CalPERS' Response to the Taskforce on Climate Related Financial Disclosure (TCFD) and Senate Bill 964

November 2022

CalPERS

Table of Content

Introduction

This report by the California Public Employees' Retirement System (CalPERS) responds to the recommendations of the Taskforce on Climate-Related Financial Disclosure (TCFD) and California Senate Bill (SB) 964.

The pandemic demonstrated with brutal clarity that tackling a systemic risk requires international cooperation between the public and private sector, driven by innovation at pace and scale. The lessons are evident: we need vision, partnership, and a relentless pursuit of scientific evidence to drive decision-making.

CalPERS' vision is to provide a sustainable retirement system and health care program for those who serve California. Today, CalPERS delivers retirement and health care benefits to more than two million members, with annual benefit payments of approximately $27 billion dollars. CalPERS' motivation to address climate change is to ensure we can sustain our mission. For every dollar paid out, 60 cents come from investment returns as of June 30, 2021. With a funding ratio of 72% and a target rate of return of 6.8%, CalPERS must seize the opportunities and control for the risks climate change presents to our portfolio.

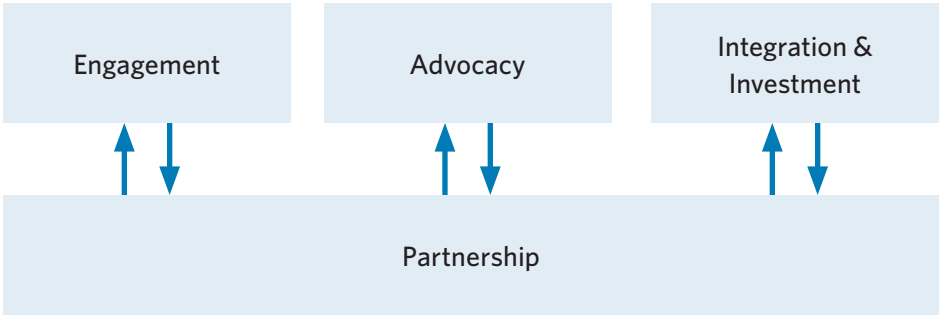
Scientific evidence demonstrates that reducing greenhouse gas (GHG) emissions is critical to slowing global warming and driving sustainable economic growth. Physical impacts pose short and long-term risks to our members' assets. These risks include rising sea levels, floods, severe storms, drought, and wildfires. Dramatic changes to the global energy economy also pose transition risks as companies are challenged to adopt new strategies, without leaving their investors holding stranded assets, or in extreme cases, bankruptcy. This is particularly important as the world recovers from COVID-19 and the U.S. implements sanctions against Russia. In addition, companies are increasingly vulnerable to litigation.

Climate change is a global challenge and one we cannot afford to ignore as long-term investors, with inviolable fiduciary duty to our members. The consequences of inaction will be measured not just in the impact on workers and communities, but also on the companies we rely upon to generate the investments that pay benefits. The White House's own *Report on the Impact of Climate Change on Migration* notes the impending impact:

"The climate crisis is reshaping our world, as the Earth's climate is now changing faster than at any point in the history of modern civilization…When combined with physical, social, economic, and/or environmental vulnerabilities, climate change can

undermine food, water, and economic security. Secondary effects of climate change can include displacement, loss of livelihoods, weakened governments, and in some cases political instability and conflict."[1] However, climate change also brings tremendous new opportunity for investors. A forecast from the Global Commission on the Economy and Climate concludes that, "Low-carbon growth could deliver economic benefits of US$ 26 trillion to 2030 - and this is a conservative estimate."[2]

CalPERS is addressing both the risks and opportunities of climate change through our four-pillar approach: **engagement,** to ensure the companies we invest in bring down their GHG emissions; **advocacy,** to support the policies and regulations that will foster the transition to a low-carbon economy; and **integration and investment,** to bring consideration of climate change risk and opportunity into our investment decision-making. The fourth pillar is based on **partnership** with others, such as Climate Action 100+ fellow investors and international bodies such as the United Nations Net Zero Asset Owner Alliance.



Acknowledging that climate reporting capabilities are fast moving and evolving, we welcome the opportunity for dialogue. Our findings are based on the most current data and methodologies. We will continue to advocate for mandatory climate risk reporting and support best practice frameworks as an interim measure. Ultimately, as corporate reporting improves so will the ability of investors to assess both the risks and opportunities of climate change and act accordingly. The transition requires the full force of the financial market, in partnership with the public sector, business and civil society to address the urgent challenge of climate change.

TCFD Framework

Recognizing the potential impact of climate change upon financial markets, the G20 Finance Ministers and Central Bank Governors asked the Financial Stability Board (FSB) to review how the financial sector can take account of climate-related issues. As part of its review, the FSB established the TCFD, an industry-led taskforce. Michael Bloomberg, former Mayor of New York City, was appointed as chair of the TCFD in December 2015.

The mandate was to develop recommendations for companies to inform their investors, lenders and insurance underwriters about climate-related financial risks and opportunities.[3] The recommendations were first issued in 2017, and refreshed in 2021, to provide voluntary, consistent, climate-related financial disclosures that would be useful to investors and others in understanding material risks.

The TCFD recommendations are intended to be: adoptable by all organizations; included in financial filings; designed to solicit decision-useful, forward looking information on financial impacts; and to provide a strong focus on risks and opportunities related to transition toward a lower-carbon economy.

CalPERS has been an active supporter of the TCFD's work from the outset.[4] Although the TCFD recommendations were first designed for corporate reporting, asset owners were also encouraged to report using the same four-part disclosure framework, which were followed in our first TCFD report by CalPERS:

- **Governance:** Detailing the CalPERS Board and Management governance around climate-related financial risks and opportunities.
- **Strategy:** Explaining how the CalPERS' investment approach accounts for current and potential climate-related risks and opportunities.
- **Risk Management:** Setting out how CalPERS' investment approach identifies, assesses, and manages climate-related risks.
- **Metrics and Targets:** Disclosing the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material.

To illustrate the relevance of climate-related financial reporting, the TCFD task-force mapped out the major categories of potential impact on corporate income statements and balance sheets. These include the potential impact on revenues for companies that may be affected by changing demand for their products and services and, also, the related expenditures.

On the balance sheet for companies, the TCFD recommendations consider changes to both assets and liabilities as changes to both supply and demand are driven by policies, technology, and market dynamics related to climate change. The TCFD advises that companies focus on existing and committed future activities and decisions requiring new investment, restructuring, write-downs or impairment.[5]

The TCFD also includes reference to capital financing, noting that climate-related risks and opportunities may change the profile of an organization's debt and equity structure, either by increasing debt levels to compensate for reduced operating cash flows or for new capital expenditure or research and development.

Moreover, the TCFD framework identifies the business sectors where they see the greatest risk, and in this report, we set out our detailed assessment of risk for each of these in our portfolio based on assessments across our public and private market asset classes.

We have conducted analysis and modeling to provide estimates of the global warming potential in our portfolio, and we assessed the impact of our engagement strategy through Climate Action 100+.

SB 964

SB 964 requires the CalPERS Board to publicly report by January 1, 2020, and every three years thereafter, until January 31, 2035. The report should explain the, "climate-related financial risk of its public market portfolio, including the alignment of the fund with the Paris Agreement and California climate policy goals, and the exposure of the fund to long-term risks."

Our investment approach on climate change is based on the scientific evidence, which shows how GHG emissions contribute to global warming, and where this in turn is having a profound impact on the world's environment. The physical impact brings risks to our funds' assets, with floods, storms, drought, and wildfires. The dramatic changes to the global energy economy also pose transition risk as companies are challenged to adopt new strategies, without leaving their investors with stranded assets, or, in extreme cases, bankruptcy. Additionally, companies are increasingly vulnerable to climate change-related litigation, bringing new risk for investors facing lawsuits and settlement costs.

Climate change also brings opportunity, as the global economy begins to shift away from the energy sources that create GHG emissions. We are finding ways to explore these opportunities through engaging companies that are shifting their strategy into new lines of business in the public markets and through new strategies in the private markets where we are finding investment opportunities that can meet our risk and return goals.

This report explains our investment approach on climate change: to make sure our portfolio is resilient to climate risk; to find the investment opportunities that the energy transition brings; and to bring down emissions that contribute to global warming. It also explains how we work in partnership with others, from international bodies like the United Nations to fellow asset owners around the world.

Executive Summary

This highlights some of CalPERS' major climate-related accomplishments. These accomplishments reinforce the positive progress that we are making on our Sustainable Investing approach.

- **CalPERS has long recognized the scale and multi-faceted nature of climate change,** which poses opportunities and risks to the portfolio. The board adopted and oversees a Total Fund Policy that includes Investment Beliefs,[6] which highlight climate change in long-term value creation and risk mitigation.
- **CalPERS' portfolio is globally diversified** and thereby broadly tracks the global warming potential of the wider real economy. CalPERS used data analysis and modeling to provide different lines of sight into the portfolio risk and opportunity related to climate change. CalPERS' Global Equity portfolio is found to have an implied temperature rise of 2.6 degrees Celsius compared to MSCI ACWI IMI at 2.9 degrees Celsius.
- **CalPERS' Global Equity weighted average carbon intensity has decreased by 30.4%** since our first carbon footprint was conducted in 2015. CalPERS' Global Fixed Income Corporate portfolio has experienced a 51% decrease in weighted average carbon intensity since 2017. Allocation changes within Global Equity and Global Fixed Income Corporate portfolio as well as company decarbonization efforts have driven this intensity reduction.
- **CalPERS completed the first carbon footprint measurement of our Real Estate portfolio that includes Scope 1+2 emissions and initial phases of capturing partial Scope 3 emissions.**
- **CalPERS' Real Estate Energy Optimization Initiative identified 291 opportunities** to make energy efficient capex investments into our portfolio that have the potential to save approximately 53 million kilowatt-hours (kWh) of energy annually.
- **CalPERS conducted an assessment of its exposure to low-carbon and climate solutions investments.** $18.9 billion of our Global Equity portfolio and $1.2 billion of our Global Fixed Income Corporate Credit portfolio is invested in companies designated as Low-Carbon Solutions. More than 37%, or $17.9 billion of the Real Estate portfolio net asset value, is invested in assets that have sustainability certifications. More than 51%, or $4.76 billion of the Infrastructure portfolio net asset value, is invested in renewable energy, energy efficiency infrastructure, sustainability certified, and carbon-neutral assets.[7]

- **CalPERS' work on engagement, advocacy and integration of climate change risk and opportunity is rooted in partnerships.** CalPERS is the convener and co-founder of Climate Action 100+, the world's largest investor engagement initiative with 700 investors representing $68 trillion in assets. CalPERS is also a founding member of the UN-convened Net Zero Asset Owner Alliance, a group of 74 institutional investors committed to accelerating decarbonization in line with limiting global warming to 1.5 degrees Celsius by 2050. In 2021, CalPERS co-founded the ESG Data Convergence Initiative to accelerate the reporting on core ESG metrics including greenhouse gas emissions and renewable energy, on Private Equity assets in collaboration with the industry. Today, the initiative has rallied more than 215 general partners and limited partners, representing about 2,000 portfolio companies. CalPERS also participates on the National Council of Real Estate Investment Fiduciaries (NCREIF) PREA's ESG Think Tank and Reporting Standards Council and contributed to the development of ESG Principles of Reporting for Private Real Estate.
- **CalPERS' advocacy on policy measures can help drive the low-carbon transition** and California's climate policy goals. To meet the goal of limiting global warming, we are working with businesses, government, and regulators to broaden and deepen carbon pricing across energy markets as well as to eliminate public subsidies for fossil fuels. We also support mandatory climate risk reporting to ensure the financial markets have information which is consistent, comparable, and reliable in order to allow pricing of risk and opportunity.

Governance

In this section, we set out how the board oversees our approach on climate change and the role of management in executing the approach.

The Role of the CalPERS Board

The California Constitution (Article XVI, Section 17) details the authority and fiduciary responsibility of the CalPERS Board of Administration. This includes discharging their duties for the exclusive purpose of providing benefits to members and their beneficiaries, minimizing employer contributions and defraying reasonable expenses.

The board comprises 13 members who are elected, appointed or hold office Ex Officio for four-year terms. The board delegates to a series of committees, which provide oversight of investment, pensions and health benefits, finance and audit, performance and compensation, and risk and governance. The board elects its president each year, who in turn appoints board members to committees which nominate their own chair and vice chair. Each committee operates under a formal delegation and policy which sets out their authority. These policies are publicly available online. The board's Investment Committee meets at least quarterly and has specific responsibility in its delegation for oversight of CalPERS' environmental, social and governance program in investments.

Board and committee meetings are held in open session to allow beneficiaries and stakeholders to attend and provide public comment. Closed session discussion is limited to personnel matters and market sensitive financial information.

CalPERS' purpose is set out in its Mission & Vision which are guided by CalPERS' Investment Beliefs, which specifically address climate change in relation to both risk and return when first adopted by the board in 2013. The Investment Beliefs are set out below, demonstrating the detail which is relevant to climate change.

1. Liabilities must influence the asset structure: Ensuring the ability to pay promised benefits by maintaining an adequate funding status is the primary measure of success for CalPERS.
2. A long-time investment horizon is a responsibility and an advantage: A long-time horizon requires that CalPERS consider the impact of its actions on future generations of members and taxpayers; encourage investee companies and external managers to consider the long-term impact of their actions.

3. Investment decisions may reflect wider stakeholder views, provided they are consistent with CalPERS' fiduciary duty to members and beneficiaries: As a public agency, CalPERS has many stakeholders who express opinions on investment strategy or ask CalPERS to engage on an issue. CalPERS preferred means of responding to issues raised by stakeholders is engagement. CalPERS' primary stakeholders are members/beneficiaries, employers and California taxpayers, as these stakeholders bear the economic consequences of CalPERS' investment decisions.
4. Long-term value creation requires effective management of three forms of capital: financial, physical and human: CalPERS may engage investee companies and external managers on their governance and sustainability issues, including: (inter alia) environmental practices, including, but not limited to, climate change and natural resource availability.
5. CalPERS must articulate its investment goals and performance measures and ensure clear accountability for their execution.
6. Strategic asset allocation is the dominant determinant of portfolio risk and return.
7. CalPERS will take risk only where we have a strong belief that we will be rewarded for it: An expectation of a return premium is required to take risk; CalPERS aims to maximize return for the risk taken.
8. Costs matter and need to be effectively managed.
9. Risk to CalPERS is multi-faceted and not fully captured through measures such as volatility or tracking error: (inter alia) as a long-term investor, CalPERS must consider risk factors for example, climate change and natural resource availability that emerge slowly over long time periods, but could have a material impact on company or portfolio returns.
10. Strong processes and teamwork and deep resources are needed to achieve CalPERS goals and objectives.

The board and committee policies are reviewed and approved annually. This includes Governance & Sustainability Principles, which since 2008 have guided CalPERS' engagement with companies including proxy voting, advocacy with policy makers and recognition of best practice initiatives across our partnerships. The Principles specifically address climate change in references to environmental management, carbon pricing, deforestation, aligning political lobbying and compensation, ensuring board climate competence and integrated corporate reporting.

The Role of Management

The board delegates management responsibility to the Chief Executive Officer (CEO). CalPERS' approach on climate change is led by the CEO and includes leadership from the Chief Investment Officer (CIO) and support from CalPERS' Sustainable Investing Program, which is led by a Managing Investment Director who works with Investment Office senior team members.

To ensure coordination across the Total Fund and CalPERS as an Enterprise, asset class leads within sustainability and net zero working groups are supported by Sustainable Investing, Corporate Governance, and Sustainable Research staff on implementing the strategy for both public and private markets. A core responsibility is driving implementation of sustainability and net zero related strategic and business plan initiatives.

Strategy

The goal of CalPERS' approach on climate change is to ensure our portfolio is resilient to risk and positioned for the investment opportunities that the transition to a low-carbon economy bring, in line with our target rate of return.

Figure 1: **CalPERS' Sustainable Investing Approach**

Advocacy	Engagement	Integration and Investment	Partnership
Objective Provide education and influence governmental bodies to take ambitious inclusive action to address climate change and catalyze a low carbon transition.	**Objective** Ensure portfolio companies consider climate risks and pursue opportunities that create value over the long-term.	**Objective** Mitigate climate-related risks and capture opportunities that arise from a transition to a low carbon economy.	**Objective** Utilize aligned investors and organizations to share experiences, pool resources, and amplify our influence throughout financial markets.
Tools & Levers – Comment letters – Meetings with policy makers, regulators and stakeholders – Staff participation on key committees • SEC • CFTC • PCAOB • FASAC • IFRS AC	**Tools & Levers** – Engage corporates, management and boards of directors – Proxy voting – Exempt solicitations – Shareowner Proposals	**Tools & Levers** – Investments: Allocation and security selection – Manager selection and expectations – Investment due diligence and processes – Sustainable Research	**Tools & Levers** – Coalitions – Working groups – CA 100+, Ceres, UN NZ AOA, PRI, ICGN, UN GISD, EDCI, IIAG, NCREIF PREA, and more

Source: CalPERS

CalPERS' approach sets out four areas of focus: Advocacy, Engagement, Integration and Investment, and Partnership. Our approach guides us, and the impact from the actions that we take also help support California's climate policy goals.

Advocacy

As part of our risk management related to climate change, we advocate for policies that can drive the transition to a thriving low-carbon global economy in which we can invest. CalPERS has consistently supported both state, federal and international policy in support of greater disclosure from companies on climate-related financial risks, reduced fossil fuel subsidies, and regulation that prices carbon emissions.

Mandatory Corporate Reporting

CalPERS believes that the voluntary recommendations of the TCFD should be integrated into mandatory corporate reporting, as overseen by the Securities and Exchange Commission (SEC) for the United States and in other markets through standards developed by the International Financial Reporting Standards (IFRS), including the International Sustainability Standards Board (ISSB).

We expect public companies in which we invest to provide integrated representations of operational, financial, environmental, social, and governance performance in terms of both financial statement and non-financial statement results and prospects. We have seen incremental progress on having companies provide voluntary climate-related disclosure, but we note that voluntary efforts fall short of getting the information we desire for investment decision-making or complying with our own reporting requirements.

CalPERS staff have met with the SEC chair and staff several times over the last two years to discuss the climate-related disclosures. Guided by extensive research, we have and continue to advocate for sound public policy and corresponding high-quality standards for mandatory climate risk reporting, which is consistent, comparable, and reliably assured. In 2022, the SEC issued proposed rules for *The Enhancement and Standardization of Climate-Related Disclosures for Investors*, and in June 2022, CalPERS provided a comment letter reflecting on the proposed rules and providing support to the SEC for taking steps forward that CalPERS, and many investors, have called for.

The SEC proposed rules require public companies to provide more extensive climate disclosure in public filings. This includes the requirement to integrate investor-focused climate-related disclosures into the financial reporting process. Integrating the data gathering processes of climate-related information with financial reporting helps investors better understand the full financial implications of climate-related data. We commend the SEC for the proposed rules. This is a giant step in the right direction.

The current trend towards progress in the management of climate risk is promising. For example, climate is included as a key aspect of the 2021 Federal Administration's priorities.[8] The global movement on climate risk management also continues to build, with the International Financial Reporting Standards Foundation's creation of

ISSB being a significant example given the ISSB's quick and clear actions to develop global climate reporting standards. It is also notable that the International Accounting Standards Board (IASB) has issued guidance that promotes the inclusion of relevant climate risk consideration in financial statements. The IASB has also added climate to its research agenda to consider including metrics in the financials, and in 2022, ISSB released draft sustainability and climate change disclosure proposals for public comment, which CalPERS submitted supportive comment letters.

COP26 Glasgow Climate Pact

The UN Climate Change Conference in Glasgow (COP26) brought together 120 world leaders and over 40,000 registered participants in fall 2021 to accelerate action towards the goals of the Paris Agreement and the UN Framework Convention on Climate Change.

Some of the most important outcomes of each COP are the agreements between governments on climate issues. The two-week event concluded with a number of positive outcomes including new goals, pledges, and commitments as shown in the COP26 Announcements and Progress table below.

Figure 2: **COP26 Announcements and Progress**

Announcement	Progress
Country Emissions Goals	New trajectory for 1.8°C to 2.4°C warming down from 3.6°C warming prior to Paris
Climate Finance	Developed nations to fulfill $100 Billion annual climate finance commitment for developing nations. Launch of Glasgow Financial Alliance for Net Zero (GFANZ).
Global Methane Pledge	100+ countries to reduce methane emissions by at least 30%
Global Transition from Coal	40 countries pledged to "phase down" unabated coal generation by 2030 for developed nations and 2040 for developing nations
Declaration on Forests and Land Use	130 countries commit to halt and reverse forest loss and land degradation by 2030
Fossil Fuel Subsidies	Glasgow Climate Pact calls for a phase-out of "inefficient" fossil fuel subsidies
Carbon Price	U.S. and Europe to discuss developing a carbon border tax for high emitting sectors
U.S.-China statement	Both countries have pledged to work together on climate change issues

Source: COP26

CalPERS' staff attended COP26 and participated in the launch of ISSB and partook in keynote speeches and panels alongside government and business leaders that focused on CalPERS work on accounting and audit climate-related practices, the Climate Action 100+ benchmark and the Just Transition.

COP27 in Egypt is just around the corner and will take place in the fall of 2022. The Ukraine and Russian war as well as the energy crises that the world, and in particular Europe, is facing will surely be topics of focus that will hopefully serve as a catalyst for countries to take action now, to develop more energy resiliency, and to invest more in low carbon energy generation assets.

Carbon Pricing

We consider that pricing carbon emissions facilitates the transition to a low-carbon economy through market mechanisms, which is an investor-aligned approach. We support pricing carbon emissions at a meaningful level to effectively drive the transition to a low-carbon economy. In September 2019, the board adopted the following language in our Governance and Sustainability Principles, which guide our advocacy efforts regarding carbon pricing policy:

"Policymakers should establish stable and clear carbon pricing policy that appropriately prices the externalized cost to the economy and society from greenhouse gas emissions. Specifically, carbon pricing should be set at a level, and with the regulatory certainty, that incentivizes the business practices, consumer behavior, and related investment decisions needed to drive the transition to a thriving, low-carbon global economy. Effective carbon pricing policies should decrease emissions and therefore the physical risk to investors' portfolios from climate change.

Additionally, policies should be designed to avoid exacerbating economic inequality and its associated geopolitical risks, and policies should be designed to provide incentives for carbon sequestration, including through natural methods, such as ecosystem protection and restoration."

Calls for Action

CalPERS has supported a number of initiatives which call on world governments to take action toward a low-carbon economy. Ahead of COP26, CalPERS joined more than 700 other investors in a call for governments to end fossil fuel subsidies, phase out coal, and mandate climate risk disclosure. This initiative was through the Investor Agenda which we support that calls on world governments through groups such as the G7 and G20 for implementation of the Paris Agreement and for strengthening country commitments through their Nationally Determined Contributions (NDCs) with the goal of limiting the global temperature rise to well below 2 degrees Celsius and pursuing efforts to limit it to 1.5 degrees above preindustrial levels. CalPERS has also signed on to a recent Investor Agenda statement that will be released publicly prior to COP27.

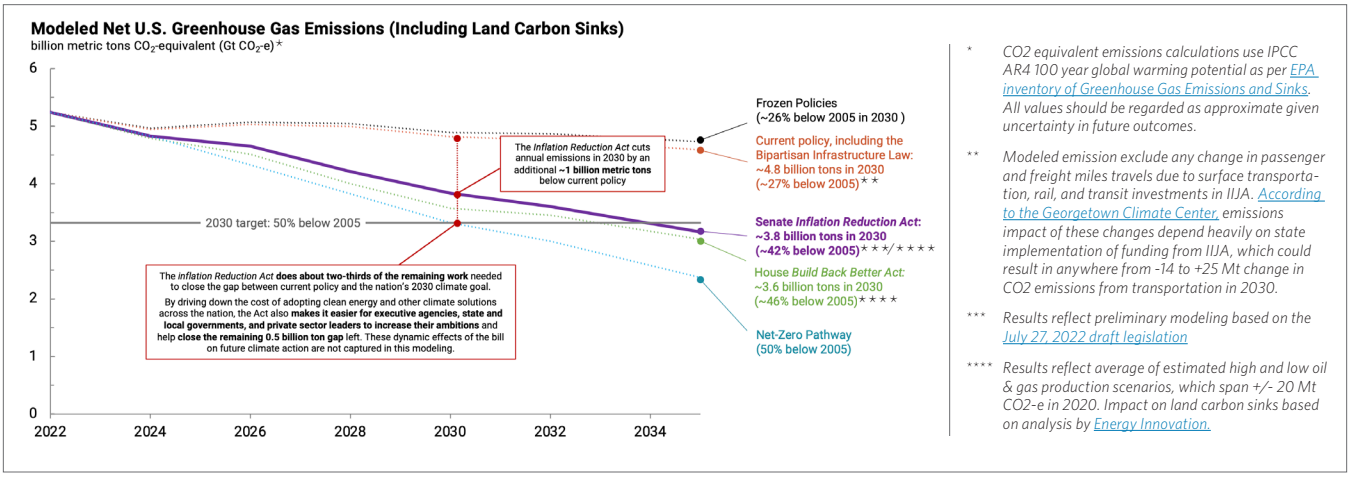
In fall 2021, CalPERS also signed on to an investor statement coordinated by CERES and the Interfaith Center on Corporate Responsibility (ICCR) that supported future U.S. federal methane regulation by the U.S. Environmental Protection Agency (EPA). Methane has more than 80 times the warming power of carbon dioxide over the first 20 years after it reaches the atmosphere and contributes to the climate-related financial risk of CalPERS' portfolio. Going into COP26, the U.S. with 30+ other countries developed the Global Methane Pledge of 30% methane emissions reductions by 2030. The request from the investors' statement were aligned with the Global Methane Pledge. Later that year, the EPA released proposed rules, that according to the EPA, will reduce emissions from covered sources, equipment, and operations by nearly 75%. These proposed rules, for the first time, extended the protections to cover existing oil and gas well sites, as well as strengthening emissions limits for existing facilities.[9]

It is important to note that CalPERS is aligned with the goals of the California Climate Policies such as the Renewable Portfolio Standards Program, the Clean Energy and Pollution Reduction Act, and the Global Warming Solutions Act. CalPERS calls for action and advocacy work to help move towards decreasing emissions and accomplishing California climate goals. Additional research and CalPERS initiatives toward California's climate goals are highlighted later in this report.

Inflation Reduction Act (IRA 2022)

Calls for action have been heard and nothing is clearer than the Inflation Reduction Act which is a historic breakthrough for climate action and transitioning the U.S. to a low-carbon economy. The U.S. will invest nearly $370 billion in renewables, electric vehicles, hydrogen, clean energy equipment manufacturing, home efficiency, and other climate programs. The policy will help drive down energy costs, provide economic opportunity and capacity-building investments in disadvantaged communities, and create good prevailing wage paying jobs.

Figure 3: **Rapid Energy Policy Evaluation and Analysis Toolkit**[10]



Source: Jenkins, J.D., Mayfield, E.N., Farbes, J., Jones, R., Patankar, N., Xu, Q., Schivley, G., "Preliminary Report: The Climate and Energy Impacts of the Inflation Reduction Act of 2022," REPEAT Project, Princeton, NJ, August 2022.

Princeton's Rapid Energy Policy Evaluation and Analysis Toolkit (REPEAT) conducted a preliminary assessment of the impact of the bill to decrease U.S. GHG emissions. The new bill would cut U.S. emissions roughly 42% below 2005 levels by 2030, or by 3.8 billion metric tons of carbon dioxide equivalent. The U.S. 2030 climate target is 50% below 2005 and the U.S., prior to the IRA Act, was projected to decrease emissions by approximately 27%. Importantly, the IRA Act will allow tax-exempt investment funds to receive government credits in an amount equal to the tax benefits that would have been received on certain projects had they not been tax-exempt. This means CalPERS will have an added incentive to invest in certain renewable projects. The IRA Act represents a significant advancement towards transitioning the U.S. to a low-carbon economy.

Thermal Coal Companies Act

In 2015, CalPERS identified the companies in our public asset investment universe as potentially meeting the definition of a "thermal coal company" as specified in California's Public Divestiture of Thermal Coal Companies Act (Act). Following the October 19, 2015, Investment Committee meeting, we prohibited new or additional investments in the identified companies and began engagement activities. In May 2017, the Investment Committee evaluated the outcome of engagement activities undertaken per the requirements of the Act, as well as the investment performance and risk considerations of the identified companies, and implications for the portfolio. All applicable holdings were divested in advance of the July 1, 2017 deadline specified by the Act.

Engagement and Proxy Voting

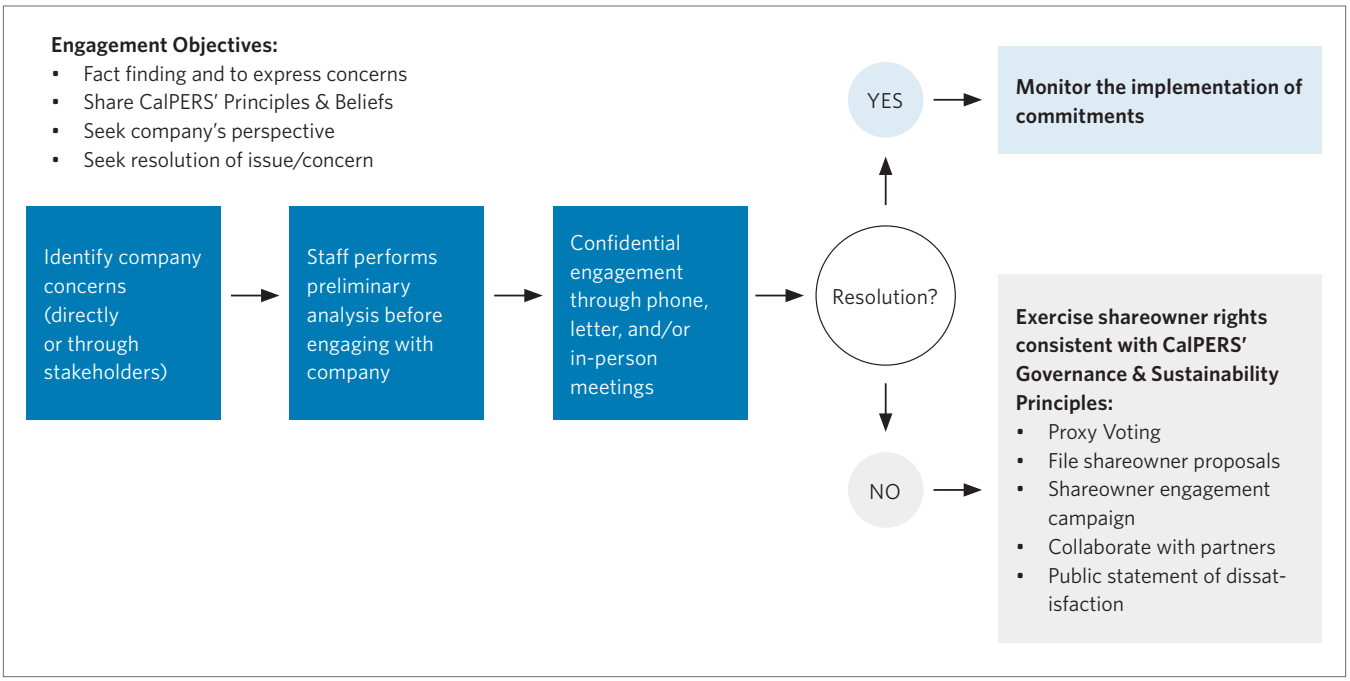
As a provider of financial capital to companies and managers, we utilize engagement to foster alignment with our climate change strategic priorities. We have engaged extensively with the largest emitters of GHGs which we identify as "systemically important carbon emitters." These engagements are intended to drive business action to cut emissions which are causing climate change. Our engagement focus also includes the need to protect and restore the natural carbon sinks which help to absorb those emissions, for example, through our work on deforestation.

Examples of our engagement and proxy voting efforts are provided on the following pages. Our engagement strategy include CalPERS' leadership role in the founding of Climate Action 100+, which is now the world's largest shareowner engagement project with signatories with assets under management totaling $68 trillion. We also use our proxy voting influence to support climate risk reporting, and alignment of corporate lobbying and executive compensation to ensure a just transition among the world's systemically important carbon emitters.

Corporate Engagement and Proxy Voting Process

An effective strategic tool that we use is company engagement. CalPERS exercises its ownership rights to hold boards accountable for their oversight of management strategy. The underlying objective is to ensure these companies are managed to create long-term, sustainable value for shareowners, consistent with CalPERS' fiduciary duty. The process is set out in Figure 4.

Figure 4: **CalPERS' Corporate Engagement Flowchart**



Source: CalPERS

Proxy Voting

CalPERS casts proxy votes at over 5,000 companies' annual general meetings, exercising our shareowner rights to reflect the results of corporate engagement in line with our Governance & Sustainability Principles. We post our votes in advance on our website, with additional information for high profile votes and company-specific shareowner campaigns. During the 2021-22 proxy season, we voted on 148 shareowner proposals across all markets related to environmental, climate, and sustainability topics. We reviewed each of the proposals in consideration of our Principles and assessed whether the proposal could add value to the investment if implemented.

Figure 5**: CalPERS' Proxy Votes on Environmental, Climate, and Sustainability Shareowner Proposals during 2021-22 Proxy Season**

	Votes FOR	Votes AGAINST	Total Votes
Say on Climate	0	7	7
Bioengineering/ Nanotechnology Safety	1	0	1
Climate Lobbying	8	2	10
Environmental Report	11	3	14
Formation of Environmental/Social Committee of the Board	0	3	3
Misc. Energy/Environmental Issues	0	20	20
Report on Antibiotics in Animal Agriculture	2	0	2
Report/Action on Climate Change	24	30	54
Reporting and Reducing Greenhouse Gas Emissions	25	11	36
Sustainability or Environmental Reports	1	0	1
Total	**72**	**76**	**148**
Percentage	**49%**	**51%**	**100%**

Source: CalPERS

In FY 2021-22, in aggregate, we supported 72 of the 148 proposals (49%) and 25 of the 36 proposals (69%) that asked companies to report on and reduce greenhouse gas emissions. CalPERS has consistently supported such proposals over the years, including filing proposals and running proxy solicitations to inform fellow investors on the issue being addressed.

In addition, FY 2021-22 was the first proxy season that CalPERS considered specific climate-related criteria to help inform our votes on board of directors. This was a new policy to hold directors accountable on climate change just as we do with diversity and executive compensation. This resulted in CalPERS voting against 95 directors at 26 Climate Action 100+ companies for not having an adequate net zero 2050 commitment, TCFD disclosure, or board oversight of climate-related risks.

Public Proxy Solicitations and Filing Shareowner Proposals

As the CalPERS corporate engagement flowchart documents, there is a process to escalate engagements. CalPERS files public proxy solicitations to provide information and our view to the financial markets and investors that are voting on specific management or shareowner proposals. These efforts can help make other investors more informed decisions on how they vote their proxy. Over the last three proxy seasons, CalPERS has filed about 20 proxy solicitations with many of the solicitations related to climate-related risks and reporting.

One of CalPERS' most notable proxy solicitations was associated with Exxon Mobil's Annual Meeting in May 2021. At that time, Exxon Mobil was involved in a proxy contest led by Engine No. 1, a long-term value investment firm. The proxy contest involved Engine No. 1 nominating four independent director candidates for election to Exxon's board of directors.

CalPERS was a very early public supporter of Engine No. 1 and its nomination of the four candidates. CalPERS' solicitation urged other investors to vote on the opposition card and support all four of Engine No. 1 nominees. The statement also noted that we believe that additional board refreshment is necessary due to the long-term financial underperformance at Exxon Mobil and the need for a greater depth of skill sets and experience on the board to address the significant challenges the company faces. We also stated that in order to effectively oversee the transition to a low-carbon economy, we believe the board would benefit from additional expertise in both its core business and in renewable energy technologies.

CalPERS' early support for Engine No. 1 candidates and our proxy solicitation gained significant media attention. Ultimately, many other investors also voted in support of Engine No. 1 candidates and three of the four candidates ended up getting elected to Exxon's board.

Furthermore, the Exxon Mobil proxy solicitation also highlighted CalPERS' view that shareowners would benefit from improved disclosure of the company's climate lobbying objectives and how they align with the goal of limiting average global warming to well below 2 degrees and pursuing efforts to limit it to 1.5 degrees (the Paris Climate Agreement's goal). The requested disclosure would also help ensure that the company is transparent in its policy objectives, mitigates against reputational risks, and affirms that company funds were spent in a manner that is consistent with stated objectives.

Over the course of the FYs 2019-20, 2020-21, and 2021-22 proxy seasons, CalPERS filed a total of ten shareowner proposals. These proposals focused on achieving net zero, climate lobbying, climate risk reporting, and emissions disclosure. Of the ten proposals that were filed, the majority were withdrawn by staff after being successfully negotiated with the company. Four of the ten proposals went to a vote, and one of those four passed with a majority shareowner support. This proposal was at BP and was focused on climate risk disclosure and strategy.

CalPERS' Pathway to Climate Action 100+

Recognizing the scale and complexity of the climate change transition, CalPERS convened a new engagement initiative to consider how long-term investors could respond to the risk and opportunities this transition presents. Critical to the work was an extensive analysis of data and modeling which identified that a small fraction of portfolio companies was responsible for the overwhelming majority of greenhouse gas emissions.

The origins of Climate Action 100+ lie in CalPERS' commitment to mapping its carbon footprint. In 2014, CalPERS committed to the PRI Montréal Pledge, as the first U.S. signatory to measure and publicly disclose the carbon footprint of our global equity investment portfolio. After analyzing more than 10,000+ companies within the portfolio at that time, approximately 80 companies were found to be responsible for 50% of the portfolio's Scope 1+2 GHG emissions. The emission trajectory of these systemically important carbon emitters is critical to whether the global economy will meet the goals of the Paris Agreement to limit average global warming to well below 2 degrees Celsius and pursuing efforts to limit it to 1.5 degrees.

CalPERS recognized other global investors were likely to have similar holdings in their portfolios and convened a series of meetings hosted by the French mission to the United Nations. The result was a new partnership between regional and global investor networks (North America, Europe, Australasia, and Asia) to found and launch Climate Action 100+. Companies in Climate Action 100+ include companies from a wide range of sectors: oil and gas, utilities, transportation, metals and mining, construction materials, industrials, chemicals, and food, beverages, and forestry. These companies were identified through CDP's estimates of emissions by Scopes 1, 2, and introduced an important selection assessment through appraisal of Scope 3 emissions.

In addition to the Climate Action 100 an additional group of companies was added reflecting their importance at regional level or importance to the global transition. These companies were dubbed the plus list, hence the moniker "Climate Action 100+" when launched at the One Planet Summit in December 2018. The initiative has since been recognized by the United Nations as one of the private sector initiatives which will drive progress towards meeting the ambition of holding global warming to 1.5 degrees Celsius.

CalPERS plays a leading role in Climate Action 100+. CalPERS served as the inaugural chair and currently serves as a member of the Steering Committee, which sets the strategy for the initiative. CalPERS also co-chairs the Climate Action 100+ Asia Advisory Group which draws together expertise for that region.

Our Corporate Governance team assumed a leading role for 22 of the companies identified for engagement which is the largest number engaged by a single asset owner in the initiative. The responsibilities of the lead investor include meeting in

person with the company's leadership, including senior management and board members to communicate and engage on the Climate Action 100+ goals of governance, greenhouse gas emissions and corporate disclosure, as listed below.

- **Governance:** Implement a strong governance framework for each company that clearly articulates the board's accountability for oversight of climate change risk and opportunities. This includes ensuring that corporate lobbying and executive compensation are aligned with the Paris Agreement to facilitate a low-carbon transition.
- **Greenhouse Gas Emissions:** Take action to reduce greenhouse gas emissions across the value chain, consistent with the Paris Agreement's goal of limiting global average temperature increase to well below 2 degrees Celsius and pursuing efforts to limit it to 1.5 degrees. Notably, this implies the need to move towards net zero emissions by 2050 or sooner.
- **Corporate Disclosure:** Provide enhanced corporate disclosure in line with the TCFD recommendations and, when applicable, sector-specific expectations to enable investors to assess the robustness of a company's strategy against a range of climate change scenarios, including well below 2 degrees, and to improve investment decision-making.

The Climate Action 100+ initiative's latest Progress Update was released in January 2022 and covers the initiative's activity in 2021. The key highlights are:

- Continued growth of the initiative
- Highlighted company commitments from around the world
- Recorded results achieved during a historic proxy season
- Launched the ground-breaking Net Zero Company Benchmark and Global Sector Strategies workstream

In the following sections, we share some of the more recent engagement successes from companies identified in Climate Action 100+.

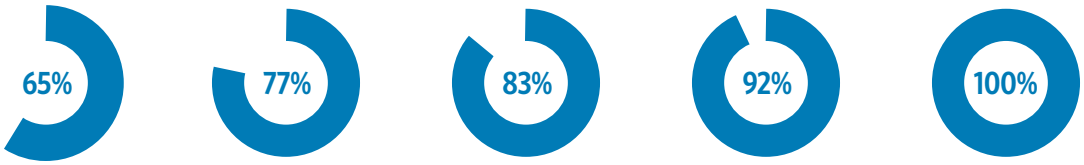
Climate Action 100+ Engagement Results: Energy and Utility Sectors

- **ExxonMobil,** an American multinational oil and gas corporation, announced its ambition to achieve net zero greenhouse gas emissions for operated assets by 2050. The net zero aspiration applies to Scope 1 and Scope 2 greenhouse gas emissions and builds on ExxonMobil's 2030 emission-reduction plans, which include net zero emissions for Permian Basin operations and ongoing investments in lower-emission solutions, including carbon capture and storage, hydrogen and biofuels. Initial steps to achieve net zero by 2050 are included in the company's plans to invest more than $15 billion by 2027 on lower-emission initiatives.

- **Chevron,** an American multinational energy corporation, adopted a 2050 net zero aspiration for equity upstream Scope 1+2 emissions. It announced a number of upstream carbon intensity (UCI) targets which include emission-intensity metrics for oil production, gas production, flaring, and methane. Its UCI 2028 reduction targets include a 40% reduction in carbon intensity per barrel of oil and a 26% reduction in carbon intensity per barrel of oil equivalent for gas. Through its New Energies division, Chevron announced it is launching a carbon capture and storage (CCS) project aimed at reducing the carbon intensity of its operations in San Joaquin Valley, California.
- **Occidental Petroleum,** an American multinational hydrocarbon exploration company, announced a target to reach net zero emissions associated with its operations before 2040 and an ambition to achieve net zero emissions associated with the use of its products by 2050.
- **Duke Energy,** a North Carolina-headquartered electric and gas utility, expanded its net zero by 2050 target to include indirect emissions from the procurement of fossil fuels used for generation, the electricity purchased for its own use, the methane and carbon from production of natural gas, and the carbon emissions from customers' consumption. Duke also committed to exiting coal by 2035 and reducing the amount of power the company produces from coal to just 5% of generation by 2030.
- **Phillips 66,** the Texas-headquartered multinational energy company, announced plans to reduce the greenhouse gas emissions intensity from its operations and energy products by 2030. It aims to reduce Scope 1+2 emissions intensity from operations by 30% and Scope 3 emissions intensity of its energy products by 15%, below 2019 levels. Phillips 66 is the first U.S. refiner and only the second U.S. oil company to set emissions reduction targets that include Scope 3.
- **Enel,** headquartered in Italy, became the first utility to commit to an exit from natural gas generation by 2040. It has set an absolute net zero emissions target for 2040, which it will achieve through producing energy exclusively from renewables and not relying on any offsets or negative emissions removal technologies.
- **KEPCO,** the largest electric utility in South Korea, and its six subsidiaries have committed to carbon neutrality and a complete phase out of coal by 2050, following the development of national plans by the South Korean Presidential Committee on Carbon Neutrality.
- **Sinopec,** one of the largest national oil companies in China, has committed to achieving carbon neutrality by 2050, 10 years ahead of the China's initial national decarbonization target of 2060. The company is also aiming to peak its emissions prior to the national timeline of 2030 and pivoting the business towards hydrogen and biofuels in the long run.
- **Xcel Energy,** a U.S. based utility company, expanded its greenhouse gas reduction target to deliver net zero greenhouse gas emissions from its natural gas business by 2050. It makes Xcel Energy one of the first North American Climate Action 100+ electric power focus companies to set a comprehensive Scope 3 GHG target.

- **NextEra Energy** is the first company in history committed to moving past net zero all the way to Real Zero, leveraging low-cost renewables to drive energy affordability for customers. While for most companies, net zero means reducing carbon emissions and acquiring traditional offsets or credits, NextEra Energy's commitment for Real Zero by 2045, which does not rely on offsets, is to completely eliminate carbon emissions from its operations. NextEra's plan is to leverage low-cost renewables to drive energy affordability for customers and would involve increasing the use of battery storage, continuing the use of nuclear power and bringing in green hydrogen for electricity generation.

Figure 6: **NextEra Energy Decarbonization Milestones with Projected Generation (GWh) by Fuel Type through 2045**[11]



2025	2030	2035	2040	2045
Renewables and Storage 46%	Renewables and Storage 62%	Renewables and Storage 71%	Renewables and Storage 80%	Renewables and Storage 89%
Nuclear 19%	Nuclear 15%	Nuclear 12%	Nuclear 12%	Nuclear 11%
Fossil Fuels 35%	Fossil Fuels 23%	Fossil Fuels 17%	Fossil Fuels 8%	Renewable Natural Gas <1%

Source: NextEra

Note: NextEra plans to build 16 GW of green hydrogen. Their generation model treats hydrogen as a storage. As such, it is not represented in their generation mix.

Climate Action 100+ Engagement Results: Industrials and Materials Sectors

- **Boral,** Australia's largest construction materials and building products supplier, has set a Science Based Targets initiative (SBTi) verified absolute target to reduce Scope 1+2 emissions by 46% by 2030, making it the first company in the cement sector to set targets aligned with 1.5 degrees Celsius for Scope 1+2 emissions. Boral has additionally set a Scope 3 emissions intensity reduction target of 22% per ton of cementitious materials produced by 2030.

- **LyondellBasell,** one of the world's largest plastics, chemicals and refining companies, announced its ambition to achieve net zero emissions from its global operations by 2050, and to achieve an absolute reduction of 30% in Scope 1+2 emissions by 2030.
- **Rolls-Royce,** a leading FTSE100 aerospace and defense company, mapped out detailed decarbonization plans, with clearer short- and medium-term targets. It committed to making all its civil aero-engines compatible with 100% Sustainable Aviation Fuel (SAF) by 2023 and embed this target into its executive remuneration policy.
- **Rio Tinto,** the world's second-largest metals and mining corporation, has more than tripled its medium-term 2030 target, setting a new target to reduce absolute Scope 1+2 emissions by 50% by 2030.
- **Sasol,** the global integrated fuels and chemicals company and fifth largest company in South Africa, committed to net zero emissions by 2050. Sasol also strengthened a previous 2030 Scope 1+2 emissions reduction target from 10% to 30% and established a new target to reduce Scope 3 emissions from the company's energy business, aiming for a 20% reduction by 2030.

Climate Action 100+ Engagement Results: Agriculture, Food, and Forestry Sector

- **ADM, Amaggi, Bunge, Cargill, Golden Agri-Resources, JBS, Louis Dreyfus Company, Olam, Wilmar and Viterra:** Ten of the world's biggest global agricultural trading and processing companies issued a joint statement committing to a sectoral roadmap by COP27 for enhanced supply chain action consistent with a 1.5 degrees Celsius pathway. The statement signals a commitment to take urgent collective action to include other key stakeholders in their supply chains. The goal is to identify solutions at scale to further progress on eliminating commodity-driven deforestation and reducing GHG.

Climate Action 100+ Engagement Results: Transportation Sector

- **Ford Motor Company, General Motors, and PACCAR,** three of the major North American automobile and truck manufacturers, each set medium-term SBTi verified targets which include Scopes 1, 2, and 3. Both Ford's and General Motors' Scope 1+2 emissions targets are aligned with 1.5 degrees Celsius.
- **Nissan Motors,** a Japanese multinational automobile manufacturer, has set goals to achieve carbon neutrality across the company's operations and the life cycle of its products by 2050, investing $17.6 billion over the next five years to speed up electrification of its products. The company also aims to have 100% of all new vehicle offerings in key markets to be electrified by the early 2030s, which will comprise a 50% electrification mix by 2030.

Note on Other Sectors

We also continue to engage companies where climate risk issues arise, beyond the Climate Action 100+ initiative and the sectors that engagement result examples were provided. The banks and financial services sector's role in financing assets at risk from transition to the low-carbon economy, as well as financing climate solutions has been quite important. CalPERS does see this as a relevant part of our portfolio for us to monitor for climate risks. An example of our work in this area is our contribution to the review of the Equator Principles' risk framework requirements for physical and transition risk analysis by global financial institutions. We will continue to engage financial sector companies on their climate-related underwriting practices and considerations of risks and opportunities.

Climate Action 100+ Net Zero Company Benchmark

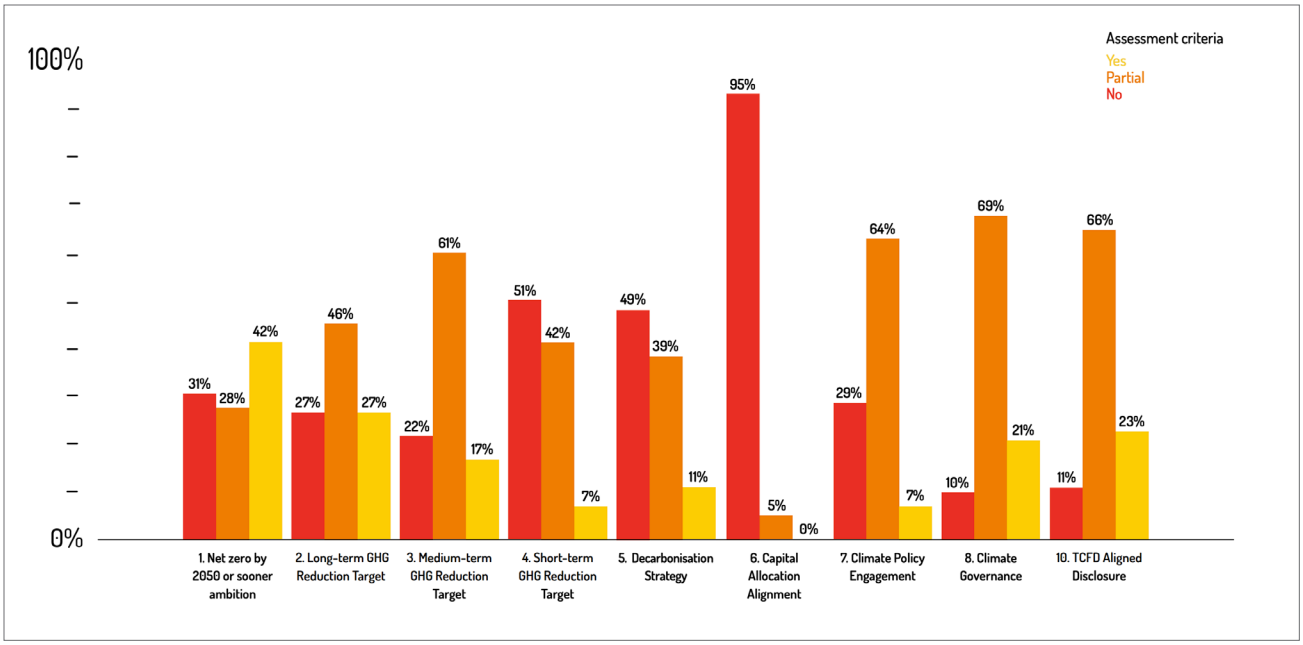
The Climate Action 100+ Net Zero Company Benchmark launched in March 2021 ahead of the U.S. and European proxy seasons. The Benchmark provides an objective way of measuring company progress against the initiative's three high-level goals: emissions reduction, governance, and disclosure. The Benchmark framework is the foundation for company engagement coordinated through the initiative and the assessments have become a widely cited demonstration of the progress companies are making in aligning their businesses to a net zero future.

The Climate Action 100+ Net Zero Company Benchmark assessment that was released in March 2022, found that:

- 69% of focus companies have now committed to achieve net zero emissions by 2050 or sooner across all or some of their emissions footprint
- 90% of focus companies have some level of board oversight of climate change
- 89% of focus companies have aligned with TCFD recommendations either by supporting the TCFD principles or by employing climate-scenario planning

Figure 7 showcases a summary of the 2022 Climate Action 100+ Net Zero Company Benchmark assessment results. Though the progress should be recognized, the majority of companies have not set medium-term emissions reduction targets aligned with 1.5 degrees Celsius or fully aligned their future capital expenditures with the goals of the Paris Agreement, despite the increase in net zero commitments. These will continue to be focus areas for CalPERS and the 700 other investors participating in the Climate Action 100+ engagements.

Figure 7: **Summary 2022 Company Disclosure Assessment Results by Indicator**



Source: Climate Action 100+

Note: The percentages relate to 166 focus companies assessed for the March 2022 benchmark. Companies scored 'Partial' if they received a 'Yes' for at least one, but not all, of the Metric comprising each Indicator.[12]

Integration and Investment

Integration ensures consideration of relevant sustainability factors in the investment decision-making process across CalPERS' total fund and includes assessing and managing transition risks in the shift to a low-carbon economy, and physical risks associated with the effects of climate change. Based on our investment policy and procedures, environmental, social, and governance (ESG) sources of financially material risks and opportunities should be considered in support of conducting thorough investment analysis to improve long-term financial performance. At CalPERS, the Sustainable Investing and Total Fund Portfolio Management Research units actively collaborate to support the integration of relevant ESG topics into investment decision-making processes across asset classes by exploring, monitoring, understanding, and communicating new research and information on ESG topics arising from academia, industry, and from Investment Office staff.

Asset Class Considerations

CalPERS primarily invests across four asset classes – Global Equity, Global Fixed Income, Real Assets, and Private Equity – through a combination of internal, external, active and index-driven management strategies. Nearly three-quarters of the total fund is invested in public markets.

Risk management is paramount at CalPERS. It is both centralized, supporting a Total Fund-level aggregated view of risk, and decentralized, capturing asset-class and investment strategy-specific risk attributes. CalPERS thrives to integrate considerations of climate risk and opportunities at all levels of portfolio monitoring and management, and across all strategies, internal or external, active or index-like.

Fundamental Analysis

Fixed Income assets are largely managed internally using internal fundamental analysis of securities. Real Assets and Private Equity are fundamentally managed but rely more upon the fundamental analysis conducted by external managers. In these asset classes, CalPERS typically retains some level of discretion regarding the security or asset selection; a level of discretion that will vary depending on strategies and investment vehicles (co-investments, separate accounts, or joint vehicles). Where possible, we use data and tools to understand our exposures to the low-carbon transition and/or physical risks expected during the time horizon of the investment and assess to what extent identified risks are priced in. This helps our staff and external managers make more informed investment decisions.

Index Orientation

CalPERS' exposure to our Global Equity asset class is largely driven by internally managed index driven strategies. In this case, levers for managing climate risk are benchmark selection and engagement with index constituting companies. The integration of climate risks and opportunities in internally-generated capital market assumptions for our strategic public equity benchmarks, a critical input to our Strategic Asset Allocation process, is an active and promising research workstream at CalPERS. In approaching this benchmark research, we acknowledge:

1. The complexity in measuring transition and physical risks and opportunities (and the evolving nature of the data and tools available to measure climate risk).
2. The uncertainty around horizons at which climate risks are likely to be expressed.
3. The dynamic aspect of corporate and government commitments and actions.

Real Assets Integration

CalPERS makes use of a range of asset class specific reporting frameworks such as the Global Real Estate Sustainability Benchmark for both real estate and infrastructure. We have also begun using tools to help us evaluate how our real estate portfolio assets may be financially impacted by weather variables related to climate such as temperature changes (extreme heat, and extreme cold), tropical cyclones, and flooding (coastal and fluvial).

Given the increasing interest by corporate tenants in reducing the carbon footprint of their operations both to meet the expectations of investors such as CalPERS and of the corporate tenant staff desiring to work in sustainable buildings, we see our real estate managers' efforts on sustainability as important to value preservation and value creation in our real estate holdings.

Where Real Assets staff has discretion regarding new asset investments, staff employs an ESG Consideration Matrix tool during due diligence to ensure that ESG factors are systematically considered. In addition, where possible, the ESG factor analyses are quantified and incorporated within the financial models for value and risk assessment. Findings and conclusions from use of the ESG Consideration Matrix and financial model analyses are then communicated to the Real Assets Investments Committee for investment decision making. The majority of real estate investments use separate account investment vehicles while infrastructure investments use more of a mix of commingled funds, co-investments and separate accounts. CalPERS' strong governance has enabled us to effectively integrate ESG considerations into decision making. Additional information on Real Assets integration can be found in its Sustainable Investment Practice Guidelines.

Real Estate Energy Optimization Initiative

CalPERS established the Real Estate Energy Optimization Initiative, which is focused on energy use in CalPERS' owned buildings, including tenants' energy use.

The purpose of the Energy Optimization (EO) Initiative which was formalized July 1, 2019, is to enable the systematic identification, implementation, and tracking of economically attractive energy-related opportunities in the CalPERS real estate portfolio. The initiative further seeks to reduce carbon intensity, helping mitigate the systemic risk of climate change to the real estate portfolio, and more broadly to CalPERS' Total Fund, while enhancing returns and the long-term value of CalPERS' investments through capturing energy cost savings and improving the attractiveness of the assets to tenants. Additionally, the initiative seeks to facilitate transitioning the CalPERS' portfolio toward carbon neutrality where accretive to performance. The initiative will apply to domestic separate account partnerships and other external managers where appropriate. Where the initiative does not apply, we encourage all of CalPERS' Real Estate managers to pursue the spirit of the EO Initiative by looking for attractive opportunities to optimize the energy used by their real estate assets.

Since the initiative began, Real Estate managers identified 291 opportunities to make energy efficient capex investments which have the potential to save approximately 53 million kWh of energy annually across the Real Estate portfolio.

Figure 8 shows three examples of projects that have been pursued within the CalPERS' Real Estate Energy Optimization Initiative.

Figure 8: **Common Wealth Fifth Street Properties**[13]

 **Lighting Retrofit (LA)**	 **Chiller Replacement (SF)**	 **Solar Installation (Boston)**
– Nearly 2,000 lighting fixtures are being retrofit with LEDs. – Over 1,500,000 kWh of electricity will be saved annually. – Payback from tenants under 3 years.	– A chiller will be replaced in Q2 that allows for a "Free Cooling" Cycle. – Over 500,000 kWh of electricity will be saved annually. – Payback estimated at less than 7 years.	– A rooftop solar installation is being contemplated to reduce utility consumption. – Up to 108,000 kWh of potential production. – Solar is becoming more economically viable on low and mid-rise buildings.

Source: Common Wealth Fifth Street Properties

Private Equity Integration

CalPERS' Private Equity portfolio is largely managed through commingled funds. As such, our approach to understanding our Private Equity portfolio's climate change risks involved internal analysis based on sectoral and portfolio company-specific information. When analyzing information provided by our Private Equity general partners, CalPERS' staff realized that the private equity industry lacks standardized and performance based ESG data from private companies, despite the proliferation of ESG frameworks and ratings providers. Staff determined that existing frameworks faced the following challenges:

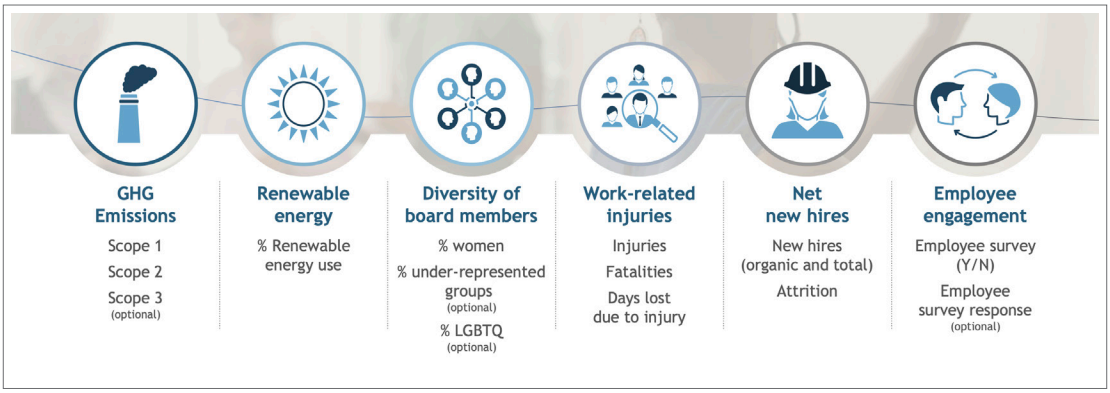
- Lack of critical mass, preventing comparisons across metrics and burdening companies and general partners with a dizzying amount of customized ESG template requests
- Different use cases/stakeholders supporting each framework
- Tension between materiality by industry/company versus. broader industry
- Low disclosure rates and data quality for the performance data that does exist
- High sophistication of frameworks (100+ definition booklets) making it impractical for privately held companies with few resources to implement

ESG Data Convergence Initiative

Through this determination, CalPERS' Private Equity staff partnered with Carlyle Group in 2021 to develop the ESG Data Convergence Initiative. The initiative streamlines the private investment industry's historically fragmented approach to collecting and reporting ESG data in order to create a critical mass of meaningful, performance based, comparable ESG data from private companies. This allows private equity general partners and portfolio companies to benchmark their current position and generate progress toward ESG improvements while enabling greater transparency and more comparable portfolio information for limited partners.

The private equity industry's response to the ESG Data Convergence Initiative has been extremely positive. As of fall 2022, there are more than 215 general partners (private equity external managers such as Carlyle) and limited partners (asset owners and others such as CalPERS) that have signed on to the initiative. The initiative's participating firms, representing about 2,000 portfolio companies, have agreed to report on a core set of ESG metrics across six categories that are drawn from existing frameworks. The categories include greenhouse gas emissions, renewable energy, board diversity, work-related injuries, net new hires, and employee engagement.

Figure 9: **CalPERS ESG Data Convergence Initiative Metrics**[14]



Source: CalPERS

The greenhouse gas emissions and renewable energy metrics will play an important role toward CalPERS' Sustainable Investing approach and towards society decarbonizing due to the meaningful transformational function that the private equity industry plays in the economy. Prior to this initiative, many private equity companies where not tracking their emissions or renewable energy use. Tracking these metrics acts as a catalyst to begin to better manage each and ultimately to increase the use of renewable energy and to reduce emissions. The data will be shared directly with initiative's participants and aggregated into an anonymized benchmark by Boston Consulting Group (BCG), which is supporting the overall effort.

CalPERS Goals

Our goal is to promote data that is: (i) quantifiable, (ii) comparable across companies, managers and industries, (iii) longitudinal (trackable over time), (iv) easy and transparent to report on, and (v) serves as a common foundation between stakeholders at various points of their ESG journeys, bringing small and big players together. We believe this type of data will bring greater clarity to the ESG performance of companies which will allow the industry to make better investment decisions and, most importantly, create value during the hold period. We believe this approach will also reduce the reporting burden on portfolio companies and general partners, who currently receive multiple ESG requests.

Investment

CalPERS has a long history of allocating capital to sustainable investments including low-carbon and climate solutions investments. After reviewing multiple tools, taxonomies, and frameworks, we decided to use MSCI's Low-Carbon Transition Risk framework to assess our exposure to 'climate solutions' in our public market asset classes. In this framework, climate solution companies are those exhibiting the greatest potential to benefit from the growth in demand for low-carbon footprint products and services supporting the decarbonization of the global economy. Examples of these types of investments would include, but are not limited to renewable electricity, electric vehicles, and solar cell manufacturers. For our private market asset classes, we referenced the green project categories from the Green Bond Principles to assess our exposure to low-carbon and climate solutions investments. Examples of these include renewable energy, energy efficiency, clean transportation, green buildings, and circular economy adapted products, production technologies and processes. Exposure to sustainability certified and carbon-neutral assets, including those that have carbon neutral operations, are also included in our methodology. Exposure for each of the asset classes is as December 31, 2021.

Global Equity Low-Carbon and Climate Solutions Investments

Using MSCI Low-Carbon Transition Risk assessment, we found that 7.8% or $18.9 billion of our Global Equity portfolio is invested in companies designated as Low-Carbon Solutions.

Global Fixed Income Low-Carbon and Climate Solutions Investments

Using MSCI Low-Carbon Transition Risk assessment, we found that 2.8% or $1.2 billion of our Global Fixed Income Corporate Credit portfolio is invested in companies designated as Low-Carbon Solutions.

CalPERS also has $498 million invested in corporate Green Bonds, Sustainability, and Sustainability-linked Bonds. The majority, $287 million, is invested in Green Bonds. Green Bonds are similar to traditional bonds in their structure but differ

in that the capital raised is earmarked for climate and environmental projects. CalPERS also holds $241 million invested in sovereign Green Bonds, Sustainability, and Sustainability-linked Bonds.

An example of one of the Green Bonds that CalPERS is invested in is with Public Service Electric & Gas (PSE&G), a diversified utility and energy company and New Jersey's largest provider of electric and natural gas service.

CalPERS Green Bond Investment Example

PSE&G will use the proceeds for one or more the following project categories:

1. **Renewable Energy** (Investments in wind and solar energy production, energy storage, and associated transmission and distribution projects).
2. **Energy Efficiency and Advanced Metering Infrastructure** (Investments in smart electric meters and digital technologies intended to promote improved customer energy efficiency).
3. **Climate Change Adaptation** (Investments in electric transmission and distribution infrastructure designed to make the system more resilient to climate change-related weather impacts).

Real Assets Low-Carbon and Climate Solutions Investments

- **Real Estate:** More than 37%, or $17.9 billion of the Real Estate portfolio net asset value, is invested in assets that have sustainability certifications. Examples of sustainability-related certifications include Leadership in Energy & Environmental Design (LEED), Building Owners and Managers Association (BOMA), and Energy Star.
- **Infrastructure:** More than 51%, or $4.76 billion of the Infrastructure portfolio net asset value, is invested in renewable energy, energy efficiency infrastructure, sustainability certified, and carbon-neutral assets.[15] Examples of these investments include interests in wind and solar farms.
- **Wind Farms:** CalPERS has invested in the Rocky Caney Wind portfolio, which holds two wind farms, the Caney River facility in Elk County, Kansas, and the Rocky Ridge facility in Kiowa and Washita Counties, Oklahoma.[16] Caney River is a 200-megawatt (MW) facility that began commercial operations in late 2011, selling all of its output to the Tennessee Valley Authority. Rocky Ridge is a 149 MW facility that began commercial operations in early 2012, selling its output to Western Farmers Electric Cooperative. Both facilities sell their output under long-term contracts.

Figure 10: **Solar Farms, Harbert Management Corporation**[17]

Source: Harbert Management Corporation

CalPERS has an interest in Desert Sunlight which owns two solar photovoltaic power generation facilities totaling 550 MWs located 60 miles east of Palm Springs, in eastern Riverside County, CA. The two facilities began commercial operations in late 2014, selling all of their output to California power utilities under long-term contracts.

Partnerships

Partnerships allow CalPERS to share insight and pool resources with fellow investors with shared objectives. Three examples of partnerships and initiatives that CalPERS co-founded or were founding members of are:

Climate Action 100+

CalPERS convened and co-founded Climate Action 100+ in order to scale up engagement with the world's largest greenhouse gas emitters to take necessary action on climate change. This investor-led initiative is represented by 700 investors with $68 trillion in assets and is engaging 166 companies.

ESG Data Convergence Initiative

CalPERS co-founded the ESG Data Convergence Initiative in 2021. The initiative, representing 215 general and limited partners, and more than 2,000 portfolio companies, streamlines the private investment industry's historically fragmented approach to collecting and reporting ESG data in order to create a critical mass of meaningful, performance based, comparable ESG data from private companies.

UN-convened Net-Zero Asset Owner Alliance

CalPERS was a founding member of the UN-convened Net Zero Asset Owner Alliance. The alliance is a group of 74 institutional investors with $10.6 trillion in asset under management that is committed to accelerating decarbonization in line with limiting global warming to 1.5 degrees Celsius (°C) by 2050. More information on this partnership is available in the Metrics and Targets section of this report.

We also work closely through membership of a number of organizations such as Ceres, Principles for Responsible Investment (PRI), Asia Investor Group on Climate Change (AIGCC), Institutional Investors Group on Climate Change (IIGCC), Transition Pathway Initiative (TPI), United Nations Global Investors for Sustainable Development, and the Vatican Dialogue on the Energy Transition.

Likewise, we use our positions on the advisory boards of regulators to argue for mandatory climate risk reporting. These include the Investor Advisory Committee to the SEC, the Investor Advisory Group to the Public Company Accounting Oversight Board (PCAOB), the Financial Accounting Standards Advisory Committee (FASAC), the Commodities and Futures Trading Commission (CFTC) Market Risk Advisory Committee (MRAC) and the special subcommittee on climate change-related risk, plus the International Financial Reporting Standards (IFRS) Advisory Council, where we represent the Council of Institutional Investors (CII).

We also participate in the ISSB Investor Advisory Group (IIAG), formerly the SASB Investor Advisory Group, to improve the quality and comparability of sustainability-related disclosure to investors as well as the NCREIF Pension Real Estate Association's (PREA) ESG Think Tank and Reporting Standards Council where we contributed to the development of ESG Principles of Reporting for Private Real Estate.

California Climate Policy Goals

California has long been a leader in developing climate policy goals that have shown to be effective in mitigating the risk of climate change. As the largest pension system in the United States, CalPERS has used its influence to advocate for climate-related policy and to engage portfolio companies that have aligned to our long-term interest and to California climate policy goals.

California is a pioneer in climate policy solutions that have influenced a number of climate-related policies and regulations in other states. California instituted America's first tailpipe emissions standards for cars, created the country's first economy-wide market, and adopted one of the first renewable electricity standards. As the world's fifth-largest economy (2022), California's climate policy has had a profound effect on decarbonizing the economy and has served as a catalyst for investments and job creation.

Three focuses of California's climate policy goals have been reducing greenhouse gas emissions, increasing renewable energy procurement, and increasing zero-emission transportation.

Reducing Greenhouse Gas Emissions

California policy requires it to reduce its overall greenhouse gas emissions to 1990 levels by 2020 and to 40% below 1990 levels by 2030. This policy also includes appointing California Air Resource Board (CARB) to develop policies, including the state's cap-and-trade program, to achieve this goal.

In 2016, California's greenhouse gas emissions dropped 2.7% to about 430 million metric tons, according to CARB.[18] That's just below the 431 million metric tons produced in 1990 and put California four years ahead of its 2020 goal to reduce its overall greenhouse gas emissions to 1990 levels. The next hurdle will be for California to continue to make progress toward reducing statewide GHG emissions to 40% below the 1990 level by 2030.

CalPERS leadership and participation on a number of initiatives is aligned to reducing greenhouse gas emissions. The Engagement and Proxy Voting section of this report highlights our role in co-founding Climate Action 100+ and the progress that companies have made to decarbonize. The Climate Action 100+ 2021 progress update report that was released in 2022 showed that 52% of the 160 plus companies that are being engaged have established net zero commitment.

Related to California's cap-and-trade program, we highlight CalPERS support for a price on carbon in the Advocacy section of this report and the increasing number of markets that have a price on carbon in the Risk Management section of the report. California's cap-and-trade program covers GHG sources responsible for approximately 85% of the state's emissions.[19] This amounts to around 450 entities across the electricity generation, large industrial, and fuel supply industries.[20] A number of these entities are being engaged by CalPERS and other investors through Climate Action 100+.

Increasing Renewable Energy Procurement

California also has legislation requiring the state to procure 60% of all electricity from renewable sources by 2030 and 100% from carbon-free sources by 2045; double the energy efficiency of existing buildings; and allow greater electric utility investment in electric vehicle charging infrastructure.[21]

On Sunday April 3, 2022 at 3:39 p.m., a new record was set when California's electric grid ran on more than 97% renewable energy.[22] Though this was temporary, it was nonetheless an accomplishment that demonstrates the progress that is being made towards achieving California's renewable and carbon-free energy.

Though this progress should be applauded, California will face headwinds as renewable energy represents a larger percentage of generation throughout the day. Power production during July 15, 2022 shows the imbalance between peak demand and renewable energy production. Total demand was about the same at 4:30 p.m. and at 7:30 p.m., but solar generation began to drop towards the later

hours and demand net of wind and solar increased approximately 30%. Plotting this data provides a visualization which has become known as the "duck curve" due to the resemblance of a duck's profile, and demonstrates the significant gap that wind and solar leaves during certain parts of the day.[23]

Figure 11: **California Summer Maximum On-Peak Available Capacity by Type**

Year	Gas	Geothermal	Nuclear	Hydro	Wind	Solar	Demand response	Battery
2017	61.1%	2.0%	4.3%	14.2%	2.5%	13.7%	—	0.1%
2018	57.9%	1.9%	4.4%	15.1%	2.8%	15.8%	—	0.3%
2019	56.4%	2.0%	4.4%	14.2%	2.9%	15.8%	2.2%	0.3%
2020	60.2%	2.4%	4.7%	16.3%	3.0%	9.0%	1.9%	0.7%
2021	57.4%	2.1%	4.5%	14.3%	3.4%	10.6%	2.3%	2.8%
2022	**55.8%**	**2.2%**	**4.5%**	**13.3%**	**2.7%**	**10.9%**	**2.2%**	**6.0%**

Source: California Independent System Operator

Note: Omits pumped hydro, biomass, and coal (2.3% of total in 2022)

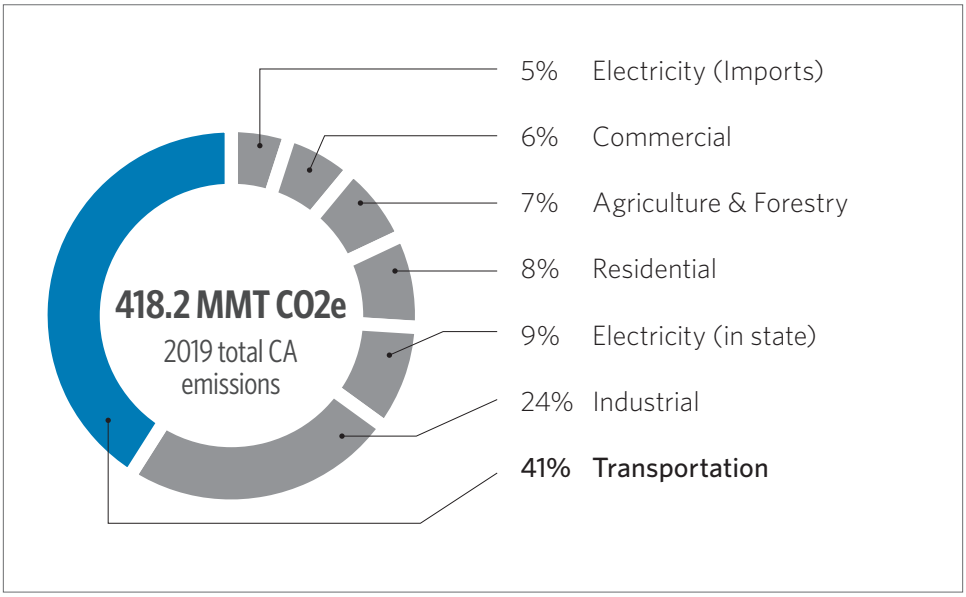
To combat the issues that are visible through the duck curve, continued build out of renewable and battery capacity has been needed. The graphic above notes the significant changes in battery capacity over the last several years. Batteries now represent 6% of California's summer maximum on-peak available capacity. This represents a larger percentage of total capacity than wind or even nuclear.

CalPERS seeks to invest in low-carbon assets and climate solutions that are consistent with our return objectives. For example, more than 51%, or $4.76 billion of CalPERS' Infrastructure portfolio net asset value is invested in renewable energy, energy efficiency infrastructure, sustainability certified, and carbon-neutral assets.[24] Additionally, the 291 opportunities to make energy efficient capex investments through CalPERS' Energy Optimization Program for our Real Estate portfolio is highlighted in the Strategy section of this report.

Increasing Zero-Emission Transportation

In 2020, California Governor Newsom issued an executive order that by 2035, all new cars and passenger trucks sold in California will be required to be zero-emission vehicles.[25] The California Air Resources Board will develop regulations to mandate that 100% of in-state sales of new passenger cars and trucks are zero-emission by 2035.

Figure 12: **California Air Resources Board, GHG Inventory Graphs**[26]



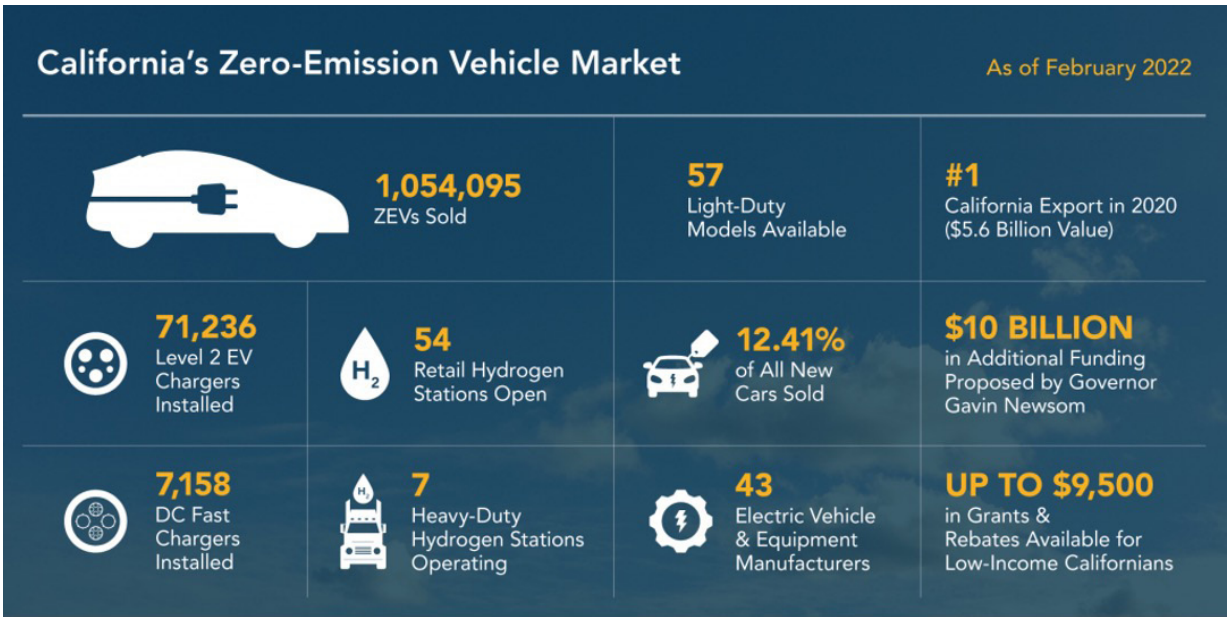
Source: California Air Resources Board

As shown in the California Air Resources Board graphic (Figure 12), transportation is the largest contributor to greenhouse gas emission in California, representing 41% of total emissions. Governor Newsom's executive order is significant as this target could achieve more than a 35% reduction in greenhouse gas emissions from cars statewide. The Air Resources Board will also develop regulations to mandate that all operations of medium- and heavy-duty vehicles shall be 100% zero emission by 2045 where feasible.

CalPERS has strongly advocated for the transition to electric and zero-emission vehicles. Staff have engaged multiple major automobile manufacturers to better understand each manufacturers strategy to build out electric and zero-emission vehicles. CalPERS has also engaged companies to publicly support California's authority to set new Clean Air Act vehicle emissions standards. Several automobile manufacturers such as Ford and GM have since came out in support of California.

As shown in the Risk Management section of this report, electric vehicles are one of few critical energy technologies and sectors that are on a successful pathway to net zero by 2050. Bloomberg has reported that the U.S. has recently passed a critical electric vehicle tipping point: 5% of new cars sold are powered by electricity only.[27] This 5% threshold is so critical because it is the point that early adopters are overtaken by mainstream demand and that a rapid acceleration typically ensues once this threshold has been met.

Figure 13: **California's Zero-Emission Vehicle Market**[28]



Source: California Air Resources Board

California has once again demonstrated its leadership. As of February 2022, 12.41% of all new cars sold were zero-emission vehicles. And with only 10% of the nation's cars, California now accounts for over 40% of all zero-emission cars in the country.

Risk Management

This section of the report describes how CalPERS' considers exposure to both short- and long-term risks of climate change.

We highlight our assessment of transition and physical climate-related financial risks and also provide our analysis of our alignment with the Paris Agreement based on our portfolios' implied temperature rise. Lastly, we highlight some of the climate-related research that we continuously assess.

Transition and Physical Climate-Related Financial Risk

Following TCFD's recommendations, we distinguish two main categories of climate-related risks:

1. Risks related to the transition to a lower-carbon economy
2. Risks related to the physical impacts of climate change

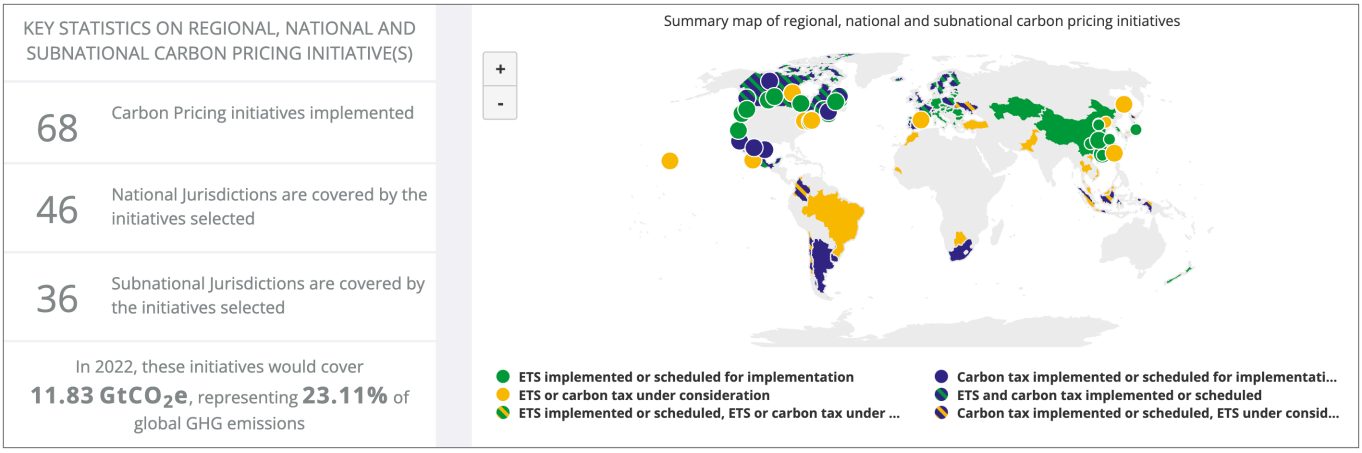
Transition Risks

Transition risks are shifts in the market, policies and technologies that can affect the financial success of existing business models and industries. Our portfolio companies' performance depends to various degrees on how successfully they can navigate the transition brought by climate change. These include indirect risks, such as disruptions that threaten global policy momentum to address climate change. Transition risks include litigation such as third-party and class action claims against public companies as well as direct action(s) by shareowners against companies relating to damages directly or indirectly stemming from climate change. These claims, while difficult to quantify, have the potential to significantly impact share price, company goodwill, and valuation.

Transition Risk Deep Dive: The World Bank's Carbon Pricing Dashboard

The Carbon Pricing Dashboard is an online tool that provides up-to-date information on existing and emerging carbon pricing initiatives around the world. A price on carbon is a way to capture the external costs of greenhouse gas emissions and ties them to their sources through a price that is typically in the form of carbon dioxide emitted.[29] One of the most common types of prices on carbon would be a carbon tax that places a set price on carbon as an explicit tax. Another would be an emissions trading system (ETS) such as California's cap-and-trade system which places a cap on emissions and conducts an auction process for emissions allowances.

Figure 14: **The World Bank, Carbon Pricing Dashboard** [30]



Source: The World Bank

The dashboard (Figure 14) builds on the data and analyses of the annual State and Trends of Carbon Pricing report series. As shown in the graphic, in 2022, the 68 carbon pricing initiatives implemented represent equivalent to 23% of the global greenhouse gas emissions.

Physical Risks

Physical risks such as wildfires, extreme weather, sea-level rise, and drought can affect fixed assets, like real estate or infrastructure, and disrupt portfolio companies' supply chains and operations. Climate change's acute and chronic physical impacts can affect people's health, food security, migration, water supply, and other ecosystem services in ways that could bring heightened volatility to financial markets and harm economic growth.

Physical Risk Deep Dive: Munich RE Insurance Catastrophe Loss Events in 2021

Munich RE highlights the natural catastrophes that occurred in 2021. In total, natural disaster caused losses of $280 billion. The costliest single natural disaster was Hurricane Ida that generated losses of $65 billion, followed by Flash floods in Germany which produced losses of $54 billion. Munich RE identified many of the catastrophe loss events as climate-related.[31]

Transition and Physical Risk Sector Insights

The chart below highlights examples of transition and physical risks and potential impacts of how they may be affecting individual sectors.

Energy

The energy sector is in a critical stage of transformation. Notable shifts are emerging that offer alternatives to the traditional model of centralized power grids

and transportation that run almost exclusively on fossil fuels. Such shifts are driven by technological advances enabling more consumer choice and decentralization along with a growing demand for electrification and desire for decarbonization. These shifts could have a profound effect on the energy sector and our investments in energy across the fund.

The following table lists some of the elements we take into consideration:

Transition: Market	• Renewable energy and natural gas are increasingly cost- competitive.[32] • Consumer demand shifting towards lower carbon assets and decentralization, where lower-cost options are available. • Fossil fuel reserves and development of new reserves face risk of becoming stranded assets due to policy and consumer demand shifts toward a low-carbon economy.
Transition: Policy	• Carbon pricing – the number of jurisdictions with carbon pricing initiatives is increasing. • Energy subsidies provided to fossil fuels currently distort market pricing and may be eliminated. • State and country commitments and targets are emerging and can affect assets in these markets: for example, – New York's Senate Bill 6599 sets a 30-year goal to pivot 100% of generation to renewables.[33] – California's Senate Bill 100 requires 100% of total retail electricity sales to come from eligible renewable energy and zero-carbon resources by December 31, 2045.[34] • Plastic regulation brings risk to oil and gas companies looking to plastic demand for revenue growth as they decarbonize. – Global growth in anti-plastics regulation (i.e. bags and straws) and consumer/ corporate sentiment due to plastics persistence and harm in the environment.
Transition: Technology	• Massive projected increases in energy from wind and solar in the future, up to 50% by 2050. • Growth of renewables and battery storage solutions may decrease role of gas peaker generation. • Technology shifts can have knock-on effects for commodities and parts suppliers.
Physical: Extreme Temperature	• Equipment may not be built to tolerate and/or function at new temperature extremes.

Physical: Hurricanes	• Oil and gas drilling rigs and refining capacity are susceptible to risks from hurricanes, which may interrupt oil exploration and production. Infrastructure may be exposed to damage, depending on location.
Physical: Water Scarcity	• Utility holdings and power asset holdings may have increased vulnerability to drought due to water use for hydropower and water-cooled thermal generation.

Materials and Buildings

Cement, steel and building management are significant sources of emissions for the industries in this category. Here, we focus on steel and cement. Our approach to energy management in buildings is covered in our discussion of the Energy Optimization Program for our Real Estate portfolio in the Strategy section.

Below are some of the elements we take into consideration:

Transition: Market	• Producing a ton of cement generates nearly a ton of CO2. And 1.9 tons of CO2 are emitted for every ton of steel produced.[35] • Those firms that can produce cement and steel with relatively lower emissions may fare better in an environment where carbon emissions are priced.
Transition: Technology	• Technology exists to lower emissions from these industries, but no commercially scalable and price competitive technology is available yet that will reduce emissions from cement or steel in line with a well-below 1.5 degrees Celsius scenario. • Decarbonization may require advances that rely on emerging technologies to further reduce the role that high-intensity thermal processes currently play in driving refinement of iron ore.
Physical: Extreme Heat, Hurricanes & Storm Surge	• Each of these variables may affect the ability of people to work outdoors. • Each of these physical risks may impair the functionality, operating costs, capital expenditures and value of fixed assets such as buildings.
Physical: Water Scarcity	• Mining operations which produce key materials within this sector depend upon water in extraction processes. • As drought and water scarcity grow, companies' license to operate may be at risk. • Drought may affect the operations and operating costs of real estate buildings.

Agriculture, Food, and Forestry

The companies involved in the Agriculture, Food, and Forestry sectors meet critical needs including the production, distribution, and security of food. These industries interact with, and in some cases imperil or support, natural ecosystems which serve as critical carbon sinks capturing significant amounts of CO2 emissions. The overall rise in temperature alongside more frequent and severe weather events create acute and chronic physical risks expected to have substantial impact on this sector.

Below are some of the elements we are monitoring:

Transition: Market	• Increased consumer demand for alternative meat proteins.[36] • Increased consumer demand for deforestation free products. • According to the CDP, many of FMCG companies are facing product demand shifts – Consumers are asking companies to rethink their product design with preferences for incorporating lower waste and greater recycling, in part due to climate awareness.
Transition: Policy	• Policy on land use change that protects or encourages natural carbon sinks, may reduce physical risks from climate change and create new business opportunities. • Policy that restricts land-use change in sensitive regions may impact specific commodities or companies.
Transition: Technology	• Developments in biological foundries and lab-grown and plant-based proteins that have significantly lower carbon footprints than traditional farming and livestock/dairy. These new foods require significantly less land use conversion away from natural carbon sinks and into land used for such activities as cattle grazing. • Developments in precision farming may disrupt incumbent farming practices by offering lower CO2 and lower water use methods of farming. • Developments in food waste prevention technologies and practices may improve agricultural companies' performance while reducing GHG emissions.
Physical: Biodiversity	• Changing climate may contribute to a decline in pollinator species (insects, birds and bats) which negatively affects the world's food crops dependent on their pollination services. • Changing climate may increase risks of, and thus costs of managing pests and pathogens. • Warming ocean imperils vulnerable marine ecosystems and the fishing industry and supply chains that rely on them.

Physical: Extreme Heat	• Decreased yield of dairy animals due to heat exhaustion. • Decreased yield of crops that cannot tolerate extremes. • Decreased productivity when workers are unable to work outside.
Physical: Flooding	• Delays in planting that could affect production for entire seasons. • Damage to planted fields, contamination of fields and/or water can create additional costs, restrict market access, and have unforeseen impacts on local communities which may further reduce productivity.
Physical: Water Scarcity	• Increased drought, and changing precipitation patterns, may decrease yield of certain crops, increasing pressure on irrigation systems which are already among the more intensive users of water.

Transportation

The transportation sector is beginning a global transformation driven by electrification, decarbonization, shared mobility and autonomous driving. Much of the change in the coming decades will be in tandem with the low-carbon transition. Battery range continues to increase and is opening opportunities for electric drive trains in new segments. Municipal, national, and international policy is driving the automotive market toward low-carbon options and improved fuel efficiency. Meanwhile, new mobility business models such as ride-hailing, and single trip bike and scooter rentals have scaled quickly around the world.

Below are some of the elements we take into consideration:

Transition: Market	• Trends towards electric, shared, autonomous transport are occurring at a different scale and pace across segments, including commercial automobiles, trucks, and buses.
Transition: Policy	• Policies supporting electrification are growing at the national and local levels. At least 30 countries already have policy goals to phase out the sales of internal combustion engine vehicles.[37] • The emergence of policies that meaningfully price carbon will drive the market toward lower carbon transport, negatively affecting more carbon intense technologies.
Transition: Technology	• Short term: Types, duties, and use cases of electric vehicles are expected to increase, with estimates of heavy-duty electric vehicles reaching total cost of ownership parity with diesel vehicles by the mid-2030s.[38] • On-going: Cost of battery production is expected to be volatile during immediate years but continue to slightly decline long term.[39]

Physical: Extreme Heat, Hurricanes & Storm Surge	• Railways and air transportation equipment and infrastructure have vulnerability to temperature extremes, with potential impacts to critical processes and services.

Climate Value-at-Risk[40]

Climate Value at Risk (CVaR) is another important framework CalPERS uses to assess the potential longer-term impact of climate risk on portfolio performance. MSCI's CVaR frameworks produces security level valuation impact estimates over a 15-year time horizon conditional on climate scenarios. These climate scenarios model several possible policy and climate change paths, with differentiated impacts on companies' issued securities, across the capital structures.

The output of this framework is an estimate of the downside or upside on securities fair value, associated with:

1. **Transition Risk and Opportunity, made up of:** Policy, which captures the commitments made by countries and companies to reduce GHG emissions; and technology, which aims to be a forward-looking opportunity measure that captures potential revenues from business activities that produce fewer GHG emissions.
2. **Physical Risk:** The expected cost to a company based on its geographic exposure, the type of hazards it might experience, and its vulnerability to damage and business disruption.

The CVaR framework helps CalPERS estimate the impact on its public market portfolio under a scenario in which the world moved toward 1.5 degrees Celsius alignment:

- **Net Zero Target:** A 2.0- and 1.5-degrees Celsius transition risk assessment with average physical risk at the enterprise level for companies in our Global Equity and Global Fixed Income Corporate portfolios. This helps us understand the risks and opportunities to our current public market portfolio if the world moves toward 1.5 degrees Celsius alignment.

Interpreting Results

The results from the CVaR analysis are summarized in the table below. These results should primarily be interpreted as directional signals and as relative orders of magnitudes, rather than absolute estimates of performance impact.

Acknowledging elevated level of noise in CVaR estimates, the results translate a clear and significant exposure to climate risk. They also reveal that transition and physical risks are both likely to cause a material drag on returns. It is therefore imperative that we develop a deeper understanding of how different risks impact CalPERS' public market portfolios.

Figure 15: **Potential Climate Value at Risk (CVaR) for CalPERS Public Market Portfolios**

	CalPERS' Global Equity Portfolio: 2°C Scenario	CalPERS' Global Equity Portfolio: 1.5°C Scenario	CalPERS' Global Fixed Income Corporate Portfolio: 2°C Scenario	CalPERS' Global Fixed Income Corporate Portfolio: 1.5°C Scenario
Transition Risk	-3.0%	-8.6%	-1.3%	-5.1%
Physical Risks	-6.9%	-6.9%	-0.7%	-0.7%
Total Climate VaR	**-9.9%**	**-15.5%**	**-2.0%**	**-5.8%**

Source: CalPERS

Key Findings

Using the results of the Climate VaR analysis as directional cues, we derive three key takeaways:

1. **The financial impact of climate change is significant.** It is a dimension of risk we believe the market is under appreciating with a primary focus on transition risk management.
2. **The financial impact of climate change is sticky.** Today's policies are unlikely to meaningfully alter physical effects over the coming 15 years. Conversely, improvements made today will be felt in generations to come. Realizing transition risk today is a way to mitigate increased physical risk in the future.
3. **There are complex interplays between risk and opportunity.** Industries that are higher risk in terms of policy, such as electricity distribution and transmission, also present significant technology opportunities.

Analysis of Alignment with the Paris Agreement

The Paris Agreement set out to avoid dangerous climate change by limiting global warming to well below 2 degrees Celsius and pursuing efforts to limit it to 1.5 degrees Celsius. We ran a data and analysis exercise to consider the lens of warming potential in the portfolio, relative to the goal of keeping global warming to the 1.5 degrees Celsius goal.

We conducted this assessment on our Global Equity and Global Fixed Income Corporate portfolios using MSCI's Implied Temperature Rise (ITR) tool. Implied Temperature Rise provides a portfolio level number in degrees of Celsius demonstrating how aligned the companies in the portfolio are to global temperature goals. This is applied at the portfolio level by estimating the sum of "owned" projected GHG emissions against the sum of "owned" carbon budgets for the underlying fund holdings. The portfolio's total estimated carbon budget over/undershoot is then converted to a degree of temperature rise (°C) using science based TCRE (Transient Climate Response to Cumulative Emissions).[41]

CalPERS Global Equity Portfolio

The results show CalPERS' Global Equity portfolio has an Implied Temperature Rise of 2.6 degrees Celsius. Using MSCI's All Country World Investable Market Index (ACWI IMI) as a benchmark, MSCI ACWI IMI has a slightly higher Implied Temperature Rise of 2.9 degrees Celsius.

A review of commitments from individual companies within the portfolio indicates that 48.3% of the companies align with the goal of limiting temperature increase to below 2 degrees Celsius, and 17.3% of the companies align with the goal of limiting temperature increase to below 1.5 degrees Celsius.

CalPERS' Global Fixed Income Corporate Portfolio

The results show CalPERS' Global Fixed Income Corporate portfolio has an Implied Temperature Rise of 3.1 degrees Celsius.

A review of commitments from individual companies within the portfolio indicates that 43.1% of the companies align with the goal of limiting temperature increase to below 2 degrees Celsius, and 17.5% of the companies align with the goal of limiting temperature increase to below 1.5 degrees Celsius.

Summary

As CalPERS is a universal owner, these results are not surprising as we track the expected temperature increase taking the current state of global climate commitments through policy into account. Current commitments made by countries through the Nationally Determined Contributions (NDC) proposals and by companies setting targets help CalPERS understand the warming potential of our public market portfolios. This reinforces the importance of activities such as company engagements through initiatives like Climate Action 100+ and public policy advocacy. It also allows us to assess how much work is needed to help us realize net zero emissions by 2050.

Climate-Related Research

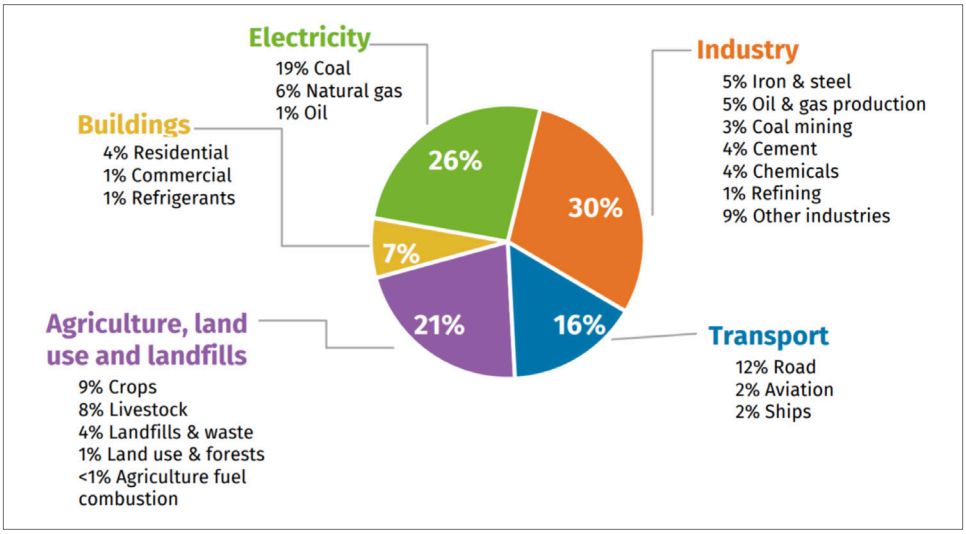
As a long-term investor in the global economy, we have long understood the scale and multi-faceted nature of climate change posing both risk and opportunity to the portfolio. We also understand that the science and data to assess climate-related risks is quickly evolving as is the technology to combat the impact of climate change and provide a mitigation of such risks. As part of our continuous education, staff are regularly reviewing the latest academic, industry, and government body publications and research.

Below we highlight sector analysis to understand what types of companies are most contributing to global warming and what opportunities exist to help decarbonize the economy.

Sector Analysis: Contributors to Emissions and Global Warming

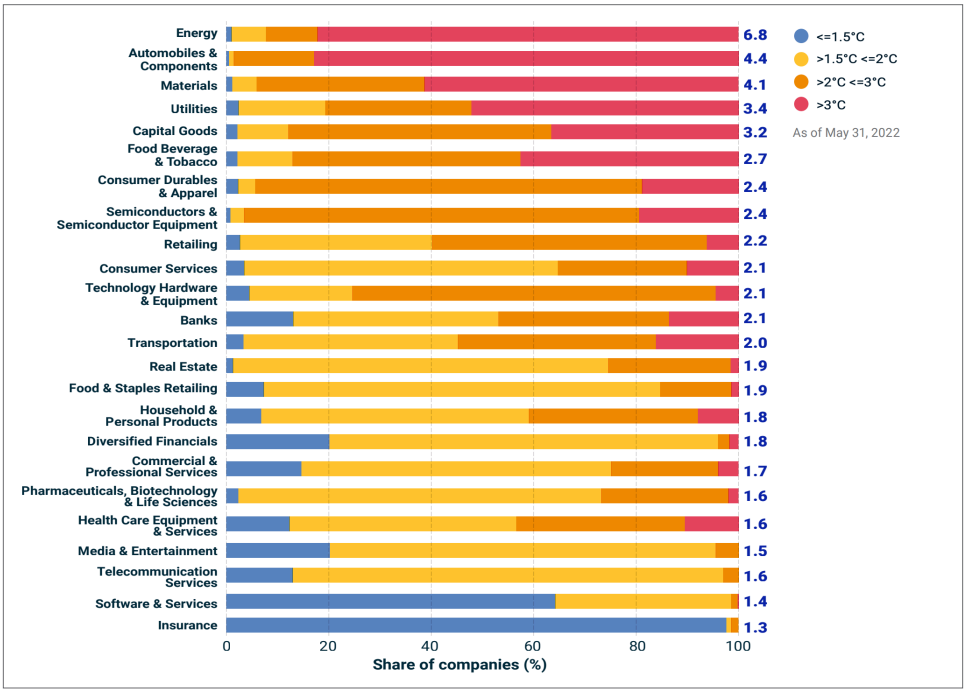
CalPERS staff continue to assess what sectors are most contributing to emissions and global warming, and also assess to what degree these sectors are aligned to a specific temperature rise. Its first helpful to understand the global GHG emissions by sector. The graphic below by Rhodium Group shows that industry and electricity sectors comprised more than 50% of 2019 net GHG emissions.

Figure 16: **Global Emissions by Sector — Share of 2019 net GHG emissions (%)**[42]



Source: Rhodium Group

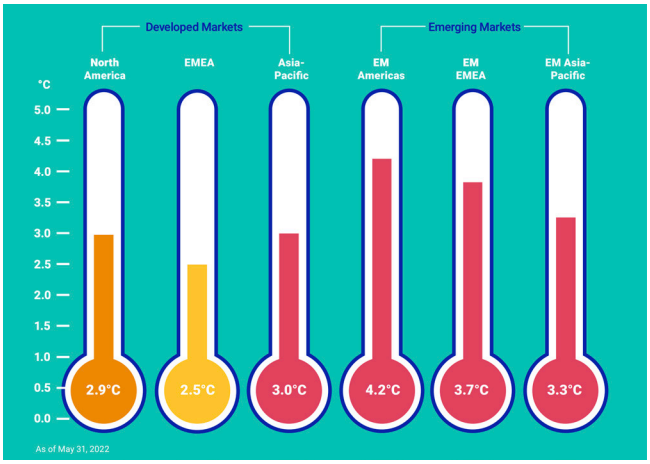
Figure 17: **Implied Temperature Rise by Sector**[43]



Source: MSCI

The MSCI Net Zero Tracker graphics below show the sector specific percent of companies that are aligned to specific temperature rises.

Figure 18: **Implied Temperature Rise by Market**[44]



Source: MSCI

The MSCI Net Zero Tracker graphic above shows the market specific implied temperature rise and developed markets tend to have lower Implied temperature rise's than emerging markets.

Opportunities

CalPERS' strategy seeks to identify investments poised to benefit from the transition to a low-carbon economy or operating in areas where transition and physical risks are lower and/or can be mitigated. It is important to note these investments must be rooted in the fund's fiduciary responsibility to meet maximize CalPERS' target rate of return. Within our large and diverse portfolio, investment strategies involve different time horizons, asset types, and geographies. Given this, our risk management process includes analysis of the progress that individual technologies are marking towards decarbonization and how that progress aligns with a net zero scenario.

IEA: Tracking Clean Energy Progress

The International Energy Agency (IEA) works with countries around the world to shape energy policies for a secure and sustainable future. The IEA's Net Zero Emissions by 2050 Scenario (NZE) is a pathway for the global energy sector to achieve net zero CO2 emissions by 2050. The IEA's Tracking Clean Energy Progress (TCEP) reports assess the status of 55 components of the energy system that are critical energy technologies and sectors and provides recommendations on how they can get 'on track' with the NZE.[45]

Figure 19: **Tracking Clean Energy Progress**

What's Tracking?	Not on track	More Efforts Needs	On track
Energy System Overview Decarbonizing the energy system will require a wide range of strategies. These should advance in a holistic manner, capitalizing on synergies among sectors.	Energy Efficiency Behavioral Changes Electrification International Collaboration Carbon Capture, Utilization and Storage	Bioenergy Hydrogen Digitalization Renewables Clean Energy Technology Innovation	
Cross-Cutting Technologies & Infrastructure Several key technologies and infrastructure will support Net Zero by 2050 Scenario alignment across multiple sectors.	Direct Air Capture Electrolyzers CO2 Transport and Storage Data Centers and Data Transmission Networks	District Heating Bioenergy with Carbon Capture and Storage CO2 Capture and Utilization	
Electricity Sector Decarbonizing the power sector is a fundamental step to reduce emissions, especially in an increasingly electrified world.	Renewable Electricity Solar PV Wind Electricity Grid-Scale Storage Coal-Fired Electricity	Hydroelectricity Nuclear Electricity Demand Response Smart Grids Natural Gas-Fired Electricity	
Oil & Natural Gas Supply A rapid step-change in policy and industry action is needed to cut flaring and methane emissions in the oil and gas sector.	Methane Emissions from Oil and Gas Operations	Flaring Emissions	
Low-Emissions Fuel Supply Biofuels and hydrogen production and distribution must be rolled out rapidly to meet the growing demand of a decarbonizing energy system.	Hydrogen Supply	Biofuels	

Transport The transport sector needs to undergo a major transformation, including vastly improving efficiency and shifts from oil to electricity and low-carbon fuels.	Cars and Vans	Aviation
	Trucks and Buses	International Shipping
	Rail	Electric Vehicles
Industry Industry processes that can't be easily electrified must cut emissions through material efficiency and innovative technologies like hydrogen and carbon capture.	Steel	Aluminum
	Chemicals	Pulp and Paper
	Cement	Light Industry
Buildings Unprecedented efficiency improvements are required in buildings, addressing growing demand from cooling, heating and powered devices.	Heating	Lighting
	Space Cooling	Building Envelopes
	Appliances and Equipment	Heat Pumps

Source: IEA

As shown in the IEA Tracking Clean Energy Progress (Figure 19), only two of the 55 critical energy components, technologies, and sectors are currently on track. Those two sectors, shown with green dots, are Electric Vehicles and Lighting. Those sectors with yellow dots are identified as having more efforts needed. And those with red dots are designated as being not on track. Though incremental progress is being made across many of these critical energy technologies, the pace of progress needed to be on track with a net zero pathway is significantly higher.

IPCC: Overview of Mitigation Options and Their Estimated Ranges of Costs and Potentials in 2030

IPCC Climate Change 2022: Mitigation of Climate Change was released in 2022. This is the third installment of the IPCC Sixth Assessment report included the linked graphic that demonstrates that there are many available options across all sectors that are that provide the potential to significantly reduce net emissions by 2030. Within the chart, on the left side, there are sectors and their corresponding mitigation options. On the right side, the width of each bar shows the potential contribution to net emission reduction by 2030. The color of each bar shows the net lifetime costs of each of the options. The blue bars in the linked graphic are mitigation options that should be actively pursued by companies and governments as their costs are already lower than the cost of reference technologies.[46]

Metrics and Targets

In this section, we dive into the climate-related metrics that we assess, the use of conducting carbon footprints to measure what we manage, and climate-related targets that we have set. Throughout these assessments we use the following metrics:

Figure 20: **Metrics That We Track**

Carbon Metrics	Asset Class Carbon Metrics	Climate Scenarios Metrics	Risk and Opportunities Metrics
Point in time	**Onging decision process**	**Trajectory**	**Point in time**
• Carbon footprint or Total Financed Carbon Emissions (tons CO2e) • Financed Carbon Emissions (tons CO2e/$M invested) • Financed Carbon Intensity (tons CO2e/$M sales) • Weighted Average Carbon Intensity (WACI)	• Opportunity Cost or Green Premium • Pricing of carbon risk premium • Investable universe	• Portfolio alignment with scenarios including 1.5°C and 2°C • Portfolio implied temperature rise	• Climate value-at-risk • Transition Risk • Physical Risk • Earnings-at-risk • Solvency-at-risk • Low-carbon solutions assessment • Green Revenue assessment

Source: CalPERS

Emissions and other climate-related data inputs can be used in the development and assessment of climate metrics. We use the metrics in the following ways:

- **Carbon metrics:** To understand the source of current GHG emissions in the portfolio.
- **Asset class carbon metrics:** To assist in the decision-making within each asset class.
- **Climate scenarios:** To understand the potential trajectory of emissions across our portfolio.

- **Risks and Opportunities:** To begin relating climate metrics to financial risk and to help identify which industries may be most impacted by future developments, for example, a price on carbon.

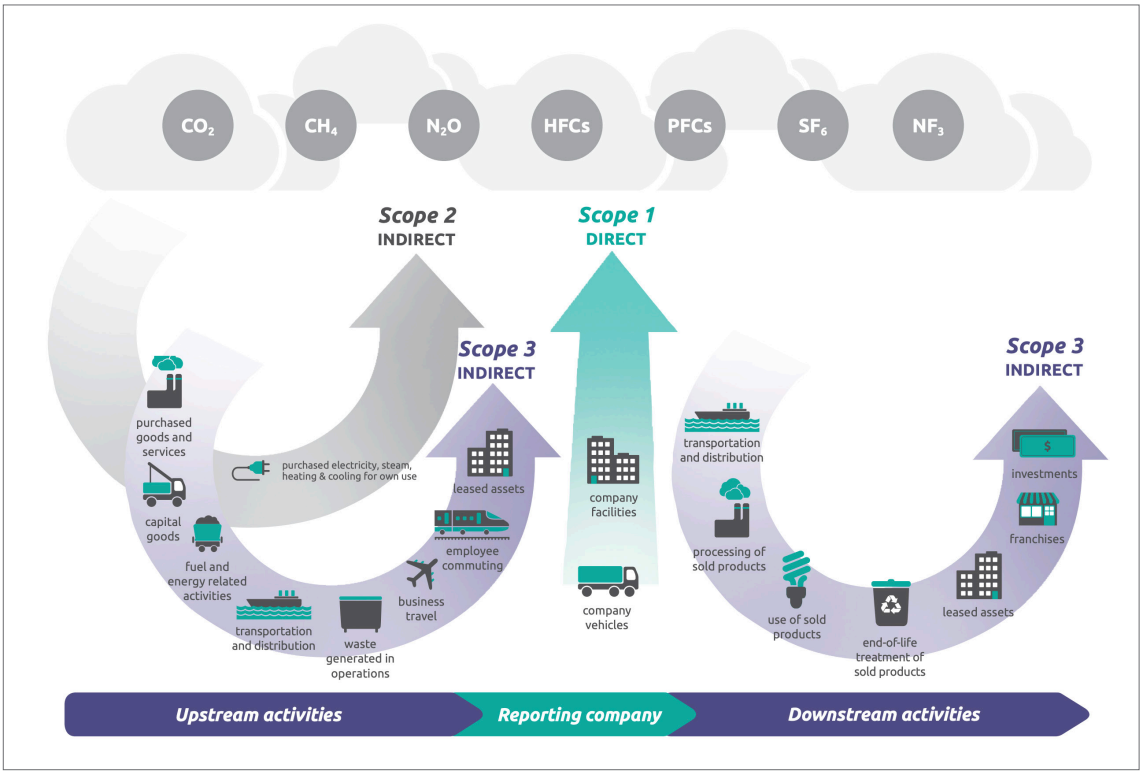
Carbon Footprints

To manage our carbon footprint, it's vital to measure it. We have provided background information that defines greenhouse gas emissions and have also documented our footprint for multiple segments of our portfolio and the progress that we have already experienced.

Defining Greenhouse Gases Emissions

The World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD) created the Greenhouse Gas Protocol (GHGP) in 2001 to streamline emissions measurement with the goal to help organizations identify and reduce emissions.[47] From this development, emissions were classified as one of three categories or "scopes." Companies that disclose their emissions report them based on these scopes. Emissions from sources within the company are referred to as direct emissions while emissions generated outside of the company are referred to as indirect emissions.

Figure 21: **Greenhouse Gas Protocol, Technical Guidance for Calculating Scope 3 Emissions, V. 1.0**[48]



Source: WRI

As shown in Figure 21, Scope 1 refers to direct emissions from an organization's facilities or the use of its vehicles. Scope 2 includes indirect emissions from purchased electricity, steam, heating, and cooling. Scope 3 includes indirect emissions from an organizations value chain, including emissions from both upstream and downstream activities.

CalPERS Carbon Footprint

CalPERS has conducted recent carbon footprints for the Global Equity portfolio, the Global Fixed Income corporate portfolio, and the Real Estate portfolio. Together these assets represented close to 70% of the total fund as of December 31, 2021. Over the next year, CalPERS will be working on refreshing the carbon footprint on its infrastructure assets. While some investors estimate their private equity emissions by using public equity emissions data as a proxy, other investors, including CalPERS, have found this to be an inaccurate methodology. CalPERS has opted to use our leadership in co-founding the ESG Data Convergence Initiative to build out a baseline over time of our Private Equity carbon footprint. This emissions methodology will take a more accurate bottoms-up approach, assessing carbon emissions at the individual portfolio company level and aggregating the data.

Figure 22: **CalPERS' Global Equity Portfolio**

Global Equity Portfolio	Total Financed Carbon Emissions (tons CO2e)	Financed Carbon Emissions (tons CO2e/$M invested)
Scope 1+2	12,702,548	52.8
Scope 3 – upstream	20,763,982	86.3
Scope 3 – downstream	41,584,832	172.9

Source: CalPERS

CalPERS' Global Equity portfolio carbon footprint metrics are shown in the table above. We utilized MSCI Climate Risk Report and tools to conduct the footprint. The metrics above used an EVIC (Enterprise Value Including Cash) methodology and approximately 99.7% of the portfolio was covered by the assessment.

When benchmarking our portfolio to a broad market index, we found that our financed carbon emissions were 11% lower than MSCI ACWI IMI[49] for Scope 1+2 emissions. The portfolio's emissions were 10.2% lower for Scope 3 – upstream emissions and 35.7% lower for Scope 3 – downstream emissions.

2015 versus 2021

CalPERS first conducted a carbon footprint of its Global Equity portfolio in 2015. The assessment at the time used a weighted average carbon intensity (WACI) approach across Scope 1+2 emissions based on tons CO2e / $M sales. In 2015, the Global Equity portfolio weighted average carbon intensity was 258.9. The Global Equity portfolio weighted average carbon intensity with holdings at the end of 2021 was 180.2. This reflects a 30.4% decrease in the Global Equity portfolio weighted average carbon intensity. This can be attributed to progress from our corporate engagements as well as changes to our security selection and asset allocation.

Figure 23: **CalPERS Global Fixed Income Corporate Portfolio**

Global Fixed Income Corporate Portfolio	Total Financed Carbon Emissions (tons CO2e)	Financed Carbon Emissions (tons CO2e/$M invested)
Scope 1+2	2,869,689	86.2
Scope 3 – upstream	3,463,221	104.1
Scope 3 – downstream	10,774,404	323.7

Source: CalPERS

CalPERS' Global Fixed Income Corporate portfolio carbon footprint metrics are shown in Figure 23. We utilized MSCI Climate Risk Report and tools to conduct the footprint. The metrics above used an EVIC (Enterprise Value Including Cash) methodology and approximately 88% of the portfolio was covered by the assessment.

2017 versus 2021

CalPERS first conducted a carbon footprint of its Global Fixed Income Corporate portfolio in 2017. The assessment at the time used a weighted average carbon intensity (WACI) approach across Scope 1+2 emissions based on tons CO2e / $M sales. In 2015, the Global Fixed Income Corporate portfolio weighted average carbon intensity was 656. The Global Fixed Income Corporate portfolio weighted average carbon intensity with holdings at the end of 2021 was 322.4. This reflects a 51% decrease in the Global Fixed Income Corporate portfolio weighted average carbon intensity. This can be attributed to progress from our corporate engagements as well as changes to our security selection and asset allocation.

CalPERS Real Estate Portfolio

CalPERS conducted a carbon footprint of the real estate portfolio. The emissions represented by the carbon footprint covers approximately 94% of this portfolio's $48 billion in net asset value (NAV) as of December 31, 2021. The emissions were reported in 2021 for the 2020 year and were likely affected by the pandemic and the related impact to real estate operations. Conducting carbon footprints of private market investments can be much more resource intensive and have longer lag times than conducting footprints on public market exposure. CalPERS Real Assets staff utilized our partnerships with external managers and with Global Real Estate Sustainability Benchmark (GRESB) to conduct the carbon footprint.

Figure 24: **CalPERS Real Estate Carbon Footprint**

Scope 1	109,301
Scope 2	328,533
Subtiotal Scope 1+2	437,834
Scope 3	365,583
Total Reported GHG Emissions	**803,417**

Source: CalPERS

This is the first carbon footprint measurement of our Real Estate portfolio that includes Scope 1+2 emissions and initial phases of capturing partial Scope 3 emissions. The majority of the reported GHG emissions for the portfolio are concentrated in Scope 1+2 emissions. Scope 3 emissions were reported for a subset of the portfolio where data is available. Data availability, collection, processes, and methodologies continue to evolve as more emphasis is placed on this effort in the industry.

Climate-Related Targets

CalPERS joined the United Nations (UN) Net Zero Asset Owner Alliance (Alliance) in 2019, committing to accelerating decarbonization in line with 1.5 degrees Celsius by 2050. CalPERS' strategy emphasizes a holistic ESG approach, incorporating climate change risks and opportunities with a focus on reducing greenhouse gas emissions in the real economy.

The UN Net Zero Asset Owner Alliance (Alliance) members seek to reach real economy decarbonization in line with 1.5 degrees Celsius, primarily through:

- Engagement with companies
- Advocacy with regulators and policymakers
- Investing in climate solutions to finance the transition to a low-carbon economy

Partnership between government, business, investors and civil society is essential to successfully navigate to net zero.

The Alliance and its members understand that this 2050 goal requires updates to assess the progress of the economy and the actions that investors are taking. Alliance members are setting near-term engagement, sector and investment targets with the goal of real economy emissions reductions at certain time periods.

CalPERS' United Nations Net Zero Asset Owner Alliance Partnership webpage provides our targets in the areas of engagement with the world's largest emitting companies to decrease greenhouse gas emissions, sectoral decarbonization pathways, and investing in the transition to a low-carbon economy. Below, we dive into our sectoral decarbonization pathways targets.

Sectoral Decarbonization Pathways Targets

Transition Pathway Initiative's (TPI) sectoral decarbonization pathways, which are based on International Energy Agency (IEA) climate scenarios, are widely used by investors and investor networks, including Climate Action 100+, to assess whether companies are aligned with the goals of the Paris Agreement. Specifically, the goal of limiting average global temperature rise to well below 2 degrees Celsius and pursuing efforts to limit it to 1.5 degrees. This analysis informs investors, including CalPERS, and underpins our engagement with companies across the range of high-impact sectors.

We're committed to assessing sectoral decarbonization pathways and targeting intensity and absolute real world emission reductions through engagement to bring sectors and individual companies in alignment to a 1.5°C pathway.

Carbon intensity targets for 2025 and 2030 for each sector are shown in the table below, which includes the sectoral carbon performance measure for each of the high emitting sectors. Sector and company pathways and sector statuses are available for use by everyone via the TPI online tool.

Figure 25: **Carbon Intensity Targets for 2025 & 2030 for Energy, Transport, and Industrials and Materials Sectors**

Cluster	Sector	2025 Target	2030 Target	Sectoral Carbon Performance Measure
Energy	Electricity utilities	0.288	0.138	Carbon intensity of electricity generation (metric tonnes of CO2 per MWh)
	Oil and gas	51.52	40.95	Carbon intensity of primary energy supply (gCO2e/MJ)
Transport	Automobiles	68	40	New vehicle carbon emissions per kilometre (grams of CO2 per kilometre)
	Airlines	1071	616	Carbon emissions per revenue tonne kilometre (gCO2/RTK)
	Shipping	5.63	4.31	Carbon emissions per tonne kilometre (gCO2/t-km)
Industrial and materials	Cement	0.43	0.373	Carbon intensity of cementitious product (tonnes of CO2 per tonne of cementitious product
	Diversified mining	49.79	41.54	Carbon emissions per tonne of copper equivalent (tonne CO2e/tonne copper equivalent)
	Steel	1.046	0.815	Carbon intensity of crude steel production (tonnes of CO2 per tonne of steel)
	Aluminium	4.004	3.069	Carbon intensity of aluminium production (tCO2e/t aluminium)
	Pulp and paper	0.427	0.353	Carbon intensity of pulp, paper, and paperboard production (tonnes of CO2 per tonne of product)

Source: Transition Pathway Initiative

Conclusion

Climate change poses an urgent and complex challenge for investors. In conducting climate change analysis across our portfolio, CalPERS observed the breadth and depth of risks across the total fund, and opportunities in the transition to a low-carbon economy.

Climate change is a systemic risk which must be managed and mitigated through global cooperation between the public and private sectors in partnership with civil society. With our long-term investment horizon and multiple generations relying on us for pension security, CalPERS believes that the shift to a sustainable low-carbon global economy is vitally important to our ability invest our members' assets and earn our target rate of return upon which they rely for the payment of benefits.

CalPERS' Global Equity portfolio roughly tracks the potential implied temperature rise of the global economy to produce global warming at 2.9 degrees Celsius which would produce unparalleled impact.[50] We believe our strategy of advocacy, engagement, integration and investment, and partnerships is showing promise, and we must stay the course, maintain our focus and continue our efforts with our partners to keep global warming to 1.5 degrees Celsius.

For an intergenerational universal owner, there is nowhere to hide from the impact of rising carbon emissions. With CalPERS' funding status and target rate of return, CalPERS acknowledges that our strategy towards a low-carbon future may differ from our peers who have different investment objectives and constraints.

The climate change transition brings opportunity. New breakthrough technologies may expedite the transition to a low-carbon economy, for example to sequester carbon emissions at a scale commensurate with the challenge. Or policymakers may establish a clear and stable carbon-pricing regime that gets the global economy on track for a thriving low-carbon future.

Climate risk poses systemic risk with global impact for society. It is still possible that collectively our global ambition falters and we do not rein in emissions through the combined and dynamic impact of government policy, technology breakthroughs, and major shifts in consumer demand. If so, then we enter a dangerous time of climate extremes, volatility, ecosystem collapse, vast migration, and resource scarcity.

CalPERS will continue to lead on climate change. We are proud to have co-founded Climate Action 100+, the ESG Data Convergence Initiative, and to have committed to the United Nations convened Net Zero Asset Owner Alliance which provides us the same goal we are setting for the largest emitters in our portfolio. We will continue to innovate in how we assess and manage climate risk and opportunities. We will continue to build climate resilience into our portfolio and seek sustainable investment opportunities in the low-carbon economy. In all this work, our partnership with fellow investors, policymakers, the business sector, and civil society will continue to be of vital importance. Tackling the climate crisis is urgent work, and it will take all sides pulling together if we are to meet the goals of limiting global warming to 1.5 degrees Celsius and meet our obligations to our beneficiaries.

Glossary

A limited number of climate-related terms can be found below. For a more comprehensive climate-related glossary, we would refer the reader to an IPCC glossary.

Limiting warming to 1.5 degrees Celsius: achieving net zero CO2-e emissions by 2050. This will require decreasing energy demand, decarbonizing electrical systems, electrification of end use energy, reducing agricultural emissions, and multiple forms of carbon storage.

2 degrees Celsius scenario: the global community's accepted limitation of temperature growth to avoid significant and potentially catastrophic changes to the planet.

Carbon capture technologies: carbon capture and storage is the process of capturing waste carbon dioxide usually from large point sources, such as a cement factory or biomass power plant, transporting it to a storage site, and depositing it where it will not enter the atmosphere, normally an underground geological formation.

Carbon footprint: the amount of carbon dioxide and other carbon compounds emitted due to the consumption of fossil fuels by a particular person, group, etc.

Carbon intensity: the total reported or estimated metric tons of C02-e emissions divided by the company's sales revenue, in millions of dollars. This metrics allows for comparison between companies.

Carbon risk premium: adjustment to the expected risk profile of an investment based on its vulnerability or resilience to political, technology and regulatory risks associated with the climate transition.

CFTC: Commodity Futures Trading Commission

Climate Action 100+: the world's largest shareowner engagement project with 700 signatories with assets under management totaling $68 trillion.

Climate Value at Risk (CVaR): modeling process developed by MSCI that provides a quantitative, forward-looking analysis regarding risks and opportunities for investments related to climate change.

Deforestation: the permanent removal of trees to make room for something besides forest. This can include clearing the land for agriculture or grazing, or using the timber for fuel, construction or manufacturing.

EVIC- Enterprise Value Including Cash: Enterprise Value Including Cash (EVIC) is an alternate measure to Enterprise Value (EV) to estimate the value of a company by adding back cash and cash equivalents to EV.

EVIC: Market capitalization at fiscal year-end date + Preferred Stock + Minority Interest + Total Debt

Financed Carbon Emissions (tons CO2e/$M invested): allocated emissions to all financiers (EVIC) normalized by $m invested. Measures the carbon emissions, for which an investor is responsible, per USD million invested, by their equity ownership. Emissions are apportioned based on equity ownership (% market capitalization).

Financed Carbon Intensity (tons CO2e/$M sales): allocated emissions per allocated sales. Measures the carbon efficiency of a portfolio, defined as the ratio of carbon emissions for which an investor is responsible to the sales for which an investor has a claim by their equity ownership. Emissions and sales are apportioned based on equity ownership (% market capitalization).

GHG per Unit of Value Added (GEVA) approach: an intensity measure of GHG emissions per unit of value added by the company.

Global carbon budget: the estimated amount of carbon dioxide the world can emit while still having a likely chance of limiting global temperature rise to 1.5 degrees Celsius above pre-industrial levels.

Greenhouse Gas Emission Scopes Levels:

- Scope 1 emissions: are direct emissions from owned or controlled sources
- Scope 2 emissions: are indirect emissions from the generation of purchased energy
- Scope 3 emissions: are all indirect emissions (not included in Scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions

GRESB: Global Real Estate Sustainability Benchmark

Intergovernmental Panel on Climate Change (IPCC): The United Nations body for assessing the science related to climate change.

Investable universe: also known as 'market portfolio' and includes all tradeable assets.

Litigation risks: include but are not limited to third-party and class action claims against public companies as well as direct action(s) by shareowners against companies relating to damages directly or indirectly stemming from climate change.

Montreal Pledge: launched in Montreal in 2014, it is a commitment by more than 120 investors to measure and publicly disclose the carbon footprint of their investment portfolios on an annual basis.

Net asset value (NAV): the value of an entity's assets minus the value of its liabilities.

Net zero carbon emissions: the removal from the atmosphere of all man-made greenhouse gas emissions through reduction measures, thus reducing the Earth's net climate balance to zero.

Paris Agreement: signed in December 2015, it is an agreement within the United Nations Framework Convention on Climate Change, dealing with greenhouse-gas-emissions mitigation, adaptation and finance. The Paris Agreement includes the goal of limiting average global temperature rise to well below 2 degrees Celsius and pursuing efforts to limit it to 1.5 degrees Celsius above preindustrial levels.

Physical risks: risks such as wildfires, extreme weather, sea-level rise, and drought that can affect fixed assets, like real estate, and disrupt portfolio companies' supply chains and operations.

Reforestation: the process of restocking of existing forests and woodlands that have been depleted, usually through deforestation.

Representative Concentration Pathways (RCPs): four independent pathways (RCP 2.6, RCP 4.5, RCP 6, and RCP 8.5) developed by four individual modeling groups that are meant to be inputs for climate models developed by the IPCC.

SASB: Sustainability Accounting Standards Board

SB964: Bill signed in 2018 that requires the boards of CalPERS and CalSTRS to publicly report on the analysis of the material climate-related financial risks of their public market portfolios by January 1, 2020, and every three years thereafter.

SEC: Securities and Exchange Commission

Sectoral Decarbonization Approach (SDA): a science-based model to help companies understand both how their current emissions are contributing to temperature rise and how much they need to decrease their emissions to align with 2 degrees Celsius, 4 degrees Celsius, or 6 degrees Celsius temperature rise scenario.

Sustainable Investments: CalPERS has a long history of allocating capital to sustainable investments including low-carbon and climate solutions investments. After reviewing multiple tools, taxonomies, and frameworks, we decided to use MSCI's Low-Carbon Transition Risk framework to assess our exposure to 'climate solutions' in our public market asset classes. In this framework, climate solution companies are those exhibiting the greatest potential to benefit from the growth in demand for low-carbon footprint products and services supporting the decarbonization of the global economy. Examples of these types of investments would include, but are not limited to renewable electricity, electric vehicles, and solar cell manufacturers. For our private market asset classes, we referenced the green project categories from the Green Bond Principles to assess our exposure

to low-carbon and climate solutions investments. Examples of these include renewable energy, energy efficiency, clean transportation, green buildings, and circular economy adapted products, production technologies and processes. Exposure to sustainability certified and carbon-neutral assets, including those that have carbon neutral operations, are also included in our methodology. Exposure shown in this report for each of the asset classes is as December 31, 2021.

Task Force on Climate-Related Financial Disclosures (TCFD): seeks to develop recommendations for voluntary climate-related financial disclosures that are consistent, comparable, reliable, clear, and efficient, and provide decision-useful information to lenders, insurers, and investors.

Total Financed Carbon Emissions (tons CO2e): allocated emissions to all financiers (EVIC). Measures the total carbon emissions for which an investor is responsible by their equity ownership. Emissions are apportioned based on equity ownership (% market capitalization).

Transition risks: shifts in the market, policies, and technologies (due to movement toward a lower carbon economy) that can affect the financial success of existing business models and industries.

Value chain: the full range of activities performed to create a product or service and deliver it to market.

Weighted Average Carbon Intensity (WACI): This metric has two steps for calculation. First the total reported or estimated metric tons of C02e emissions for each company is divided by the company's sales revenue, in millions of dollars (carbon intensity). This output is then multiplied by the company's weight in the investor's portfolio. Measures a portfolio's exposure to carbon-intensive companies, defined as the portfolio weighted average of companies' Carbon Intensity (emissions/sales).

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