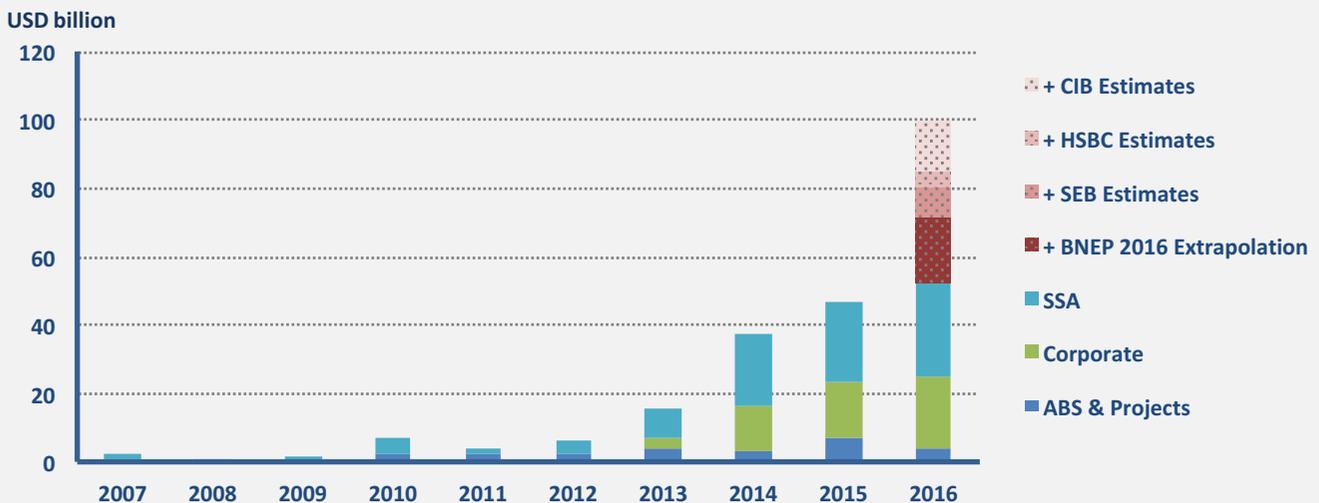
Impact potential

Additionality. Even once the greenwashing problem solved, the impact potential of green bonds is not a straightforward question. An important issue is if green bonds provide additional funding that would not have been reached via traditional bonds. Indeed, most green bonds to date are considered to have brought very little additionality, as underlying projects would have been financed by mainstream bonds anyway (e.g. Natixis, 2015; I4CE, 2016; WWF, 2016). This statement is even made clearer when green bonds are used as a refinancing tool: the project, whatever green it is, already exists or is already financed, when the green bond is issued. As a matter of fact, such green bond issuance does not trigger an additional green project. Therefore, it is legitimate to ask what is the value add of green bonds in general if one cannot prove the environmental benefit they finance beyond what traditional bonds already do. But the question of additionality is now addressed differently by many green bonds promoters. Indeed, their refinancing characteristic can be seen as an additionality *per se*, since companies are more confident about starting green projects when they know they will easily have access to refinancing tools later on.

Target market size. The size of the market can also be considered as a criteria to judge the impact potential. The current market growth is seen as very positive in this regard and estimates of trends over the next months are published by analysts (Fig. 26). However, very few assessments of what would be a relevant size for the climate bond market are available. How big is enough? CBI (2016) estimates that a minimum \$1 trillion per year would be a relevant target for 2020, knowing the \$2.5-3 trillion capital needed each year to invest in the low-carbon economy. Whether this \$1 tn/yr would ensure to finance the shift to a <<+2°C target of course depends on how the 'green' \$1 tn and the 'non-green' \$1.5-2 tn together make a good mix, aligned with a <<+2°C decarbonisation pathway. The OECD has started filling this gap and calculated the potential bond market contribution to meet the IEA 2DS up to 2035 through analysing investment needs over the next two decades and estimating the share that could be financed through bonds. The analysis currently covers only investments in renewable energy and low emission vehicles as well as energy efficiency investments in buildings and the geographies EU, US, China and Japan. The OECD estimates the annual low carbon bond issuance potential in 2035 to be between \$623 bn and \$720bn (OECD, 2016).

Sector specific targets. However, any aggregate market targets need to be handled with care. In order to achieve the transition and meet the climate goals, targets need to be specific for each sector as more investment in one sector cannot be offset with less investment in another sector. Eventually all relevant sectors need to undergo the transition to achieve the climate goals.

FIG. 26: LABELLED GREEN BOND ISSUANCE AND MARKET COMPOSITION
(SOURCE: JUN ET AL. 2016)



*SSA: Sub-sovereign, Supranational and Agency

2.3 China Green Credit Policies

The Chinese green credit policy was initially launched in 2007 by the Ministry of Environmental Protection (MEP), China Banking Regulatory Commission (CBRC) and People’s Bank of China (PBOC) and was revamped in 2012 as “Green Credit Guidelines” for Chinese policy banks, commercial banks, rural cooperative banks and rural credit cooperatives. The guidelines require banking institutions to promote green credits at a strategic level (CBRC, 2012).

Core elements. The green credit policy consists of three core elements (MEP, 2010):

- Use of appropriate credit policies and instruments (including loan types, maturity, interest rate and credit limit, etc.) to support environmental protection and energy conservation projects or enterprises;
- Possibility of suspension or termination of loans, or adoption of other credit penalties for those projects or companies who violate environmental protection, energy conservation and other related laws and regulations.
- Enhancement of the role of banks / lending institutions to guide and supervise the borrower, in order to prevent environmental risks, implement social responsibility through credit instruments, and thereby reduce credit risk.

After the initial “Green Credit Guidelines” kick-off, a series of policies and standards was added to complement the framework, related to more precise recommendations, criteria and metrics, with a progressively broader parameters (Box 4).

Uptake. According to CBRC, the outstanding green credit of 21 major banks stood at 7.26 trillion yuan (\$1.09 trillion) by the end of June 2016, accounting for around 9% of banks’ overall loans. Of this, 1.69 trillion yuan were invested in transport (‘new energy vehicles’) and other strategic emerging sectors, while the other 5.57 trillion yuan were invested on energy conservation and environment protection projects and services (Xinhua, 2016) (see also Fig. 27).

Low default rate. In terms of asset quality, the default rate estimated for green credits is only 0.41% by the end of June 2016, about 1.35% lower than that for other loans at the same time period (Xinhua, 2016).

BOX 4: THE DEVELOPMENT OF CHINA’S GREEN CREDIT POLICY (CGIRC, 2016)

2007

- “Credit Guidelines for Energy Conservation And Emission Reduction”

2012

- “Green Credit Guidelines”
- First “International Green Credit Forum” (CBRC & IFC)

2013

- “Green Credit Statistical System”
 - Banks’ credit on outdated production capacity, environment, safety and other major risks
 - Banks’ green credit implementation
 - Asset quality of green credit
 - Benefits calculation: coal equivalent conservation, CO₂ emissions reduction, chemical oxygen demand, ammonia, SO₂, nitrogen oxides, water saved

2014

- “Evaluation Index for Green Credit Policy Implementation”
- CBRC added “Social Responsibility” section in “Guidelines for Performance Appraisal of Banking Financial Institutions”, organizing 21 major Chinese banks to do self-evaluation on the green credit implementation

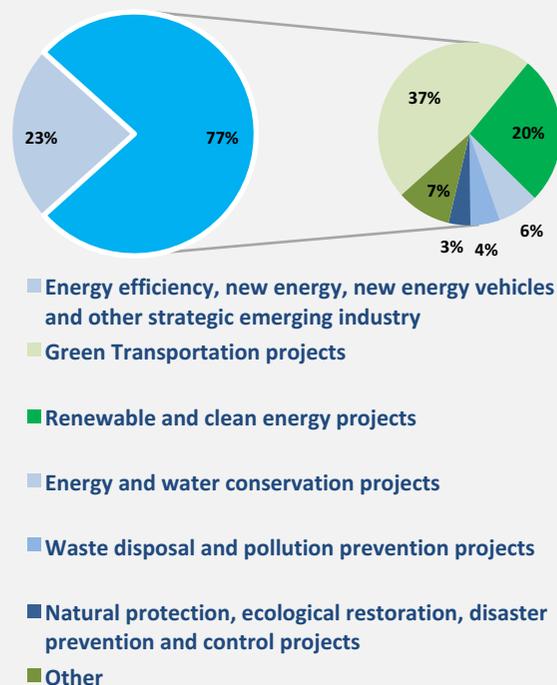
2015

- “Energy Efficiency Credit Guidelines”

Ongoing

- CBRC is establishing Green Banking Evaluation System

FIG. 27: GREEN CREDIT PROJECTS DISTRIBUTION BY THE END OF JUNE 2016 (SOURCE: CBRC 2016 , via XINHUA)



Feasibility

Capacity challenges. Environmental regulators and the banking industry face a proficiency challenge when it comes to implementing green credit policy at a large scale. For example, there is an unquestionable lack of human capital to identify whether financed projects and activities are green or climate-friendly, because green credit information collection is rather new and technically difficult and requires specialized environmental and engineering knowledge. Moreover, environmental risks are not well captured in financial risk assessment and stress testing frameworks, which makes standard financial risk management quite ineffective (MEP, 2010).

Acceptability

Social acceptability. Similar to what was discussed in relation to green bonds, the definition of a green loan is essential for social acceptability just as it is for climate impact (see below).

Market acceptability. In China, financing through banks is the primary financing solution for most companies. As in other emerging economies, China's financial system remains heavily bank-based (B. Eichengreen, 2015). Moreover, the Chinese financial sector is more regulated and controlled compared to other countries. Although there is some uncertainty about the level of enforcement of the policy, implementation could still meet less resistance in China than in other countries where the banking industry is more independent from the government.

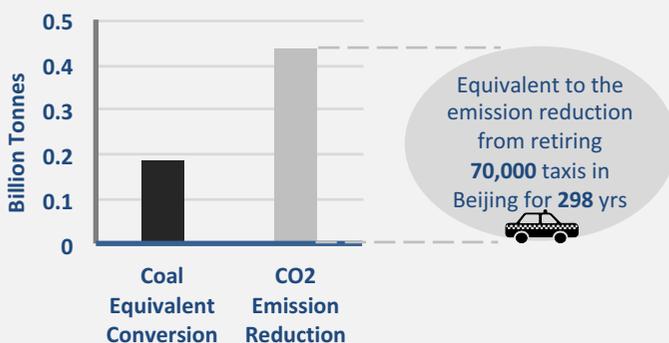
Increasing attractiveness. Although green credit show lower default rates than usual, green credit may not seem attractive enough for banks due to the capacity issues mentioned above. To solve this problem, CBRC envisions a sovereign guarantee scheme serving for green credits to reduce their risk weight (Yicai, 2016).

Impact potential

Emission reductions: Yes, but. CBRC estimates that green credits resulted in an emission reduction of 435 million tonnes of CO₂ (see also Fig. 28), equivalent to the emission reduction contributed by the Three Gorges Dam over 7.4 years (Xinhua, 2016). But it is impossible at this stage do determine if those credits would have been issued anyway without the policy in place. Additionally, despite the fact that China has ratified the <<+2°C target, its credit policy criteria are so far not benchmarked to it. Moreover, the current policy framework is mainly a suggestive guidance, rather than a mandatory law. In a country where voluntary codes are unusual this could become a major obstacle for the long-term development of green credit in China (Modern Bankers, 2016).

Consistency challenges. This policy is only limited to Chinese banks operating in China. There is no evidence that Chinese banks implement the same policy in their operations overseas (The Guardian, 2014). Given that Chinese investments abroad are soaring, especially with regard to energy and infrastructure investments in developing countries, this leaves a huge potential impact unaddressed and a high risk of offsetting positive impacts domestically with negative impacts abroad. Indeed, China's foreign direct investments outflow has increased rapidly for the last 10 years and is now estimated to be \$140bn (RHG, 2016). Therefore, the extension of the green credit policy to Chinese banks overseas seems crucial to ensure a real green impact.

FIG. 28: GREEN CREDIT POLICY'S ESTIMATED ENVIRONMENTAL BENEFITS
(SOURCE: CBRC 2016, VIA XINHUA)



2.4 Low-carbon indices and mainstream indices

Listed markets. After exponential growth since the 1970s, the size of the listed market has reached about \$240 trillion, consisting of one quarter listed equities, and three quarters of bonds. In both the equity and bond investment space, indices play a major role to orient investors. Modern portfolio theory suggests that a portfolio performs best when it is optimally diversified, i.e. a mirror of the economy as a whole. The most highly used indices are market capitalization-weighted. They are used to measure and track the price level of a market, representing a specific listed economy (e.g. by sector, currency, geography) via its biggest companies (by market capitalization). Investors either replicate the index to 'passively' follow the market, or actively manage their portfolio, aiming to outperform the market. In any case, investors' performance will be benchmarked against an index.

Passive investment on the rise. During the last decade, passive investment gained much attention from investors compared to active funds (see Fig. 29). In 2015, 72% of new investments went into passive funds (Business Insider, 2016), which makes the share of passive funds about 35% of the fund market as of May 2016, whereas it was less than 20% in 2009 (BofAML, 2016). This is the result of a growing perception that passive investment outperforms active investment given e.g. lower cost structures.

Moreover, 30-40% of active investors use "closet indexing" strategies that closely hug indices while not exactly replicating them (Petajisto, 2013). But also more generally, even active investors tend to at least stick very closely to the sector allocation of the benchmark against which their performance is assessed (Thomae et al., 2015), as sectoral diversification of a portfolio is one of its defining characteristics.

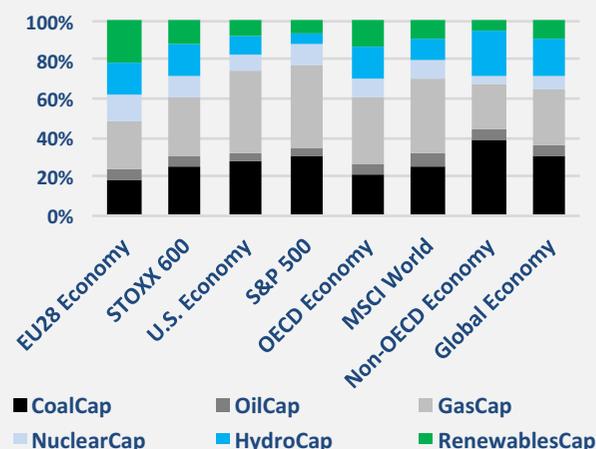
Greenness of mainstream indices. Today's mainstream stock indices are not very green, and probably not 2°C aligned just like the economy as a whole. High-carbon companies compose a significant share of major equity indices, mostly consistent with their relative markets, and are sometimes even over-represented by some indices. Figure 30 shows for instance that STOXX 600, S&P 500, and MSCI World hold more coal capacity than their listed equity universe, which are Europe, US and OECD economies respectively. Likewise, Figure 30 shows that these major indices contain relatively less renewable energy capacity than their respective markets. It seems therefore that indices not only do not provide exact pictures of the market in terms of energy technology exposure, but that they even slightly favour 'brown' over 'green' investments (2dii, 2014).

Low-carbon indices. In order to address this dilemma, and to answer the emerging demand initiated by institutional investors in the prelude of COP21 negotiations (Novethic, 2015; UN SG 2015; 2°ii, UNEP FI and WRI, 2015), all major index providers have created some specific indices, offering low-carbon or climate-friendly features, after about a decade of stagnation since the first low-carbon indices. These indices are often built on mainstream ones, where companies are either re-weighted or excluded (best-in-class), on the basis of their carbon footprint or other climate-related metric such as their share of green activities. They can also be constructed on sector or industry exclusion (e.g. 'FTSE ex Fossil Fuels', 'Fossil Free Indexes US', both excluding fossil fuels), or even retain only pure-players (e.g. 'MSCI Global Green Building Index', 'S&P Global Clean Energy Index'). About 100 low-carbon and related indices are now available to investors.

FIG. 29: CUMULATIVE EQUITY FUNDS FLOWS (SOURCE: BofAML GLOBAL INVESTMENT STRATEGY, EPFR GLOBAL, 2016)



FIG. 30: 2015 POWER CAPACITY MIX FOR VARIOUS INDICES AND ECONOMIES (SOURCE: 2°ii BASED ON GLOBALDATA 2015)



Feasibility

Methodological drawbacks. Low-carbon indices currently suffer from a number of limitations and caveats (2°ii, 2013-2015b; Coeslier et al, 2016). The underlying metrics used, typically the emission data from companies, are rarely relevant to assess their 'climate performance' nor their 'climate risk'; these data are backward looking based on historic emission patterns and are thus a meager indicator of future emissions. In addition, these types of metrics face a number of challenges related to the calculation of locked-in emissions, double counting of emissions, reduction and avoidance of emissions, etc. (see 2°ii, UNEP FI and WIR, 2015). Indices based on exclusion or pure-players, such as fossil-free indices or clean-tech indices, suffer less from these types of caveats. However, except for the new Euronext Low Carbon 100 index, green indices do not include the 2°C target as a methodological constraint. Alignment checks are now available to test how indices compare against the global climate goals (2dii, 2015a) and will hopefully support future index development that are clearly aligned with climate goals.

Acceptability

Indices are an established tool and do not face social or political acceptability issues. However, their rather negligible market size – about 1% of passive management uses low-carbon indices (Novethic, 2015) despite a sharp rise of green indices availability – can be an indicator for a yet low market acceptability.

Impact potential

General impact of benchmarks. Given the importance of benchmarks for listed markets, the composition of market indices has a large influence on how investors' money flows to companies, at least on the secondary market. Buying a security on the secondary market does not fetch directly new money to the issuing company, but has several indirect impacts on the company and sector: it increases the information flow and improves price signals, reduces volatility, increases investor confidence, and ultimately contributes to a reduction in the cost of capital (UN SG, 2015).

Impact of green indices. The two main approaches also need to be differentiated with regard to impact: First, re-weighting and best-in-class indices have potential for high attraction and a potential high volume effect, as they do not challenge sector diversification and liquidity characteristics. But for the same reason, they seem limited to a low and gradual impact, accompanying the dynamic of the industry, and opening the opportunity for more engagement and shareholder activism with companies. The idea is that while investors stay invested in polluting sectors they engage with their investees and use their voting power to align the company strategy with climate goals. Second, sector exclusion and pure-players selection are targeting a much smaller audience, more committed to climate issues, which is ready to employ investment strategies that do not follow the main benchmarks and thus take higher risks aiming for high impact on climate change. Such index products are attractive to investors typically involved in divestment strategies (withdrawing investments from polluting companies or industries). Reinvesting divested funds in dedicated climate friendly industries (as opposed to "climate neutral sectors" e.g. communication, health, etc.) may create impact, especially if these industries are in need of capital. While the potential impact may be more direct, they have less capacity to orient the market (2°ii, UNEP FI and WRI, 2015).

FIG. 31: THE CUMULATIVE NUMBER OF LOW-CARBON INDICES HAS GROWN RAPIDLY IN THE LAST DECADE (SOURCE: SG UN, 2015)

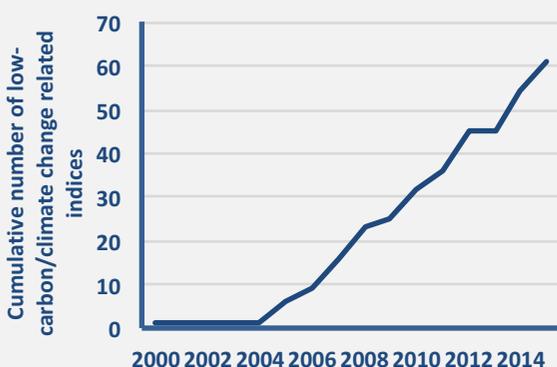


FIG. 32: AVERAGE ENERGY SECTOR EXPOSURE OF FOSSIL FUEL EXCLUSION INDICES RELATIVE TO BENCHMARK (SOURCE: 2°ii, UNEP FI, WRI, 2015)



2.5 Greening Banking regulation

Banking regulation. The Basel framework has been set up to enhance the supervision of the banking sector globally. After the last financial crisis, Basel III particularly focused on financial stability, via the following main items (BIS, 2016):

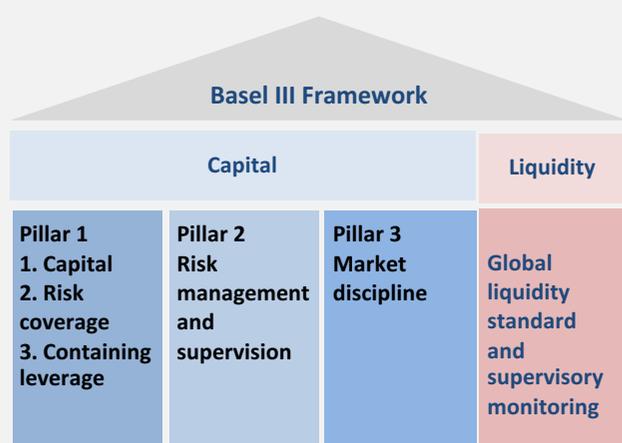
- “Improve the banking sector's ability to absorb shocks arising from financial and economic stress, whatever the source,
- Improve risk management and governance,
- Strengthen banks' transparency and disclosures.”

Ability to absorb shocks whatever the source. While climate change is consistently recognized as a global systemic economic threat, climate-related risks are not specifically identified in the current Basel framework, even if the wording “whatever the source” allows for inclusion of climate change as a potential risk factor. Environmental issues are mentioned, but focus mainly on transaction-specific risks (CISL & UNEP FI, 2014), which are more related to creditworthiness and insurance liability than systemic risk. Indeed, Basel does not provide any broader portfolio- /bank-wide or macro-prudential approach of climate and broader environmental risk assessment. The two main reasons are : 1) climate-related risks are still poorly defined and understood at financial institution and financial system levels; 2) time horizons involved in financial stability discussions are far too short to capture climate-related risks, those become material only after the period usually considered (2°ii, 2012).

Risk management side effects. Another key point concerns the minimum capital requirements that are put in place to improve the resilience of banks against major shocks. Capital and solvency requirements imposed by Basel III for financial stability reasons may have unintended negative effects on banks and investors’ long-term activities. Typically, the Net Stable Funding Ratio is a structural measure, intended to ensure that banks hold sufficient stable funding (e.g. capital and long-term debt instruments, retail deposits, etc.) to match their medium and long-term lending (KPMG, 2012), making long-term lending more expensive and uncertain (VCFSS, 2014). While infrastructure and innovation finance must play a major role in the fight against climate change, these are very often long term investments. Thus, the consistency between short term financial stability objectives and availability of financing for long term, climate-friendly finance is questioned (EC, 2015). The exact effect of current capital ratios on long-term financing is not well documented and views among regulators and market players are not consensual.

Transparency and disclosures. On the third item of Basel 3 concerning transparency and disclosure, no specific climate-related point is so far required, but practices and requests from national regulators have started to evolve in that direction (Tab. 6).

FIG. 33: FRAMEWORK OF BASEL III
(SOURCE: BIS BASEL III SUMMARY)



TAB. 6: SOME CENTRAL BANKS’ INITIATIVES ON CLIMATE CHANGE
(SOURCE UNEP INQUIRY, 2015)

The Bank of England	Did a prudential review of climate-related risks for UK insurance sector based on UK Climate Change Act.
The Central Bank of Brazil	Focuses on socio-environmental risk management.
The Bangladesh Bank	Supports rural enterprises and green finance which help maintain financial and monetary stability.
The People’s Bank of China	Harnessed the public balance sheet to make equity investments in policy-directed investment vehicles.

Greening the Basel framework. Two main pathways are discussed that would allow to incorporate climate-related issues in the Basel framework:

Time horizons. Time horizons for risk assessment in the frame of Basel rules need to be clearly defined and extended from current practice to capture more risks related to climate change (2°ii, 2012). Currently clear definitions are lacking and the longest timeframe usually taken into account in risk management frameworks appears to be 5 years, the most common being 1 year (e.g. regulatory Value-at-Risk). Taking the three main risk factor categories highlighted by the FSB-TCFD (2016), namely physical, liability, and transition risks, there is a low probability that significant systemic financial risks materialize within existing risk analysis timeframes: factors such as changing weather patterns or more frequent extreme events, widespread lawsuits that would hurt companies and countries, or stringent climate policies resulting in global high CO₂ price or other very material economic signal, are not expected to emerge meaningfully before typically 10-20 years.

Lowering capital requirements. Lower capital (and liquidity) requirements could be introduced for climate-friendly financial assets. It is not clear whether current capital ratios have a real negative effect on long-term financing (FSB, 2013; CISL & UNEP FI, 2014), and if such a negative effect would be compensated. But if for other reasons, it appears that capital is misallocated to with in relation to climate change and energy transition financial challenge, it would then rationalize the support of climate-friendly assets with lighter capital requirements, for the contribution they bring to de-risking the economy in the long run through lowering climate change impacts (2°ii, 2012).

Feasibility

Time horizons. While the idea of extending the time horizon for risk assessments itself sounds simple, it comes with fundamental changes on the framework and the way it operates. New methods and metrics would be required to implement longer term forecasts, e.g. scenario analysis and uncertainty measures, requiring specific knowledge with regard to climate change. This which may hamper the feasibility of implementation of the approach.

Lowering capital requirements. Lowering capital requirements appears to be within the parameters of the Basel rules mandate, as it deals with systemic risk related to climate change and the potential consequences on long-term financial stability. The Basel framework has already been adjusted in 2016 to avoid too many disincentives to trade related finance (EC, 2016b), which can be seen as a precedent for adjustment of this kind of requirements.

But it also raises the question whether such a provision favouring climate-friendly assets may create an adverse trade-off with shorter-term financial stability. Not to mention that it would *de facto* give the Basel framework an economic mandate that is potentially very sector-specific. Such a mandate is not supposed to be initiated by central banks themselves, but is a political decision that need to be taken by governments. This articulation between the respective roles and limits of regulators and financial policy makers is core in the highly publicized visions of Mark Carney (2015) and François Villeroy de Galhau (2015) about the connexion between climate change and financial stability issues (see boxes 5 & 7).

Lower capital requirements would be applied to financial institutions' investments in assets that support the energy transition. Here again, such an approach calls for a robust methodology to determine the climate-friendliness of those assets.

Acceptability

Time horizons. The acceptability of extending time horizons for risk assessment is currently unclear as this proposition is currently little debated in the public sphere and few actors have positioned themselves. However the current widespread calls for improved information and transparency (see e.g. box 5) may help in this regard.

Lowering capital requirements. The Basel framework has considerable influence on the global behaviour of banks. The fact that climate change is currently not at all considered by prudential rules may seem surprising when at the same time climate change is acknowledged as a major source of financial risk (Villeroy de Galhau, 2015; Carney, 2015; 2ⁱⁱ, 2015c; ET RISK, 2016). But whether capital requirements should consider climate change is still debated and is ultimately a political decision to take. While the Bank of England governor Mark Carney prominently took a stance against such an approach, voices from science and the banking sector itself have started to support the idea. In 2016 the ESRB proposed to introduce increased capital requirements for investments in high carbon assets (see Box 6). A few month later the French Banking Federation (FBF, 2016) suggested the creation of a “Green supporting factor” in the form of a preferential prudential treatment for bank assets that support the energy transition, arguing that it can build on the SME supporting factor that is envisaged by the European Parliament and Council Regulation, lightening capital requirements for credit risks on exposures to SMEs.

Impact potential

Time horizons. The extension of time horizons used for risk assessment would gradually but more rapidly capture more risk as climate change and policies become more concrete. Once the potential risk has been identified, it can either directly influence investment decisions as part of regular risk management arbitration or it can be used as a basis for new regulation such as exposure limits for assets identified as risky following suggestion of the ESRB (see box 6). However, the impact of extended time horizons for risk assessments will still be limited by the real time horizons of financial portfolios. In other words, if investors have high portfolio turnover (confer p. 23) they may not be worried about medium-term risks, even if these are identified.

Lowering capital requirements. Changes in capital requirements for low carbon asset investments would directly contribute to make those assets more attractive in financial terms and have an undisputed potential to orient financial decisions on a large scale.

BOX 5: MARK CARNEY ON “BREAKING THE TRAGEDY OF THE HORIZON”

(Bank of England Governor, “*Breaking the Tragedy of the Horizon - climate change and financial stability*”, Sept. 2015)

“Once climate change becomes a defining issue for financial stability, it may already be too late.

*[...] Financial policymakers will not drive the transition to a low-carbon economy. **It is not for a central banker to advocate for one policy response over another.** That is for governments to decide.*

*[...] Some have suggested we ought to accelerate the financing of a low carbon economy by adjusting the **capital regime** for banks and insurers. **That is flawed.** History shows the danger of attempting to use such changes in prudential rules – designed to protect financial stability – for other ends.*

*More properly our role can be in developing the frameworks that help the **market itself to adjust** efficiently. Any efficient market reaction to climate change risks as well as the technologies and policies to address them must be founded on **transparency** of information. A ‘market’ in the transition to a 2 degree world can be built. It has the potential to pull forward adjustment – but **only if information is available** and crucially if the policy responses of governments and the technological breakthroughs of the private sector are credible.*

BOX 6: FOUR POTENTIAL PRUDENTIAL POLICIES THAT COULD BE PUT IN PLACE PROPOSED BY THE EUROPEAN SYSTEMIC RISK BOARD ADVISORY SCIENTIFIC COMMITTEE (ESRB, 2016A):

- *“Building systemic capital buffers (for example, to protect against the macroeconomic and macro-financial implications of a “hard landing” [late “climate-friendly” policy adjustment]);*
- *Regulatory loss absorbency requirements to, for example, encourage the issuance of “carbon risk bonds”, the payoff of which would be contingent on a contractually defined critical event (e.g. the imposition of a prohibitive carbon tax);*
- *Specific capital surcharges based on the carbon intensity of individual exposures; and*
- *Large exposure limits applied to the overall investment in assets deemed highly vulnerable to an abrupt transition to the low-carbon economy. “*

2.6 Consistency issues, trade-offs and complementary approaches

Issues across the approaches discussed

No alignment without definitions. All of the four approaches have in common, that as long as there is no agreed definition of what constitutes an "investment consistent with climate goals", they can not reap their full impact. Moreover there is a clear risk of greenwashing (e.g. bonds and credits) and provision of incentives in the wrong direction (e.g. indices and change of capital requirements), as long as the definitions used for the approaches are not clearly linked to climate goals. While this may seem obvious, it is a strong concern that needs to be addressed with urgency. Methodology developments are already underway (discussed in part B) and the International Standardisation Organisation has agreed to take up the issue (see page 18).

Climate disclosure to provide the basis. Once the definitions are clear it will also be easier to define what kind of information is needed to assess the alignment. This is where climate disclosure of non-financial companies comes into play. The theory behind is that if financial institutions retrieve better climate-related information from companies that seek financing, they would 'automatically' make better financial choices. Such climate disclosure from non-financial companies is not directly part of the Basel framework (discussed here), but asking banks to report on their climate risk exposure as part of Basel requirements would push them to request this information from loan recipients, either driven from regulatory or voluntary initiatives. This is also the logic behind the current dynamic in place with the FSB task force on climate-related disclosures (TCFD, 2016) and the Article 173 of the French Law on Energy Transition (Box 2). Linked to the concept of disclosure, two other challenges need to be mentioned, concerning the availability and confidentiality of data, and the verification and relevance of such disclosure so that the whole process is efficient and really brings new sound information in the financial decision chain. Better disclosure would however benefit to all approaches discussed here.

It's all about time horizons. The question of time horizons has been discussed in detail with regard to Basel prudential regulation, however it is also relevant to the other approaches. The time frame of the analysis is generally important for judging the alignment with climate goals (see also page 16). And even if the time horizons of the analysis are sufficient, the time horizons of decision makers may still lead to non aligned investment decisions. Typically, the performance of asset managers is evaluated on a short term basis (quarterly or even weekly...). Asset managers are therefore driven by short term returns and longer-term oriented investments can become almost irrational from this perspective, even if they are sound. This is why the time horizons along the whole investment chain need to be analysed and where needed reformed.

Issues related to specific approaches

Capital weighted indices underrepresent green assets. Most indices, commonly weighted by market capitalization, over-represent large listed companies and underrepresent smaller listed companies. However, green innovation is more common in smaller companies. To illustrate this point, the average market capitalisation of companies in the MSCI Global Environment index is less than 20% of the average market capitalisation of companies in the MSCI World index (MSCI Index fact sheets, 2017). As a consequence, major market indices are relatively less exposed to green innovation and low-carbon energy than the global economy is. Consequently, investors passively replicating indices, invest even less in low-carbon assets than the global economy does.

Indices miss out on non-listed economic activities. The important role of indices and their potential has been discussed in detail (see p. 31-32). While modern portfolio theory suggests that investors should be exposed to all parts of the economy to achieve optimal diversification, listed markets only represent a part of the economy and, specifically with regard to climate goals, important economic activity is taking place outside of the listed space, e.g. energy efficiency services delivered through SMEs.

Climate stress-tests as an option. A parallel and related approach to greening the Basel framework would rely on the existing stress-test framework promoted by broader macro prudential frameworks more generally. It would consist of extending existing risk scenarios with climate-related risks. This would allow testing of the response of companies and financial institutions to adverse climate/carbon scenarios. This approach converges with the climate stress-test provision included in the Art. 173 of the French Energy Transition Law, and with the propositions of the European Systemic Risk Board (ESRB, 2016a). The European supervisory authority suggests to incorporate climate-related prudential risks into regular stress testing of regulated financial institutions. Indeed, no parameter related to carbon nor climate are currently in the ESRB adverse macroeconomic scenarios. In the existing stress test scenario framework provided by the European supervisory authority, the closest parameter related to climate issues is ‘Oil and commodity price shocks’ (ESRB, 2016b). The US framework provides shocks on several GHG emission credits (US DT, 2016). Furthermore, dedicated ‘carbon stress tests’ could be run by the regulator, to identify potential systemic risks resulting from adverse events that may occur in a long time horizon. Despite being supported by central bankers (see box 6), the operability of climate stress testing depends on the capacity of risk management of banks and of supervisory authorities to seize the technical matter quickly, as it confronts them to new challenges — whether related to modelling, data access, or more cultural and political aspects. The European project Energy Transition Risk (ET Risk, 2016) has been launched to help investors manage some of these difficulties, through the development of a carbon risk assessment framework to assess the impact on company valuations and credit risk.

BOX 6: FRANCOIS VILLEROY DE GALHAU ON "THE FINANCIAL SECTOR AND PATHWAYS TO 2°C "

(Governor of the Bank of France, *"Climate change - the financial sector and pathways to 2°C"*, Nov. 2015)

*"The market value of most carbon-intensive industries has already been impacted. And re-pricing may occur rapidly and abruptly. [...] For central banks or prudential authorities, three questions arise: that of **financing** -and interaction with monetary policy-, that of **information** - and of disclosure-, and lastly that of **time horizons** -and stress tests-.*

*[...] **Stress testing** is an integral part of risk management by financial institutions. [...] the current regulatory framework for banks somehow **overlooks climate change as a source of risk**. Yet this would be the way to handle the question of the **time horizon**. However, achieving this raises serious questions. Two approaches are possible. Either comprehensive stress testing, covering **all risks and associated asset classes** for financial institutions, which would allow supervisors to monitor the total exposure to climate risk. Or granular stress testing, focusing on assets that are **more specifically exposed to climate risk**, which would be more appropriate for analysing specific sectors and financing needs, such as the financing of the oil sector.*

*Whatever the approach chosen, the main challenge would be to **take account of climate risks** [...] This, of course, would mean relying on expert judgment on these issues, in a context where financial institutions **do not have enough experience to understand future risks.**"*

D - CONCLUSIONS

“Holding the increase in the global average temperature well below 2°C above pre-industrial levels”¹

“Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development”²

The Paris Agreement, which came into force in 2016, made very clear both the climate goal itself and the important role of the finance sector in achieving it. With it the overarching narrative has fundamentally changed, from merely scaling up climate finance to integrating climate change concerns across finance flows in general. Mainstream financial markets discovered the climate change issue quite recently. The initial phase of progress, led by a few committed investors, was bottom-up and did not reach the most influential stakeholders of the finance system. The ground breaking move currently witnessed is “top-down”, notably from policy makers and central banks, and spreads among financial institutions. The fact that climate advocacy is no longer the domain of environmental NGOs and activist shareholders but is supported by very mainstream leaders and organisations is indeed an important shift that shifts the narrative about finance and climate.

While both the magnitude and urgency of the challenge are clearly recognized by recent landmark declarations and regulations, the principal effort is still mainly confined to disclosure and reporting, and does not directly come with new constraints and concrete directives. Financial regulators and supervisors emphasize that the financial system will be able to work properly, and make its contribution to tackle climate change, once the relevant information on companies’ climate risk and performance is available to the the market.

Hence, while the forces at work undoubtedly changed during these last few years, the question is now about the capacity of the finance sector to mobilize at the right speed and scale to meet the challenge. And while many high-level initiatives are currently moving forward in order to foster green and climate-friendly finance (e.g. FSB/TCFD, G20/GFSG), it becomes crucial to monitor the finance flows that really contribute to fight climate change, and more specifically to track their alignment with the climate goal. But despite this new ‘alignment’ narrative that is gaining momentum, many challenges remain. First, the importance of disclosure and reporting should not hide the necessity to rely on robust methodologies and distribution channels that guarantee the relevance and the availability of underlying data. Typically, the intuitive ‘carbon footprint of portfolios’ is by no means a one-size-fits-all metric able to solve the climate finance equation alone. Perfect disclosure of misleading information will lead nowhere but far above the +2°C. Moreover, the <<+2°C target itself needs to be translated into manoeuvrable roadmaps that financial institutions can follow, so that they are not lost in the transition to a zero-carbon economy and can play the leading role they are expected to. These two elements shall open the way to reliable definitions of what is ‘green’ and ‘climate-friendly’ (i.e. <<+2°C-compatible) depending on the type, duration and geography of assets, and restrain the risk of greenwashing that is flourishing as the topic gains traction in the finance field.

Furthermore, given the urgency and magnitude of the challenge, policymakers should consider their role in facilitating the contribution of the financial sector to the universal, legally-binding Paris Agreement. Governments can indeed develop sets of policies that would help markets to adjust, if indeed these were not able to shift by themselves to a <<+2°C economic pathway. A number of policy approaches are currently explored and debated, seeking to offset the potential financial unattractiveness of climate-friendly assets and compensate for the lack of materiality of climate-related risk today. Such approaches can rely on core frameworks such as capital requirements, which have the ability to propagate economic signals at large scale, or be embedded in national policies, whether targeting asset owners through fiscal incentives on <<+2°C-compatible products, or directly piloting public financial institutions with explicit <<+2°C-compatible investment mandates matching national climate strategies.

¹ Paris Agreement, Article 2a [extract], 2015

² Paris Agreement, Article 2c, 2015

BIBLIOGRAPHY

- 2° Investing Initiative – 2° ii (2012)** “Connecting the dots between climate goals, portfolio allocation, and financial regulation”
- 2° ii (2013)** “From financed emissions to long-term investing metrics — State-of-the-art review of GHG emissions accounting for the financial sector”
- 2° ii (2014)** “Optimal Diversification and The Energy Transition”
- 2° ii (2015a)** “Assessing the Alignment of Portfolios with Climate Goals”
- 2° ii (2015b)** “Carbon footprint ≠ carbon risk”
- 2° ii (2015c)** “Financial Risk And The Transition To A Low-Carbon Economy”
- 2° ii (2015d)** “Decree Implementing Article 173-VI of The French Law for The Energy Transition”
- 2° ii (2015e)** “Measuring Progress on Greening Financial Markets”
- 2° ii (2016b)** “Investor Climate Disclosure: Stitching Together Best Practices”
- 2° ii (2016c)** “Trails for Climate Disclosure”
- 2° ii (2017)** “All Swans are Black in the Dark”
- 2° ii and Generation Foundation (2015)** “The Long-term Risk Signal Valley of Death: Exploring The Tragedy of The Horizon”
- 2° ii, Mercer & Generation Foundation (2017)** “The long and winding road”
- 2° ii, UNEP FI and WRI — Portfolio Carbon Initiative (2015)** “Climate Strategies And Metrics”
- 2° ii and University of Oxford (2016)** “Climate Disclosure: How To Make It Fly”
- Accenture/Barclays (2011)** “Carbon Capital”
- Allen, M. (2015)** “Can we hold global temperatures to 1.5°C?”
- Bank for International Settlements (2016)** “Basel Committee on Banking Supervision reforms - Basel III” summary table
- Bank of America Merrill Lynch (2016)** “What are your neighbors doing?”
- Bloomberg New Energy Finance (2016)** “New Energy Outlook 2016”
- Boissinot J., D. Huber and G. Lame (2016)** “Finance and climate: The transition to a low-carbon and climate-resilient economy from a financial sector perspective”
- Bowen, A., S. Dietz and N. Hicks (2012)** “Why do economists describe climate change as a market failure?”
- Business Insider (2016)**, quoting Deloitte (2015) <https://goo.gl/FnUdyu>
- Carbon Brief (2016)** “Scientists Compare Climate Change Impacts at 1.5C and 2C”
- Carbon Tracker Initiative (2011)** “Unburnable Carbon – Are The World’s Financial Markets Carrying A Carbon Bubble?”
- Carney, M., (2015)** “Breaking The Tragedy of The Horizon: Climate Change And Financial Stability”
- Carney, M., (2016)** “Resolving the climate paradox”
- CDP (2015)** “Mind the Science”, WRI, WWF and CDP Science Based Targets project <http://sciencebasedtargets.org>
- China Gold International Resources Corp. Ltd. (2016)** “CBRC: Accelerate The Development of Green Credit System, Improve The Development of Green Finance” (in Chinese) <https://goo.gl/B7tQ2i>
- Chinese Banking and Regulatory Commission (2012)** “Green Credit Guidelines”
- CICERO (2016)** “Framework for CICERO’s ‘Second Opinions’ on Green Bond Investments”
- CIRED/SMASH (2016)** “Energy investments in low carbon roadmaps” <http://2degrees-investing.org/IMG/pdf/d1.1.pdf>
- CISL & UNEP FI (2014)** “Stability and Sustainability in Banking Reform”
- Climate Bonds Initiative (2015)** “Climate Bonds Standard”
- Climate Bonds Initiative (2016)** “Bonds and Climate Change: State of the Market 2016”
- Climate Bonds Initiative (2016b)** “Poland wins race to issue first green sovereign bond” <https://goo.gl/hTo1sg>
- Climate Policy Initiative (2014a)** “Moving to a Low-Carbon Economy: The Financial Impact of the Low-carbon Transition”
- Climate Policy Initiative (2014b)** “What is climate finance? Definitions to improve tracking and scale up climate finance”
- Climate Policy Initiative (2016)** “Global Climate Finance: An updated view on 2013 and 2014 flows”
- Coeslier, M., C. Louche, J.F. Hétet (2016)** “On the relevance of low-carbon stock indices to tackle climate change” <https://goo.gl/thwUll>
- Credit Suisse/WWF (2011)** “Transition to a Low Carbon Economy – The Role of Banks”
- Deep Decarbonization Pathways Project, SDSN - IDDRI (2015)** “Pathways to deep decarbonization 2015 report”
- Edenhofer, O. et al. (2009)** “The Economics of Decarbonization. Report of the RECIPE project.”
- Eichengreen, B. — Chicago Booth Review (2015)** “China’s challenge: How to strengthen the financial system”
- ESRB Advisory Scientific Committee (2016a)** “Too late, too sudden: Transition to a low-carbon economy and systemic risk”
- ESRB (2016b)** “Adverse macro-financial scenario for the EBA 2016 EU-wide bank stress testing exercise”
- ET RISK (2016)** “Energy Transition Risk Project Launched In Paris” <https://goo.gl/KPQSaO>
- European Commission (EC) (2015)** “Action Plan on Building a Capital Markets Union” <https://goo.gl/6FUCrQ>
- EC(2016)** “Accelerating Europe’s Transition To A Low-carbon Economy”
- EC (2016b)** “FAQ: Capital requirements (CRR/CRD IV) and resolutions framework (BRRD/SRM) amendments” <https://goo.gl/dofnqC>
- European Investment Bank (2013)** “Energy Lending Criteria”
- European Investment Bank (2015)** “EIB Climate Strategy - Mobilising finance for the transition to a low-carbon and climate-resilient economy”
- Financial Stability Board (2013)** “Financial regulatory factors affecting the availability of long-term investment finance”
- Financial Stability Board (2015)** “Global Shadow Banking Monitoring Report”
- Financial Stability Board - Task Force on Climate-related Financial Disclosures – FSB/TCFD (2016)** “Phase I Report”
- Financial Times (2016)** “Renewables short of targets, says IEA”, <https://www.ft.com/content/653ab50e-79c7-11e6-a0c6-39e2633162d5>
- Financing the Future Consortium (2014)** “Shifting Private Capital to Climate-Friendly Investment”
- French Banking Federation (2016)** “How to successfully finance the energy transition” <https://goo.gl/WmZ3a>
- G7 (2015)** “Leaders’ Declaration G7 Summit, 7-8 June 2015” <https://goo.gl/mLUNVF>
- G20 Green Finance Study Group (2016a)** “G20 Green Finance Synthesis Report”
- G20 Climate Finance Study Group (2016b)** “Promoting efficient and transparent provision and mobilization of climate finance to enhance ambition of mitigation and adaptation actions” <https://goo.gl/pEZxqp>

Global Capital (2016) “Green finance tests limits with controversial issuers” <https://goo.gl/Aj2zvn>

Greenpeace (2015) “The Energy [R]evolution”

The Guardian (2014) “What good are China's green policies if its banks don't listen?”

Hollande, F. (2016) Discours lors de la 4e Conférence environnementale, <https://goo.gl/7EcuWA>

Hongo, T. (2013) “Definition and reporting system of Climate Finance”

I4CE (2016) “Beyond transparency: unlocking the full potential of green bonds”

I4CE (2016b) “Landscape of climate finance in France”

ICMA (2016) “The Green Bonds Principles”

International Energy Agency (2013) “Technology Roadmap: Carbon Capture and Storage”

IEA (2007) “Climate policy uncertainty and investment risk”

IEA (2014) “World Energy Investment Outlook”

IEA (2015) “World Energy Outlook”

IEA (2015) “Energy Technology Perspectives”

IEA (2016a) “Energy Technology Perspectives 2016”

IEA (2016b) “World Energy Investment 2016”

International Monetary Fund (2011) “Mobilizing Climate Finance”

IPCC (2013) “Climate Change 2013, The physical science basis”

IPCC (2016) “WG1, Scoping meeting background document - IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels”

Jun, M. et al. (2016) “Green bonds: Country experiences, barriers and options”, supporting the G20 Green Finance Study Group

Kay, J. (2015) “Other People's Money”, http://newfinancial.eu/wp-content/uploads/2015/10/Discussion_summary_Kay_Nov_2015.pdf

KPMG (2012) “Liquidity: A Bigger Challenge Than Capital”

Langner, Ch. — Bloomberg Gadfly (2016) “In China, Black Is The New Green”

Leave It In the Ground Initiative LINGO — (2016), <http://leave-it-in-the-ground.org/lingo-history/>

Long-Term Investment Intergroup on Infrastructure Financing (2016) Letter to / Response from ECVP Dombrovskis <https://goo.gl/q15n9O>

McCraw, K. (2014) “Energy Finance 101: An Intro to Yield Cos”

MetOffice (2016) “Global climate in context as the world approaches 1°C above pre-industrial for the first time” <https://goo.gl/NdlUu>

Ministry of Environmental Protection, P.R. China, Policy Research Center For Environment And Economy (2010) “China Green Credit Development Report” (in Chinese) <https://goo.gl/Ecf2Zm>

Ministry of Environment, Energy And The Sea, France (MEEM) (2016) “Energy Transition for Green Growth Act”

Japan Ministry of Environment (2016) “Overview of The Plan for Global Warming Countermeasures”

Modern Bankers (2016) “Can Green Credit Become The ‘Thoroughfare’ of Ecological Civilization?” (in Chinese) <https://goo.gl/mj2S9X>

Meinshausen, M., The University of Melbourne (2015) “Facts4COP21: Paris Agreement includes ambitious long-term goal”

Mercer (2011) “Climate Change Scenarios – Implications for Strategic Asset Allocation”

Montréal Carbon Pledge (2014) <http://montrealpledge.org>

MSCI (2015) “IIGCC carbon footprint assessment”

NASA (2016a) “Global Climate Change: Vital Signs of the Planet”, <http://climate.nasa.gov/vital-signs/global-temperature/>

NASA (2016b) “Annual global Analysis for 2016”, https://www.nasa.gov/sites/default/files/atoms/files/noaa-nasa_global_analysis-2016.pdf

Natixis (2015) “Green Bonds II: Reality check, analysis of green bond issues and reporting”

New Climate Economy (2014) “Infrastructure Investment Needs of A Low-carbon Scenario”

Novethic (2015) “Responsible investors acting on climate change”

Novethic (2016) “Montréal Carbon Pledge: accelerating investor climate disclosure”

OECD (2012) “Towards a Green Investment Policy Framework – The case of Low-carbon, climate resilient infrastructure”

OECD (2015) “Annual Survey of Large Pension Funds and Public Pension Reserve Funds”

OECD (2015b) “Mobilising the debt capital markets for a low-carbon transition”

OECD (2015c) “Aligning Policies for a Low-carbon Economy”

OECD (2016) “Analysing potential bond contributions in a low-carbon transition”

Stern, N. (2006) “Stern Review on the Economics of Climate Change”

Petajisto, A. (2013) “Active share and mutual fund performance”

People's Bank of China and UNEP Inquiry (2015) “Establishing China's Green Financial System”

People's Republic of China, State of Council (2015) “Belt and Road Initiative boosts trade, outbound investment”

PricewaterhouseCoopers and International Emissions Trading Association (2016) “GHG Market Sentiment Survey 2016”

Responsible Investor (2016) “Switzerland to launch voluntary climate-disclosure guidelines for companies and investors” <https://www.responsible-investor.com/home/article/swiss-climate-guidelines/>

RHG (2015) “A New Record Year for Chinese Outbound Investment in Europe”

Risk Magazine (2015) “Basel may soften trading book rules on emissions” <https://goo.gl/zN33nO>

Rogelj, J., M. Schaeffer and B. Hare (2015), “Timetables for Zero emissions and 2050 emissions reductions”

Rogelj, J., M. Schaeffer M., P. Friedlingstein, N.P. Gillett, D.P. van Vuuren, K. Riahi, M. Allen and R. Knutti (2016) “Differences Between Carbon Budget Estimates Unravelling”

Royal, S. (2015) “The French national low-carbon strategy (SNBC)” <https://goo.gl/B5WYDX>

Royal, S. and M. Sapin (2016) “La France confirme l'ambition d'émettre la première obligation verte souveraine” <https://goo.gl/k0Gxk2>

S&P DJI and Trucost (2016) “A Process for Rating the Green Impact of Green Bonds”

Schneider, S.H. (2006) “Climate Change: Do We Know Enough for Policy Action?”

Shell (2016) “A better life with a healthy planet”

Spencer, T. and J. Stevenson (2013) “EU Low-Carbon Investment and New Financial Sector Regulation: What Impacts and What Policy Response?”

Thomae, J., S. Dupré, F. Hassan and N. Robins (2015) “Equity Markets, Benchmark Indices, and the Transition to a Low-Carbon Economy”, UNEP Inquiry Working Paper <https://goo.gl/7WjaDh>

Thomae, J. and H. Chenet (2016) "Transition risks and market failure - A theoretical discourse on why financial models and economic agents may misprice risk related to the transition"

United Nations Conference on Trade and Development (2012) "Financialization is the root cause of oil and commodity price volatility"

UNEP FI (2014) "Financial Institutions Taking Action on Climate Change"

UNEP Inquiry (2015) "The Financial System We Need: Aligning The Financial System With Sustainable Development"

UNFCCC (2015) "The Paris Agreement", http://unfccc.int/paris_agreement/items/9485.php

UNFCCC (2016) "Report of the Standing Committee on Finance to the Conference of Parties", <http://unfccc.int/resource/docs/2016/cop22/eng/08.pdf>

UN Secretary-General (2015) "Trends In Private Sector Climate Finance"

UN (2016), C.N.735.2016.TREATIES-XXVII.7.d (Depositary Notification), <https://treaties.un.org/doc/Publication/CN/2016/CN.735.2016-Eng.pdf>

US Department of the Treasury, OCC (2016) DFAST 2016: Adverse scenario <https://goo.gl/oRTZ0Q>

Venugopal S., S. Patel (2013) "Why Is Climate Finance So Hard to Define?"

Anderson, V. (2015) "Green Money: Reclaiming Quantitative Easing"

Villeroy de Galhau, F. (2015) "Climate change - the financial sector and pathways to 2°C"

Vlerick Center For Financial Services (2014) "Regulatory Impact on Banks' and Insurers' Investment"

World Bank (2015) "State and Trends of Carbon Pricing"

World Bank Database (2016) <http://data.worldbank.org>

WWF (2016) "Green bonds must keep the green promise!"

Xinhua News (2016) "Chinese banking sector reports healthy green credit growth" (in Chinese), <https://goo.gl/BVMtru>

Xin Li, Oxford (2015) "Driving Forces of China's Energy and Emission Growths Between 2007 and 2010: A Structural Decomposition Analysis"

Yicai (2016) "CBRC Expert: Establish A Professional Guarantee System to Develop Green Credit" (in Chinese) <https://goo.gl/OwtPMP>



ABOUT 2° INVESTING INITIATIVE

The 2° Investing Initiative [2°ii] is a multi-stakeholder think tank working to align the financial sector with 2°C climate goals. Our research work seeks to align investment processes of financial institutions with climate goals; develop the metrics and tools to measure the climate friendliness of financial institutions; and mobilize regulatory and policy incentives to shift capital to energy transition financing. The association was founded in 2012 and has offices in Paris, London, Berlin, and New York City.

CONTACT

Email: contact@2degrees-investing.org

Website: www.2degrees-investing.org

Paris: 97 rue La Fayette, 75010 Paris, France

Tel: +33 1 4281 1997

New York: 205 E 42nd Street, 10017 NY, USA

Tel: +1 516 418 3156

Berlin: Am Kupfergraben 6A, 10117 Berlin

Tel: +49 176 87617445

London: 40 Bermondsey Street, SE1 3UD London, UK