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2018 CLIMATE CHANGE REPORT





Climate change is one of the biggest and most daunting challenges facing the world.

Managing climate change in a highly interconnected global economy involves many underlying uncertainties. It encompasses risks to traditional economic and business models associated with the transition to a low-carbon economy; the chronic and acute physical risks of a warming climate; and the interaction between these forces. For us, the Ontario Teachers' Pension Plan (Ontario Teachers' or the plan), actively managing the related risks and opportunities is therefore central to our investment strategy.

Climate change impacts are considered alongside myriad other risks in the decisions we make and actions we take as an organization. We have been evolving and refining our approach to climate change for more than 10 years, and continue to do so.

Most recently, Ontario Teachers' created and rolled out our Low Carbon Economy (LCE) Transition Framework to guide a more systematic approach to help understand the potential impacts of climate change and make more informed decisions on individual public and private investments and our portfolio as a whole. At the core of the framework are three scenarios that describe what the future could look like in 2030. These range from an orderly transition to a low-carbon economy to a middle scenario that extrapolates from current climate policies and actions to a high-carbon world where fossil fuels dominate until drastic and disruptive action is taken. The scenarios are defined by the direction and rates of change in five key catalysts: policy, technology, consumer preference, capital and physical impacts. Each scenario gives rise to very different implications, so we have also identified "signposts" that indicate which scenario the world might be heading to.

Collectively, these tools help stretch our thinking about what the future could look like, give us a common language and understanding to work from internally, and build the foundation for future efforts to understand the impacts of climate change.

We have processes in place that consider material climate change impacts in our investments. We integrate climate change considerations across the investment cycle, from the opportunities we look for, to the assessment and decision-making processes before acquiring an asset, to how we manage an asset once we own it. We will continue to refine this process as understanding of the interconnectedness of physical and transition risks associated with climate change improve, and robust data and tools emerge.

At the national and international level, we encourage proactive and positive corporate behaviour and promote disclosure of the climate-related information we need to manage the investment portfolio. We do this by:

- encouraging companies and financial institutions to adopt the Task Force on Climate-related Financial Disclosures (TCFD) Recommendations in their own reporting through the development of good practice guidance;
- promoting standardized and complete data on company-level climate-related risks;
- working through industry associations to drive awareness and provide guidance to company and pension plan boards on the oversight of climate-related risks.

These points will be discussed in greater detail in this document. Despite much positive work done already, we know this is a journey. It will take ongoing effort and resources dedicated to climate change, and a willingness and flexibility to evolve our approach over time.

The following pages outline our responses to the TCFD Recommendations.



Governance

Governance of our climate-related risks and opportunities

1. BOARD OVERSIGHT OF CLIMATE-RELATED RISKS AND OPPORTUNITIES

The terms of reference of the board's Investment Committee recognize the board's role in overseeing investment risks relating to climate and other environmental, social and governance (ESG) factors.

The board:

- reviews our approach to responsible investing annually;
- reviews and approves annual objectives and the corporate and investment scorecards for performance and compensation;
- reviews our progress on applying our climate change approach.

The board's ongoing education includes climate-related content. In 2018, the board heard internal and external presentations on our climate change approach and topical climate-related issues such as peak oil demand, and fiduciary duty and legal liability.

2. MANAGEMENT'S ROLE IN ASSESSING AND MANAGING CLIMATE-RELATED RISKS AND OPPORTUNITIES

Our approach to climate change, which is reviewed and approved by the Chief Executive Officer (CEO), is integrated into our overall investment strategy.

All executive and senior managing directors in Investments are accountable to the Chief Investment Officer (CIO) for developing an approach to managing climate change risk for the assets under their management. This includes leveraging our LCE Transition Framework and other tools and expertise as needed. The incorporation of ESG risk management (including climate-related risks) is a component of the corporate and departmental scorecards that are used to assess performance and determine compensation.

Our portfolio managers are responsible for the identification, assessment and management of material ESG risks and opportunities, including climate change, in their investments.

Our Responsible Investing team, which reports to the Chief Risk and Strategy Officer, as well as a cross-departmental climate change working group, support the Investment teams in the assessment, management and reporting of material climate-related issues.

As part of the investment approval process, our investment committees review deal documents prepared by the investment teams that include discussions of climate change and other material ESG factors. Senior investment staff receive updates on plan-wide, climate-related initiatives and their progress.

The plan also has an ongoing speaker/education series. In 2017, this included Dianne Saxe, former Environmental Commissioner of Ontario, and Paul Polman, former CEO of Unilever and widely recognized for integrating ESG considerations into business strategy. In 2018, we had two educational sessions on strategic topics: one covered oil demand peak and implications to the global economy and was provided by Peter Tertzakian, Executive Director of ARC Financial and an oil specialist from Bloomberg New Energy Finance. The second session deliberated how climate change impacts our fiduciary duty and the role of directors. The session was administered by fiduciary duty subject matter experts from the University of British Columbia and Osgoode Law School.



Strategy

Climate-related risks and opportunities in the short, medium and long term and their impact on our businesses, strategy and financial planning

CLIMATE CHANGE APPROACH

Our climate approach is based on integrating climate change considerations and exercising our influence by sitting on the boards of private companies. Where appropriate, we engage with boards and management to encourage climate-positive actions by portfolio companies. More broadly, we use our influence with policy-makers, regulators and industry to encourage them to provide clarity on climate-related policies and raise standards to put us on a more orderly low-carbon trajectory.

Our approach also includes developing tools that can help us understand and project future impacts of climate change. For instance, in 2016 we started to develop our LCE Transition Framework. As illustrated on the next page, the framework starts with three scenarios that describe potential transition pathways to a low-carbon economy. The scenarios are driven by five catalysts: policy, technology, consumer preferences, capital and physical impacts. Each scenario gives rise to very different implications for the plan, so we also identified “signposts” that indicate how the catalysts are changing, and as a result, which path the world might be on. For each signpost we estimate its expected value under each scenario at the end of 2020, 2025 and 2030 and use this to help indicate which scenario we are closer to. The short, medium and long horizons in the discussions that follow correspond to these years.

SHORT-TERM INVESTMENT OPPORTUNITIES (ONE TO THREE YEARS)

Sectors and technologies that accelerate the transition to a low-carbon economy and increase resilience to climate change impacts represent potentially attractive investment opportunities. Examples include energy storage, energy efficiency projects, renewable power, industrial/commercial redesign and retrofit projects, and the electrification of transportation. Our Greenfield and Renewables team has made investments in areas such as battery storage, microgrids and smart meters. Our real estate subsidiary, Cadillac Fairview, has an ongoing focus on energy and emissions efficiency opportunities (please see “Spotlight on Our Real Estate Portfolio”, [page 18](#)).

Signpost Direction

The signposts help us understand how the catalysts are changing, and which scenario we are trending towards

We update and monitor the signposts' progression and compare them with expected values under the three scenarios. See below which scenario the signposts are pointing to according to our latest update:

● LOW-CARBON WORLD

1. Fossil fuel subsidies
2. Batteries for electric mobility
3. Levelized cost of electricity
4. Distributed electricity systems
5. Deforestation
6. Building energy efficiency

● PRE-2018 WORLD COMMITMENTS*

7. Climate policy commitments
8. Carbon price level and coverage
9. Smart city technologies
10. Average annual meat consumption

● HIGH-CARBON WORLD

11. Interconnectivity of electricity networks
12. Carbon capture and storage



* Represents the status quo, extrapolating from current climate policies.



SHORT-TERM RISKS AND IMPACTS (ONE TO THREE YEARS)

In the short term, predominant risks will likely come from policy changes aimed at reducing carbon emissions, litigation related to perceived failures on the part of companies to disclose or manage climate risks, physical risks from extreme weather events, and changing consumer behaviour.

SOURCE OF RISK	IMPLICATIONS FOR COMPANIES	IMPLICATIONS FOR ONTARIO TEACHERS'
Policy and legal	<p>Companies with higher emissions may be at a competitive disadvantage. We expect regulations would lead to an advantage for lower-cost, lower-emission producers. Policies may also be introduced to improve resiliency, such as revised building codes that may increase costs for some.</p> <p>Some stakeholders have begun to launch lawsuits against governments, companies and investors alleging failure to disclose or manage climate change risks, as well as making demands for companies to compensate for their climate change impacts. Action is primarily focused on publicly listed companies and governments at this point.</p>	<p>May result in increased costs for certain companies, and depending on investment selection, reduced investment returns.</p> <p>May increase litigation risk associated with some public companies in the portfolio.</p>
Physical risks	<p>More frequent and acute weather events (such as floods, droughts, storms, heat waves, cold snaps and wildfires) may damage property and interrupt operations and supply chains, and otherwise impact assets in areas vulnerable to extreme weather events.</p>	<p>Short-term physical risks impact different parts of the portfolio in different ways. For example, real estate and infrastructure may be vulnerable to events like hurricanes and flooding, while agricultural assets are sensitive to water risks. All of these will likely drive up costs and hurt profitability.</p> <p>As physical impacts and their frequency increase, our assets may face increasing challenges to insure themselves adequately and affordably.</p>
Consumer preference/Social licence to operate	<p>Companies viewed as significant contributors to climate change and/or laggards on progressive climate action may face material headwinds if consumers take action, such as boycotting certain companies or products. This increases financial and reputation risk, and may affect returns.</p>	<p>Financial and reputation risk may extend to the asset owner, and may impact our social licence to invest and/or the performance of our portfolio companies.</p>



MEDIUM- (3–10 YEARS) AND LONG-TERM (10+ YEARS) ANALYSIS

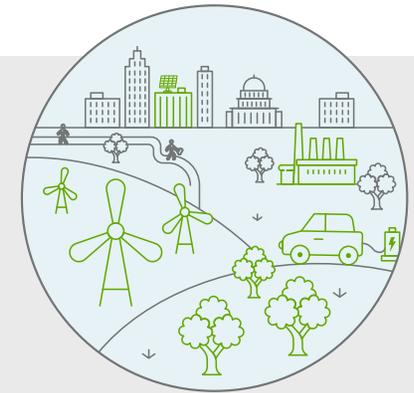
The range of risks and opportunities will depend on which path the world takes, and how quickly. Below, we examine the two extreme scenarios from our LCE Transition Framework: 1) a rapid transition to a low-carbon economy (the “low-carbon world”), and 2) a slower, more volatile pathway in a “high-carbon world”. These scenarios are not predictions or forecasts, but represent possible future developments.

MEDIUM- AND LONG-TERM INVESTMENT OPPORTUNITIES IN A LOW-CARBON WORLD

In a low-carbon world, over the medium and long term, opportunities are tilted towards mitigation rather than adaptation. The plan may benefit from early entry into the most promising areas. This must be executed in the context of the plan’s return objective, risk profile and tolerance, and market conditions to ensure that they will meet our risk-return evaluation. There may be increasing opportunities around adaptation technologies such as desalination facilities, as some amount of physical climate change impacts are already “baked-in”.

Some potential areas of opportunity include:

- **Clean energy** – wind, solar, biofuels, waste-to-energy and hydrogen.
- **Technological innovation and emerging technologies** – battery storage, energy efficiency, microgrids, smart metering and artificial intelligence.
- **Carbon capture** – deployment of infrastructure to capture carbon emissions from operations, or directly remove emissions from the atmosphere.
- **Energy efficiency** – many opportunities across all sectors of the economy, but particularly buildings and heavy industry.
- **Electrification** – medium-term opportunities in passenger vehicles, short-range fleets, mass transit, building heating and supporting infrastructure; longer-term opportunities in long-haul freight, shipping and possibly aviation.
- **Agriculture** – meeting demand for protein through sustainable, lower-emission agricultural products and improving efficiency throughout the supply chain.



SCENARIO: LOW-CARBON WORLD

There is a rapid and coordinated acceptance of low-carbon technologies and a fundamental shift in consumer behaviour toward clean energy options. Policy-makers collaborate to implement climate-oriented policies at national and international levels. These actions limit growth in emissions and reduce the severity of the most serious physical impacts.

**MEDIUM- AND LONG-TERM RISKS AND IMPACTS IN A LOW-CARBON WORLD**

SOURCE OF RISK	IMPLICATIONS FOR COMPANIES	IMPLICATIONS FOR ONTARIO TEACHERS'
Policy and legal	<p>Stricter standards, restrictions on resource use, and/or emissions and other carbon policies may put unprepared businesses at a competitive disadvantage.</p> <p>Companies that fail to act on climate change may face legal liability for their inaction.</p> <p>Lower returns for high-cost and/or emissions-intensive fossil fuel companies, and high-emission and fossil fuel-dependent sectors that are unable to pass costs through to consumers.</p>	<p>More costly energy sources may see reduced demand; our investments in emissions-intensive assets with elastic demand may see dampened returns due to the inability to pass on costs.</p> <p>Our oil and gas investments are concentrated on lower-cost and lower emission-intensity producers, which should partially mitigate impact.</p> <p>Assets that are tied to fossil fuels and the transport sector, such as airports and toll roads, may also see reduced demand. We monitor trends in the electrification of fleet and implementation of charging infrastructure to identify opportunities. Our airports are achieving carbon neutrality and working with third parties and partners, including airlines, to reduce their emissions and mitigate risks.</p> <p>As policies supporting new technologies take effect and mature, there may be increased policy risk for climate-smart investments that are reliant on policy.</p>
Technology	<p>Major technology breakthroughs and cost improvements enable large-scale deployment and grid integration of clean energy.</p> <p>Companies involved in low-carbon energy, electric vehicles, energy efficiency, near-zero emissions industrial processes and other lower-emission technologies benefit from higher demand. Assets tied to high-carbon emission technologies become less competitive and could grow obsolete.</p>	<p>Investing early in transition infrastructure, such as battery storage, and tilting away from traditional fossil fuel-based businesses may benefit the portfolio by mitigating some technology risk.</p> <p>This needs to be balanced against the potential for more rapid obsolescence, due to quickly emerging and developing technologies, as well as increased competition from other investors flowing into this space.</p> <p>With this low-carbon technological development, we will need expertise in assessing which are likely to succeed commercially.</p>
Capital	<p>Capital flows away from high-carbon opportunities in favour of low-carbon opportunities. Increase in the issuance of green and climate bonds.</p> <p>Borrowing by companies in high-carbon industries, and those that have not addressed material climate change risks, will be costlier or unavailable.</p>	<p>Capital flows into climate-smart investments may create challenges in finding attractively priced investments.</p> <p>Companies in our portfolio that have not addressed climate change risks may be unable to expand or grow as a result of the increased costs of funding.</p>

**MEDIUM- AND LONG-TERM RISKS AND IMPACTS IN A LOW-CARBON WORLD (CONTINUED)**

SOURCE OF RISK	IMPLICATIONS FOR COMPANIES	IMPLICATIONS FOR ONTARIO TEACHERS'
Consumer preference/Social licence to operate	<p>Consumers respond to climate change; businesses need to incorporate this understanding into their products and services.</p> <p>Companies that develop sustainable products and services may see increased consumer demand and overall value.</p>	<p>Laggard companies in the portfolio may lose market share or suffer other negative business effects, affecting returns.</p> <p>Our social licence to invest and attractiveness as an investment partner could be influenced by the degree to which we are seen as a proactive enabler of the low-carbon future.</p>
Physical risks	<p>Increasing incidences of heat waves, water shortages and storms continue in the immediate future, but plateau in the long term as policies and actions take effect. Physical risks affect a variety of assets either directly (damage and destruction of physical assets) or indirectly (disruption of supply chains or markets).</p>	<p>Physical climate risks impact different parts of our portfolio in different ways. For example, real estate and infrastructure may be vulnerable to catastrophic events like hurricanes and flooding, while agricultural assets are sensitive to water risks. This will increase costs and decrease profitability.</p>

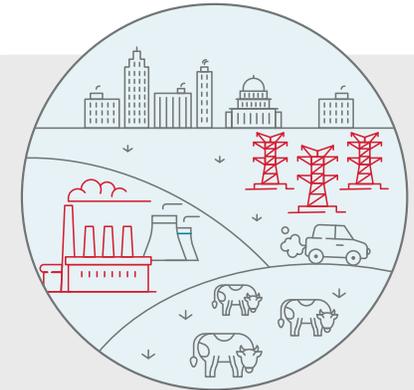


MEDIUM- AND LONG-TERM INVESTMENT OPPORTUNITIES IN A HIGH-CARBON WORLD

In a high-carbon world, over the medium and long term, opportunities are tilted towards adaptation as physical risks worsen. While traditional fossil fuel-based investments can continue to perform, policy and regulatory risks will increase in the later years as we head down this path. As such, we would need to balance investments that may be successful in the shorter term with their potential to create challenges to our ability to earn long-term returns as physical and transitional risks increase.

Some potential areas of opportunity:

- **Fossil fuels** – over the medium term, demand for oil and gas continues to grow.
- **Industrial technologies and energy efficiency** – opportunities in improving recovery and/or streamlining operations as resources become scarcer and costs increase.
- **Healthcare** – heat-related health issues, disease resilience and human migration.
- **Infrastructure** – opportunities to deal with more acute physical impacts, increase resiliency of infrastructure and develop defensive structures.
- **Water** – water distribution, water treatment, desalination and water efficiency technologies.



SCENARIO: HIGH-CARBON WORLD

In this scenario, hydrocarbons continue to dominate the energy mix and low fuel prices allow industry to ignore low-carbon technologies. Insular and protectionist policies impede international cooperation and discourage sustainable actions. Substantive physical effects of climate change are felt globally and accelerate in the long term. Ultimately, governments are forced to act decisively and forcibly to curb emissions. This is a disruptive path that will require careful monitoring.

**MEDIUM- AND LONG-TERM RISKS AND IMPACTS IN A HIGH-CARBON WORLD**

SOURCE OF RISK	IMPLICATIONS FOR COMPANIES	IMPLICATIONS FOR ONTARIO TEACHERS'
Policy and legal	<p>Governments adopt protectionist policies, preventing an internationally coordinated approach to addressing climate change.</p> <p>Longer-term, dramatic and sudden policy changes could strand or severely impair high-emission assets.</p>	Investments in renewables and clean technologies may struggle to compete with inexpensive fossil fuel alternatives, imperiling their commercial viability.
Technology	Companies in high-emitting industries, such as extractives, materials and transportation, do well in aggregate, while those tied to renewable energy or other clean technologies may face headwinds. Emerging and pilot-scale clean technologies stagnate; although, towards the end of this scenario, clean technology companies that do survive may see a reversal.	The plan may benefit from best-in-class, low-cost energy producers driven by sound economic fundamentals, which mitigates potential high risks originated from rare but significant events that may happen under this scenario.
Capital	<p>Capital flows away from low-carbon opportunities in favour of enhanced fossil fuel production processes. Issuance of green and climate-aligned bonds stagnates.</p> <p>Spending on adaptation technologies and hardening of infrastructure pulls attention and capital from other parts of the economy.</p>	<p>Our investments in renewables and climate-smart assets may see depressed returns.</p> <p>We may miss profitable opportunities if we diversify away from certain fossil fuel investments, such as oil sands.</p>
Consumer preference/Social licence to operate	<p>Climate mitigation and adaptation responses are rejected. Businesses successfully lobby against attempts to introduce stringent climate policies or to foster technological innovation.</p> <p>Businesses that continue to look at historical demand patterns may be disrupted by abrupt policies and actions in the tail end of this scenario.</p> <p>Climate change activists are the minority, yet become increasingly vocal and forceful.</p>	As physical risks continue to increase in frequency and severity, companies continuing to contribute to climate change will face increasing reputation risks and loss of social licence to operate.
Physical risks	<p>Physical climate impacts become more extreme. In the longer term, there are increasing crop failures, frequent and extensive periods of drought, extreme heat and flooding. Sea levels rise. Infectious disease epidemics, species extinction and the spread of pests increase.</p> <p>Demand for natural resources may hit scarcity constraints.</p> <p>These risks may cause total losses of some assets.</p>	Our real assets, particularly in coastal areas, may see higher maintenance and capital expenditures to enhance resiliency. Some portfolio companies may have difficulty in getting insurance. Agricultural investments in drought prone locations such as California and Australia may see lower returns, while sustainable agriculture may see benefits due to expected food shortages globally. Portfolio companies with vulnerable supply chains may see disruptions in their businesses.



Resilience of our strategy

Our strategic approach is primarily qualitative, using the scenarios and signposts in our LCE Transition Framework to influence behaviour and culture, and help us develop the capabilities to manage climate change implications at both the investment and total portfolio levels.

We have processes in place at the individual public and private investment level that include evaluating ESG risks, and we integrate material climate change considerations across the investment cycle.

For example, we use the scenarios to stress test our assumptions at the individual asset level on select investments (primarily in oil & gas and agriculture). Our analytics may include the range of expected returns from our investments under each scenario, and under carbon prices varying from \$25 to \$100 per tonne of carbon dioxide. We also stress test our investment thesis against relevant assumptions (such as electric vehicle adoption rates and battery technology costs) under our three scenarios. We're evaluating tools and approaches to assess our portfolios at a more granular level and over a longer time horizon (see [page 19](#)).

As of our last climate signpost update at the end of 2018, there remains considerable uncertainty as to the pathway we are trending toward. As such, we are building agility and preparedness into our portfolio by introducing the LCE Transition Framework into our thinking to enable quick action as opportunities and risks emerge.

We support our direct portfolio companies who have been developing their own climate strategies, investing in resilience and creating resource efficiencies. Our [2018 Responsible Investing Report](#) highlights some examples, such as investing in high-efficiency irrigation systems in our agriculture investments, and supporting and encouraging carbon-neutral strategies in our airport investments.

We continue to engage with public companies on how they disclose and manage climate change risks, both independently and collaboratively with like-minded peers, to improve the overall quantity and quality of data available. Given the current state of corporate reporting, disclosure is still a prime focus, but we believe that you can't manage what you don't measure, so compelling companies to provide information on their resource use and emissions will lead to management of these factors. Management of resources and emissions is an increasing focus of our dialogue with companies. As data improves and analytical processes become more advanced, our engagement efforts with public and private companies should result in more insightful investment decisions and therefore make the portfolio more resilient to a variety of climate-related scenarios.



Our LCE Transition Framework has provided an excellent starting point for portfolio managers and deal teams to begin understanding climate change risks and opportunities. However, we will need new tools to help us understand how the total fund is positioned and where we would like to be. These will be developed over the coming years. We are working to measure and monitor our aggregate climate risk exposure and understanding what our risk appetite is for climate change risk. For example, what is the right balance across the spectrum of energy investments (oil, gas, biofuel, hydro, nuclear, wind, solar, etc.) that allows us to achieve the required risk-return profile to meet our pension liabilities, while also navigating the range of possible futures implied by our scenario analysis? We are also exploring quantitative scenarios that stress test and assess impact on the plan's returns, but robust models have not yet been developed, and data quality and transparency remain a challenge.



Risk management

How we identify, assess and manage climate-related risks

RISK IDENTIFICATION AND ASSESSMENT

Our enterprise risk management (ERM) program includes a systematic framework that helps management identify, assess, manage, measure, monitor and report on enterprise risks. Climate change is an enterprise risk within our ERM framework, where it is defined as a systemic risk that can impact investment returns through physical, transition and/or reputation risks. The framework notes that climate change risk could increase significantly in the next 10 years if we do not address it with appropriate mitigation strategies and resources.

Our CEO chairs the ERM Committee, which includes the executive team. The ERM Committee reviews enterprise risks at least twice a year and makes decisions on risk appetite, prioritization of mitigation strategies and resourcing. Climate change risk is owned by the CIO, who is responsible for identifying, analyzing and managing the risk and implementing risk mitigation strategies. The Chief Risk & Strategy Officer is the risk partner on climate change, assigned to provide risk insights and establish effective risk monitoring and assessment capabilities.

RISK MANAGEMENT APPROACH

Our approach for managing climate change risk is embedded in our strategy and processes, and is built on four pillars: integrate, engage, influence and evolve.

Ultimately, these pillars focus on the long-term sustainability of the pension plan so that we can deliver retirement security to our members.

OUR FOUR PILLARS

Integrate

We integrate ESG considerations into our investment process to manage risk and add value.

Engage

We build relationships with the companies we invest in to improve our understanding of these companies, influence change and nurture success.

Influence

We use our influence as a global investor to improve the investing landscape and clarify expectations of companies.

Evolve

We adapt and improve our own processes as the world evolves and new risks and opportunities arise.



1. INTEGRATE

Climate change considerations are part of a broader set of ESG considerations that are embedded in our risk management practices and culture. We evaluate material climate-related factors across the investment cycle.

We use a responsible investing lens to anticipate potential impacts on our investments and identify emerging trends, risks and opportunities. This helps us find investments with growth potential that support our long-term investment objectives. It can also give us an early-mover advantage in promising new areas.

Before we make a decision to invest, we undertake a due diligence process to identify potential risks and assess their materiality to the investment. We look at ESG factors that are significant to a company based on the sector(s) they operate in, where they operate and our own professional expertise. We also use external resources, such as the Sustainability Accounting Standards Board’s (SASB) Materiality Map, to help identify material issues. We assess how the company has performed in those areas compared to international standards and peers, as well as their results over time. If the investment involves partners, we also analyze the partners’ policies and practices to ensure they are aligned with our own.

When we invest in private companies, portfolio managers monitor the company’s exposures to ESG risks and opportunities and review management’s governance and processes around them. When we appoint board members, at least one of the directors focuses on flagging material ESG risks back to management.

Our public equity portfolio managers also monitor and assess material ESG risks, with support from the Responsible Investing and Corporate Governance teams.

External managers are subject to annual reviews of performance, practices and outcomes. We review how they integrate ESG factors into their company assessments. We also review outcomes – what investment decisions were made and how any ESG-related incidents were managed.





2. ENGAGE

We build relationships with the companies we invest in to improve our understanding of these companies, influence change and nurture success.

In our private company investments, we have regular discussions with management, and often have at least one board seat. Where climate change factors are expected to have a significant impact, we encourage our companies to take a balanced approach to climate change including tracking issues in the risk register.

Examples of resiliency and efficiency projects in our portfolio companies:

- incorporating physical climate-related risk in new construction and maintenance projects in our port investment;
- adding high-efficiency irrigation in agriculture investments to conserve water and energy;
- opening a new plastics recycling plant at a building supply company.

Climate change has been a focus area of our engagement with public companies for many years.

Our engagement strategy:

- allows for meaningful engagement aimed at influencing change in both the short and long term;
- clarifies our position on ESG issues;
- makes our engagements more effective by linking them with our proxy voting decisions.

Companies in our investment portfolio will be prioritized for engagement based on climate-related disclosure deficiencies and/or emissions intensity relative to their sector.

We want at-risk companies to:

- have board-level oversight of climate change;
- include material climate change considerations in their corporate strategy;
- disclose clear and specific information about risk management practices around climate change;
- provide metrics and targets on climate-related factors, including emissions.

To encourage greater disclosure, we have published our views on relevant disclosures in the oil and gas sector and supported shareholder proposals that seek more transparency from companies in their reporting of climate change risks. As a follow-up to our votes, we have also engaged with issuers in more robust dialogue about their climate change disclosures.

In 2018, we published a [report](#) examining alignment between shareholder value and management compensation programs that reward short-term oil and gas production growth regardless of expense. This also called into question the long-term sustainability of the oil and gas sector's exploration and production model in an era of energy transition. This report was followed by a series of engagements to discuss findings with companies.

In addition to our individual engagements, we participate in group efforts with like-minded investors where we believe that collective action will lead to improved disclosure and performance. Below are a couple of examples of collective engagements we are involved in.



Climate Action 100+ is a five-year initiative to engage with systemically important greenhouse gas emitters. We're leading or participating in a number of engagements. As of publication, in aggregate, there are over 320 investors engaging with over 160 companies around the world on climate action.



The **Sustainability Accounting Standards Board (SASB)** launched a pilot engagement program to learn companies' views on the standards, which include material climate-related factors, and get their commitment to adopt SASB in their corporate reporting. We were part of an engagement team that met with a number of companies across sectors in 2018. Thirty-three companies have committed to adopting the standards since they were launched in 2018. In 2019, following a successful pilot, 51 companies are being added to the engagement program as of the publication date of this document.



3. INFLUENCE

We use our influence to help drive progressive action and meaningful change on climate-related risks and opportunities.

INITIATIVE	WHAT IT DOES	HOW WE ARE INVOLVED	WHY WE ARE INVOLVED
Accounting for Sustainability CFO Leadership Network	Works with Chief Financial Officers (CFOs) and finance teams across Canada to advance understanding of and enhance discussion about sustainability and the contribution of the finance industry.	Our CFO, David McGraw, is a member of the network and we're participating on the <i>Engaging Boards and Senior Management Project</i> to: <ul style="list-style-type: none"> learn how member organizations have integrated ESG issues into business strategy, processes and decision making; use that information to develop tools and guidance for companies who need help engaging their senior teams. 	Gives us tools and metrics we can use to engage more effectively on climate change factors with the boards and management of the companies we invest in.
Canadian Coalition for Good Governance (CCGG)	Promotes good governance practices in Canadian public companies on behalf of institutional investors.	Chief Risk & Strategy Officer Barbara Zvan sits on the board and chairs the Environmental and Social (E&S) Committee. In June 2018, CCGG released a <i>guide</i> to help directors assess and oversee E&S factors. It includes E&S issues in governance engagements with companies.	Helps improve the capacity to effectively manage material climate change risks and opportunities through the establishment of good governance frameworks and practices at the boards of the companies we invest in.
Expert Panel on Sustainable Finance	Helps to foster a regulatory and policy framework in Canada that can help fight climate change and build the low-carbon economy.	Ms. Zvan is one of four expert panel members. Read about our work this year in the case study included in our <i>2018 Responsible Investing Report</i> and in the <i>Final Report of the Expert Panel on Sustainable Finance</i> .	Helps create attractive long-term investment opportunities needed to support an orderly transition to a low-carbon economy, which reduces our investment risk and fosters a better environment for all investments.



INITIATIVE	WHAT IT DOES	HOW WE ARE INVOLVED	WHY WE ARE INVOLVED
Global Real Estate Sustainability Benchmark (GRESB)	Assesses and benchmarks the sustainability performance of real estate and infrastructure portfolios and assets worldwide.	Head of Responsible Investing Deborah Ng chairs GRESB's Infrastructure Advisory Board (IAB), which gives strategic advice, particularly on products and services relating to its Infrastructure Assessments.	Provides a systematic framework for our real assets to track, benchmark and manage sustainability and climate-related risk and opportunity.
International Centre for Pension Management (ICPM)	Stimulates leading-edge thinking and practice about pension design and management.	We were part of ICPM's Climate Change Working Group, which developed <i>Climate Change for Asset Owners</i> , a guide for trustees and plan managers to begin integrating climate change considerations in the investment process.	Encourages more asset owners to manage climate risks in the portfolio, thereby creating more impetus for regulators, companies and financial service providers to, in turn, take action on climate change.
Investor Leadership Network	Advances key issues related to sustainability and long-term growth.	Ontario Teachers' is a founding member of the organization and is a part of the steering committee focused on creating a set of guidance documents outlining leading practices in climate-related disclosures for institutional investors.	Is a network to collaborate with some of the world's largest investors to develop solutions to global challenges, such as climate change.
Sustainability Accounting Standards Board (SASB)	Sets sustainability disclosure standards that are industry-specific and based on materiality.	In 2019, Ms. Zvan will chair the Investor Advisory Group, which promotes adoption of SASB as a framework for disclosure by investors and companies.	Helps companies report meaningful ESG information, including material climate change issues, which helps us assess risk and enhances our decision-making process.



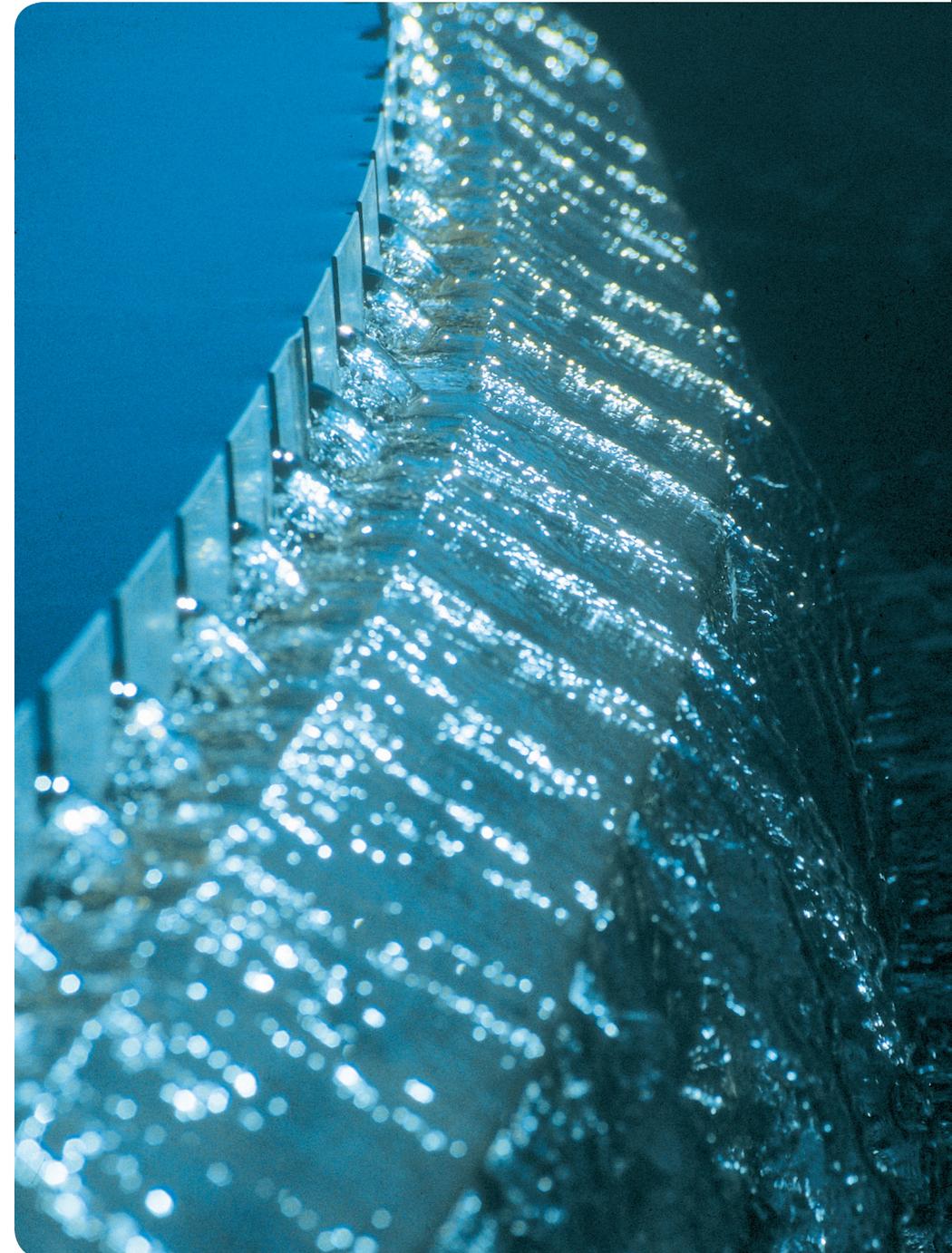
4. EVOLVE

We acknowledge that investors do not have all the information they need to make a robust assessment of climate-related exposures. However, that does not mean we can't take action. What gets measured gets managed. We are using the data we have, engaging with companies and working with peers to foster proactive corporate behaviours and promote disclosure of information. These activities also help us to learn about and stay abreast of best practices at various organizations.

The science of climate change, the nature of the information that investors are seeking and investment practices related to climate risks and opportunities continue to evolve. We believe that more work needs to be done to develop metrics that are relevant, applicable and comparable for a diversified portfolio like ours and that reflect the broad range of climate change-related risks.

We are committed to:

- evaluating new tools;
- helping push the industry forward to better enable analysis of climate risks and opportunities;
- better equipping our board and senior management to continue improving the evaluation of climate factors in our investment strategy.





SPOTLIGHT ON OUR REAL ESTATE PORTFOLIO

Our wholly owned real estate subsidiary, Cadillac Fairview (CF), has been managing and reporting on its sustainability impact for 10 years. For commercial building managers, there are direct links between managing climate-related impacts and profitability: tenants demand sustainable, healthy work spaces and will pay higher rents for such spaces, while energy and water efficiencies reduce operating costs for landlords and tenants alike.

CF's operating environment is constantly changing. There has been an emergence of disruptive technologies, an advance of local and national carbon regulation, an increase in extreme weather events and an evolution in stakeholder expectations. The strength of CF's business depends on its ability to proactively prepare for and address these broader trends. Recently, CF adopted a more comprehensive alignment of its sustainability strategy with its overall business strategy and organizational values, with clear objectives and measures that provide focus and priority to current and new initiatives.

To stay ahead of the curve, CF established a *Climate Change and Greenhouse Gas (GHG) Corporate Statement of Principles* that stipulates that it:

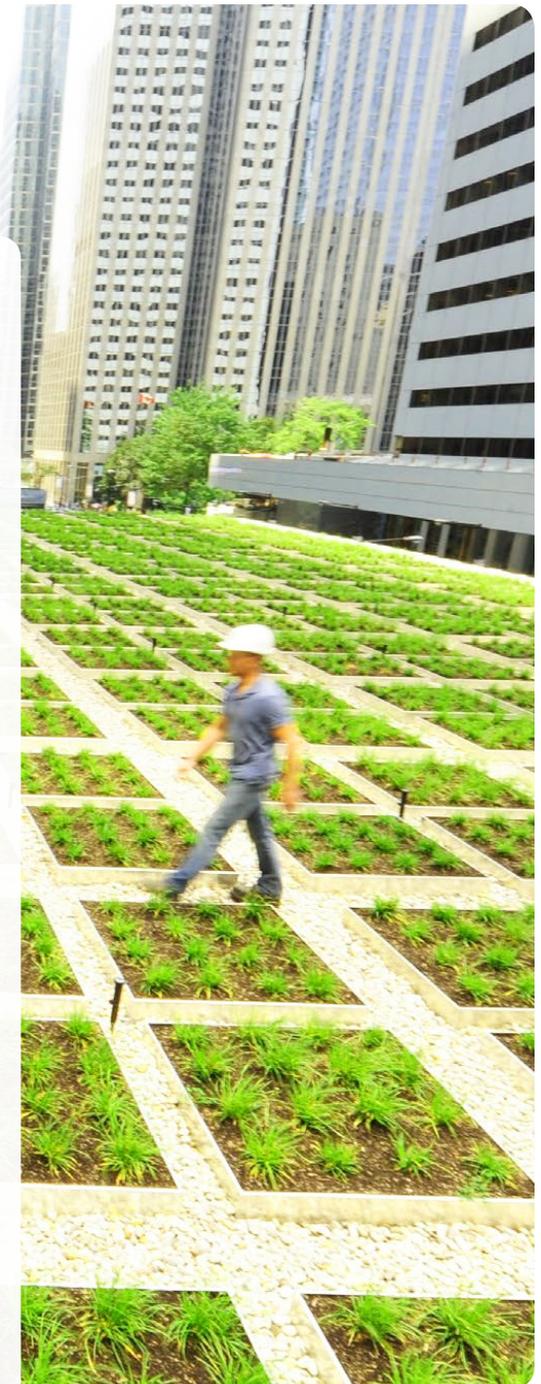
- exceed regulatory requirements related to climate change;
- track and disclose emissions generated from building operations;
- prohibit chlorofluorocarbons and hydrochlorofluorocarbons (refrigerants used in cooling equipment);
- incorporate environmental design into new construction activities;
- collaborate with stakeholders to achieve emission-reduction goals;
- investigate opportunities for innovation by piloting new technologies such as geo-thermal exchange and deep-water cooling systems, technology upgrades and retro-commissioning, as well as operational practices such as comprehensive energy audits.

As part of this, it has established clear objectives and measures that provide focus and priority to current and new initiatives. It also developed a Corporate Responsibility Management Council to identify opportunities, support cross-departmental coordination, report on progress, contribute to internal and external reporting on ESG matters, and advance opportunities to senior management.

Annually, CF identifies measures to reduce energy use by introducing efficiency upgrades and new technologies for smarter energy management. Each property undergoes a third-party energy audit or retro-commissioning completed every four years. To support this, CF management has established an annual energy reduction target for each building in the portfolio. This is integrated into incentives at many levels across the organization.

CF's leading sustainability practices are reflected in its consistently high scores in the GRESB Real Estate Assessment. GRESB is the global standard for ESG benchmarking and reporting for real assets. The assessment covers areas such as climate change governance, risk management, resilience and adaptation, and information on performance indicators, such as energy consumption, GHG emissions and water consumption.

CF has responded to GRESB for three years and has consistently achieved five green stars (highest rating and recognition for being an industry leader) in relation to all real estate respondents. To put that into context, in 2018 alone, more than 900 property companies, real estate investment trusts, funds and developers participated in GRESB's Real Estate Assessment. In North America specifically, CF has ranked first or second in its category over the past three years.





Metrics and targets

The metrics and targets we use to assess and manage relevant climate risks and opportunities

1. METRICS TO ASSESS CLIMATE-RELATED RISKS AND OPPORTUNITIES IN LINE WITH STRATEGY AND RISK MANAGEMENT

We use SASB, GRESB and our own proprietary frameworks to assess individual assets. These frameworks generally set out guidance and standards in three categories:

- **Governance** – establishment and quality of policies and goals.
- **Implementation** – application and execution of procedures.
- **Performance** – metrics that demonstrate outcomes or achievements related to governance and implementation.

Within our proprietary framework, we are developing our own system to quantitatively assess a company's ESG practices. We do this through a combination of assessing existing practices that we see across a range of companies in various jurisdictions, consultation with third-party industry, and accessing and analyzing appropriate data sets.

We also look to the GRESB real asset sustainability assessments to support our evaluation of sustainability performance for our real estate and infrastructure investments.

Within these frameworks, climate-related metrics are based on materiality, sector or subsector, but generally include measures like absolute and relative emissions; energy, water and waste management; physical resiliency; supply chain management; and the proportion of operations in climate-sensitive locations.

We are evaluating data and working with peers, industry and service providers to develop metrics that can be applied to portfolios that are diversified across geographies and asset classes (e.g., equities, infrastructure, real estate).





Some measures of exposure to climate change risk under development include:

RISK METRIC OR AREA OF EXPOSURE	WHAT IT ATTEMPTS TO ANSWER	LIMITATIONS
Physical exposure	<ul style="list-style-type: none"> • What proportion of assets is exposed to acute climate change impacts? • What proportion of assets is exposed to chronic climate change impacts? 	<ul style="list-style-type: none"> • Very difficult to get data on locations of all public company operations • Difficult to get specific details; many vendors provide physical risk information at city level or higher • Many tools provide comparative or score based measures as opposed to direct risk measures that could be input into valuation models
Legal exposure	<ul style="list-style-type: none"> • What companies in the portfolio could face legal and litigation risk based upon climate change impact or poor disclosure? 	<ul style="list-style-type: none"> • Difficult to assess without legal precedence • No vendors have been identified who provide this data
Ratio of low-carbon to high-carbon linked revenues	<ul style="list-style-type: none"> • How much of the portfolio is invested in a low-carbon economy vs. a high-carbon economy? • What is the portfolio's level of preparedness or consistency with the current climate scenario pathway? 	<ul style="list-style-type: none"> • Challenging to get good data on companies' different revenue streams • Coverage limited to sectors that can be delineated by green/brown
Value at risk	<ul style="list-style-type: none"> • How much can the portfolio lose under different climate change scenarios? 	<ul style="list-style-type: none"> • Modelling challenges • Limited transparency on underlying assumptions makes it difficult to evaluate the quality of the model



2. GREENHOUSE GAS EMISSIONS AND RELATED RISKS

A portfolio carbon footprint is a common starting place for organizations trying to understand climate risk. Following industry practice, we consider it to be the sum of the equity ownership of each portfolio company's greenhouse gas emissions, resulting in our portfolio's exposure to greenhouse gas emissions.

We include scope 1 and scope 2 emissions in our portfolio carbon footprint¹. Scope 1 emissions are direct emissions from owned or controlled sources at our portfolio companies. Emissions from a furnace in your home would be a scope 1 emission. Scope 2 emissions are those associated with purchased energy. Emissions from a power plant that supplies your electricity would be scope 2 emissions. Emissions are quantified from a number of greenhouse gas sources, e.g., carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), etc., and standard practice is to convert them to CO₂ equivalents, or CO₂e, which is the measure we use.

Looking at the changes in a company's carbon emissions year over year, or between companies in the same sector, can provide us with insights on how companies are working to reduce their impact on the climate. It is also a useful starting point to identify companies and sectors that could be more exposed to carbon pricing or other transition risks. We also believe that measuring and reporting on our carbon footprint encourages others to do the same, supporting the development of a more robust ecosystem of carbon footprint data. We recognize, however, that there are limitations to assessing a portfolio's carbon footprint, including the following:

- at the portfolio level, it is not a measure of portfolio risk – each company needs to be looked at in a broader context;
- at the company level, it is backward looking – data is from the previous year or older, and does not capture forward-looking dynamics, such as research and development that may reduce future emissions;
- data availability is limited – there are many companies that still do not report their footprint and many estimates are used;
- emissions estimates are not standardized – different sources of information provide different estimates.

Another useful measure related to portfolio carbon footprint is the weighted average carbon intensity, or "WACI." WACI is determined by dividing a company's carbon emissions by its revenue, and then allocating those emissions based on our proportionate holding. It provides insight on the carbon efficiency of companies in our portfolio, including whether they are reducing emissions on a relative basis.

While we reported on WACI in 2017, we have expanded the scope of our 2018 reporting to include our private holdings. We are in the process of obtaining the data required to report on the WACI for this portfolio as well as for our corporate and sovereign credit portfolios and expect to include it in our next climate change report.

¹In 2017, our portfolio carbon footprint calculation included upstream emissions (also known as scope 3 emissions), such as those from manufacturing purchased materials. Including some of these scope 3 emissions made our reporting more comprehensive; however, their calculation relies completely on estimates, thus increasing the inaccuracy of the calculation.

**2018 CARBON FOOTPRINT**

2018 CARBON FOOTPRINT METRIC	PUBLIC EQUITIES	PRIVATE ASSETS	TOTAL
Market exposure of holdings in C\$ millions ²	16,554	92,235	108,789
Carbon footprint (tonnes of CO ₂ e/C\$ millions)	283	59	93

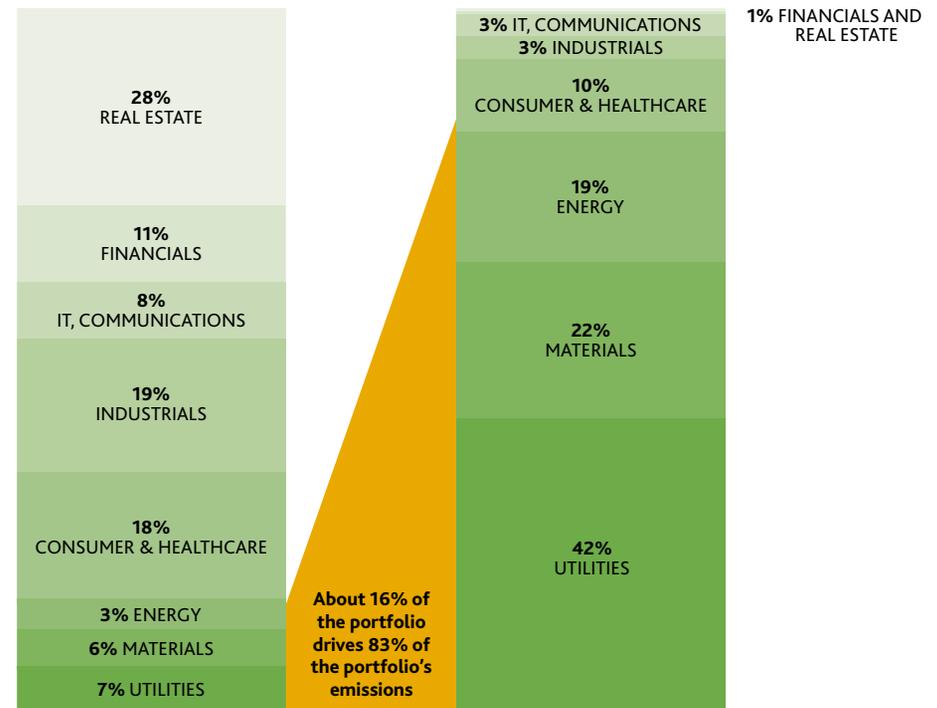
The table above shows that for 2018, our equities portfolio had a carbon footprint of 93 tonnes of CO₂ equivalent for every million dollars of exposure. In general, our public equity holdings, which represent broad global equity markets, had a higher carbon footprint than our private investments.

The figure on the right shows that 83% of the portfolio's absolute emissions come from relatively small holdings of utilities, materials and energy companies, representing about 16% of the portfolio.

Sector-based carbon footprint contribution

SHARE OF MARKET EXPOSURE

SHARE OF EMISSIONS



²Market exposure values are not directly comparable to the Ontario Teachers' Pension Plan consolidated financial statements, due to exclusions (refer to appendix), differences in asset categorization, and the use of notional value to account for equity exposure of derivatives.



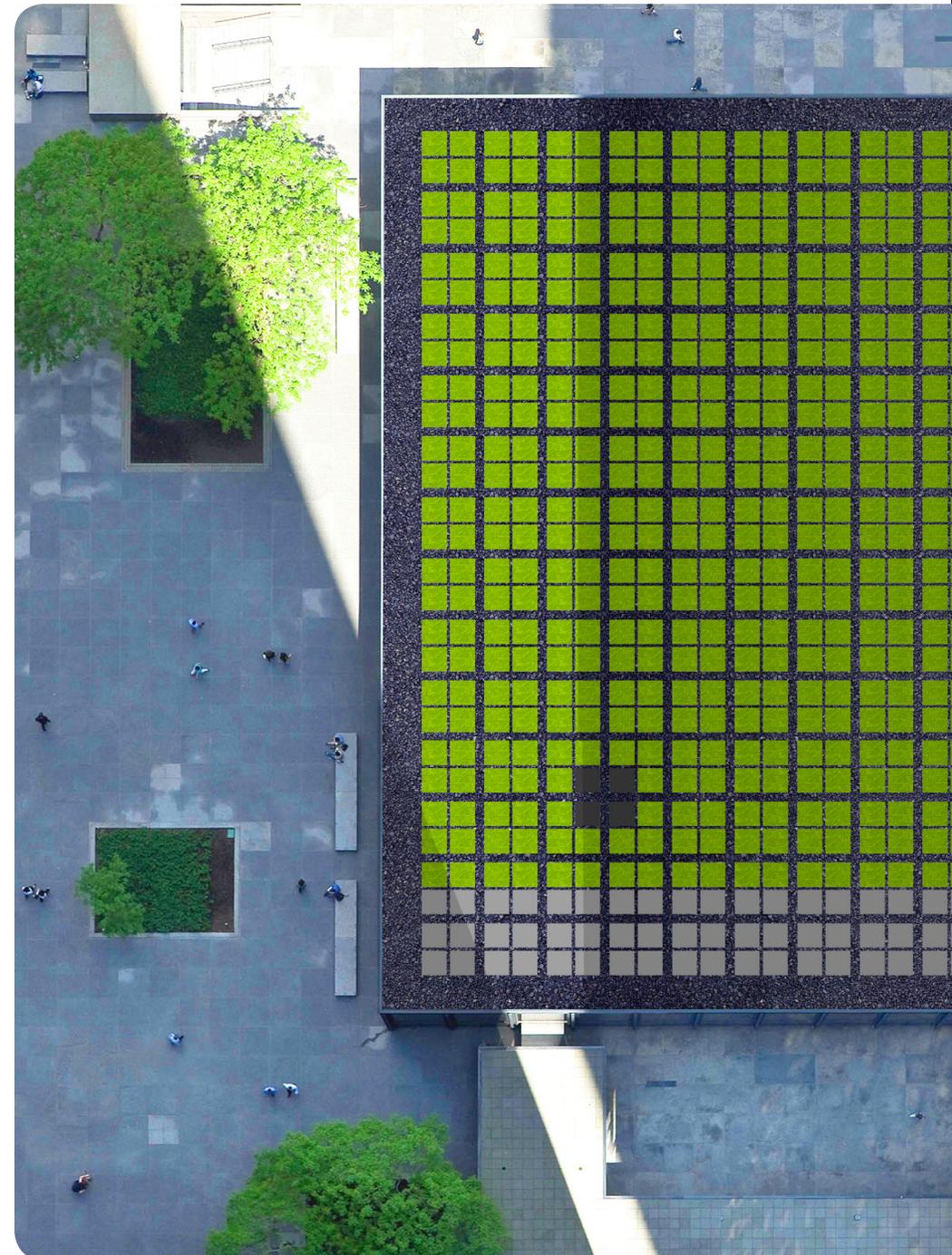
3. TARGETS USED TO MANAGE CLIMATE-RELATED RISKS AND OPPORTUNITIES

Ontario Teachers' does not have targets that specifically address climate-related risks and opportunities. Instead, we integrate ESG factors into our investment decision-making process, and consider material climate change risks throughout the investment lifecycle across all asset classes and investment teams. This approach has helped us steer away from high-risk investments, and made us an early investor in climate-related opportunities like renewable energy, energy storage and water treatment.

We encourage proactive management of climate change by Investments through the establishment of scorecard objectives that impact performance evaluation and compensation.

We are evaluating data and working with peers, industry and service providers to develop metrics that can be applied to a large, diversified investment portfolio. However, inherent data challenges remain. Until we develop relevant climate risk measures and understand what the metrics reveal about our portfolio, it is premature in our view to establish targets for climate-related risks and opportunities.

We are committed to developing a measurement framework that encourages the appropriate behaviours, including improving the emissions-efficiency of our investments.





Appendix

METHODOLOGY

Ontario Teachers' published its first carbon footprint in the *2017 Responsible Investing Report*, which only covered our public equity portfolio. For 2018, we expanded the coverage of our portfolio carbon footprint to include our private equity and real assets.

Our portfolio carbon footprint is calculated as:

$$\frac{\sum_i^n \text{OTPP's equity share}_i * \text{Issuer's scope 1 and 2 GHG emissions}_i}{\text{Market exposure of OTPP's equities}}$$

SCOPE:

We assessed our shares held in public companies and derivative positions in our long-only public equity strategies. Derivative positions include index swaps and futures used to obtain cost-effective exposure to equity growth and equity options held as part of our equities strategy.

We also included the carbon footprints of our private holdings, including direct private equity and private equity funds, infrastructure, real estate and natural resources³.

Combined, the public and private equity and real assets portfolios represent over 55% of our net assets as of December 31, 2018.

EXCLUSIONS:

The following asset classes and strategies were excluded from the portfolio carbon footprint assessment: investments held in absolute return strategies and hedge funds, commodities futures, inflation-linked securities, sovereign and corporate credit, and money market instruments.

³Natural resources include Heritage Royalty, a portfolio of mineral rights, with underlying exposure to oil and gas projects. The emissions associated with these oil and gas holdings are not included in our footprint as Heritage does not own or operate these assets.

The table below shows the breakdown of the portfolio into long and short positions, and the derivative exposures embedded in those numbers.

PORTFOLIO	MARKET EXPOSURE (C\$ MILLIONS)	PORTFOLIO CARBON FOOTPRINT (TONNES OF CO ₂ e/C\$ MILLIONS)
Long equities	110,201	82
Short equities	(1,451)	34
Long derivatives	12,888	161
Short derivatives	(12,849)	72
Total	108,789	93

**EMISSIONS DATA:**

Public Equities: Emissions data was taken from S&P Trucost (Trucost)⁴. Trucost applies the following approach for estimating emissions:

1. Company-reported emissions
2. Estimate based on company-specific factors
3. Proprietary sector-based model

Trucost has data for 96% of our public equities portfolio. The remaining 4% was estimated by proxy using Global Industry Classification Standard (GICS) sub-industry average emissions calculated from Trucost's database.

Private Equity and Real Assets: Carbon emissions were assessed using the following approach similar to Trucost, in preferential order:

1. Company-reported emissions
2. Estimate based on company-specific factors
3. Estimate based on similar publicly listed companies
4. Proxy based on sub-industry average emissions

The following table breaks down the estimation methods used by number of companies and percentage of market exposure (ME):

	PUBLIC EQUITIES		PRIVATE EQUITIES		TOTAL	
	COUNT	PERCENT OF ME	COUNT	PERCENT OF ME	COUNT	PERCENT OF ME
Company-reported emissions	1,221	52	7	35	1,228	38
Estimate based on company-specific factors	996	23	23	14	1,019	15
Trucost models	4,534	21	–	–	4,534	3
Proxy based on custom peer group	–	–	8	8	8	7
Proxy based on GICS sub-industry average	597	4	1,297	43	1,894	37
Total	7,348	100	1,335	100	8,683	100

⁴ Source: S&P Trucost Limited © Trucost 2019. All rights in the Trucost data and reports vest in Trucost and/or its licensors. Neither Trucost, nor its affiliates, nor its licensors accept any liability for any errors, omissions or interruptions in the Trucost data and/or reports. No further distribution of the data and/or reports is permitted without Trucost's express written consent.



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