

CORPORATE CLIMATE DISCLOSURE SCHEMES IN G20 COUNTRIES AFTER COP 21

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Executive Summary

Since the late 1990s, governments and others have recognised that engagement with the private sector is crucial to the successful design, financing and implementation of measures to address climate change. This recognition has led to the expectation, also reflected in legislation, that companies provide more, and better information on their climate-related risks, and (more recently), opportunities.

A report by OECD and CDSB launched at COP21 analysed mandatory corporate climate change reporting schemes in G20 countries (OECD-CDSB, 2015). It showed that, by end 2015, 15 G20 countries had mandatory corporate climate reporting schemes in place, but that most were limited in scope. Overall, while these schemes individually contribute to the evolution of climate change-related reporting, collectively they present a fragmented and heterogeneous landscape. This in turn reduces the usefulness of information for decision-makers, including investors and other financial market participants.

Since COP21 there have been two significant developments that start to address some of the gaps in corporate climate reporting requirements, especially for the financial sector. Article 173 of the French Energy Transition Law and the draft recommendations published by the Task Force on Climate-related Financial Disclosures (TCFD) both now assign heightened reporting responsibilities to financial market participants. In the case of the French law, institutional investors are strongly encouraged to explain whether and how their policies and targets align with national strategies for energy and ecological transition. In the case of the industry-led TCFD, which was established by the Financial Stability Board (FSB) at COP21, the recommendations target financial and non-financial sectors. The TCFD's recommendations focus on future-oriented information by requiring companies to conduct scenario analysis referring at least to the 2-Degree scenario envisaged by the Paris Agreement.

Although climate reporting schemes are starting to address gaps that have hitherto constrained the usefulness of information, additional evidence is needed to better understand the impact climate reporting has. It is therefore currently difficult to correlate corporate climate reporting activity with specific climate outcomes. Despite this, much work has been done by business coalitions including the Business Commission on Sustainable Development, to define the opportunities for business to report on and make corresponding contributions to national and international climate policies.

There is a clear need for accurate, high quality, and comparable information on how companies are exposed to climate change and how they are addressing climate change-related risks and opportunities, including in financial and non-financial sectors. Governments have a key role to play in improving mandatory climate disclosure schemes. Increasingly, enhanced climate reporting schemes are therefore likely to become part of the policy-toolkit that can be used by governments to create policies that favour and facilitate assessment of the pathways towards a low-carbon economy.

1. Introduction

In the past three decades, there has been a significant growth in the number of public-private partnerships and in the level of collaboration between policymakers and the private sector in addressing climate change. This has contributed to shaping a new mindset in the way climate change-related legislation across different countries is designed. Companies are increasingly expected to disclose better quality information on the risks and opportunities connected to climate change and the way they are addressing them.

Climate disclosure requirements take different forms, appear in a range of schemes implemented by various actors (including stock exchanges, governments, non-governmental organizations and others), through multiple policy routes, and serve a range of objectives.

Climate reporting schemes¹ can serve a range of objectives:

- Facilitate policymaking by analysing emissions at different resolutions (entity, sector, or economy-wide), providing a basis for emissions projections to inform climate change/energy policy or source-specific GHG-reduction strategies;
- Support policies and regulations, such as emissions trading schemes, by providing reporters with a uniform methodology to calculate, report, monitor and verify emissions;
- Inform national GHG inventories under the United Nations Framework Convention on Climate Change;
- Provide information to stakeholders to facilitate their involvement such as investors tracking and benchmarking emissions; and
- Help reporting entities assess their climate risks and opportunities.

A report by OECD and CDSB launched at COP21 analysed mandatory corporate climate change reporting schemes in G20 countries (OECD-CDSB, 2015). It showed that, by end 2015, 15 G20 countries had mandatory corporate climate reporting schemes in place, but that most were limited in scope. Overall, while these schemes individually contribute to the evolution of climate change-related reporting, collectively they present a fragmented and heterogeneous landscape. This in turn reduces the usefulness of information for decision-makers, including investors and other financial market participants.

The 2015 OECD-CDSB report highlighted existing gaps in the climate reporting landscape. For example, the way in which companies manage climate change risks has rarely been treated as an integrated part of corporate reporting on risks, opportunities, strategy and governance practice. Corporate climate risk management targets have been developed by individual companies internally rather than by reference to sectoral, national or global goals, thus making it difficult to assess corporate contributions to wider policy goals. Other gaps relate to the scope of climate reporting activity, which historically has not extended to financial market participants in their capacity as custodians of financial stability and information content

¹ Climate disclosure obligations take different forms, appear in a range of schemes implemented by various actors (including stock exchanges, governments, non-governmental organizations and others), through multiple policy routes and serve a range of objectives. For the purposes of this update, we focus on mandatory schemes with the characteristics described in OECD/CDSB (2015) “Climate Change Disclosure in G20 Countries: Stocktaking of corporate reporting schemes” (page 25): mandatory schemes that impose a legal obligation to report; cover climate-related information, apply at national or regional (e.g., EU) level; are currently in place or have been published in draft form; and apply to corporate entities.

that focuses only on historical information (such as GHG emissions) rather than future-oriented assessments of climate risk.

The changing international context now defined by agreements and accords has strengthened calls for careful consideration to be given to how regulation and policy could be aligned with and facilitate investment practices and sustainable financing to support the Sustainable Development Goals and the global climate target of remaining below two degrees of warming (Business Commission, 2017 a,b). Among these calls, the investment community has highlighted the need for standardised reporting schemes that provide decision useful information exposing systemic risks and that present solutions and opportunities to accelerate the transition to a low-carbon economy and fulfil the aims of the Paris Agreement.

Against this background, this report provides an update on developments in climate reporting schemes that have taken place since the adoption of the Paris Agreement in December 2015, with a focus on:

- Updates or amendments to climate-related reporting schemes in G20 countries;
- New climate change reporting schemes in G20 countries; and
- Significant global or national developments that are likely to influence climate change reporting practice.

2. Key developments in climate disclosure in G20 countries since the adoption of the Paris Agreement

The OECD/CDSB (2015) report 'Climate change disclosure in G20 countries: Stocktaking of corporate reporting schemes' evidenced the multiplicity of reporting requirements under different schemes and corresponding difficulties in the evaluation and comparison of reported information.

These schemes request some or all of the following types of information:

- GHG emissions;
- Consumption of resources and energy that affects climate change (e.g. fossil fuels);
- The strategy and governance practices and policies implemented by companies to mitigate, adapt to and manage climate change impacts, including extreme weather events, resource shortages, changing market conditions etc.;
- Performance (e.g.: in reducing emissions) against targets;
- The principal risks and opportunities expected by the company as a result of climate change, for example, demand for new products, regulation related to climate change, increased costs to transition to a low-carbon economy and supply chain resilience.

The report also highlighted that current schemes are often missing requirements related to climate-related risks, opportunities, strategy, management, policies and governance procedures. In addition, despite sharing some features, significant differences between the objectives and requirements of schemes, variation in the scope and quality of reported information and the absence of enforcement measures limit the impact and effectiveness of the schemes and the ability of users of information to evaluate, compare results and use relevant information.

At the time the above report was published, shortly before COP21, 15 G20 countries had some form of mandatory scheme related to climate-related reporting. The exceptions are Argentina, India², Indonesia³, Russia⁴ and Saudi Arabia. This number has not changed, although there have been some developments in existing schemes, which will be discussed later.

² The top 500 companies listed on the Bombay Stock Exchange (BSE) and the National Stock Exchange (NSE), based on market capitalization, are required to disclose Business Responsibility Reports on environmental, social and governance issues as part of their annual reporting process (section 34). Other listed entities which have listed their specified securities on SME Exchange, may include these business responsibility reports on a voluntary basis in the format as specified.

³ Ministry of Environment Regulation No. 15 on measurement, reporting, and verification (MRV) of Climate Change Mitigation Action includes guidance and recommendations for certain government and non-government activities. Certain organisations should measure, report and verify emissions and forward results to the Ministry of Environment, where they may be recorded on the National Registration System contributing towards National Emissions Inventories.

⁴ The Concept to Form the System of Monitoring, Reporting and Verifying Greenhouse Gas Emission Volumes in Russia (approved by Government Directive No 716-r of 22 April 2015) determines that upon implementation (due 2017-2018), organisations with emission volumes over 50,000 tonnes of CO₂-eq/year (including indirect energy greenhouse gas emissions) will be responsible for presenting reports on greenhouse gas emissions.

Current schemes in G20 countries include and often share, a number of characteristics, including explicit requirements to report direct (Scope 1) GHG emissions for the so-called “Kyoto gases”; requirements for verification of reported information and specification of the approach to be used for the preparation of reporting information. The vast majority of mandatory corporate reporting schemes do not require reporting of indirect (or Scope 3) GHG emissions, but some recommend it.

The main differences between G20 country schemes relate to thresholds for reporting, measurement approaches, for example by estimation or direct methods, calculation formulae, units and emission factors, verification and assurance requirements, and penalties for non-compliance.

None of the G20 schemes that were in place before the Paris Agreement have been significantly modified. Some countries have made minor amendments (see Annex 2) to existing schemes, including changes that limit the extent to which GHG emissions offsets can be taken into account for reporting purposes (Australia) or that alter the frequency with which greenhouse gases need to be reported (France). Others have developed further interpretive guidance or introduced trial measures to support enterprises developing GHG emissions reporting practice (China). And some have announced forthcoming consultations on proposed changes (Canada). South Africa’s proposed GHG Reporting Regulations are now established and in force. And the UK’s climate-related reporting regulations were reviewed through public consultation exploring efficiencies and efficacy.

Even in G20 countries that do not have a climate reporting scheme, voluntary arrangements are often in place to obtain climate related information from corporations. For example, in Brazil the voluntary GHG Protocol Program aims to provide a national public registry for corporate GHG inventories, calculation methodologies, and emissions factors. Brazilian GHG program members must include in their emissions inventories Scope 1 and 2 GHG emissions. Brazil has also introduced a framework for banks as part of the local implementation of Basel III’s Pillar 3, which requires disclosure of banks’ physical and transition climate risks. These disclosures can be used by the Central Bank of Brazil to conduct specific stress tests.

3. Wider developments

The availability of private finance has been identified as being crucial for the successful implementation of the Paris Agreement and SDGs as both rely on predictable and adequate flows of funds to enable countries to reduce GHG emissions. A significant development since the Paris Agreement is that finance ministries have become involved in addressing climate change not just from the point of view of funding new technologies and the transition to a low-carbon economy, but also to address and vulnerabilities in the financial system associated with climate change.

Certain regulatory developments signal greater alignment between investment practice and SDG/Paris goals. For example, the European Union’s revised Institutions for Occupational Retirement Provision (IORP II) Directive requires European pension funds to disclose how they consider ESG issues in their investment approach, as part of a drive to improve governance and transparency to scheme members and beneficiaries. In Italy, the Italian Corporate Governance Committee included ESG risks and governance considerations in its review of the Code issued in July 2015. In Japan, the amended Corporate Governance Code ensures investors have access to the information needed to be an active owner, and companies have a common framework to enhance their governance practices. It proposes 5 general principles including equal treatment of shareholders, cooperation with stakeholders beyond shareholders, appropriate disclosure of information, proper board supervision and dialogue with shareholders. It recommends that proactive measures towards ESG are taken.

Two significant developments that extend climate reporting from corporations to investors are the Final Decree on the Implementation of Article 173 of the French Law on Energy Transition which became effective from 1 January 2016 and the release of the Task Force on Climate-related Financial Disclosures' (TCFD) draft recommendations on Climate-related Financial Disclosure. The TCFD was established in December 2015 by the Financial Stability Board (FSB) to address the fragmentation in climate reporting practice and lack of focus on financial impacts, which prevent investors, lenders, insurance underwriters and others from accessing the type of information they need to inform their economic decisions and identify potential financial system-wide exposures from climate change-related risks.

4. The current corporate climate change reporting landscape

Current climate-related reporting schemes have a number of key gaps that are limiting the impact, outcome and efficacy of reporting. The gaps may be categorised as follows:

- **Enabling environment:** The success of climate (and other) reporting schemes depends on support from an enabling environment that provides:
 - Technical resources such as calculation methodologies, indicators, reporting standards, data and quality assurance standards and legal architecture;
 - Capacity building so that systems, practical capabilities, experience and accepted practices emerge;
 - Practical tools such as information collection systems and reporting templates;
 - Verification, assurance and enforcement approaches.
- **Integration:** Climate change information is often reported alongside other corporate information relating to, for example, the company's strategy and business model, the risks to which they are exposed, opportunities, governance practices and financial statements. Currently climate change reporting schemes are focussed on GHG emissions and energy use and generally do not ask for information about a company's strategy, mitigation and adaptation plans/actions or risks related to climate change, nor how climate change affects the company's risks, strategy, governance practices and financial results. Therefore climate change information often appears separately from other corporate information – for example in a sustainability report - and it is difficult to evaluate how climate change affects the company's strategy, governance practices, and financial results which are generally reported through mainstream channels.
- **Evaluation and coherence:** There are no mechanisms for evaluating the impact of corporate climate reporting, including how investors and others use information for their analyses and decision-making and the extent to which corporations are contributing towards the Paris Agreement and Sustainable Development Goals. Climate reporting schemes do not currently contain provisions that encourage coherence between national domestic climate policy, international commitments and activity by businesses, and decisions by financial market participants on investment, credit, and insurance underwriting.
- **Sector specificity:** Many existing mandatory reporting schemes only apply to non-financial companies who meet specific criteria (e.g. from utilities or energy sectors) or a certain threshold

(e.g. emissions exceeding 50,000 tCO₂e or number of employees exceeding 500 or more), but instances of provisions that apply at sector level are rare.

- **Investor reporting:** Climate reporting schemes do not generally extend reporting responsibilities to financial market participants such as asset owners and managers and banks despite the fact that information from them would facilitate greater understanding of systemic risks to financial systems and concentrations of climate-related risks.
- **Future orientation:** Unlike other types of reporting which largely depend on past results, climate risks and opportunities are expected to manifest in the future and investors have therefore expressed interest in climate information that is forward-looking. However, few schemes include provisions that require forward-looking information.

A number of these gaps are addressed by the proposed recommendations provided by the Task Force on Climate Related Financial Disclosures and policy measures introduced under Article 173 of the French Energy Transition Law as described below.

The French Energy Transition and Green Growth Law

1. The French *Law for the Energy Transition and Green Growth* was adopted in August 2015. The law aims to reduce French GHG emissions, cap fossil fuel and nuclear production and increase renewable energy usage. Article 173 is aimed at increasing disclosure of climate change risks by listed companies and financial institutions including institutions investors, as well aligning institutions investors' portfolios with French and international climate policy, through a "comply or explain" approach. A consultation process on developing the implementation decree for Article 173 culminated in the final Decree on the Implementation of Article 173 of the French Law on Energy Transition, which became effective from 1 January 2016. The decree applies to insurance companies, pension and social security funds, asset managers, the *Caisse des Dépôts et Consignations* (CDC), institutions providing supplementary pension schemes (public and private) and pension fund for local government officials which are subject to the French Monetary and Financial Code.

Article 173 provides that:

1. Listed companies shall disclose in their annual report:
 - a) Financial risks related to the effects of climate change;
 - b) The measures adopted by the company to reduce them;
 - c) The consequences of climate change on the company's activities and of the use of goods and services it produces.
2. Banks and credit providers shall disclose in their annual report:
 - a) The risk of excessive leverage (not carbon-specific) and the risks exposed by regular stress tests.
3. Institutional investors shall disclose in their annual report:
 - a) Information on how ESG criteria are considered in their investment decisions;

- b) How their policies (and targets) align with the national strategy for energy and ecological transition.

Article 173 therefore goes a long way to addressing current gaps in climate-related reporting schemes. For example, transition risks are described in the implementation decree as the exposure to the changes caused by the transition to a low-carbon economy. Transition risk is not specifically addressed in regulation in any other G20 nation. Development of the enabling environment for understanding and reporting on transition risk will be important as it cuts across a number of other key risk categories such as policy/legal, technology, market and reputation. It is also associated with challenging questions linked to time horizons, uncertainties and scenarios.

The requirement for investors to report on how their policies and targets align with national energy and ecological targets is also unique in the G20. Institutional investors are encouraged to set quantitative sector targets in line with national and international targets. This has the potential to change the frame of reference for companies and investors who will begin to look to global and societal needs and use science and external data to set goals, targets and policies. This is a significant change from current practices where priorities are often set internally, from current trends and projections of a company's performance, with benchmarks set against industry peers.

The following table summarises some of the gaps that Article 173 fills in current reporting schemes.

Gap	Article 173
Integration	Companies must report information about financial risks associated with climate change, measures adopted by companies to reduce them, the consequences of climate on the company's activities and the use of goods and services it provides.
Integration	Companies must disclose information in their mainstream reports, which should encourage greater integration between climate and other corporate information.
Investor reporting	Requirements extend beyond listed companies to banks, credit providers and institutional investors.
Investor reporting	Institutional investors must provide information about how ESG criteria are considered in their investment decisions.
Evaluation and coherence	Institutional investors are required to explain how their policies and targets align with the national strategy for energy and ecological transition.

Task Force on Climate-related Financial Disclosures (TCFD)

The Task Force on Climate-related Financial Disclosures (TCFD) was set up by the Financial Stability Board to develop a set of recommendations for voluntary and consistent climate-related financial risk disclosures in mainstream filings.

2. On 14 December 2016, the TCFD issued three documents:

- Draft recommendations on disclosing climate-related financial information;
- An annex providing draft guidance on how to implement the recommendations; and
- A technical supplement, which provides guidance on using scenario analysis.

3. At the time of writing, the recommendations are in draft form and following a public consultation, which closed on 12 February 2017, the final recommendations are scheduled to be finalized in time for the G20 Leaders' Summit on 7-8 July 2017. Although the recommendations are not final and they will be voluntary when they are finalized, the TCFD's work is discussed in this report as it contains provisions that have the potential to address many of the gaps in current reporting requirements identified above. Furthermore, it represents authoritative guidance that affects the work of regulators seeking to address corporate reporting practices.

The TCFD's draft recommendations

There are four main recommendations focusing on four thematic areas of disclosure: governance, strategy, risk management, metrics and targets.

These four thematic areas are accompanied by:

- Eleven recommended supporting disclosures – three supporting disclosures are recommended for each of the thematic areas, except governance which has two supporting disclosures;
- Guidance for all sectors – explains what sort of information companies should report in response to the recommended supporting disclosures;
- Supplemental guidance for specific non-financial and financial sectors – elaborates further on how different sectors should respond to the recommended supporting disclosures;
- Illustrative metrics for non-financial sectors – further elaborated in the annex.

Recommendation 1: Governance – The Task Force encourages organizations to disclose their governance around climate-related risks and opportunities. Supporting disclosures should describe:

- a) The board's oversight of risks and opportunities;
- b) Management's role in assessing and managing risks and opportunities.

Recommendation 2: Strategy – the actual and potential impacts of climate-related risks and opportunities on the organization's businesses, strategy and financial planning.

Supporting disclosures should describe the:

- a) Risks and opportunities the organization has identified over the short, medium and long-term;
- b) Impact of these risks and opportunities on the organization's businesses, strategy and financial planning;
- c) Potential impact of different scenarios, including a 2-degree scenario on the organizations' businesses, strategy and financial planning.

Recommendation 3: Risk management – how the organization identifies, assesses and manages climate-related risks.

Supporting disclosures should describe the:

- a) Processes used for identifying and assessing climate risks;

- b) Processes for managing climate risks;
- c) How the processes in a) and b) are integrated into the organization's overall risk management.

Recommendation 4: Metrics and targets - Disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities.

Supporting disclosures should:

- a) Disclose the metrics used to assess risks and opportunities in line with strategy and risk management processes;
- b) Disclose Scope 1 and 2 and if appropriate Scope 3 GHG emissions and the related risks;
- c) Describe targets used by the organization to manage risks, opportunities and performance against targets.

The TCFD's draft recommendations therefore address many of the gaps in current climate reporting schemes. Perhaps the most significant feature of the TCFD's draft recommendations is the emphasis it places on the use of scenario analysis for identifying and monitoring climate risks and making future-oriented disclosures. Scenario analysis is described in the draft recommendations as a process for identifying and assessing a potential range of outcomes of future events under conditions of uncertainty. Scenarios are designed to allow an organization to explore and develop an understanding of how the physical and transition risks of climate change may impact its businesses, strategies, and financial performance over time. The Task Force sets out recommendations and guidance for the application of scenario analysis. In the Strategy c) recommended disclosure all organizations are encouraged to describe the potential impact of different scenarios, including a 2°C scenario, on the organization's businesses, strategy, and financial planning. Associated guidance also identifies the steps that certain organizations with more experience or greater exposure can take considering processes, inputs, scope definitions, parameters and assumptions associated with undertaking scenario analysis.

TCFD's focus on integration

Various measures seek to improve the way in which climate information is integrated with other corporate information. In particular:

- **Integration of climate and financial information** – The TCFD's draft recommendations introduce financial impact definitions outlining how climate-related risks and opportunities potentially affect organisations' revenues and expenditures, estimates of future cash flows, as well as their assets and liabilities. The draft recommendations also include several examples of climate-related risks and potential financial impacts including:
 - Changing revenue mix and sources, re-pricing of assets and speed of re-pricing (e.g., fossil fuel reserves, land valuations, securities valuations);
 - Write-offs and early retirement of existing assets;
 - Impaired assets;
 - Increased operating costs (e.g., compliance costs);
 - Upfront research and development (R&D) expenditures and capital investments in new and alternative technologies; and
 - Reduction or disruption in production capacity (e.g., shutdowns, transport difficulties, supply chain interruptions).

Draft recommendation 2 requests information on the actual and potential impacts of climate-related risks and opportunities on the organization's businesses, strategy and financial planning. The explicit link to financial planning with accompanying guidance encourages some sectors and industries to think about the link to financial impact and integration with existing processes and procedures such as indicative costs of supply for current and committed future projects (e.g., through a cost curve or indicative price range). Further additional relevant metrics are introduced to indicate flexibility of capital deployment, portfolio allocation and capital payback. The guidance also introduces some illustrative metrics associated with investment in low-carbon/water alternatives, and existing reserves/assets (e.g. proportion of capital allocation to long-lived assets versus short-term assets or assets committed in vulnerable regions).

- **Integration of climate and risk information** –The draft recommendations ask how climate-related risk identification and management is integrated with overall enterprise risk management procedures. This has the potential to change the quality, controls and sophistication of internal processes assessing climate risk and could then support decision useful disclosures and a move away from boilerplate narrative to quantitative and qualitative disclosures. It is likely however that many companies will need support as they explore how existing risk management processes (such as scenario analysis and stress testing) used for other principal risks (e.g. market expansion, cyber security, supply chain disruption etc.) can be applied to climate change (through the use of formal tools and techniques, decision trees, forecasting, modelling, quantification, etc.).
- **Integration of climate information into mainstream reports** - The draft recommendations encourage disclosure of climate-related financial information in financial filings and mainstream reports. They seek to provide more integrated and connected disclosures where for example discussions related to risks the organization has identified over the short, medium and long-term, and the impact of these risks are joined up with existing reporting requirements in commercial codes, management reports, annual reports and financial filings.

TCFD's recommendations for specific sectors

Another gap addressed by the draft recommendations is the inclusion of sector specific requirements and guidance. The TCFD recommendations and supporting disclosures apply to all sectors. However, supplemental guidance elaborates on how particular industries in the financial and non-financial sectors respectively are expected to respond to those recommendations. Sector-specific guidance aims to target the financial sector and twelve non-financial industries that account for the largest proportion of GHG emissions, energy and water usage.

Non-financial sector industries are organized into four main groups, as listed below. They have been selected based on three factors most likely to be affected by both transition and physical risk (such as GHG emissions, energy usage and water usage).

- Energy;
- Materials and Buildings;
- Transportation and Agriculture;
- Food and Forest Products.

The financial sector focus is on banks, insurance companies, asset managers and asset owners (including private and public sector pension plans, insurance companies, endowments and foundations). Disclosures by the financial sector are designed to foster an early assessment of climate related risks and opportunities, improve the pricing of climate risks and lead to more informed capital allocation decisions. For example, in response to the recommended disclosure on strategy, banks are encouraged to describe significant concentrations of credit exposure to carbon-related assets and climate-related risks associated with their lending and other financial intermediary business activities. Similarly, in response to the recommended disclosure on metrics and targets, banks are asked to provide the metrics used to assess the impact of climate-related risk associated with their lending and other financial intermediary business activities.

The following table summarises some of the gaps that the TCFD’s recommendations fill in current reporting schemes:

Gap	TCFD draft recommendations
Integration	Companies should report information about financial risks associated with climate change and how climate affects financial planning and results.
Integration	Companies should disclose information in their mainstream reports, which should encourage greater integration between climate and other corporate information.
Integration	Companies should explain how processes for identifying and managing climate risks are integrated into their overall enterprise risk management systems.
Investor reporting	Requirements extend beyond listed companies to banks, credit providers, asset owners and managers and institutional investors.
Sector specificity	Recommendations are adapted to apply to particular financial and non-financial sectors
Future orientation	Scenario analysis is to be used to evaluate future risks and opportunities

5. Impacts of climate change reporting on company and investor behaviour

Making the connection between climate reporting and actions and decisions that result in sustainable outcomes can be challenging as many factors influence the choices and decisions made by those preparing reports and those using the information contained within them. Research and evidence about the impact of reporting focuses more on the limitations of reporting requirements and practice and on the opportunities for change, rather than identifying actual correlations between reporting activity and sustainable outcomes.

For example, a recent report prepared by the We Mean Business Coalition (2016) identified that by 2030 business could cut its greenhouse gas emissions by 3.2-4.2 billion tonnes per year below current trends by joining climate change initiatives and reporting on progress, equivalent to up to 7-9% of the world's 2010 emissions. These initiatives include science-based targets, EP100, RE100, Zero Deforestation. They concluded that if every relevant business that could join in these initiatives actually did so, the result could be to cut emissions of around 10 billion tonnes of greenhouse gases. That would go considerably closer to closing the gap in 2030, between the 61 billion tonnes projected without the Paris Agreement, and the 42 billion tonne limit for keeping global warming below 2°C. The report also recognises the importance of public disclosure and clear communication of commitments and targets, and then subsequent reporting on progress.

Similarly, the report by the Business Commission for Sustainable Development (2017) "Valuing the SDG Prize" highlights opportunities offered by the SDGs and specifically actions that address Climate Action (SDG 13). It presents the evidence for example that the largest business opportunities in the energy and materials system could be worth more than US\$4.3 trillion in 2030. Other key studies have also identified that the shift to circular models for a range of durable and fast-moving consumer goods could generate an opportunity of over US\$3 trillion by 2030 (Ellen MacArthur Foundation, 2011).

The International Energy Agency (2015) estimates that additional energy-efficiency measures could reduce global final energy consumption by almost 11 per cent in 2030. Based on weighted average energy prices, this equates to an impact of US\$1.45 trillion. The International Renewable Energy Agency (2016) estimates that renewables could reach 45 per cent of total global power generation by 2030 – which equates to US\$605 billion per year more in revenue for renewables generators compared to a business-as-usual scenario. This evidence and the certainty brought by domestic policy signals and international agreements has led to significant growth in 'sustainable investments'. Globally, over US\$21 trillion of professionally managed assets are held in sustainable investments (as of 2014). And the growth in these investments—60 per cent between 2012 and 2014—is outpacing that of traditional investment, which only increased by about 15 per cent in the same time frame (GSIA, 2015).

The investment community has called for high quality, standardised data related to corporate sustainability impacts and dependencies, including climate-related information to inform their decision-making and actions. However currently investors are frustrated by the lack of comparability between sustainability information reported by businesses (Business Commission, 2017).

A survey by PWC (2015) found that 82 per cent of investors were dissatisfied by the comparability of sustainability reporting between companies in the same industry, while 74 per cent were dissatisfied with the relevance and implications of sustainability risks being reported. Research by SASB (2016) concludes that climate risk is not adequately disclosed and not providing decision useful information – limiting impacts on behaviour. Despite increasing awareness and investor demand, U.S.-listed companies have not

provided the capital markets with adequate disclosure on climate risk. Although 75 per cent of SASB's climate-related disclosure topics are already being addressed in SEC filings, they are not being reported in a decision-useful way. Of those disclosures, more than 40 per cent use boilerplate language, while only 17 per cent use metrics.

Research suggests that sustainability information generally and climate change information specifically can have an impact in terms of improved returns and outperformance, as well as wider risk mitigation and transparency benefits, if it is taken into account in decision-making. McKinsey (2016) for example conducted a study on the effect on financial returns of investors' treatment of ESG issues, using factors from the SASB reporting framework. The study shows significant share-price outperformance for companies with high performance on material versus immaterial ESG issues. Similarly, academic research exploring the relationship between corporate carbon emission performance, financial performance and corporate carbon disclosures found a significant positive correlation between corporate carbon disclosure and corporate financial performance (Liu, Y.S., 2016).

Investors have developed strategies for incorporating negative screens, positive screens, ESG integration, impact investing, and shareholder engagement based on sustainability information (Lewis, et al., 2016). Acting on these strategies however depends on appropriate governance mechanisms and decision making procedures being in place within companies to generate decision-useful information. The board of directors or trustees must set the priorities, scope, and objectives of the investment, as well as delegate authority, manage distinct roles and responsibilities, and provide continuous oversight. Once a mandate is approved, it will then become the responsibility of the investment management team—CIO, CFO, other staff, investment consultants, and investment committees—to implement the decisions.

6. Climate disclosure as part of an enabling effective contribution to the objectives of the Paris Agreement

The TCFD's draft recommendations expect that companies undertake scenario analysis consistent with the 2-degree goal of the Paris Agreement and with one or more other scenarios including Nationally Determined Contributions (NDCs). This is one indication of the ways in which climate reporting is starting to link to climate policies, the purpose of which is to highlight the link between business resilience to transition risks and business' contribution to the transition as articulated through global climate policy. Therefore, the TCFD recommends that an organization's management, shareholders, and analysts should take into account the stated measures and outcomes of governments' NDC plans. This framing of business actions and solutions is an important starting point that takes into account energy security priorities and national infrastructure developments. However, current NDCs are not aligned with the objective of the Paris Agreement and they are subject to ratcheting requirements every 5 years to communicate enhanced NDCs.

The TCFD therefore recommends that, at the very least, organizations take into account a 2°C scenario in their analyses. A 2°C scenario provides a common reference point that is aligned with the objectives of the Paris Agreement and will support the evaluation, by analysts and investors, of the potential magnitude and timing of transition-related implications for individual organizations, across different organizations within a sector, and across different sectors. The TCFD scenario analysis supplement discusses why scenario analysis is useful and what a scenario is, its application including key parameters, publicly-available climate scenarios, assumptions, and analytical choices organizations should consider, and some of the application challenges.

Similarly, Article 173 of the French Energy Transition Law requires investors to explain how their policies are aligned with national strategies for energy and ecological transition.

These developments represent significant changes compared with current reporting practices where priorities are often set internally, from current trends and projections of a company's performance and with benchmarks set against industry peers. Developing the enabling environment for the private sector to understand, design and report their contributions to national and global climate policies and also their exposure under certain scenarios associated with the Paris Agreement is arguably one of the most important forms of enhanced disclosure that needs to be supported by relevant schemes.

Meanwhile, corporations are taking steps to respond to policy measures on climate change. Currently projections suggest that the world is heading for temperature rise of 2.9 °C to 3.4°C this century, even with Paris pledges. Urgent collaborative action is needed to curb emissions by 2030 as they are currently likely to be 12 to 14 gigatonnes above levels needed to limit global warming to 2°C (UNEP, 2016). Business solutions are being developed, for example through the Low Carbon Technology Partnerships Initiative (LCTPi). LCTPi aims to achieve systemic economy wide impact across sectors that will get 64-68% of the way towards achieving a two degrees scenario (PwC, 2015). The action areas of the LCTPi initiative include renewables, carbon capture and storage, cement, energy efficiency in buildings, low carbon fuels, climate smart agriculture and forests as carbon sinks.

Despite the significant changes and progress offered by Article 173, the TCFD Recommendations and a number of other initiatives, significant challenges remain for non-financial and financial companies seeking to disclose information that begins to reflect the true value, true costs and true profits of climate-related impacts and dependencies. For example, organizations will require significant support to comply with some aspects of the TCFD's recommendations, particularly those relating to scenario analysis. As a relatively new reporting requirement, scenario analysis will necessitate development of methodologies and approaches to address the significant differences and unique challenges across physical and transitions risks, different sectors, geographies etc. A number of questions also remain about the timeframes over which climate related risk should be assessed. For example, how should organizations disclosing climate risks define short, medium and longer term time frames? Furthermore, disclosures about the result of scenario analysis will inevitably raise questions about how to report assumptions and uncertainties and how to treat results that potentially compromise confidentiality.

Conclusion

The TCFD's recommendations and the French Energy Transition Law are addressing gaps in climate change reporting requirements and practices. In particular, they bring investors and other financial market participants within scope of reporting and, in the case of the TCFD's recommendations, encourage integration of financial and non-financial information, future oriented reporting and more sector specificity. The similarities in approach to reporting by the TCFD and French Energy Transition Law and the fact that the EU is delaying the production of its guidance on non-financial reporting in anticipation of the TCFD's final recommendations suggests that there is growing coalescence around certain trends which are also reflected in voluntary frameworks. This, together with the involvement of the G20 and central bankers in the TCFD's work, might encourage governments to consider adopting requirements or principles from the TCFD's recommendations and French Energy Transition Law.

ANNEX 1: OVERVIEW OF G20 COUNTRIES CLIMATE DISCLOSURE SCHEMES

Country	Scheme name	Description
Argentina		
Australia	National Greenhouse and Energy Reporting (NGER) Act, 2007	The scheme is overseen by the Department of the Environment and administered by the Clean Energy Regulator. The scheme aims to inform government policy and the public, to help Australia meet its international reporting obligations and to provide a single national scheme for energy and GHG emissions reporting. The scheme expects to account for around 60% of Australia’s corporate GHG emissions.
Brazil	Despacho 3034/2006	The scheme was implemented by the Agencia Nacional de Energia Eletrica (ANEEL) to promote GHG reporting practices amongst public electricity providers and other companies.
Canada	Greenhouse Gas Emissions Reporting Program 2004 (GHGRP) pursuant to section 46 of the Canadian Environment Protection Act 1999	Environment Canada operates the scheme and is responsible for its development. Entities that do not meet the threshold requirements are encouraged to report voluntarily.
	National Instrument 51-102	The continuous disclosure obligations in NI 51-102 have been interpreted in Canadian Securities Administrators Notice 51-333 to apply to disclosure of environmental information.
China	National Development and Reform Commission (NDRC) Regulation 2014	The aim of this scheme is to increase transparency among major air pollutant emitters and strengthen the national infrastructure for measurement, reporting and verification of carbon emissions by mandating reporting of GHG emissions across 10 specific industry sectors. The scheme applies to 20,000 companies.
	Guidelines for Accounting and Reporting Greenhouse Gas Emissions from Enterprises (2016 Trial)	The National Development and Reform Commission (NDRC) has formulated ‘the Guidelines’ with the aim to help enterprises (from various industries including Cement Production, Chemical Production, Civil Aviation, Electricity Generation, Iron and Steel Production) (i) scientifically calculate and report in a standard format their GHG emissions, (ii) formulate their GHG emissions control plans, (iii) actively participate in carbon trading, and (iv) enhance their social responsibilities.
EU	Directive 2014/95/EU on disclosure of non-financial and diversity information by certain large undertakings and groups	The scheme amends Directive 2013/34/EU (the Modernisation Directive) to “increase the relevance, consistency and comparability of information disclosed by certain large undertakings and groups across the Union”. According to Art. 2 of Directive 2014/95/EU on disclosure of non-financial information by certain undertakings and groups, which entered into force in December 2014, the Commission shall prepare non-binding guidelines on methodology for reporting non-financial information.
	Directive 2003/87/EC EU Greenhouse Gas	The scheme covers companies in energy-intensive sectors, i.e., energy production, production of ferrous metals, cement and lime, ceramics, bricks,

Country	Scheme name	Description
	Emissions Trading Scheme and subsequent revisions	glass, pulp and paper.
France	Grenelle II Act, 2010, and subsequent revisions	The Grenelle II legislation in France was developed and implemented by the Ministry for Ecology, Sustainable Development and Energy.
	French Energy Transition Law Articles 70 and 173	The Final Decree on the Implementation of Article 173 of the French Law on Energy Transition (adopted and released in August 2015) became effective from 1 January 2016.
	Article L. 229-25 of the Environmental Code - Bilan des émissions - Décret No. 2015-1738 of 12/24/15 on greenhouse gas emission balances	The Act of 12 July 2010 relating to the "National Commitment to the Environment" (Engagement National pour l'Environnement) laid down the principle of the general application of greenhouse gas emission inventories. The objective of GHG emission inventories is to produce detailed accounts of the greenhouse gas emissions of public and private stakeholders, with a view to identifying emission reduction opportunities.
Germany	Reform Act on Accounting Regulations 2004 (BillReG) – to be amended by Directive 2014/95/EU	A scheme introduced to implement European Accounting Directives, now updated by the Modernisation and NFR Directives.
India		
Indonesia		
Italy	Legislative Decree No. 32 2007	A scheme introduced to implement European Accounting Directives now updated by the Modernisation and NFR Directives.
	Legislative Decree No 216 2006	A scheme introduced to implement the EU ETS.
Japan	Act on Promotion of Global Warming Countermeasures (Act No. 117 of 1998)	A scheme administered by the Ministries of Environment and Economy Trade and Industry that forms a framework for a package of measures on climate change. GHG emission reporting is part of a broader package of regulation and incentives to reduce energy consumption and increase energy efficiency.
	JP-8 Mandatory Greenhouse Gas Accounting and Reporting System 2006	A scheme developed and implemented by the Ministry of Environment and Ministry of Economy, Trade and Industry that imposes GHG reporting requirements on entities and facilities designated under the Act Promoting the Rational Use of Energy.
Mexico	National Register of GHG emissions	Compliance with the scheme is necessary to obtain an annual operating license for companies within scope. The Ministry for Environment and Natural Resources (Secretaría del Medio Ambiente y Recursos Naturales,

Country	Scheme name	Description
	Regulation 2014	SEMARNAT) is responsible for its development and implementation.
Russia		
Saudi Arabia		
South Africa	National Greenhouse Gas Emission Reporting Regulations 2016 pursuant to the National Environmental Management Air Quality Act 39 of 2004	In Government Gazette No. 40052, the Department of Environmental Affairs published its intention to make the National Greenhouse Gas Emissions Reporting Regulations under the National Environmental Management: Air Quality Act 2004. The purpose of the GHG Reporting Regulations is to introduce a single national reporting system for the transparent reporting of GHG emissions. The DEA will publish Technical Guidelines to clarify the reporting methodology including how the emissions are to be determined and how a data provider can review emission factors.
South Korea	The Framework Law on Low-Carbon Green Growth 2010	The scheme provides a framework for a package of measures aimed at addressing climate change.
	Greenhouse Gas and Energy Target Management Scheme 2012	A scheme established by the Greenhouse Gas Inventory and Research Center that requires the submission of climate change mitigation strategies by organisations within scope of the scheme as well as submission of an emissions report.
Turkey	Regulation Concerning Monitoring of Greenhouse Gas Emissions ratified by Law No. 5836 and effective from 25 April 2012	A scheme implemented by the Ministry of Environment and Urbanisation in Turkey. Organisations within scope of the scheme must disclose a GHG Monitoring Plan and their GHG emissions. In its first year of implementation, the regulation covered around 600 facilities.
UK	Companies Act (Strategic Report and Directors' Report) 2013 Regulations implementing Climate Change Act 2008	As part of a package of measures, the amendments require disclosure of greenhouse gas emissions in the directors' report. Associated guidance issued by Defra supports compliance with the legal requirements and provides guidance on voluntary reporting by those outside the scope of the law.
US	EPA Mandatory Reporting of Greenhouse Gases Rule 2009 introduced under the Clean Air Act 1970	The scheme is operated by the Environmental Protection Agency (EPA). This piece of legislation is reported to capture some 85% of US emissions.
	US Securities Act and Regulations S-K - Commission Guidance Regarding Disclosure Related to Climate	In February 2010, the Securities and Exchange Commission (SEC) issued interpretive guidance advising that existing Regulations S-K under the US Securities Act are capable of being interpreted to apply to climate reporting.

Country	Scheme name	Description
	Change	

ANNEX 2: AMENDMENTS/DEVELOPMENTS TO G20 CLIMATE DISCLOSURE SCHEMES SINCE DECEMBER 2015

In China the National Development and Reform Commission (NDRC) has formulated sector Guidelines (for many industries including Cement Production, Chemical Production, Civil Aviation, Electricity Generation) with the aim to help enterprises (i) scientifically calculate and report in a standard format their GHG emissions, (ii) formulate their GHG emissions control plans, (iii) actively participate in carbon trading, and (iv) enhance their social responsibilities. The Guidelines are designed to pave the way for the competent authorities to establish and implement the reporting system for GHG emissions from key enterprises in support of decision-making processes. The Guidelines have clearly defined references, terminology and definitions, accounting boundaries, accounting methodologies, quality assurance and documentation, as well as the basic framework for enterprise-based GHG emission reports.

Environment and Climate Change Canada (ECCC) has announced that it will conduct consultation activities in 2017 in relation to proposed changes to its facility Greenhouse Gas Emissions Reporting Program (GHGRP). Specifically, the Department is proposing to amend the reporting requirements under this program to gather additional information on facility GHG emissions in order to enable the direct use of the reported data in Canada's National GHG Inventory, increase the consistency and comparability of GHG data across jurisdictions, and obtain a more comprehensive picture of Canadian facility emissions. The proposed changes will expand reporting requirements, including:

- Lowering the reporting threshold from 50,000 tonnes to 10,000 tonnes. All facilities that emit the equivalent of 10,000 tonnes (10 kilotonnes) or more of GHGs in CO₂ eq units per year will be required to submit a report.
- Reporting of additional data (e.g., more detailed emissions, quantities of fuels or feedstocks consumed, etc.) and applying specific quantification methods to determine emissions.

In Australia the safeguard mechanism ensures that emissions reductions purchased through the Emissions Reduction Fund are not offset by significant increases in emissions above business-as-usual levels elsewhere in the economy. It does this by encouraging large businesses not to increase their emissions above historical levels. Facilities whose net emissions exceed the safeguard threshold must keep their emissions at or below a baseline set by the Clean Energy Regulator. The safeguard mechanism applies to facilities with scope 1 covered emissions of more than 100,000 tonnes of carbon dioxide equivalence (tCO₂-e) per year. Safeguard obligations rest with the person with operational control of the facility, the 'responsible emitter'. This person is required to keep the facility's net emissions at or below its emissions baseline. The safeguard mechanism will be administered through the NGER scheme and it is designed to minimise additional mandatory reporting requirements.

In France Decree No. 1738 of 2015 (related to the "National Commitment to the Environment" (Engagement National pour l'Environnement) applies from 1 January 2016 and extends the frequency with which a greenhouse gas balance report must be updated from three or four years. The report must include data on both direct emissions of greenhouse gases and indirect emissions from the use of electricity, heat, or vapor, as well as a summary of emission reduction activities. The Act of 12 July 2010 relating to the "National Commitment to the Environment" (Engagement National pour l'Environnement) laid down the principle of the general application of greenhouse gas emission inventories. The objective of GHG emission inventories is to produce detailed accounts of the greenhouse gas emissions of public and private stakeholders, with a view to identifying emission reduction opportunities. Government, public authorities,

and companies meeting certain thresholds are required to establish balance sheets on their greenhouse gas emissions. Companies employing more than 500 persons in France, or more than 250 persons overseas, and public authorities employing more than 250 persons are within scope.

In autumn 2015 the UK government put forward a consultation related to reforming the business energy efficiency tax landscape. The purpose of the consultation was to obtain views on the business energy efficiency tax landscape, in order to review and consider the interactions between business energy efficiency policies and regulations. The consultation document set out proposals to reform the landscape in order to deliver a simpler and more stable environment for business. The questions and proposals put to stakeholders included suggestions to amend and repeal some climate-related reporting requirements including the main GHG emission reporting requirements as set out by UK Companies Act 2006 (Directors' Report) Regulations 2013 (Part 7 15-20) amending the Large and Medium-sized Companies and Groups (Accounts and Reports) Regulations 2008. Following an extensive consultation, the decision was made to keep the existing requirements to 'ensure data transparency for investors and to establish London as a centre of global green finance'. The government also indicated its support for the Financial Stability Board's industry-led Task Force on Climate-related Financial Disclosures (TCFD).

South Africa has now brought the proposed GHG Reporting Regulations into force. In Government Gazette No. 40052, the Department of Environmental Affairs published the National Greenhouse Gas Emissions Reporting Regulations under the National Environmental Management: Air Quality Act 2004. The purpose of the GHG Reporting Regulations is to introduce a single national reporting system for the transparent reporting of GHG emissions. The GHG Reporting Regulations apply to any person conducting an activity listed in Annexure 1 where the capacity is equal to or above the thresholds indicated. A data-provider includes a South African holding company, all its subsidiaries and legally held operations, including joint ventures and partnerships where it has a controlling interest or where it is nominated as the responsible entity, and all facilities generally over which it has control. The reporting thresholds vary according to the activity but generally in respect of energy the threshold is 10MW(th). A data-provider must register on the National Atmospheric Emissions Inventory System (NAEIS) and must report to the NAEIS by 30 April of each year in respect of GHG emissions and activity data for all its facilities the preceding calendar year. The reporting methodology is based on Intergovernmental Panel on Climate Change (IPCC) Guidelines. The DEA will publish Technical Guidelines to clarify the reporting methodology including how the emissions are to be determined and how a data provider can make a submission to review emission factors which it believes are not appropriate. A data provider must define its reporting boundaries based on "operational control" for all its "facilities" or premises where the activities are being undertaken.

ANNEX 3: CURRENT AND PROPOSED NON-GOVERNMENTAL INITIATIVES ON CLIMATE DISCLOSURE

Current significant developments outside the G20 policy landscape besides the FSB TCFD include the development of standards by the Global Reporting Initiative (GRI), the Sustainability Accounting Standards Board (SASB) and the Reimaging Disclosure work of CDP. Within CDP in particular significant efforts are underway to consider a sector specific approach to climate disclosures and to provide a wider range of relevant forward looking disclosures for a range of stakeholders. One important related initiative is a collaboration between ADEME and CDP for the ACT project (Assessing the Low Carbon Transition). The ACT project is beginning to take a more holistic view of a company's operational impacts and dependencies, as well as of its supply chain, to consider how companies can drive action for a 2°C compatible pathway. The pilot has considered this question and developed a methodology that includes forward looking metrics and indicators such as ratio of total CAPEX to CAPEX into tech and solutions that mitigate climate change, expenditure level for smart grids and energy storage solutions, and finance associated with changing installed capacity for electric utilities. Three sectors have been explored in collaboration with relevant businesses and other experts - auto manufacturers, retail and electric utilities.

The **Sustainability Accounting Standards Board** has produced a Technical Bulletin on Climate Risk that explores findings related to climate risk arising from research conducted by SASB as part of its standards-setting process. The report provides an overview of the types of risk that are present and financial implications. It also summarizes, the quality of existing disclosures on climate-related risk by SEC registrants. SASB's research demonstrates that 72 out of 79 Sustainable Industry Classification System (SICS) industries are significantly affected in some way by climate risk. The report highlights the diverse nature of climate risk, that manifests itself differently between sectors and industries. They note that for example, agricultural companies must manage water as an increasingly stressed resource, oil and gas companies need to properly value reserves in a carbon-constrained world and understand implications for capital expenditures, and commercial banks have to effectively manage the carbon embedded in their loan portfolios (SASB, 2016). SASB also introduce their Climate Risk Framework, grouping impacts into three primary types of risk to a company and its investors: physical, transition, and regulatory risk.

Some ratings agencies are also beginning to look at these factors with **S&P Global Ratings** developing the guide titled 'How Environmental and Climate Risks Factor Into Corporate Ratings' and **Moody's Investors Service** introducing the 'Environmental Risks Heat Map'. The S&P Global Ratings guide identifies subsectors which are most exposed to environmental and climate-related risks and how ratings have been impacted over a two year period by related risks. They highlight nearly 300 cases where such risks impacted the rating analysis and around 60 cases where rating revisions were made. Moody's Investor Service qualitatively scores 86 rated sectors globally for credit exposure to environmental risks in terms of both the materiality and timing of any likely credit effects. Scoring is based on five subcategories of environmental risk, of which one subcategory is carbon regulation. It identified 13 sectors with very high or high exposure to carbon regulations.

NGOs including Ceres, World Resources Institute (WRI) and 2degrees investing initiative have produced guidance on scenario analysis, carbon asset risk and climate disclosure.

Ceres' (2016) "A Framework for 2 Degrees Scenario Analysis: A Guide for Oil and Gas Companies and Investors for Navigating the Energy Transition" proposes the basis for 2 Degrees Scenario Analysis, the Key Components for a 2 Degrees Scenario Analysis Framework, examples of best practices to date, the

basics for meaningful climate disclosures, and key questions for investors to ask when engaging with companies on the analysis. **WRI and United Nations Environment Program Finance Initiative** (2015) Discussion Framework on Carbon Asset Risk explores sector-level exposure to three indicators of carbon risk (sector carbon intensity of sales, physical assets life span, and EBIT margin). The report identifies sectors with the highest potential exposure to a low-carbon transition.

Transition Risk Toolbox: Scenarios, Data and Models by **2degrees investing initiative** (2016a) is a guide for relevant stakeholders seeking to define the ‘tools’—scenarios, data needs, and models—required for transition risk modelling. It seeks to map these inputs, how they have been used to date, and the missing pieces requiring further research and analysis. "Climate Disclosure: How to make it fly" (2degrees investing initiative, 2016b) considers wider issues limiting the impact and efficacy of climate disclosure, including the high proportion of non-reporters, aggregation, benchmarking and data quality issues, limited descriptions of forward looking opportunities, and the fact that current reporting focusses on large cap listed equities – missing other key asset classes (equity, sovereigns, real assets, municipalities). "Trails for Climate Disclosure" (2degrees investing initiative, 2016c) explores the questions for countries and policy makers as they consider mechanisms and schemes supporting climate-related transparency for financial markets. They highlight different objectives, users and supported decisions associated with understanding capital allocation and potential systemic/market risks, the alignment of financial flows with the Paris Agreement and informed consumer/stakeholder choices on climate-related issues. The report concludes that in designing options that develop disclosure practice and address key gaps, decision makers should specify a clear objective that then defines the model and subsequent choices. Relevant persons should consider how any new schemes fit with existing regulatory reporting, ensure comparability but avoid competitive bias and seek to support international coordination efforts and monitoring.

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