Missing the forest for the trees

A review of climate risk data providers as part of the Sustainable Edge project

°CICERO

Center for International Climate Research

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Abstract: The financial sector is beginning to integrate climate into their business models and demanding climate related information tailored to financial decision making. A growing market of services and information sources exist and are being developed to meet this demand. We briefly review possible approaches: environmental social and governance (ESG) information covering climate, specialized approaches to physical and transition risk and approaches combing aspects of climate risk and impact. We also present a discussion on how different sources can be used to understand climate risks in a sector and provides insights on the user perspective based on earlier work by CICERO. We discuss the limitations of existing approaches and present a new approach to corporate climate risk assessment that will be developed in the Sustainable Edge project

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Executive summary

The financial sector is beginning to integrate climate into their business models and demanding climate related information tailored to financial decision making. A growing market of services and information sources exist and are being developed to meet this demand. **We briefly review available approaches: environmental social and governance (ESG) information covering climate, specialized approaches to physical and transition risk and approaches combing aspects of climate risk and impact.**

There is a lack of consistency and transparency on methods making comparison across and within services difficult. It can be difficult to understand how climate is assessed as an aspect of a ESG method, but also to combine an analysis of physical risk and transition risk. There are a limited number of approaches focusing on holistic climate risk and impact. The Sustainable Edge project is one example of a holistic climate methodology under development.
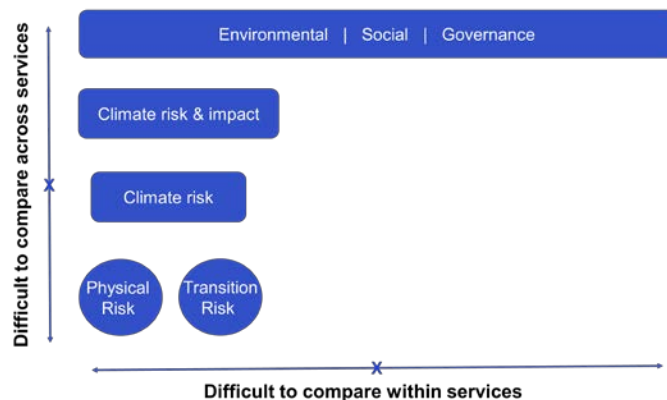
Figure 1 Available approaches to climate related information

The available approaches to physical climate risk largely use proprietary methodologies so the methods are difficult to assess, but comparisons can be made across the types of hazards covered. Access to asset-level data could be a barrier to comprehensive physical risk assessment.

Most approaches to transition risk analysis use the International Energy Agency scenarios, and all include a 2 C degree scenario. As with physical risk analysis, providers have different target

audiences, coverage and outputs. A major focus is on carbon emissions and carbon management, often tied to a projection of carbon pricing.

There are a couple of approaches combing physical and transition risk. A limited number of consultancies already offer services that assess both physical and transition risk or allow users to add a physical risk assessment module to an existing transition risk tool.

ESG services provide information on climate as one of many sustainability aspects. Many of the current methodologies have a heavy reliance on carbon emissions as a proxy for climate impact and risk. While emissions give a good indication of an entity's contribution to climate change, they are not forward looking and for many sectors emissions are concentrated in the supply chain (scope 3) were there is a lack of consistent reporting. ESG ratings have also been criticized for inconsistent evaluations. Several ESG scoring, rating and index providers focus on benchmarking within sectors. This combined with a number of metrics focused on social and corporate governance procedures can give non-logical conclusions for investors focused on climate.

The use of ESG data by financial institutions in Norway is highly individual, partly due to varying needs and possibilities to incorporate ESG data and partly due to the perceived quality and usefulness of such data. A single unified ESG score for a company may seem as an attractive way to quantify risks that are not easily quantifiable. But such a score may contain high risks in one area which will not show in the index if they are balanced by great performance in another area. If you have one hand in the fire, and the other one in a bucket of ice, on balance, you are fine.

One of the key barriers to assessing climate risks for compamies is the availability of reliable data for sectors and companies. This is partly because the classification of data is grouped into categories that are not ideal for climate risk assessments and the general unavailability of specifically relevant climate data on a sector level. These barriers may be possible to overcome by engaging with sector specific data providers and companies within the sector.

We have identified a demand for an approach that focuses on climate risk and impact, that is based on climate science and includes forward-looking elements. The Sustainable Edge project will assess how companies are changing their investments and development efforts over time towards a green transition, thus enabling tracking of the share of green investments and revenue over time. In addition the approach is giving an assessment of risk management for physical climate risk and transition risk. The project is led by CICERO Center for International Climate Research in partnership with ENOVA, a government enterprise, and leading Norwegian financial institutions, service providers and Finance Norway, the industry organization.

1   Introduction

Investors and asset owners are increasingly aware of both the need for a global economic green transition and the financial risks posed by climate change. At the same time, the financial sector is key to steering the economy through this broad landscape of challenges. With capital availability exceeding what is necessary to finance the transition to a 2°C world and avoiding the worst impacts of climate change, the sector has the financial interest to take informed decisions on how to address climate risks.

The growing awareness of climate and other sustainability issues has led to a burgeoning market for what is often called Environmental, Social and Governance (ESG) data and information. The consultancy Opimas estimated that in 2018 as much as $ 505 million was spent on ESG data, including ESG content and indices. They predict continued growth in demand, with spending reaching $ 745 million by 2020[1].

For investors looking specifically for information on climate risks, there are different approaches available:

- ESG information that covers climate risks under environmental data

- Specialized approaches to physical climate risks

- Specialized approaches to transition risks

- Tools that combine analysis of physical and transitions risks

This report covers key aspects of each of the above approaches and summarizes some of the available methodologies.

We also present a discussion on how different sources can be used to understand climate risks in a sector and provide insights on the user perspective based on earlier work by CICERO. We discuss the limitations of existing approaches and present a new approach to corporate climate risk assessment that will be developed in the Sustainable Edge project.

This report does not cover the landscape of corporate reporting on climate risk. Data availability from companies is identified as a key barrier to improved information to investors. Most climate-related data is currently voluntarily reported by companies outside of the annual report. The efforts from initiatives like the Taskforce on Climate Related Financial Disclosure (TCFD) is expected to improve data quality over time. The Sustainable Edge project also plans to engage with companies to improve data availability and quality.

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[1] http://www.opimas.com/research/428/detail/

2   Defining climate risk

Climate change impacts financial value and is a risk to investors and lenders. The ways climate change poses risks to financial value are often categorized into physical and transition risk (Clapp, Lund, Aamaas, & Lannoo, 2017).

Physical risk is risk caused by changes in temperature, precipitation and extreme weather. These could be sudden risks, for example, storm surges destroying property and disrupting supply chains. Changes can also be chronic, for example, climate change is going to impact the growth conditions for a number of agricultural products.

Transition risk are political, legal and technological risks as a result of the transition to a low carbon economy. Policy changes could include carbon pricing, as well as incentive to promote low carbon growth. For example, policies incentivizing the purchase of electric vehicles change the market conditions for car manufacturers. Technology changes include potential continued rapid reductions in the costs of renewable energy and energy storage technologies. Liability risks are the potential for certain companies or countries to be held liable for their contribution to climate change in a court of law. Transition risk also includes changes in consumer preferences, for example, some European countries are experiencing a shift towards more plant-based diets and away from red meats – a risk to the meat and dairy industry.
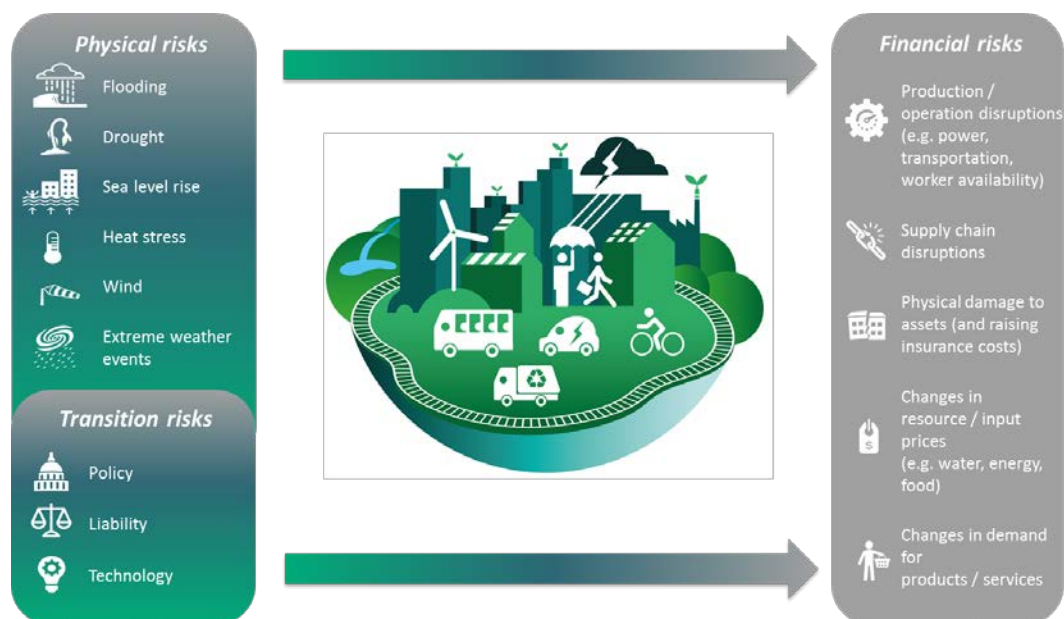
Source: (Clapp, Lund, Aamaas, & Lannoo, 2017)

Climate change will also provide economic opportunities in many sectors. The transition to a low carbon economy will require a host of low carbon technologies providing market opportunities to innovative forward-thinking companies. The physical impacts of climate change will lead to opportunities in resilience and adaptation technologies, for example a number of Dutch companies have begun exporting their expertise in flood management across the world.

3   Climate risk analysis

3.1   Landscape of ESG analysis

According to Environmental Finance, a trade magazine, there are some 150 Environmental, Social and Governance (ESG) data providers in the market currently. These range from broad ratings on social, environmental and governance to specialized providers offering insight on for example the company reputational risk (Cripps, The ESG data files – introduction, 2019). In addition, many providers of financial data and information are beginning to incorporate ESG considerations or issues into their services.

Broadly, the types of services can be split into five categories:

> **ESG data** which could include for example scope 1-3 emissions[2] or corporate emissions intensity targets. The data is analyzed by the financial users and requires that users have an understanding of how the different data points are linked to climate impact or risk. For climate-related data, CDP is the leading provider to the financial sector, see text box. CDP provides corporate data sets to investor members and sells data to other providers[3], in fact CDP data is often the source of emissions data for many of the other providers discussed.

> **ESG scores and ratings** where several ESG metrics are analyzed by the provider and an overall ESG score or rating is calculated for the company. These providers will often also make available the underlying metrics and separate environmental, social and governance scores. Specialized providers of ESG scores and ratings include Sustainalytics[4], ISS-Oekom[5] and Vigeo Eiris[6]. As an example of how these scores can be complied, the index provider MSCI uses over 100 data sets, in addition to corporate disclosures and media surveillance. For each industry, 37 key issues are selected, these may also be weighted differently for the different industries. Each company is scored on both exposure and corporate management and assigned a final rating from AAA-CCC[7].

> While one score may be easier to operationalize into the investment process, the combination of dozens of metrics makes it hard to immediately understand the climate

CDP data
CDP provides self-reported climate related information from companies. The questionnaires began with a focus on emissions reporting and have detailed sections on methodologies and indicators for all scopes of emissions. The 2018 questionnaire also aligned with the TCFD framework for climate-related financial disclosures. This entails that reporting companies should describe their governance, strategies, risk management and metrics related to climate risk. The data from CDP could therefore include important information on both physical and transition risk management.

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[2] Scope 1 includes all direct emissions, scope 2 are indirect emissions from purchased electricity and scope 3 includes supply chain emissions.

[3] In addition to climate data, CDP also collects corporate data on water, forests and supply chains. CDP also ranks companies on disclosure and performance. See https://www.cdp.net/en

[4] https://www.sustainalytics.com/esg-ratings/

[5] https://www.issgovernance.com/esg/ratings/

[6] http://vigeo-eiris.com/solutions-for-investors/esg-research/

[7] https://www.msci.com/documents/10199/123a2b2b-1395-4aa2-a121-ea14de6d708a

impact or risk of the company. Different metrics and weighting of these make comparison across providers difficult, and the industry has been criticized for providing inconsistent scoring of the same companies[8].

ESG indexes where companies are evaluated on their sustainability performance. For example the best in class companies within their sector are included in an index. There is overlap with the category above as some of the methodologies may also provide scores or metrics for all companies, and that some providers above also create indexes. For example, MSCI offers a number of indexes based on their ESG ratings[9]. The advantage of an ESG index is that is provides a readymade benchmark for investors to use, however, many of the issues with ESG scores and ratings also apply to this category.

The oldest ESG index is the Dow Jones Sustainability Index (DJSI). This index relies on detailed corporate questionnaires to analyze company performance and determine the index composition. The top ten percent of companies within each sector are included in the benchmarks[10]. Other ESG index providers include the FTSE4Good series[11] and Fossil Free Indexes[12].

ESG research including more qualitative information on companies and sectors. Many investors are wary of relying purely on quantitative ESG information given the challenges with data quality, consistency and comparability. A number of service providers offer ESG research targeted towards the investment community, and there are a number of public sources available to investors. For example, the NGOs Carbon Tracker and 2Degrees Investing have published a number of reports on climate risk for specific sectors or market segments[13].

ESG integrated into financial services for example credit reports. The major credit agencies S&P, Fitch and Moody's have all begun incorporating ESG factors into the standard credit ratings. For example, S&P states that ESG factors could be considered in their assessment of business risk, financial risk and/or management and governance. The credit agency also may consider ESG in their industry specific analysis[14].

In addition, the credit agencies have acquired specialized ESG providers, adding to their sustainability capacities. Many of the agencies offer standalone ESG services, for example the S&P owned Trucost offers a suite of ESG data and analysis services[15].

Many of the providers have offerings in different categories, for example Systainalytics can provide ESG data, as well as scores and research[16].

In addition to the above, investors use a number of publicly available sources, including sustainability reporting from companies. Other potentially useful sources of ESG information include rankings by environmental organizations. A number of initiatives rank companies based on sustainability performance and publicize the best or worst performers. For example, the Canadian

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[8] See for example (Allen, 2018) https://ftalphaville.ft.com/2018/12/06/1544076001000/Lies--damned-lies-and-ESG-rating-methodologies/

[9] https://www.msci.com/esg-indexes

[10] https://www.robecosam.com/csa/indices/djsi-index-family.html

[11] https://www.ftserussell.com/products/indices/ftse4good

[12] http://fossilfreeindexes.com/index-products/

[13] https://www.carbontracker.org/reports/?category=power & https://2degrees-investing.org/

[14] https://www.spglobal.com/ratings/en/products-benefits/products/esg-in-credit-ratings

[15] https://www.trucost.com/capital-markets/

[16] https://www.sustainalytics.com/our-solutions/

company Corporate Knights has provided a ranking of the top 100 "most sustainable companies" since 2005[17].

The field of ESG providers is rapidly evolving and the last years have both seen major consolidations and many new entrants. One trend is the application of big data analytics and artificial intelligence (AI). For example, Truvalue labs ESG tool applies AI to analyze unstructured data[18]. A different approach is focusing on specialized expertise and engagement with companies to overcome the current gaps in quality and consistency of corporate ESG data. The Sustainable Edge project is an example of the latter approach.

ESG providers all incorporate a consideration of climate in their environmental analysis. There are different approaches, however, many of the current methodologies have a heavy reliance on carbon emissions as a proxy for climate impact and risk. While emissions give a good indication of an entities contribution to climate change, they are not forward looking and for many sectors emissions are concentrated in the supply chain (so called scope 3 emissions) were there is a lack of consistent reporting.

3.2   Landscape of physical climate risk analysis

The CICERO led ClimINVEST project, see text box, reviewed available physical climate risk service providers in 2018. They found a limited number of available approaches tailored to financial institutions. The below text and table on the next page summarizes their findings[19].

The target users for the different approaches are mainly investors, with three exceptions. Acclimatise focuses on pre-screening before financing for project officers and risk managers (more suitable for development banks). Moody's provides an exploratory approach and is based on illustrative data for risk managers in all financial institutions. WRI provides an analysis of portfolio exposure to water scarcity for all financial institutions.

While service providers target different end-uses and end-users, they all try to answer the same question: how physical impacts of climate change can potentially affect counterparties such as projects, companies or governments. To investigate potential impacts, the approaches combine information in four broad categories:

- climate hazards;
- the counterparty's exposure to these hazards;
- the sensitivity of the counterparty to this exposure; and
- its capacity to address these potential impacts[20].

> **The ClimINVEST project** promotes structured dialogue between climate change scientists and financial decision-makers to bridge the gap between physical climate risk and financial impacts.
>
> The project brings scientists and investors together in a series of science-practice labs to co-design tailored information on climate change to support financial decision-making in the face of physical climate risks and opportunities.

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[17] https://www.corporateknights.com/reports/global-100

[18] https://www.truvaluelabs.com/solutions/asset-managers

[19] Full report can be downloaded here: https://pub.cicero.oslo.no/cicero-xmlui/handle/11250/2589503

[20] Not all of the selected approaches cover every type of counterparty and every aspect of potential impacts. In terms of analysis of potential impacts, WRI and Trucost focus exclusively on a sub-category of climate hazards related to water scarcity, while the other approaches seek to incorporate different aspects of risk (i.e. information not only on hazards but also on counterparties).
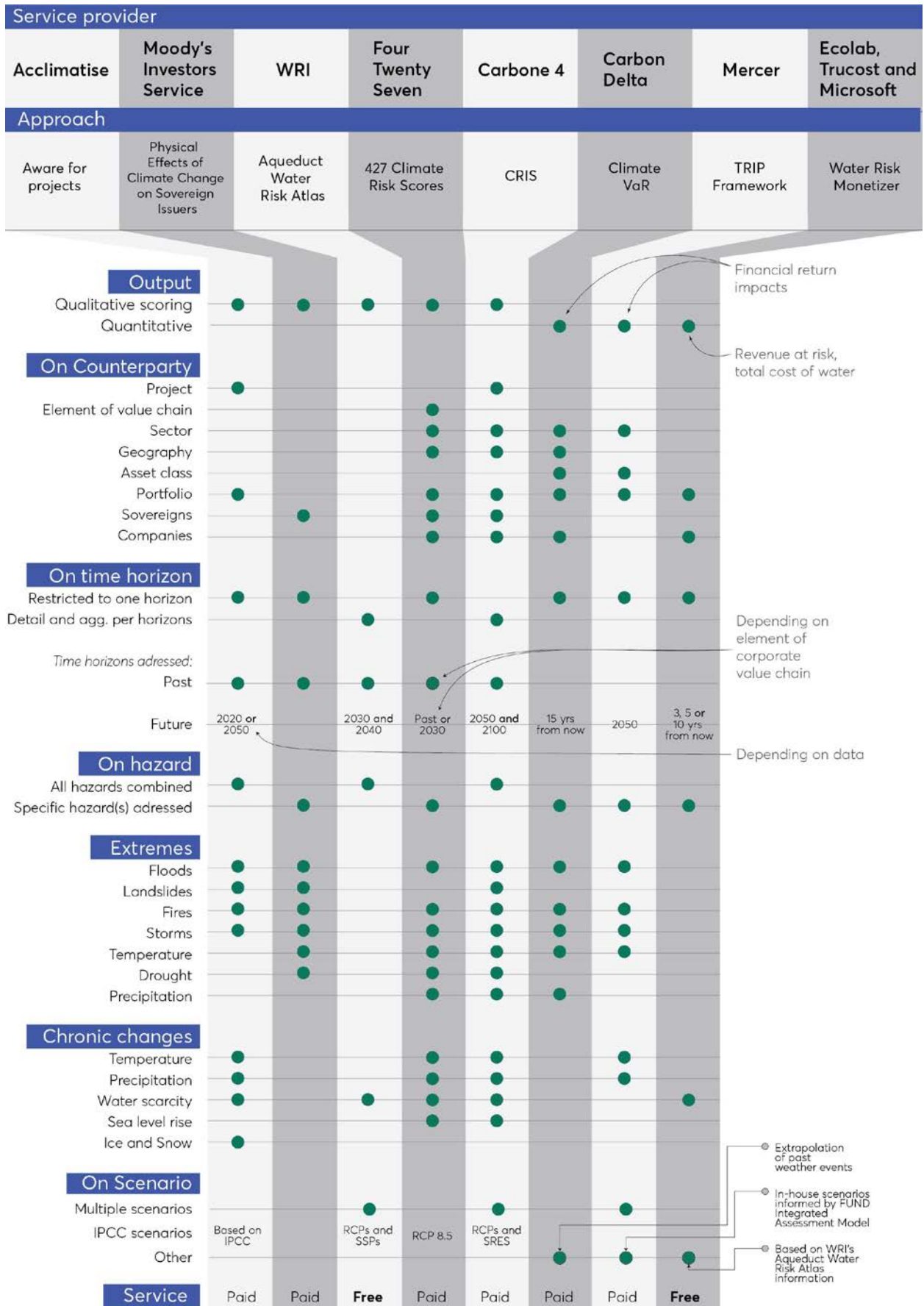
Figure 2 Available approaches on physical climate risk analysis. Source: (Bruin, et al., 2019)

The approaches build on public data sources on climate hazards which are further processed by service providers internally. The exposure to climate hazards can be provided by the end-user of the approach or by a combination of the counterparty's publicly reported information and commercial and proprietary databases. Sensitivity data can also be provided by the end user or arise from combinations of public and commercial databases, public or proprietary cost functions, and expert judgment. The adaptive capacity is addressed for sovereigns with publicly available databases, while it is less covered by corporate counterparties.

Existing approaches provide qualitative scores or quantitative estimates with different details. Five service providers choose to provide qualitative scores on the level of physical climate risk of the counterparty. Three other approaches produce quantitative information, such as estimates of potential cost or asset value impact resulting from climate-related risks to a single counterparty. The information provided to end users also differs in the type of detail (e.g. per type of hazard, climate scenario, time horizon, category of impact or counterparty) and the level of detail (e.g. counterparty or sectorial level analysis) they provide. The scope of hazards covered by each approach also varies. In addition, the existing methodologies covered by this analysis address different climate-related impacts on corporate counterparties.

Key information gaps

- Limited availability of counterparty-specific data, especially for companies.
- Service providers offer limited coverage of climate data, for instance by selecting specific time horizons. The publicly available approaches only cover water scarcity.
- The available approaches make limited use of scenarios of long-term climate change and do not provide scenarios of counterparties' evolutions.
- Cross-comparability between approaches is not possible, as service providers use different information formats, methodologies, and information. This prevents financial actors from using of a combination of methodologies to analyze their different portfolios.

3.3   Landscape of transition risk analysis

There are a variety of approaches to transition risk analysis. Most approaches use the International Energy Agency scenarios included in their World Energy Outlook (WEO) report, and all include a 2ºC degree scenario. A major focus is on carbon emissions and carbon management, often tied to a projection of carbon pricing. The majority of approaches provide qualitative outputs, though approaches with quantitative results are available.

Many providers use energy scenarios, such as those from the IEA, to provide information on policy and technology risks. The WEO scenarios are a useful tool as they are updated annually and cover a number of sectors of the economy. However, since many providers base their services on the WEO scenarios, the limitations of these scenarios should be kept in mind.

The WEO scenarios model the energy system. The use of energy stands for a considerable part of global emissions. However, emissions sources like land use are not included. The 2ºC degree scenario assumes the availability of carbon captured and storage (CCS) technology at a large scale within the next 20 years. The actual implementation of CCS technology is not on track to meet the modelled levels. Still, the CCS assumptions in the WEO scenarios are modest compared to some other scenarios used in the IPCC system.

The 2ºC degree scenario included in the WEO roughly matches other scenarios that have a 66 % chance of keeping the rise in global temperatures below 2ºC degree. As the WEO scenarios only stretch until the middle of the century, we have to assume that the scenario keeps following a 2ºC degree pathway in the second half of the century. However, the WEO model does not include

assumptions beyond 2040 even if they are relevant to long-standing energy infrastructure. In many other scenarios, for example some of those used in the IPCC process, CCS and negative emissions technologies are featured at varying scales in the second half of the century in order to achieve the 2ºC degree target.

The below table summarizes some of the available methodologies.

Name	Approach	Coverage				Scenarios	Output	Sectors
		Equities	Bonds	Lending	Company			
2 Degrees Investing PACTA[21]	*Alignment of portfolio with 2 C scenario*	X	X	Pilot		2ºC (IEA)	Qualitative	Energy (fossil fuels), power, transport (light-heavy duty vehicles, aviation, shipping), and industrial sectors (cement, steel)
Carbon4 Finance Carbon Impact Analytics (CIA) [22]	*Greenhouse gas emissions of the portfolio and contribution to the energy and climate transition.*	X	X			2ºC (IEA)	Qualitative and quantitative	All, but simplified analysis for "low-stake" sectors
Carbon Tracker 2 degrees of separation[23]	*Company alignment with fossil fuel energy demand levels across various climate scenarios*				X	2,7ºC, 2ºC and 1,75ºC (IEA)	Quantitative	Oil and gas
Transition Pathways Initiative [24]	*Assessment of companies' carbon management quality and carbon performance*				X	Paris pledged, 2ºC, 1,5ºC (IEA)	Qualitative	Airline, Aluminum, Auto, Cement, Coal mining, Consumer Goods, Electricity utilities, Oil & Gas, Oil & Gas Distribution, Other Basic Materials, Other Industrials, Paper, Services, Steel
Vivid-economic Net-Zero Toolkit[25]	*Assess the impact of low-carbon transition risk on financial assets* *	X	X	Can be customized		Compatible with IEA, IPCC and bespoke scenarios *	Quantitative	All sectors
Trucost (S&P) The Carbon Pricing Investor Toolkit[26]	*Assess impact of current and potential carbon pricing*				X			**
Engaged Tracking ET Portfolio Analytics Report[27]	*Understand exposure to climate-risks on a portfolio and individual company level*				X	2,7ºC, 2ºC and 1,75ºC		***

Source: UNEP FI (2019) Report and own research. *Vivid economics can also incorporate physical risks into the Net-Zero toolkit. **There is limited public information on the different Trucost (S&P) offerings. In addition to the Carbon Pricing Investor Tool, the Green Transition Tool might also be relevant. *** There is limited public information on the Engaged Tracking ET Portfolio Analytics Report

[21] https://www.transitionmonitor.com/
[22] http://www.carbone4.com/wp-content/uploads/2016/10/CarbonImpactAnalytics-1.pdf
[23] http://2degreeseparation.com/online-tool.html
[24] http://www.lse.ac.uk/GranthamInstitute/tpi
[25] https://www.vivideconomics.com/net-zero-toolkit and interview with Thomas Bligaard Nielsen (Vivid Economics)
[26] https://www.trucost.com/capital-markets/the-corporate-carbon-pricing-tool/
[27] https://www.engagedtracking.com/portfolio-solutions

As with physical risk analysis, providers have different target audiences, coverage and outputs. The scope of analysis also varies. None of the available approaches identified cover the spectrum of transitions risks including policy, technology, market and liability risks. Some methodologies use greenhouse gas emissions or carbon management as a proxy for transition risks, other approaches could analyze the portfolio or company alignment with climate scenarios. For example, the Carbon Pricing Investor Toolkit is a quantitative analysis of the impact of potential carbon prices. Whereas the Transition Pathways Initiative is a qualitative assessment of how well a prepared a company is for the low carbon transition.

The timeframe applied by the different approaches varies greatly and depends on the extent to which corporate strategies are taken into account. For example, the PACTA model has 5-year timeframe that considers capital expenditure planning. The Carbon Impact Analytics (CIA) directly analysis a firm's investments and R&D expenditures. While the 2 degrees of separation tool assesses oil and gas capex to 2025.

A recent report from UNEP Finance Initiative surveyed available scenario-based methods for transition risk (UNEP FI, 2019). They found that policy risk is often summarized into a carbon price, rather than analyzing the impacts of all climate related polices. Technology risks could be analyzed through changes in relative prices of renewables and fossil fuels, and market risk could be viewed as treated within policy and technology risks. The survey did not find any services that include a consideration of liability and reputational risk. The UNEP report found that there is scope for more bottom up analysis that takes into account companies' strategies and actions on climate mitigation (UNEP FI, 2019).

3.4   Combining physical and transition risk

There are a limited number of service providers offering tools that combine physical and transition risk.

The Vivid Economics Net-Zero Toolkit can incorporate an analysis of both acute and chronic physical risks. The tool is customizable and can either be used to analyze the impact of transition and physical risks separately or in combination. The basis for the Net-Zero Toolkit is a discounted cash flow model, a financial valuation model for assessing the current value of future cash flows.

The UNEP Finance Initiative piloted a method developed by Carbon Delta combing physical and transition risk (UNEP FI, 2019). The method estimates a "Climate Value at Risk" (CVaR). Value at Risk (VaR) is a common metric used in the financial sector to analyze the risk of loss for investments. The Carbon Delta methodology takes into account aspects of both chronic and acute physical risks, as well as transition risks related to policy and green opportunities. A financial model translates these impacts into financial value returning a dollar amount of Climate Value at Risk for the portfolios.

Both the Vivid Economics and Carbon Delta approaches provide quantitative outputs. For example, the pilot study applied the CVaR to a number of portfolios, including a market portfolio assembled to represent the investable market universe. The study found transition risk could be as much as 13,16 percent of overall value in a 1,5ºC degree scenario. The presentation of an exact value of financial risk may provide users with an unjustified level of confidence in results[28]. Any approach

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[28] Note that there are steps providers can take to mitigate this risk. For example. Vivid Economics assists clients understand their process and allows them to run multiple scenarios exploring the consequences of factors which are inherently uncertain.

translating climate risk to financial values must make several assumptions and simplifications. Nonetheless, these approaches could provide a useful lens for investors.

There are also services that provide more qualitative outputs. For example, South Pole offers a service that "maps major transition and physical risk 'hotspots' across a range of timeframes for TCFD reporting"[29]. Due to the propriety nature of these methods it is hard to compare methodologies and the resulting outputs from the services.

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[29] https://www.southpole.com/sustainability-solutions/climate-risk-quick-assessment-tools

4   Norwegian perspective

4.1   Reflections on - and the use of - ESG data providers in Norway

In our experience[30], the use of ESG data by financial institutions in Norway is highly individual. This corresponds to practice in other places around the world. This is partly due to the varying needs and possibilities to incorporate ESG data in different financial services such as lending, investing, underwriting or advisory services. For example, the due diligence process around a loan application from a large corporate allows for a deeper dive into a company's performance and policies regarding environmental, social and governance matters, which may affect the pricing of the loan. For an asset manager with a passive portfolio that mirrors an index, ESG data can be used to adjust the exposure to certain investee companies within the confines of a stable sector weighting. For actively managed funds, ESG data can be used to engage with companies.

Another aspect that can explain the individualistic use of ESG data is the perceived quality and usefulness of such data. Given the relative novelty of ESG data collection, reporting from companies is not necessarily consistent. In addition, a single unified ESG score for a company may seem an attractive way to quantify risks that are not easily quantifiable. But such a score may contain high risks in one area which will not show in the index if they are balanced by great performance in another area. If you have one hand in the fire, and the other one in a bucket of ice, on balance, you are fine.

New reporting initiatives, like the 2017 recommendations by the Task Force on Climate-related Financial Disclosure (TCFD), had reached all financial institutions we contacted in Norway (Torvanger, 2019). There was however great insecurity as to what the implementation of TCFD reporting would look like, and how internal processes would have to be set up. There is a risk that it may add to the notion of "reporting fatigue", even though TCFD is a systematic approach that covers all essential parts of climate risk.

In addition to these challenges, some individuals we spoke to thought that ESG data simply was not applicable to their work. A short investment time horizon or repayment periods of 3-5 years was seen as an obstacle to prioritize climate risks, since climate risks were perceived to be long-term (Torvanger, 2019). Some lenders have taken elements of ESG risk into their standard credit models. One example is a narrow focus on local environmental impacts of debtors, and these sections of the credit model bears more resemblance to a compliance function. This is legitimate and necessary; however, it does not cover climate risk in its totality.

However, among portfolio managers, most of the people we have spoken to are actively incorporating some aspects of ESG risk management. The main applications are to set standards, such as minimum performance for inclusion in a portfolio, active ownership (i.e. asking questions to company management and trying to influence operations), exclusion, and ESG risk analysis

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[30] The information in this section is based on a interviews with representatives from twenty larger financial institutions in Norway and Sweden (conducted as a part of the project Greening investments in the face of climate risk), in addition to meetings with financial institutions conducted during the preliminary study fall 2018

(Torvanger, 2019). In general, collecting information from each company is possible when the portfolio consists of a limited number of assets, but not for a big portfolio (Torvanger, 2019).[31]

4.2   Identifying and analyzing sector specific data

The internal feasibility study preceding the current phase of the Sustainable Edge project revealed that one of the key barriers to assessing climate risks for companies is the availability of reliable data for sectors and companies (Alnes, et al., 2019). This is mainly due to two reasons:

1. Reporting from companies and other available sources is not ideal for climate risk assessments (e.g., classification of data on corporate activities by geography or broad business units, reporting of financial indicators not tied to climate relevant activities) and,
2. The general unavailability of specifically relevant climate data on a sector level.

Addressing the latter is a key focus of the current phase of Sustainable Edge as the project will develop sector briefs with relevant climate data for several Norwegian sectors. In this process we have gained insights into the reality of assessing climate risk at a sectorial level. We have consulted a plethora of Norwegian data sources in order to identify most relevant sector specific climate data. We find that data availability, even among the leading data experts in Norway, is often scattered, patched, partly inconsistent and incomplete. By addressing the unavailability of data on a sector level, we provide guidance to corporates on the type of reporting that is most helpful to investors, and as such may also contribute to improvements in corporate reporting.

One example is the real estate sector. The most established and currently applied climate related data to assess "green" in the real estate sector in Norway is ENOVA's energy label. Based on third-party or self-reporting, a score from A (best) to G (worst) is allocated based on an energy efficiency calculation and a color score from red to green is allocated based on buildings' heating characteristics. While new buildings according to the Norwegian building regulation TEK17 have to receive at least a score of B, older buildings do not necessarily have to obtain a score. Therefore, only about 20% of the Norwegian building stock have received an energy label. In addition, self-reporting as well as a lack of incentives to obtain a label leads to distortions of actual building codes and, e.g., a significantly higher portion of G-rated buildings. Another draw-back for CICERO's analysis is the heating characteristic's color scale, which mixes electric heating with fossil fuel heating criteria across the scale. This does not contribute substantial foundation for climate risk assessment. As the energy label is the most established system in Norway by now, ENOVA is currently in the process of updating the energy labelling system "Energimerking" to create a more transparent and consistent set of climate related data in the real estate sector.

As the grouping of the sector to gather relevant data has been identified as a challenge, we decided to focus on the real estate sector as defined by the NACE code, but also to include asset level data on buildings in Norway. The NACE codes refer to the Statistical Classification of Economic Activities in the European Community. The challenge arose due to fact that buildings are owned by nearly all sectors and that, e.g., construction, building material production, recycling and private households play a major role for buildings' climate impact. As NACE codes are used by the financial sector, Statistics Norway (SSB) and the EU taxonomy, our sector classification follows the same system to allow for consistent comparisons. The reason for including asset level assessments into this sector brief and, therefore, also including cross-sector data, is given by the fact that some companies outside of the real estate sector might hold substantial amounts of real estate while not

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[31] As an illustration a big portfolio could be defined as containing more than a hundred assets. For lenders, such as commercial banks, collection of information is easier since they require enough documentation from companies to provide loans.

classifying as a real estate company – this can lead to significant distortions when gathering climate data for real estate. Therefore, we have worked in close collaboration with industry experts to holistically as possible capture a representative climate risk overview of the Norwegian real estate sector.

On a NACE sector level, Statistics Norway (SSB) data has been used, e.g., to gather emissions data from the real estate sector, building material emissions or energy consumption data. In addition, together with Eiendomsverdi, a major provider of data on real estate to the Norwegian real estate market, data has been gathered and aggregated to allow for development of industry figures and benchmarks. Eiendomsverdi gathers data, e.g., from Google, the Norwegian Mapping and Cadastre Authority (Kartverket), ENOVA SF and Finance Norway and from the Norwegian Water Resources and Energy Directorate (NVE) on physical climate risks as well as from own climate risk assessments. In addition, Entro, a company focusing on energy efficiency of commercial buildings, gathers and supplies data on commercial buildings data that is used by the Sustainable Edge project for benchmarking and commercial real estate figures. The Norwegian Green Building Alliance (Grønn byggallianse), a think tank in Norway working on green buildings, has agreed to provide complementary data on the above as well as data on building certifications.

A similar approach to effectively provide indicators and benchmarks most relevant to understand climate risks associated with the sectors and eventually with companies operating in these sectors is applied in other sector briefs we are compiling for land transportation, shipping, agriculture and industry. Available SSB data is gathered on NACE code level and the Sustainable Edge project team collaborates closely with established sector specific data providers and practitioners to complement SSB data.

5   Gaps in the landscape of data and approaches

There are a plethora of service providers offering climate related information to the financial sector. For investors seeking information on climate risk and impact, it can be difficult to compare across approaches and among methodologies within an approach.

Separate transition risk and physical risk approaches provide information on aspects of climate risk and impact, but do not provide investors with a full understanding. There are a limited number of approaches that combine physical and transition risk analysis. Cross-comparability between approaches is hard, as service providers use different information formats, methodologies, and information. This prevents financial actors from using of a combination of methodologies to analyze their different portfolios.

ESG services provide information on climate as one of many sustainability aspects. Many of the current methodologies have a heavy reliance on carbon emissions as a proxy for climate impact and risk. While emissions give a good indication of an entities contribution to climate change, they are not forward looking and for many sectors emissions are concentrated in the supply chain (scope 3) were there is a lack of consistent reporting. Our view is that additional information on the company's green transformation and activities supporting this strategy should supplement emissions data.

The landscape is dominated by consultancies with different approaches and non-transparent methodologies. ESG ratings have also been criticized for inconsistent evaluations. Several ESG scoring, rating and index providers focus on benchmarking within sectors. This combined with a number of metrics focused on social and corporate governance procedures can give non-logical conclusions for investors focused on climate. As pointed out in a recent Environmental Finance article, oil and gas and mining companies are regularly given high ESG scores and electric car companies do not necessarily score higher than their mainly fossil-fuel car producing competitors (Cripps, ESG data files – part 3: ESG rating providers, 2019).

The goal is not necessary for all available tools to have consistent approaches, as investors have different focus areas and needs for ESG and climate related data. When it comes to climate, investor goals can broadly be broken down into creating impact and/ or avoiding risk. The market may develop different tools for these goals, the key is to be transparent on scope, method and limitations for each methodology.

We have identified a demand for an approach that focuses on climate risk and impact, that is based in climate science and includes forward-looking elements and allows for tracking progress along a green transition pathway over time. With the Sustainable Edge project, we are attempting to provide information relevant to both climate risks and impact, however, we exclude any other aspects of ESG. The below table illustrates the current gap in the landscape of data and approaches.
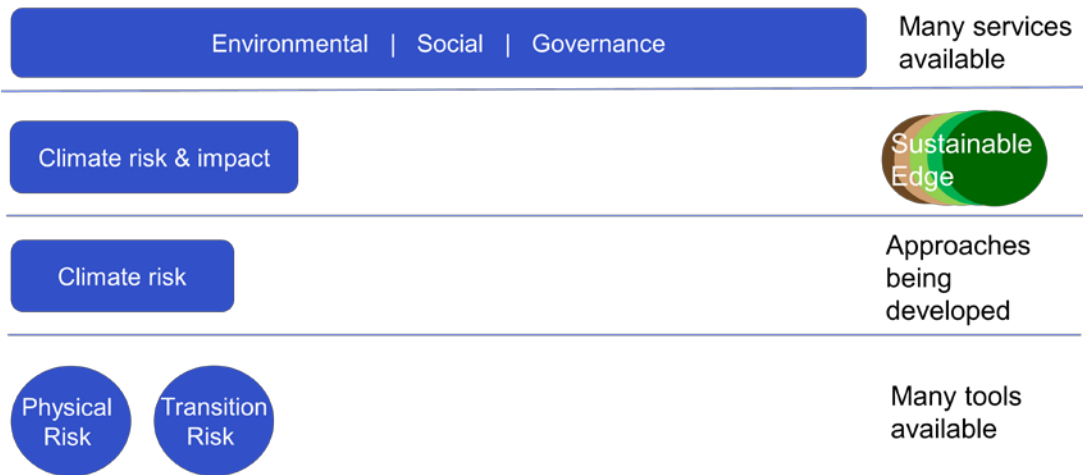
Figure 3 Available approaches for climate related information to the financial sector

6 The Sustainable Edge approach

The Sustainable Edge project is developing a tool for investors and creditors to understand how well-aligned a company's business activities are with the transition to a low carbon economy.

The new tool will:

- Assess current revenue streams and planned investments against a spectrum of brown to green, thus enabling tracking of how companies are changing their investments and development efforts over time towards a green transition
- Give an assessment of risk management for physical climate risk and transition risk
- Give an assessment of use of climate scenarios and alignment with the climate risk reporting recommendations from the Task Force on Climate-related Financial Disclosure (TCFD), and
- Include target questions for analysts to dig deeper into corporate management of the green transition.

The analysis methodology builds on CICERO's acknowledged Shades of Green methodology for green bond framework assessment (CICERO, April 2016). The methodology is rooted in and developed to apply CICERO's climate science to the green bond market. This climate-science based rating method, focused on avoiding lock in of greenhouse gas emissions over the assets' lifetime and promoting transparency on resiliency planning and strategy.

Our view is that the green transformation must be financially sustainable to be lasting at the corporate level. We have therefore shaded the companies' current revenue generating activities. Shaded investments, as well as research and development efforts, add a forward-looking element and provide insight into future revenue streams and corporate strategy in relation to the green transformation. To encompass the full scale of potential projects, we have added two 'brown' categories, as described below.

Dark green is allocated to projects and solutions that correspond to the long-term vision of a low carbon and climate resilient future. Fossil-fueled technologies that lock in long-term emissions do not qualify for financing. Ideally, exposure to transitional and physical climate risk is considered or mitigated.

Medium green is allocated to projects and solutions that represent steps towards the long-term vision but are not quite there yet. Fossil-fueled technologies that lock in long-term emissions do not qualify for financing. Physical and transition climate risks might be considered.

Light green is allocated to projects and solutions that are climate friendly but do not represent or contribute to the long-term vision. These represent necessary and potentially significant short-term GHG emission reductions but need to be managed to avoid extension of equipment lifetime that can lock-in fossil fuel elements. Projects may be exposed to the physical and transitional climate risk without appropriate strategies in place to protect them.

Light brown is allocated to projects that can lower emissions, but still represent risk of locking in fossil fuel infrastructure and are exposed to risk of stranded assets.

Dark brown is allocated to the heaviest emitting projects, with the most potential for lock-in of investments and risk of stranded assets.

Dark Green		Solar energy projects with a governance structure that integrates environmental concerns.
Medium Green		Green buildings with a high level of certification and energy effieciency.
Light Green		Hybrid personal vehicles.
Light Brown		Natural gas replacing coal as a fuel source.
Dark Brown		New infrastructure for coal.

Figure 4 CICERO Shades of Green and Brown

The application of this methodology to companies requires input from project partners with complimentary skillsets. As a climate change research institute, CICERO houses a broad set of scientific expertise. Enova SF brings technical sector expertise and a valuable practical element to the analysis. The financial sector partners each add viable financial expertise and represent different financial sector users. Through actively participating and shaping the tool, they help ensure that the project and its results are relevant to the wider financial sector. Throughout the project we will also take an iterative approach to methodology development that allows for early results to be disseminated during the project period. This supports the key desired outcome to benefit both financial actors and forward-thinking companies to profit from more informed investment and lending decisions that lead to further climate-related business opportunities.

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CICERO is Norway's foremost institute for interdisciplinary climate research. We help to solve the climate problem and strengthen international climate cooperation by predicting and responding to society's climate challenges through research and dissemination of a high international standard.

CICERO has garnered attention for its research on the effects of manmade emissions on the climate, society's response to climate change, and the formulation of international agreements. We have played an active role in the IPCC since 1995 and eleven of our scientists contributed the IPCC's Fifth Assessment Report.

- We deliver important contributions to the design of international agreements, most notably under the UNFCCC, on topics such as burden sharing, and on how different climate gases affect the climate and emissions trading.
- We help design effective climate policies and study how different measures should be designed to reach climate goals.
- We house some of the world's foremost researchers in atmospheric chemistry and we are at the forefront in understanding how greenhouse gas emissions alter Earth's temperature.
- We help local communities and municipalities in Norway and abroad adapt to climate change and in making the green transition to a low carbon society.
- We help key stakeholders understand how they can reduce the climate footprint of food production and food waste, and the socioeconomic benefits of reducing deforestation and forest degradation.
- We have long experience in studying effective measures and strategies for sustainable energy production, feasible renewable policies and the power sector in Europe, and how a changing climate affects global energy production.
- We are the world's largest provider of second opinions on green bonds, and help international development banks, municipalities, export organisations and private companies throughout the world make green investments.
- We are an internationally recognised driving force for innovative climate communication, and are in constant dialogue about the responses to climate change with governments, civil society and private companies.

CICERO was founded by Prime Minister Syse in 1990 after initiative from his predecessor, Gro Harlem Brundtland. CICERO's Director is Kristin Halvorsen, former Finance Minister (2005-2009) and Education Minister (2009-2013). Jens Ulltveit-Moe, CEO of the industrial investment company UMOE is the chair of CICERO's Board of Directors. We are located in the Oslo Science Park, adjacent to the campus of the University of Oslo.