

# LOOKING *Forward*

A Guide to Climate Risk Scenario Analysis Design  
for California's Insurance Regulator

APRIL 2023  
Policy Report



CLIMATE  
& ENERGY



WATER



OCEANS



LAND USE



# FOREWORD FROM CALIFORNIA INSURANCE COMMISSIONER RICARDO LARA

Climate change is intensifying many of the risks faced by our society—shifting the playing field on which financial regulators and companies operate. Our goal must be maintaining reliable, affordable insurance for Californians now and in the future. At the California Department of Insurance, we partnered with the UN to build the first state-level Sustainable Insurance Roadmap, providing a proactive, long-term vision and strategy to achieve sustainable insurance markets and climate resilient communities.

A key piece of that roadmap includes incorporating climate risk assessment exercises into our oversight of California’s insurance sector. This report summarizes the use of new forward-looking scenario analysis tools and provides recommendations that take into account the unique context of the California insurance market and our mission to protect consumers from the impacts of climate change.

Insurance regulators need to understand new tools to address the changes brought by climate change. Businesses and individuals have traditionally used insurance to guard against risk, and state regulators, including the California Department of Insurance, have helped consumers understand and access products by overseeing insurance markets. **The insurance sector no longer has the luxury of thinking only of the year ahead. Insurance companies, regulators, and consumers all must learn to consider and prepare for the long-term. I commissioned this report to bolster our capacity to understand climate scenarios and meet this challenge.**

Maintaining reliable insurance for Californians necessitates that insurance companies understand and manage the impact of the climate-intensified physical hazards and the actions being taken to address climate change. Scenario analysis is a critical tool for understanding this risk. Scenarios are not predictions. They provide the practical opportunity for planning, making proactive policy choices, and building a foundation for a deeper understanding of how the insurance sector is positioned to respond to possible futures.

We need new methods to better prepare for future uncertainty. For the first time, the International Energy Agency projects that global demand for fossil fuels will peak as early as 2025, given current policies and investments in clean energy. Slow-to-adapt companies in the sector will risk being left behind as our society approaches a transformation towards clean and renewable energy.

I welcome this Scenario Analysis Design Guide as a resource for insurance regulators, in U.S. states and internationally, and look forward to working with its authors as we continue to assess climate risks and oversee a reliable insurance market for Californians.



Ricardo Lara  
CALIFORNIA INSURANCE COMMISSIONER



APRIL 2023 | POLICY REPORT

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# ABOUT THIS REPORT

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*The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the information presented herein, and do not necessarily reflect the official views or policies of the State of California or the California Department of Insurance.*

## ABOUT THE CENTER FOR LAW, ENERGY & THE ENVIRONMENT

The [Center for Law, Energy & the Environment](#) (CLEE) channels the expertise and creativity of the Berkeley Law community into pragmatic policy solutions to environmental and energy challenges. CLEE works with government, business, and the nonprofit sector to help solve urgent problems requiring innovative, often interdisciplinary approaches. Drawing on the combined expertise of faculty, staff and students across University of California, Berkeley, CLEE strives to translate empirical findings into smart public policy solutions to better environmental and energy governance systems. CLEE's Climate Risk Initiative seeks to research and develop market based, regulatory and public policy tools to assist the insurance and financial industries in recognizing, addressing, and responding to the risks caused by climate change.

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## I. EXECUTIVE SUMMARY

This report explores the topic of climate risk scenario analysis and stress testing—a set of tools for financial institutions and regulators to anticipate and manage the economic and financial risks posed by climate change—and key considerations for their potential application to the insurance sector in California and beyond.

The goal of the report is to identify options available to the California Department of Insurance (CDI) as it considers new scenario analysis and stress testing exercises and to offer recommendations for CDI and peer institutions as they begin to structure and implement these exercises. The report focuses primarily on scenario analysis, but many of the goals and principles discussed will apply to both scenario analysis and exploratory climate stress testing.

This report seeks to address the following questions:

- What goals should CDI pursue in developing scenario analysis tools and capacity for California’s insurance sector?
- What is the legal and policy precedent for scenario analysis by CDI?
- What scenario analysis exercises are peer institutions conducting and what best practices have emerged when setting priorities for scope, specificity, and application of the results?
- What scope of scenario analysis should CDI undertake, in terms of covered entities, risk types, and time horizons?
- What structure of scenario analysis should CDI undertake, in terms of exercise leadership, locus of analysis, and role of partners?
- What data gaps and institutional needs or limitations should CDI consider as it designs a scenario analysis exercise?
- How should CDI’s scenario analysis strategy integrate with peer exercises and evolve over time?

Based on the research, expert interviews, and stakeholder roundtable that informed this report, CLEE offers recommendations for CDI including the following:



- Early exercises should focus on departmental and insurer capacity-building, but the Department should quickly shift into analyses that inform policy decision-making (for both insurance supervision and broader climate risk management) once adequate capacity is built.
- A top-down approach may be most appropriate for initial efforts, but the Department should rapidly develop limited-scope, bottom-up pilot exercises.
- The Department should explicitly structure exercises to facilitate collaboration and information-sharing with peer supervisors, other California climate policymakers, and academic institutions.
- The Department should conduct exercises on an annual or biennial basis with new iterations tackling new risk types and scenarios in line with defined supervisory objectives and broader state climate policy goals.

The chart on the following page depicts a hypothetical five-round scenario analysis exercise pathway that CDI could implement in coming years based on these recommendations. The chart is intended to present potential exercise rounds and not to prescribe specific pathways. For a complete list of conclusions and recommendations, see [Section IV](#).

[Section I](#) begins with an introduction and overview of scenario analysis and CDI's legal and policy background. [Section II](#) reviews current practices by leading North American supervisors, [Section III](#) assesses the core design choices for crafting an exercise, [Section IV](#) and identifies lessons learned and offers recommendations for the design of new exercises.

**EARLY STAGES** **LATER STAGES**

**ROUND 1** **ROUND 2** **ROUND 3** **ROUND 4** **ROUND 5** **ROUND 6+**

**KEY OBJECTIVES:**

Internal capacity building	Internal capacity building	Internal capacity building	Internal capacity building	Insurer capacity building	TBD
	Physical risk assessment expertise	Insurer capacity building	Insurer capacity building	Peer supervisor data/strategy development	TBD
				California climate policy decision-making	

**RISK TYPES:**

Transition risk - investments only	Wildfire and flood physical risk - underwriting only	Transition risk - investments only	Transition and physical risk - underwriting and investments	Transition and physical risk - underwriting and investments	TBD
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**STRUCTURE:**

Pure top-down	Hybrid top-down/bottom-up	Hybrid top-down/bottom-up	Pure bottom-up	Hybrid top-down/bottom-up	TBD
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**COHORT:**

All CA licensed insurers	Select small group of CA insurers	All CA licensed insurers	Select small group of CA insurers	All CA licensed insurers	TBD
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*Hypothetical five-round GDI scenario analysis pathway*



## I. INTRODUCTION

Insurance companies in California and around the world face significant financial risks due to climate change as both investors and insurers. These include both the significant transition risks facing investors worldwide as the global economy shifts toward decarbonization and the particular combination of compounding physical risks—wildfire, drought, coastal hazards, extreme heat—that threaten California’s landscape.

Accurately assessing and managing these risks will be vital to ensuring the long-term viability of the insurance market in California, the availability and affordability of insurance for California residents and businesses, and the state’s physical and financial resilience in a changing climate. Assessing and managing risks is a key element of California’s efforts to foster a reliable insurance market and plan for the transition to a low-carbon economy by integrating financial regulation and decision-making into the state’s broad suite of climate policies.

Accurately assessing and managing the financial risks of climate change to promote solvency, affordability, and availability also aligns closely with the prudential authority and priorities of the California Department of Insurance (CDI), the state’s insurance supervisor. Since 2010, CDI has taken a number of pioneering steps to assess and manage systemic climate change-related economic and financial risks facing California’s insurance sector.<sup>1</sup>

Examples include, but are not limited to:

- The Climate Risk Carbon Initiative, launched in 2016, through which the Department required large insurers to report on fossil fuel investments and requested that insurers doing business in California divest from thermal coal.<sup>2</sup>
- Leadership in the climate risk task force of the National Association of Insurance Commissioners (NAIC), including development and administration of the NAIC’s climate risk disclosure survey and its 2022 adoption of updated standards in line with the recommendations of the Task Force on Climate-Related Disclosures (TCFD); and co-

founding and leadership in the Sustainable Insurance Forum for international cooperation on sustainable insurance practices.<sup>3</sup>

- The Climate Smart Insurance Products Database, a list of green insurance products for consumers, launched in 2020.<sup>4</sup>
- Appointment of the nation's first Deputy Insurance Commissioner of Climate and Sustainability.<sup>5</sup>
- Two scenario analyses of California insurers' 2017 year-end investment portfolios under a 2° Celsius economic transition scenario, conducted for the Department by the 2 Degrees Investing Initiative (2Dii), released in 2018 (focused on transition risk) and 2019 (focused on physical risk).<sup>6</sup>
- A state Sustainable Insurance Roadmap designed to “enhance consumer protection by accelerating alignment with the Paris Agreement on Climate Change, strengthening community risk reduction, and testing new insurance approaches to closing protection gaps in our most vulnerable communities.”<sup>7</sup>

The Department has taken these actions in parallel with California's continued advancement of climate policies across emissions reduction, technology development, resilience, and just transition. It has also taken them alongside a series of measures designed to reduce risk to California communities by incentivizing home hardening to wildfire and promoting policy renewal and affordability for disaster-hit areas.<sup>8</sup> The Sustainable Insurance Roadmap details many of these efforts.

California leaders have increasingly looked to state financial regulators and pension funds to incorporate climate risk policy into this ecosystem, including Governor Newsom's 2019 Executive Order calling for a state Climate Investment Framework.<sup>9</sup> In 2021, an advisory group co-led by the Governor's Office of Planning and Research issued a state climate risk disclosure framework that emphasized, among other recommendations, the importance of state support for public and private scenario analysis exercises.<sup>10</sup>

Leading financial institutions, regulators, and experts are increasingly recognizing climate risk scenario analysis as a “vital tool” “to identify, assess and understand how best to manage climate risks in the financial system.”<sup>11</sup> It “can help financial institutions assess and ultimately manage the risks and opportunities associated with the transition” to a decarbonized economy and “help insurers adapt and plan an informed long-term climate strategy.”<sup>12</sup> As leading financial regulators and institutions begin to use climate risk scenario analysis to assess and manage systemic risk, CDI and other insurance supervisors are considering strategies to engage these tools for the insurance sector. But, as CDI has noted, “these tools can appear opaque and inaccessible to both insurers and insurance regulators” and “significant advances” are needed in technical capacity and communication.<sup>13</sup> At the same time, some leading insurance sector representatives are urging caution, noting that current scenarios and models generally do not account for firm-specific factors or exogenous shocks and climate feedback

## SCENARIO ANALYSIS AND STRESS TESTING

This report discusses climate risk scenario analysis and stress testing, which are related but distinct risk-assessment instruments. The report focuses on scenario analysis and may use that term to describe both instruments in some cases.

loops, and emphasizing the need for alignment between financial regulatory efforts and the other economic transition and risk management policies of the broader climate policy apparatus.<sup>14</sup> Others argue that, given the singular wildfire threat facing California’s communities and insurance sector, enhanced wildfire modeling initiatives and related policies should take precedence over scenario analysis.

## STATE LEADERSHIP ON CLIMATE RISK

California is one of a growing number of states exploring strategies to anticipate and mitigate climate-related financial risk to the insurance sector. For example, in 2021, New York’s Department of Financial Services became the second US state to run a scenario analysis exercise for domestic insurers and published guidance on management of financial risks.<sup>15</sup> In October 2022, the Connecticut Insurance Department issued guidance for insurers (in furtherance of the department’s requirement to biennially report to the legislature on climate risk) including expectations for organizational structure, risk management, and “exploratory” scenario analysis.<sup>16</sup> And since California began administering the NAIC climate risk disclosure survey in 2009, 14 states representing 80 percent of the US insurance market have joined.

## US FEDERAL ACTION ON CLIMATE RISK

While this report focuses on state-level insurance supervisory authority, recent developments in federal climate risk policy provide support for CDI’s strategies. In May 2021, President Biden signed Executive Order 14030 directing the development of a government-wide climate-related financial risk strategy and the assessment of climate risks by financial regulators, including assessment by the Federal Insurance Office of “issues or gaps in the supervision and regulation of insurers” and “the potential for major disruptions of private insurance coverage.”<sup>17</sup> In October 2022, the office proposed a data collection from certain property and casualty insurers regarding “climate-related exposures and their effects on insurance availability for policyholders,” including potential disruptions of insurance coverage and effects on insurance affordability.<sup>18</sup> (The NAIC responded to the proposal expressing concern about its scope and timeline and urging a state regulator-led approach.<sup>19</sup>) The Office of the Comptroller of the Currency, the Federal Deposit Insurance Corporation, and the Federal Reserve have all issued draft guidance to large banks setting forth the regulators’ expectations that banks will analyze, disclose and take steps to mitigate the financial risks associated with climate change.<sup>20</sup> In addition, in April 2022 the Securities and Exchange Commission proposed new rules standardizing climate risk disclosure requirements for publicly traded companies, which when finalized could substantially increase the frequency and comparability of disclosures in the US and support scenario analysis exercises throughout the economy.<sup>21</sup> In January 2023, the Federal Reserve Board announced a pilot climate risk scenario analysis for the nation’s six largest banks, including both Board-selected physical and transition risk modules and individual bank-designed scenarios, with the Board responsible for publication of aggregate data.<sup>22</sup>

Given the climate risks that are already manifesting in the global and California economies and the relative newness of scenario analysis in the insurance sector, CDI can play a pioneering role in identifying effective and appropriate scenario analysis strategies for early implementation and subsequent iteration. The remainder of this implementation guide will analyze the key goals and structures of scenario analysis with a focus on best practices and strategies ready for adoption by CDI and its peers.

### A. Defining scenario analysis and stress testing

Scenario analysis and stress testing are related but distinct tools that enable financial institutions to identify and assess different economic risk scenarios resulting from potential direct and indirect impacts of climate change and associated policy and economic transitions.<sup>23</sup> While their goals are broadly similar, they differ somewhat in scope and methodologies:

- In **scenario analysis**, financial institutions and their regulators assess risk by modeling various possible economic scenarios (representing combinations of policy and technology outcomes, for example) and how their assets would perform under those scenarios.
- **Stress testing** is a form of risk analysis in which institutions assess financial outcomes in one or more specific adverse scenarios (such as an extreme weather event) against specific capital requirements, typically returning a quantitative assessment (and sometimes a “pass/fail” outcome) of one or more risk metrics.<sup>24</sup>

Financial institutions and regulators can use scenario analysis, stress testing, or a combination of both approaches to expose climate risks— and they can use them to assess both firm-specific (microprudential) and system-wide (macroprudential) impacts of the decarbonization transition.<sup>25</sup> As the global economy decarbonizes, companies and investors that successfully anticipate the transition may benefit from significant economic opportunities, while companies that fail to prepare for decarbonization may be exposed to significant risk of loss.<sup>26</sup> Thus, financial regulators have a prudential interest in ensuring that the entities and economies they supervise are engaging in robust, right-sized, and up-to-date exercises.

### B. Insurers and climate risks

Climate risk scenario analysis and stress testing can assess the financial effects of both a global economic transition to decarbonization and the impacts of physical changes to the environment due to climate change (including both incremental effects like sea-level rise and acute climate-driven events such as wildfires and hurricanes). While these related but distinct forms of financial risk—typically described as transition risk and physical risk—are well understood in the climate-related financial risk space, their distinctions are relevant to the design of scenario analysis exercises and merit brief discussion.<sup>27</sup>

- **Transition risks** result from economic transitions away from carbon intensive industries, including direct financial impacts of divestment or loss of value and indirect financial impacts of regulatory decarbonization measures. Transition risks generally arise from impacts to the profitability of carbon-intensive industries due to climate change mitigation policies, climate-related litigation, developments in low-carbon technologies, market shifts and reputational considerations.<sup>28</sup> Transition risks are typically sector-specific and long-term in nature and will vary depending on the smoothness or suddenness of economic and policy decisions.<sup>29</sup> Transition risks can manifest as **market risks** (large-scale changes in financial markets), **credit risks** (the inability of borrowers to make debt payments), or **litigation risks** (lawsuits that companies or their directors and officers could face for their historical emissions or their failure to disclose or act upon certain risks).
- **Physical risks** arise from both the economic impacts of long-term weather and climate changes (**chronic risks**) and from the immediate impacts of climate-driven extreme weather events (**acute risks**); and they are often geography- and sector-specific. Impacts including direct damage to physical assets and operations, disruption of supply chains, and long-term shifts in availability of raw materials or viability of traditional business activities can generate physical risks.<sup>30</sup>

Transition and physical risks break down further into two distinct forms of risk for insurers as a result of the insurance business model:

- First, insurance companies, like other financial institutions, face **investment risk** with regard to the significant investment portfolios that may decrease in value due to physical or transition risks.
- Second, insurers' core business—providing various forms of risk transfer to individuals and to companies throughout the real economy—could expose them to **underwriting risk** if climate change impacts increase the amount that they have to pay out in claims under existing insurance policies (for example, following a major wildfire) or limit their ability to offer insurance policies in particular areas or to cover particular risks. In general, insurers' risk modeling and ability to regularly adjust the availability and scope of coverage or raise premiums may enable insurers to address and reduce climate change-driven losses, but scenario analysis is nonetheless important to determine whether insurers are adequately responding to climate-driven underwriting risks.

The size of an insurer and the nature of its underwriting activities will shape the relative importance of physical and transition risks (and, relatedly, portfolio and underwriting risks) and the insurer's capacity to analyze those risks. For example, larger insurers may derive a greater portion of their financial strength from their investment portfolios while also operating diverse underwriting portfolios with no dominant physical risk exposure; as a result, transition risks may be more relevant and analytical capacity may be greater. By contrast, smaller insurers with a property and casualty focus may face more acute



exposure to physical risk with underwriting implications relative to their economic transition-related risks.

As climate change causes economic actors to experience financial losses, face litigation, and bring associated insurance claims, financial institutions' and insurers' asset and policy portfolios may suffer accordingly. To date, scenario analyses have generally focused on transition risks, and to the extent they have covered physical risk they have focused more on chronic risks than on acute shocks.<sup>33</sup> This focus of scenario analysis on transition risks may be because physical risk assessment is more complex and uncertain for banks and banking regulators, which have led many early exercises. However, insurers may in general be more familiar with physical risk due to their line of business, which includes (for property and casualty insurers and reinsurers) sophisticated physical risk and catastrophe modeling. As the New York Department of Financial Services has noted, “[a]s a general matter across the industry, the impact of climate change on insurers’ investments receives less attention than the impact of climate change on insurers’ liabilities, and low-carbon transition risks are less understood than climate-related physical risks.”<sup>34</sup>

As CDI and other supervisors structure new exercises, the scope of risks to analyze and the capacity available to do the analysis will be key decision points. If insurers are generally less adept and experienced at analyzing transition risks to their investments, then these risks may be an appropriate area of focus for initial supervisor-led exercises. At the same time, supervisors may wish to consider the relative size of insurers in the market to determine how an early-stage transition risk exercise is relevant to all insurers. However, given the prominence of certain physical risks in certain jurisdictions—in particular wildfire risk in California—and the prudential responsibility to protect insurance affordability and availability, supervisors will also want to develop capacity in assessing and reporting on these risks as part of ongoing scenario exercises.

### C. Informing risk management and decision-making

The broad goal of any scenario analysis or stress test exercise is to better inform decision-making regarding climate risks. But different exercises can yield different types of decision-useful information for both regulators and financial institutions, and the type of information sought will determine key elements of the exercise design.

- For **regulators and supervisors**, the information developed in an exercise could, for example, inform development of new supervisory guidance or public reports; lead the regulator to meet with potentially vulnerable companies to discuss climate risk strategies; trigger additional information gathering

### SCENARIO ANALYSIS AND REINSURANCE

Reinsurers play a critical role in the insurance sector by providing insurance for primary insurers’ underwriting risk of loss through their standard policies. The nature of this coverage means that reinsurance will be critical to insurer solvency under future climate scenarios,<sup>31</sup> but it also may expose reinsurers to a significant risk of extreme losses in the case of compounding climate-related physical risks.<sup>32</sup> As a result, the scope and limitations of reinsurance will be a key consideration in scenario analysis exercises, and supervisors should take care to include inquiries about insurers’ reinsurance coverage and its role in their resilience to climate-related underwriting risks.

and investigation; initiate new supervisory policies or legislation; or identify stakeholders that can play a role in driving risk reduction.

- For **financial institutions**, the information could inform development of new climate risk management systems or governance structures; support participation in industry forums and coalitions on climate risk; trigger additional internal information gathering; reshape investment decision-making; or educate residents and businesses about risks.
- For **other public entities**, information on physical risk exposure could inform future development plans, building codes, public communications, and investments in risk reduction; information on transition risk exposure could inform transition plans across multiple economic sectors.

Given the early stage of scenario analysis practice and the need for capacity-building at state-level supervisors like CDI, informing actual decision-making or regulatory policy may not be the primary goal of the initial rounds of new exercises. As the Bank of Canada noted following its six-party pilot exercise, “developing awareness and capabilities around climate-related risks is as important as assessing the risks themselves” at this juncture.<sup>35</sup> But in subsequent exercises, CDI may wish to gather information for key areas of decision-making that tie directly to its specific regulatory role and the risk profile facing California insurers. These could include:

- Regulatory decisions regarding affordability and availability of insurance in California, in particular with regard to wildfire risk, which could be informed by physical risk data (and would necessarily link to state, local, and consumer risk-reduction strategies that may be driven by state policies).
- Insurer risk management and governance structures, which could be informed by a range of data.
- Alignment of California’s insurance sector with the state’s ambitious climate change agenda, which could be informed by a range of data.

As the Department of Insurance and other supervisors develop their exercises, identifying areas of decision-making to inform (whether immediately or in later iterations) will be a key aspect of goal setting and exercise design.

#### D. CDI’s legal background for scenario analysis

As California’s insurance regulator, CDI has a legal and prudential duty to assess and address climate risks facing California insurers.<sup>36</sup> Although climate risk is not discussed specifically in the California Insurance Code, the two core responsibilities of the Department of Insurance and the Insurance Commissioner—ensuring solvency of insurers and affordability and availability of insurance for consumers—clearly encompass assessment of climate-related financial risks and collection of relevant data. The Department of Insurance (through the Commissioner) has expansive powers within the statutory framework in the Insurance Code,<sup>37</sup> which is a product of both the Legislature and the voters’ 1988 approval of Proposition 103, which established goals of consumer protection, departmental accountability, market competition, and insurance

affordability and availability.<sup>38</sup> These powers include the authority to regulate insurance companies to ensure that they remain solvent<sup>39</sup> and to request and examine insurance company information relevant to the Department's oversight responsibility, such as underwriting and investment portfolio information that could be included in a scenario analysis or stress test exercise.<sup>40</sup> CDI has consistently interpreted these powers to include climate risk-related prudential actions such as the implementation of the NAIC climate risk disclosure survey and regulations requiring insurers to reflect policyholders' wildfire safety measures in property insurance coverage.<sup>41</sup> As a result of these statutory and constitutional provisions, the Commissioner has legal authority to conduct (or commission by third-party analysts) exercises with data provided by insurers, authority the Department has exercised in the past through the 2017 and 2018 scenario analysis exercises.<sup>42</sup>

## **E. CDI's policy precedent for scenario analysis**

Based on its broad prudential authority and the increasing relevance of climate risk-related issues in the insurance sector in general and California in particular, CDI has taken a number of steps to gather information on climate-related risks facing California insurers. The NAIC Climate Risk Disclosure Survey, the 2018 scenario analysis exercises, and the Department's 2022 Sustainable Insurance Roadmap offer the most relevant precedent for future scenario analysis and stress testing exercises.

### **1. The NAIC Climate Risk Disclosure Survey**

Since 2010, CDI has administered a Climate Risk Disclosure Survey on behalf of the NAIC, the coordinating and policy body for state insurance supervisors in the United States. The Survey is "a voluntary risk management tool for state insurance regulators to request from insurers on an annual basis a non-confidential disclosure of the insurers' assessment and management of their climate-related risks."<sup>43</sup> According to NAIC, the purposes of the survey include enhancing transparency about climate risk management, promoting strategic management, and providing a baseline supervisory tool for assessing industry impacts of climate risk.<sup>44</sup>

In 2022, NAIC updated the Survey to align with the climate risk disclosure framework of the Task Force on Climate-related Financial Disclosures (TCFD), adding questions on climate risk management, climate-related business strategy, and risk assessment metrics and targets that a wide range of international financial institutions are already answering on an annual basis.<sup>45</sup> TCFD disclosure does not expressly require a scenario analysis exercise, but for insurers that do perform scenario analyses, the TCFD framework states they should disclose the scenarios used, critical parameters and assumptions, analytical choices, and timeframes. The framework also recommends that insurers with significant weather-related exposures should also consider greater than 2° scenarios.<sup>46</sup> An insurer could also use the results of a scenario analysis or stress test to provide the material for many Survey responses (or incorporate it wholesale),

and the risk assessment and data management strategies described in a Survey response would substantially inform a scenario analysis or stress test.

## *2. The 2017–2018 2Dii scenario analyses*

In 2017, CDI commissioned from the 2 Degrees Investing Initiative (2Dii) a first-of-its kind climate risk scenario analysis of California-licensed insurers.<sup>47</sup> 2Dii analyzed the investment portfolios of insurance companies operating in California and earning over \$100 million annually in national premium, representing a total portfolio value of over \$4 trillion.<sup>48</sup> 2Dii’s Paris Agreement Capital Transition Assessment (PACTA) model assesses portfolios’ exposure to climate-relevant sectors (e.g., fossil fuels, energy, automobile manufacture) over a five-year period that includes a range of warming scenarios for each of those sectors, identifying whether the portfolio is likely to align with a low-, medium-, or high-warming future for the sector.<sup>49</sup> (Clean energy nonprofit RMI has since taken stewardship of the PACTA model.)

The analysis assessed California-licensed insurance companies’ current exposure to transition risks, projected transition risks over the next five years, and exposure to high- and low-carbon activities.<sup>50</sup> (It did not consider the underwriting risk of increased insurance claims or diminished business due to climate change.) 2Dii compared the insurers’ fixed income and listed equity portfolio holdings in oil and gas production, coal production, power generation, and automobiles relative to the market in terms of their alignment with future warming scenarios.<sup>51</sup> The analysis found that “in terms of trajectory, the investment choices made by insurers operating in California with over \$100 million in annual premiums are more aligned with a 1.75°C transition pathway than financial markets but that the insurers’ coal and oil investments were aligned with greater than 2° increases by 2100.<sup>52</sup>

Although an important first step, 2Dii’s scenario analysis was not a complete picture of California-licensed insurance companies’ climate risks. A second 2Dii scenario analysis commissioned by the Department in 2018 included for the first time an analysis of physical risks to investments in key sectors. This analysis considered the physical location of assets held through insurers’ investments overlaid on maps of water supply risks, wildfire risk, and flood risk to derive metrics of physical risk exposure. The analysis looked only at insurance firms’ investment portfolio risks (and only covered a subset of insurers) and did not consider underwriting risk or risk of decreased business. Finally, the five-year timeframe employed by the PACTA model provides a limited, though business decision-useful, picture of the risk landscape facing insurers. Understanding of physical risk drivers such as wildfire and flooding has evolved substantially since the implementation of this exercise, presenting an opportunity for more sophisticated analyses.

## *3. The Sustainable Insurance Roadmap*

In November 2022, the Department of Insurance released the California Sustainable Insurance Roadmap, a set of “objectives and foundational strategies

the Department is pursuing to protect consumers and create more sustainable insurance markets in an era of accelerating climate risks.”<sup>53</sup> Two of the roadmap’s four strategies relate to assessment and management of insurers’ financial risks, including actions to improve insurer climate risk disclosure, assess fossil fuel investments, accelerate sustainable investment strategies, and implement scenario analysis and stress testing.<sup>54</sup>



## II. EXAMPLES FROM LEADING INSTITUTIONS

Climate risk scenario analysis and stress testing for financial institutions is quickly becoming a standard practice internationally, particularly among central banks in Europe and Asia.

Dozens of central bank members of the NGFS are planning or have conducted exercises.<sup>55</sup> The European Central Bank conducted a supervisory climate risk stress test in 2022 (building on its 2021 economy-wide stress test), finding that “many banks are still at an early stage in terms of factoring climate risk into their credit risk models” and “the majority of supervised institutions are still at a very early stage in the development and implementation of such frameworks,” among many other key points.<sup>56</sup> As discussed earlier, the United States Federal Reserve in January 2023 announced its first scenario analysis exercise involving the nation’s six largest banks.

Examples from leading international financial supervisors demonstrate varying coverage of risks modeled, time horizon, exercise structure (top-down, bottom-up, or hybrid), and other structural choices. See [Appendix A](#) for an overview of select international efforts. These institutions’ exercises demonstrate that no single approach is clearly preferable without consideration of jurisdiction-specific goals. In North America, a handful of supervisors have initiated scenario analysis exercises including for the insurance sector:

- **CDI’s** 2017 exercise focused on transition risk using 2Dii’s PACTA model to assess a five-year time horizon, covering a subset of large California insurers via a top-down approach; its 2018 assessed insurers’ physical risks based on location of investment assets and wildfire, flood, and water supply risks.
- The **Bank of Canada’s** 2020-2021 pilot exercise assessed transition risks, made long-term projections through 2050, employed a hybrid approach engaging six financial institutions, and focused on quantitative methods.<sup>57</sup>

- The [New York State Department of Financial Services \(NYDFS\)](#) engaged 2Dii to perform a 2021 stress test of climate risks to the investment portfolios of New York’s insurance industry using the PACTA model.<sup>58</sup> Before releasing its exercise results, NYDFS also promulgated a guidance document which advised New York insurers on how to manage climate change risks. The NYDFS guidance document advises that “an insurer’s analysis of climate risks and assessment of their materiality for its business should shift from a qualitative approach to an approach that is both qualitative and quantitative for risks that can be quantified.”<sup>59</sup>

The US insurance sector is a relative newcomer to climate risk scenario analysis. A number of European and Asian insurance regulators have undertaken climate risk scenario analysis or stress testing and many insurance supervisors are beginning to consider climate-related risk in insurance supervision and regulation.<sup>60</sup> California’s 2018 exercise and New York’s 2021 exercise, both assessing insurers’ transition risks through the 2Dii PACTA model, are the only examples of US-based insurance exercises to date. EIOPA’s 2022 report outlining methodological principles for insurance climate risk stress testing identifies multiple forms of underwriting risks that insurers may face due to climate change.<sup>61</sup> These include higher-than-expected claims on damaged non-life assets, on life/health assets due to increased morbidity and mortality, and on professional indemnity cover due to climate litigation, leading to decreased underwriting business due to cost and behavior changes.<sup>62</sup> The report suggests two broad approaches to predicting physical risks: event-based scenarios, which use historical data to assess the effect of a specific set of catastrophic events (such as floods or windstorms) on a sector; and parameter changes, which evaluate the changing severity and frequency of physical climate events to assess broader, systemic risks.<sup>63</sup> These findings suggest a path forward for supervisors to assess underwriting and physical risks, which are highly relevant to the health of the insurance sector but have not been a focus of exercises to date.





## III. STRUCTURING THE SCENARIO ANALYSIS EXERCISE

The design and structure of scenario analysis exercises involve decisions that will be informed by supervisors' goals and capacity and which will determine the nature of the information developed and decisions influenced.

As CDI and other supervisors begin to implement scenario analysis, key considerations will include:

- What objectives the supervisor is pursuing
- Which scenarios are modeled
- What time horizon is assessed
- What entities are covered or participate
- What exercise structure is used
- Who conducts the exercise

This section will provide an overview of these design choices.

### A. SETTING AND PRIORITIZING OBJECTIVES

Within the broad goal of developing climate risk information in order to promote management strategies, the objectives of specific scenario analysis exercises will depend on the posture, capacity, and geographic and business needs of the regulator and participating entities. Objectives may include:

- Capacity-building for the supervisor or regulator leading the exercise
- Capacity-building for the regulated or participating entities
- Building baseline understanding of climate risks and modeling approaches
- Identifying gaps in climate risk data
- Developing risk management strategies for firms

- Informing policy and prudential strategies for regulators and supervisors
- Publicly reporting findings and communicating with other state climate and financial agencies
- Setting the stage for future exercise rounds<sup>64</sup>

Most exercises will likely seek to advance a combination of goals, but some goals may be determinative in exercise design, and the mandate and jurisdiction of the supervisor or regulator will shape core goals. For example, a supervisor seeking to build internal agency capacity may focus first on a top-down, regulator-led exercise to cultivate staff expertise and develop engagement and reporting processes. The Bank of Canada stated of its 2021 pilot exercise that a “core goal” was to “build up the capacity of authorities and financial institutions for conducting climate scenario analysis, which is a natural prerequisite for system-wide assessments,” which resulted in an analysis of a small subset of financial institutions and only a portion of their balance sheets.<sup>65</sup>

CDI has a recent history of climate risk initiatives—and a number of established goals—but is still shaping its departmental role with respect to scenario analysis. As a result, early exercises likely should focus on capacity-building within the Department and among regulated insurers to develop agency expertise, mutual understanding of exercise parameters, and strong information-sharing practices. However, CDI should craft and conduct these capacity-building exercises with an eye toward rapid iteration and development of more decision-useful information—in particular, information that can inform CDI’s prudential responsibilities to promote insurance affordability and availability and that can inform insurers’ own business decision-making.

## B. SELECTING SCENARIOS AND MODELS

The choice of scenario or model forms the core of a scenario analysis. The Network on Greening the Financial System (NGFS) defines a scenario as a “plausible description of how the future may develop based on a coherent and internally consistent set of assumptions about key driving forces (e.g., rate of technological change, prices) and relationships.”<sup>66</sup> NGFS designed six scenarios which are used in many exercises (sometimes with sector- and jurisdiction-specific adjustments, and often in combination) and organizes them into four categories:

- **Orderly:** Climate policies are introduced early and become more stringent over time; transition risks and long-term physical risks are relatively subdued.
- **Disorderly:** Climate policies are delayed and divergent across countries and sectors; carbon prices are high; transition risks are relatively high as a result, but the worst long-term physical risks are mitigated.
- **Hot house world:** Some climate policies are introduced but they are insufficient to halt significant warming, leading to severe and cascading physical risks and some irreversible impacts, but limited economic transition. The “current policies” scenario falls within this category.

- **Too little, too late:** A late transition fails to limit physical risks but also results in substantial transition risks. (No specific scenarios are developed for this category and it is generally not modeled, but it occupies the highest-risk quadrant of NGFS' framework.)<sup>67</sup>

While the NGFS scenarios are not the only example of scenarios used to identify future risks, they have been widely used in scenario analysis exercises to date and are generally well understood within the developing field (thus enabling relatively easy adoption and comparability across exercises). As such, they represent a potentially good fit for CDI and peer supervisors seeking to build capacity and share information, although they have been developed at the national level and would require some downscaling for California-specific exercises. Additional and related scenarios include:

- **International Energy Agency (IEA)** scenarios based on the World Energy Outlook, which focus on the energy-sector implications of four futures from current policies to net zero emissions by 2050.<sup>68</sup>
- **Bespoke scenarios** developed by EIOPA, Bank of England, and other leading supervisors, many of which bear similarities to or build on the NGFS scenarios and follow scenario development principles outlined by the International Renewable Energy Association.<sup>69</sup>
- **Representative Concentration Pathways (RCPs)**, which use four different emissions/radiative forcing trajectories to estimate 2100 temperature increase scenarios and the extreme weather, sea level rise, adaptation cost, and policy and technology shifts associated with each.<sup>70</sup> RCPs are not stand-alone scenarios but rather potential warming futures that can be used as an input to define discrete scenarios.
- **Shared Socioeconomic Pathways (SSPs)**, which are five narrative future scenarios that could develop in the absence of coordinated global climate policy, ranging from “green road” (a gradual but pervasive shift to sustainability, with low mitigation and adaptation challenges) to “rocky road” (increased focus on nationalism, high mitigation and adaptation challenges).<sup>71</sup> SSPs are not stand-alone scenarios but rather sets of assumptions that must be matched with data inputs to generate scenarios.

**PACTA** is an open-source tool created by 2Dii (and now stewarded by RMI) that uses a five-year time horizon to assess asset-based company data against Paris Agreement-aligned economic production scenarios for a set of high-carbon industrial sectors. PACTA is not a scenario but rather a methodology for comparing companies' production pathways against emissions reduction pathways that are consistent with Paris Agreement targets. Because of its short-term time horizon and open-source format, PACTA has been a leading tool for early exercises run by insurance supervisors.

While this report does not recommend a specific scenario or methodology for CDI to employ, departmental goals and capacity suggest the following considerations:

- Using NGFS (or NGFS-inspired) scenarios could promote capacity-building and information-sharing in early exercises due to their relatively common use among peer institutions, which would facilitate learning for staff and comparison across jurisdictions.
- Using PACTA or another short time horizon model could help align early efforts most directly with insurers’ business concerns and build on CDI’s prior scenario analysis exercise.
- Customizing or expanding a physical risk-focused model to adequately account for the most prominent physical risk facing California insurers—wildfire—could be essential to crafting exercises that accurately reflect risks in the California physical risk environment and insurance market. However, recent drought and flood events also demonstrate the multifaceted nature of physical climate risk in California and the long-term need for comprehensive scenarios.
- Embracing flexibility in selection of scenarios for later exercise iterations could support capacity-building within CDI and the broader US insurance regulatory community.

These examples generally involve “exploratory” scenarios that describe potential futures in order to identify risks and management options. By contrast, “normative” scenarios would “identify desirable or undesirable outcomes by considering stakeholder values and interests and examining how such futures could arise,” potentially developing information on more business-appropriate timelines.<sup>72</sup> In a normative analysis, an insurer would “define climate change risk appetites” for common risk metrics such as average annual loss and historical disaster events “and explore how business decisions affect desirable or undesirable outcomes.”<sup>73</sup> This approach is also sometimes referred to as a “reverse stress test.” By prioritizing insurers’ existing risk management metrics, normative scenarios may potentially better inform business decision-making (in a complementary role to exploratory analyses that could better inform systemic and policy-oriented decision-making). As normative methods develop, CDI and other supervisors should consider options to incorporate them into regular exercises or encourage their use among insurers, alongside more traditional financial risk analyses.

CDI’s initial choice of scenario or model should reflect current departmental and insurer capacity. But the Department could seek to address different scenarios and questions in future iterations along the lines of the “exploratory” approach taken by the Bank of England. This strategy encompasses “a wider range of risks than those closely linked to the financial cycle” and stands in contrast to annual solvency exercises, with only system-level (rather than firm-level) results disclosed.<sup>75</sup> Through an exploratory approach, CDI could develop data on a range of risks while building capacity over time. It could also consider emerging scenarios that account for new risks and measures, such as land- and nature-related policy levers that may form a substantial portion of state climate efforts in the coming decades.<sup>76</sup>

## DETERMINISTIC AND STOCHASTIC MODELING

Risk modeling experts distinguish between deterministic models that center on assumptions of discrete future scenarios (such as a clear emissions pathway) and stochastic models that compile a range of possible outcomes and assign different probabilities to their occurrence (which their proponents argue are a more accurate reflection of potential climate futures). Many leading scenario analysis frameworks rely on primarily deterministic methods to build their scenarios, which may be more straightforward (and lower-cost) to implement and may be better for understanding the drivers of risk, but stochastic models that incorporate more complex, random, and multi-risk factors are emerging and may prove to be business decision-useful.<sup>74</sup> As stochastic approaches and tools become more widely available, CDI and peer supervisors should monitor their development and use.

## C. STRUCTURING THE EXERCISE

Exercises are broadly grouped into “bottom-up” and “top-down” approaches:<sup>77</sup>

- In **top-down exercises**, a supervisor performs the analysis without the direct involvement of financial institutions, using data gathered from the institutions to assess individual and system-wide risks under selected scenarios.<sup>78</sup> For instance, the European Central Bank performed an economy-wide top-down climate stress test conducted centrally by ECB staff using internal datasets and models, applying the same assumptions and models across financial institutions.<sup>79</sup>
- In **bottom-up exercises**, the supervisor or regulator sets out one or more scenarios and a set of methodological rules and financial institutions individually run the provided scenarios against their own balance sheets.<sup>80</sup> The regulator or supervisor can then conduct additional analysis based on the results produced by each financial institution to develop a system-wide assessment. For example, in 2021 the Bank of England conducted voluntary bottom-up climate risk scenario analysis with a number of large banks, insurance companies, and other financial institutions, building on past exercises including 2019 bank and insurance stress tests.<sup>81</sup> More recently, the US Federal Reserve has announced that it will be conducting a bottom-up scenario analysis exercise with the participation of six major US banking institutions.

In general, top-down exercises can ensure more consistency in application of methodology and may be better designed to cultivate information for use by supervisors in policy decision-making, while bottom-up exercises may improve individual financial institutions’ data collection and understanding of the financial implications of climate-related risks.<sup>82</sup> In practice, supervisors can combine elements of top-down and bottom-up analysis depending on capacity and legal authority.<sup>83</sup> The Bank of Canada, for example, used elements of both methods throughout its scenario analysis.<sup>84</sup> The Bank assessed credit risk through “[b]orrower-level assessments by the financial institutions, using sectoral-level financial impacts based on the scenarios” and “capture[d] nuances from the bottom up, while [its] top-down portfolio impact assessment extrapolate[d] these borrower-level impacts to portfolio segments.”<sup>85</sup> For market risk, however, the Bank’s modeling was purely top-down.<sup>86</sup>

<b>BOTTOM-UP</b>	<b>BOTTOM-UP WITH TOP-DOWN ELEMENTS</b>	<b>TOP-DOWN WITH BOTTOM-UP ELEMENTS</b>	<b>TOP-DOWN</b>
Supervisor designs scenario	Supervisor designs scenario, insurers run exercise, supervisor runs additional analysis using insurer submissions	Supervisor runs exercise based on targeted data requests from insurers	Supervisor runs scenario with own data and models
Insurers run exercise with own data and models			No involvement from insurers

*Types of bottom-up and top-down exercises. Adapted from NGFS, Scenarios in Action.*

Early scenario analyses have tended toward top-down approaches; CDI's 2017 and 2018 analyses and New York's 2021 exercise, both using the PACTA model, involved analysis conducted on behalf of supervisors using insurer-provided data. While CDI will likely begin new regular exercises via primarily top-down methods, it should incorporate bottom-up elements over time (potentially through voluntary pilots) to encourage more active participation and analysis by insurers. However, to ensure baseline consistency of results, properly inform agency decision-making, and build coordination with other state climate policy institutions, CDI likely will retain top-down elements across future exercises.

## D. DEFINING SCOPE AND TIME HORIZON

Defining the scope and time horizon of risks evaluated is a key step in designing an exercise, although (as in the case of PACTA, for example) the selection of a particular model may largely determine the scope and timeline. The particular risk geography of a jurisdiction and a supervisor's regulatory mandate (and concerns about the market) will inform risk scope, while the chosen risk scope and the goal of the information yielded in the exercise (policymaking, business decision-making, or both) will inform time horizon decisions.

### 1. Scope

In broad terms, CDI and peer supervisors must decide whether an exercise will cover:

- Transition risks, physical risks, or both
- Among transition risks
  - Investment risks, underwriting risks, or both
  - Market risks, credit risks, or both
  - Litigation risks
- Among physical risks
  - Investment risks, underwriting risks, or both
  - Chronic risks, acute risks, or both
  - Individual risks (such as wildfire) or comprehensive risks

Most early scenario analysis frameworks have focused on investment portfolio transition risks—as did CDI's 2017 exercise—but supervisors such as the Bank of England have begun to incorporate more physical risk analysis into their exercises. For CDI's new exercises, the importance of establishing viable practices and engaging industry partners suggests continuing and building on the prior investment portfolio work including both transition and physical risks and expanding that work to include underwriting risks. The acuteness of physical risks in California (in particular wildfire) points toward robust inclusion of physical risks in subsequent iterations.

## FREQUENCY OF EXERCISES

Timing and frequency of scenario analysis exercise(s) are key structural considerations. Greater frequency (i.e., annual or bi-annual) may build more robust data sets and consistent analytical practices, but longer intervals between exercises could better reflect the pace of policy and technology development and may be necessary due to capacity limitations. An iterative approach that revisits internal business functions affected by analyses, materiality of findings, and disclosure methods may be particularly important for insurers to define a business use case for regular exercises.<sup>87</sup> Over time, as scenario exercises become more common and industry actors incorporate best practices throughout their risk management, exercises should become more regular (and lower cost).

## 2. Time Horizon

Due to their distinct natures, gaps in data, and other factors, transition and physical risks present different short- and long-term scenario analysis implications. At the same time, climate risk scenarios, which might deem 5-10 years “short-term” and 20-30 years or more “long term” with regard to policy and technological decarbonization plans, can diverge substantially from shorter economic and business model timeframes, compounding uncertainty.<sup>88</sup> As a result, the choice of time horizon for an exercise can have significant implications for the outcome. Risk landscapes may also vary significantly across short- and long-term time horizons depending on both risk type and insurer type. For example, property and casualty insurers’ natural catastrophe models may already embed short-term physical risks in pricing and risk management strategies but lack the current ability to encompass long-term secondary effects on water access or supply chains; while life insurers may face few impacts from short-term natural catastrophes but more severe impacts in the long term.<sup>89</sup> Financial institutions and supervisors may choose to run multiple scenarios to mitigate the uncertainty specific to each time horizon.<sup>90</sup>

The range of insurer considerations across different time horizons for different risks highlights the importance of considering multiple timeframes for a robust exercise, although many leading exercises have tended to use a 30-year period for both physical and transition risks.<sup>91</sup> For example, the Bank of France analyzed physical and transition risks from 2020 to 2050, divided into five-year increments. By contrast, the Australian Prudential Regulation Authority divided its analysis into two separate timeframes: short term (the current business planning cycle) and long-term (until and beyond 2050).

CDI and peer supervisors selecting time horizons should consider the following factors:

### a. Risk types

Although many scenario analysis and stress testing exercises model both physical and transition risks, these risks can be difficult to project over identical timeframes. Many physical climate risks are manifesting today, but the most severe and sustained impacts (and second-order changes such as major population displacement) may not occur until the end of the century; differences between scenarios are likely to manifest early for transition risks but could be delayed for physical risks. As a result, scenario analysis exercises may analyze physical and transition risks on separate time horizons. CDI’s 2018 exercise focused on transition risks and considered only a few kinds of physical risks. If the Department chooses to broaden its risk analysis, it may decide to employ multiple time horizons to evaluate different risks. The Department may also wish to consider strategies to ensure that physical risks are subject to robust analysis in all exercises, even though the most significant temperature increases are only likely to manifest toward the end of the century. For example, the Bank of England’s No Additional Action scenario deliberately shifts forward in time the anticipated occurrence of significant temperature



shifts to “allow the Bank to explore the impact of these more extreme risks” even though in reality they may arise decades later.<sup>92</sup>

### **b. Regulatory mandate and objectives**

Focusing on shorter-term risks may encourage firms to make near-term adjustments to their business practices and investments. By contrast, exercises that focus on long-term risks may better inform policymaking at the state level. Although CDI often focuses on short-term risks to firm solvency, its expansive mandate could embrace longer-term modeling of climate risks to the state’s insurance sector and individual insurers.

## **E. IDENTIFYING THE PARTICIPATING COHORT**

A truly robust, ideal exercise would cover all insurers in California (or the geographic and legal jurisdiction of a given supervisor), but capacity and financial limitations for both supervisors and insurers, coupled with the early stages of most scenarios and models, will likely limit the application of exercises in the near term to a subset of relevant institutions. In this context, potential participating cohorts include:

### ***1. Individual institutions selected for a pilot exercise***

If a supervisor or regulator is conducting a pilot exercise to build capacity, then a select group of participants—even in the single digits—may be appropriate. This model may be particularly appropriate for a pilot bottom-up or hybrid exercise; in its initial transition risk pilot, the Bank of Canada engaged two banks, two life insurers, and two P&C insurers, with a goal of building capacity and increasing industry and regulator understanding of risks.<sup>93</sup>

### ***2. Threshold/cutoff for a broader, top-down exercise***

If a supervisor or regulator directly conducts an early-stage exercise, a size threshold based on annual premium may be appropriate to ensure that smaller entities are not required to provide data, but selection of individual institutions is not necessary since the supervisor (or a third party) applies scenarios and models directly to institutions’ data. This can help ensure useful results for the first iterations of scenario exercises; smaller institutions can be incorporated later. For example, CDI’s 2018 exercise covered only insurers with annual premiums over \$100 million (679 total), while the New York State Department of Financial Services’ 2021 insurer exercises covered only 250 total insurers, including small insurers.<sup>94</sup> (Both exercises were run by 2Dii using the PACTA model.)

In many cases, large and small insurers may require different approaches. For example, large insurers may be better situated to conduct analysis internally and report results to a supervisor (bottom-up), while smaller insurers may be

better positioned (at least initially) to report data to a supervisor for a top-down exercise. Some small insurers may also need to work with reinsurers to obtain complete risk data. Supervisors can structure exercises with different requirements for different insurers, such as a top-down approach for all insurers with additional hybrid elements only for large insurers.

Given CDI's past experience in conducting exercises with a minimum-premium cohort and potential limitations facing small insurers, this approach likely would be appropriate for further near-term exercises. CDI could expand the cohort to include more small insurers over time, potentially beginning with fully top-down exercises at first to address capacity limitations. If CDI begins to design future iterations that rely on a diverse set of models, include different risk mixes, or cover new time horizons, or shifts from conducting direct analyses to engaging insurers in more bottom-up analysis, it should consider selecting individual entities for pilot efforts.

## F. ESTABLISHING PARTNERSHIPS AND COLLABORATIONS

Third-party partnerships offer a number of advantages to supervisors, particularly those that have not yet developed expertise in scenario analysis and stress testing or lack in-house staff resources. CDI and peer supervisors may benefit from collaborating with a range of partners including:

- **NGOs and other third parties.** Regulators may seek to partner with non-governmental organizations for technical assistance and access to proprietary scenario analysis models. For example, CDI engaged 2Dii in 2017 and 2018 to perform its first scenario analyses focusing on climate risks to California insurance firms' investment portfolios. CDI may also consider engaging with other providers of open-source tools for assessing physical risk, such as Pyregence (which provides models and maps for assessing wildfire risk) and First Street Foundation (which develops property-level flood risk maps).
- **Academic institutions.** Academic institutions may be particularly useful in providing technical assistance with scenario analysis modeling or offering policy recommendations. For example, the Bank of Canada's 2020 scenario analysis partnered with MIT's Joint Program on the Science and Policy of Global Change, which employed its Economic Projections & Policy Analysis (EPPA) model. EIOPA partnered with researchers at the University of Zurich, Vienna University, and Boston University on a 2019 analysis of European insurers' sovereign bond portfolios.<sup>95</sup>
- **Government agencies.** Regulators may also partner with other governmental agencies where there is overlap between the agencies' work and alignment on policy objectives. In January 2022, for example, the Bank of Canada announced the results of a scenario analysis pilot project performed jointly with the Office of the Superintendent of Financial Institutions.<sup>96</sup>
- **Other jurisdictions.** While supervisor-led exercises are jurisdiction-specific, many insurers operate in multiple jurisdictions and the information generated in an exercise (as well as the methods and

strategies used to implement it) will be useful to supervisors and insurers in other jurisdictions. CDI should consider strategies to cultivate information-sharing and joint exercises with peer jurisdictions, such as creating data sets that can be sorted into findings for other states and working with partners in the NAIC Climate and Resiliency Task Force and Catastrophe Modeling Center for Excellence.

The following criteria may inform decision-making regarding potential partnerships:

### *1. Regulator and partner capacity*

Partnerships are most likely to be useful when the partner institution has important capacities relevant to successful scenario analysis and stress testing exercises that the regulator may not. For example, partner institutions may have available staff with technical and subject-matter expertise in quantitative modeling who regularly conduct analyses for a range of financial institutions. Because CDI is still building the internal capacity and expertise to conduct scenario analysis, the Department may consider entering a partnership with an academic institution or with an NGO or other third party (as it did with 2Dii for the 2017 and 2018 exercises) for access to modeling expertise and proprietary models and to build agency capacity over time.

### *2. Policy mandate*

A supervisor with a strong commitment to statewide policymaking may choose to invest in partnerships with other state agencies in furtherance of a whole-of-government approach to climate risk. A regulator that wants to deepen its connections to academic institutions and support academic research and work on climate risk scenario analysis and stress testing may, by the same token, choose to work with a public university's modeling team instead of a private firm. Because CDI's work to prepare California's insurance industry for the impacts of climate change fits into a broader statewide strategy for climate change adaptation, the Department may consider entering partnerships with other state agencies that are also working on climate change adaptation policies. For example, the Governor's Office of Planning and Research (OPR), one possible partner, works on climate resilience through the ICARP Technical Advisory Council<sup>97</sup> and was the state lead for the California Climate-Related Risk Disclosure Advisory Group's report on climate risk disclosure practices.<sup>98</sup> CDI might also seek to collaborate with state agencies that have expertise and responsibilities associated with specific physical risks, such as the California Department of Water Resources (for flood risk), Cal Fire (for wildfire risk), and the California Coastal Commission (for sea-level rise).

## **COST CONSIDERATIONS**

Previous scenario analyses have not made public descriptions of their exercises' budgets, although many previous exercises have been conducted by national supervisors with expansive staff and budgets. As a result, it is challenging to assess the cost of different formats and stages of scenario analysis and stress testing. However, CDI should consider a number of cost-related factors in exercise design, including the high upfront costs but potential long-term savings of conducting exercises in-house; increased costs associated with greater numbers of participating firms, broader risk scope and time horizon, and more analytical granularity; potential company-side costs of bottom-up exercises; the value of external partnerships versus in-house capacity; and the potentially greater cost-effectiveness of more robust exercises that better inform effective risk management.



## IV. CONCLUSIONS AND RECOMMENDATIONS

Key takeaways from analysis of recent exercises and leading literature, expert interviews, and the October 2022 stakeholder roundtable include:

### A. CAPACITY BUILDING AND COLLABORATION

Given the relative novelty of climate risk scenario analysis in the insurance sector, skill development and dissemination of knowledge within institutions, as well as mutual exchange of information and realistic expectations for cooperation between institutions, will be important.<sup>99</sup> Supervisors and regulators are building internal capacity and will need to focus early efforts on developing competence and expertise. If the long-term goal of scenario analysis exercises is to drive insurers to fully incorporate climate risk assessment into their enterprise risk management practices, then building capacity within insurers is also key. This is likely best achieved through bottom-up exercises with supervisor oversight, although top-down exercises may fall more clearly within supervisors' existing authority and current capacities.

### B. DATA GAPS

Financial institutions and supervisors tended to encounter a range of similar data gaps, suggesting that cross-institutional collaboration and data sharing could be helpful.<sup>100</sup> To date, the most robust scenarios have focused on transition risk, and location- and sector-specific physical risk assessments are still in early stages. Supervisors can approach early exercises as an opportunity to identify and address data gaps.

## C. UNCERTAINTY AND TIME HORIZONS

Supervisors and financial institutions can struggle to account for uncertainties created by modeling climate risk with a standard 30-year time horizon, which inevitably leads to significant uncertainties in the scenarios “relate[d] to projections of climate change, the macroeconomic impacts from climate change, assumptions on the evolution of financial institutions’ balance sheets (particularly in the case of a dynamic balance sheet assumption) and long-term mitigation strategies.”<sup>101</sup> Scenarios to date also tend not to account for exogenous shocks (such as armed conflict) with energy and climate implications, or for long-term climate feedback loops.<sup>102</sup> Solutions include considering multiple scenarios and timeframes from medium-to-long-term time horizons side-by-side, applying multiple models, using uncertainty bands for unknown variables like future global temperature, and tailoring scenarios to individual firms’ balance sheets and business models.<sup>103</sup> Supervisors may also consider focusing on short-term analyses first, to maximize certainty and development of business-useful information.

## D. BOTTOM-UP CHALLENGES

In bottom-up exercises, “a lack of standardised assumptions and models [can make] comparisons across participating financial institutions difficult” and extending flexibility to participants can make it “more difficult to ensure the scenario exercises yielded consistent and meaningful results.”<sup>104</sup> Bottom-up exercises also rely more heavily on insurers’ internal capacity, which will vary widely for insurers of different sizes and between physical and transition risks; and on supervisors’ trust in insurers’ willingness to report on potentially severe risks. Solutions include retaining top-down exercise components and stringent supervisory guidance. Alternatively, supervisors may seek to keep bottom-up exercises as simple as possible and rely on insurers’ own modeling strategies to flesh out the scenario. In all contexts, exercises are likely to be iterative and adjust over time.

## E. PHYSICAL RISK

Most exercises to date have focused on transition risks, but the immediacy and centrality of physical risks in the insurance landscape suggest they should play a more prominent role in scenario analysis. Most existing scenarios fail to account for the localized impacts of acute physical risks and the potential for physical risks to compound with each other (or to combine with other shocks), limiting firms’ and supervisors’ ability to properly model the most severe impacts. Supervisors could help ensure comparability by using prescriptive physical risk parameters and focus on liabilities (rather than assets) first to develop the most useful early results.<sup>105</sup> Supervisors can also pair scenario analyses with stress tests to ensure the most severe physical tail risk scenarios are captured.

## F. PUBLIC REPORTING

Supervisors and insurers have legitimate concerns regarding the depth and specificity of public reporting of scenario analysis and stress test results because discussion of portfolio and underwriting risks for specific insurers could have adverse impacts on the insurer (and due to the need to protect certain insurer data). Supervisors may consider publishing aggregate data or limiting public reports to summaries of conclusions for specific insurers to reduce these impacts. At the same time, the goal of risk assessment is to identify risk and develop management strategies and protect the integrity of insurance markets; many supervisors have affirmative obligations to make data public, and for competitive markets to function as intended, it is important that shareholders, policyholders, and consumers have a complete picture of the risks facing insurers.

In general, CDI's first goal of scenario analysis exercises should be to build capacity within the Department and insurers. While all exercises will produce some decision-useful information about anticipated climate risks, CDI should design early exercises with the goal of identifying effective strategies and building the participating cohort rather than influencing near-term policy decisions. CDI should also aim to foster collaboration with other regulators and participation by regulated insurance firms. CDI should consider limiting the scope of the initial rounds of new exercises (in terms of risk types, time horizons, and participating cohort) but build on its first two scenario analysis exercises by expanding the scope to include more insurers and to cover transition and physical risks to both investment portfolio and underwriting risks. And CDI should initially structure new exercises as top-down to account for its likely reliance on third-party partners, limited exercise experience within regulated firms, and the Department's own capacity-building goals. As supervisors and participating firms build capacity, CDI should expand its exercises to give participating firms more responsibility by introducing more bottom-up elements in hybrid exercises.

The table on the following page lists CLEE's recommendations for the Department. Recommendations are divided across exercise objectives, exercise scope, exercise structure, and departmental structure, with some recommendations further divided into "early stage" (i.e., CDI's next one to three exercises) and "late stage" (i.e., CDI's future beyond initial exercises).

## DESCRIPTION

What objectives should CDI prioritize in performing scenario analysis and stress tests? E.g.:

- Building capacity
- Gathering data and addressing data gaps
- Producing decision-useful information for the insurance sector
- Producing decision-useful information for insurance regulation
- Supporting and informing other climate policy priorities
- Facilitating information sharing and collaboration among regulators and between regulators and regulated entities
- Identifying solutions to reduce risk and promote insurance affordability and availability

## RECOMMENDED ACTION

**Early stage:** CDI's first objective in performing scenario analysis and stress test exercises should be to build capacity within the Department, starting from the analytic and information-gathering capacity CDI developed in its 2017 and 2018 exercises.

**Later stages:** CDI should plan subsequent iterations with the goal of informing specific departmental and state policy priorities, such as ensuring availability and affordability of property insurance and promoting resilience throughout the state's economy. For example, the Department could conduct early efforts on physical risk assessment and stress testing with a focus on wildfire in California's wildland-urban interface geographies (including the impacts of home- and landscape-scale risk-reduction actions) and inquiries on insurers' plans to protect solvency and availability (such as through risk diversification).

**Early stage:** CDI should aim to build capacity at participating firms by providing opportunities (where possible) for firms to fill in data gaps and provide additional proprietary analysis.

**Later stages:** Future exercises should involve more bottom-up elements to build insurer capacity and business decision-useful information.

**All stages:** CDI should seek to promote collaboration with other regulators (in particular fellow state regulators through the NAIC) and to facilitate the dissemination of best practices for scenario analysis and stress testing exercises.

## PRECEDENT

The Bank of Canada's scenario analysis exercise was a limited-scope pilot exercise explicitly intended to build capacity for future exercises. Capacity-building, not the production of decision-useful information for regulators or regulated entities, was the primary objective.

Following its 2022 stress test exercise, the European Central Bank set a deadline for all banks to meet new disclosure and risk management requirements by 2024.



DESCRIPTION	RECOMMENDED ACTION	PRECEDENT
<p>What kinds of risks should CDI model? E.g.:</p> <ul style="list-style-type: none"> <li>Physical, transition, or both</li> <li>Investment, underwriting, or both</li> </ul>	<p><b>Early stage:</b> CDI should start with a small range of risks for initial exercises, focusing on transition risks to insurer portfolios in line with past exercises and current capacity.</p> <p><b>Later stages:</b> CDI should gradually increase the range of risks as exercise capacity grows, incorporating more physical and underwriting risks alongside transition risks.</p>	<p>CDI's 2017 and 2018 exercises considered transition risks but only a small set of physical risks including water supply, wildfire, and flood risks for key sectors. CDI only analyzed investment portfolio risks (and only covered a subset of insurers) and did not consider underwriting risk or risk of decreased business. CDI should return to, and gradually build from, this limited set of risks.</p> <p>Similarly, the Bank of Canada's pilot exercise considered only transition risks, not physical risks. The Bank intends to assess physical risks and their interactions with transition risks in the future.</p>
<p>What firms should participate in CDI's exercises?</p>	<p><b>Early stage:</b> For initial top-down exercises, CDI should include as many insurers as possible and consider a minimum annual in-state premium threshold if data production proves problematic for the smallest insurers. (As exercises become more regular and CDI's data-collection practices become more streamlined, the Department should consider eliminating such a threshold.)</p> <p><b>Later stages:</b> As CDI transitions to bottom-up components, it should start with a relatively small cohort of participating firms—given limited regulatory and industry capacity—and gradually increase the cohort size.</p> <p><b>Later stages:</b> As CDI integrates more small insurers in exercises, it should consider lower levels of granularity (or a more top-down approach) for those insurers.</p>	<p>CDI's 2018 exercise covered 679 insurers with in-state annual premiums over \$100 million.</p> <p>The Bank of Canada's pilot exercise included six firms representing a mix of size and business lines.</p>
<p>What time horizon should CDI use?</p>	<p><b>Early stage:</b> CDI should prioritize shorter time horizons (e.g., 5 or 10 years) for early exercises to maximize decision-useful information for firms.</p> <p><b>Later stages:</b> CDI should gradually incorporate longer and multiple time horizons (e.g., 30 years in addition to 5-10 years) in later iterations and pilots to inform more regulatory objectives.</p>	<p>CDI's 2018 exercise used a short time horizon of only 5 years.</p> <p>For contrast, the Australian Prudential Regulation Authority divided its analysis into two separate timeframes: short term (the current business planning cycle) and long-term (until and beyond 2050). CDI should target this type of dual approach.</p>

DESCRIPTION	RECOMMENDED ACTION	PRECEDENT
<p>Should CDI's exercises be "top-down" or "bottom-up"?</p>	<p><b>Early stage:</b> CDI should begin the first round of new exercises with a top-down approach, since the Department may lack the internal capacity to closely supervise bottom-up exercises and many firms are still developing the capacity to perform bottom-up work with comparable results.</p> <p><b>Later stages:</b> As CDI and insurance firms' exercise capacity grows, CDI should implement more bottom-up elements and hybrid exercises to provide firms more freedom to gain hands-on experience and develop creative approaches.</p> <p>CDI should keep in mind that the size of participating firms impacts their ability to succeed in top-down or bottom-up exercises. Smaller firms with less exercise capacity may be less likely to succeed in bottom-up exercises that require more work at the firm level, than in more prescriptive top-down exercises. Larger firms with more internal capacity may thus be better able than smaller firms to participate in bottom-up exercises.</p>	<p>CDI's 2018 stress test was a limited-scope top-down exercise in which 2Dii performed the modeling.</p> <p>The European Central Bank performed an economy-wide top-down climate stress test conducted centrally by ECB staff using internal datasets and models, homogeneously applying the same assumptions and models across financial institutions in the sample.</p> <p>The Bank of England's 2021 scenario exercise used a hybrid bottom-up approach with supervisor-prescribed scenarios.</p>
<p>What role should strategic partners play in CDI's exercises?</p>	<p><b>All stages:</b> CDI should consider partnerships with entities that would provide comparative advantages and further CDI's policy mandate. As it did in 2018, CDI should partner with a firm like 2Dii for modeling expertise while it works to build its own internal capacity. If CDI wants to eventually be able to perform scenario analysis and stress testing modeling on its own, it may</p> <p><b>All stages:</b> CDI should also consider partnering with other state agencies with climate change adaptation mandates, such as the Governor's Office of Planning and Research, the Department of Water Resources, Cal Fire, the Department of Financial Protection and Innovation, the Department of Finance, the state Treasurer, and/or the state Controller.</p> <p><b>All stages:</b> CDI should design new exercises and results to maximize utility and translatability for peer supervisors and coalitions such as NAIC and SIF (such as through jurisdiction-sortable data) and should consider joint exercises in future iterations.</p>	<p>The Bank of Canada partnered with another government agency, Canada's Office of the Superintendent of Financial Institutions, for its pilot exercise.</p> <p>CDIs' first scenario analysis was performed in concert with 2Dii, a private think tank with extensive modeling expertise.</p>

EXERCISE STRUCTURE (CONT.)			
	How should CDI report results?	<p><b>All stages:</b> CDI should report results on a publicly accessible website with data for use by other supervisors and academic institutions, and through summary analyses for use by policymakers and the public. CDI should maximize transparency wherever possible but may need to anonymize certain data, particularly in early exercises.</p>	CDI currently maintains a public website with all NAIC survey responses submitted by US insurers in the participating states.
	How often should CDI conduct exercises?	<p><b>Early stage:</b> CDI should craft and publish a roadmap describing its planned exercises, their anticipated scopes/structures, and target objectives over an initial 3-5 year period, with subsequent updates as appropriate.</p> <p><b>All stages:</b> CDI should conduct exercises on an annual or biannual basis, using each iteration to explore new scenarios, risk types, and participating cohorts.</p>	The Bank of England's Biennial Exploratory Scenario exercise incorporates new components on a regular basis.
DEPARTMENTAL STRUCTURE	DESCRIPTION	RECOMMENDED ACTION	PRECEDENT
	How should CDI structure its internal scenario analysis team?	<p><b>Later stages:</b> CDI should invest in a permanent internal scenario analysis team as part of its broader ongoing climate risk assessment and management efforts, with multiple full-time employees committed to implementing regular exercises, working with third-party modelers and scenario providers, and engaging with peer supervisors and California climate policymakers. CDI should consider developing proprietary exercises or modules where appropriate (such as for wildfire risk).</p>	Canada's Office of the Superintendent of Financial Institutions created an internal Climate Risk Hub with full-time staff dedicated to scenario analysis, analytics, stakeholder engagement, and policy development, with the eventual goal of developing proprietary, standardized scenario analysis exercises for transition and physical risks.



# APPENDIX A: LEADING FINANCIAL SUPERVISORS' INITIAL APPROACHES TO SCENARIO ANALYSIS

Adapted from Geneva Association, Insurance Industry Perspectives on Regulatory Approaches to Climate Risk Assessment (2021).

ORGANIZATION	TYPE OF RISK	TIME HORIZON	METHODOLOGY
International Association of Insurance Supervisors and Sustainable Insurance Forum	Physical	The Application Paper indicates that 'it is expected that the ORSA also includes appropriate scenarios that use a more extended time horizon' but does not specify	No specific prescriptive approaches
	Transition		
	Liability		
Network for Greening the Financial System	Physical	2050 and beyond	Focus on quantitative analysis
	Transition		
European Insurance and Occupational Pensions Authority	Transition (introduction of carbon tax, technological breakthrough, market expectations towards transition to low-carbon economy)	Longer than currently considered in the ORSA, e.g., an order of magnitude of decades	Qualitative approach: insight in the relevance of the main drivers of climate change risks in terms of prudential risks
	Physical (changes in frequency, severity, distribution of extreme weather events)	Short term: a higher level of precision is expected to help determine whether overall solvency needs improvement	Quantitative approach: assess exposure of assets and underwriting portfolios to physical and transition risk, forward looking
Bank of England	Physical	30-year modeling horizon (2020-2050 with five-year intervals)	Quantitative: quantification of change in value of assets and liabilities for each scenario.
	Transition		
			Qualitative: description of how business models would change
			Reporting frequency: firms need to submit projections at every five-year point in the test horizon
	Liability	-	Quantitative (general insurers only)
De Nederlandsche Bank	Physical	-	Mainly quantitative
	Transition		
Banque de France/ Autorité de Contrôle Prudentiel et de Résolution (ACPR)	Physical	2020-2050 (using five-year intervals)	Quantitative
	Transition		
Monetary Authority of Singapore	Physical	Short term	Quantitative
	Physical	Short term	Stress testing and scenario analysis, both using quantitative and qualitative methodologies
	Transition	Long term	

Australian Prudential Regulation Authority	Physical Transition	Short term (current business planning cycle) Long-term (2050 and beyond)	In its draft, Prudential Practice Guide CPG 229 on Climate Change Financial Risks APRA states it expects the use of scenario analysis and stress testing for climate risks to be proportionate to an institution's size, business mix and complexity. Depending on the firm, it expects qualitative and quantitative scenarios to be developed. It proposes several degree temperature increase as well as transition pathway scenarios to be considered. Insurers are expected to consider both physical and transition risks within each scenario.
Bank of Canada	Transition	A 30-year horizon (2020-2050)	Quantitative
New York State Department of Financial Services	Physical Transition	Short term (current business planning cycle) Long term (in the order of decades)	Qualitative (and potentially quantitative) exercise used to inform strategic planning and decision making.
European Central Bank	Physical (drought/heat, flood)  Transition	One year  Short-term (3 years) and long-term (30 years)	Qualitative and quantitative

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- 33 See generally Nicola Ranger et al., World Bank, “Assessing Financial Risks from Physical Climate Shocks: A Framework for Scenario Generation” (2022), available at <https://documents1.worldbank.org/curated/en/760481644944260441/pdf/Assessing-Financial-Risks-from-Physical-Climate-Shocks-A-Framework-for-Scenario-Generation.pdf>.
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- 35 Bank of Canada and Office of the Superintendent of Financial Institutions, *Using Scenario Analysis to Assess Climate Transition Risk* (2022), p. 54, available at <https://www.bankofcanada.ca/wp-content/uploads/2021/11/BoC-OSFI-Using-Scenario-Analysis-to-Assess-Climate-Transition-Risk.pdf>.
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- 37 See State of California ex rel. Nee v. Unimprovident Corp., 140 Cal. App. 4th 442 (2d Dist. 2006), as modified, (July 11, 2006).
- 38 Proposition 103 (1988) established the Insurance Commissioner as a statewide elected officer and established the Commissioner’s authority to review and approve all proposed insurance rate increases, while numerous provisions of the Insurance Code authorize the Commissioner to examine insurers’ books and records for general prudential purposes and require the Commissioner to issue public reports on any insolvencies. See generally Cal. Ins. Code §§ 729-739, 985.5.
- 39 See, e.g., Samson v. State, 55 Cal. App. 2d 194, 130 (1942). “Insurance companies organized in other states are permitted to transact business in California upon complying with the requirements of the Insurance Code, designed to secure an examination by the insurance commissioner to determine, among other things, the solvency of such organizations.”
- 40 Under Section 730 of the Insurance Code, the Insurance Commissioner may “conduct an examination” of any insurance company “whenever he or she deems necessary” and “as often as the commissioner in his or her discretion deems appropriate.” The Commissioner “shall consider the results of financial statement analyses and ratios, changes in management or ownership, actuarial opinions, reports of independent certified public accountants, market analysis results, including consumer complaint analysis, evaluation of ongoing regulatory activities, analysis of data derived from industry surveys or interrogatories, and other criteria. Cal. Ins. Code §§ 730(a)-(b). This broad power includes “free access” to company information, inspection and examination of all company affairs and assessment of the company’s “condition and ability to fulfill its obligations,” and company officers are obligated to provide access to books, records, and accounts in the courts of an examination. Cal. Ins. Code §§ 733-734.

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Although the Department commonly collects data from insurance companies (e.g., wildfire related policy information, non-renewal counts, and loss data after certain wildfire or floods), either expressly authorized by statute or under general data collection authority, legal authority to require insurers to participate in a bottom-up exercise is somewhat less clear. No provision of the Insurance Code explicitly creates this authority, and the Department has not directed such a prescribed exercise in the past. One potential legal pathway is through the submission of Own Risk and Solvency Assessment (ORSA) reports which are “confidential internal assessment[s] ... appropriate to the nature, scale, and complexity

of an insurer or insurance group, conducted by that insurer or insurance group, of the material and relevant risks associated with the insurer’s or insurance group’s current business plan and the sufficiency of capital resources to support those risks.” Cal. Ins. Code § 935.2(c). The Insurance Code provides that “[u]pon the commissioner’s request, and no more than once each year, an insurer shall submit to the commissioner an ORSA Summary Report or any combination of reports that together contain the information described in the ORSA Guidance Manual, applicable to the insurer or the insurance group of which it is a member.” Cal. Ins. Code § 935.5(a). At present, the guidance manual for ORSA reports, promulgated by the NAIC, does not require climate risk stress testing, but NAIC’s Climate Resiliency Task Force recommended in March 2022 that NAIC officially include climate change risk assessments in the manual. Kathleen Birrane, NAIC, Climate Resiliency (EX) Task Force, Referral on Proposed Climate Risk Enhancements (March 2022), available at <https://content.naic.org/sites/default/files/inline-files/Solvency%20Workstream%20Referral%20to%20ORSA%20Subgroup.pdf>. If that were to occur, then CDI could likely require individual insurance companies to submit individual assessments of their climate risk. The European Insurance and Occupational Pensions Authority (EIOPA), the European Union’s regulatory authority tasked with overseeing insurance and occupational pensions in Europe, has also issued guidance on incorporating climate risk scenarios in ORSA assessments. EIOPA, *Application guidance on running climate change materiality assessment and using climate change scenarios in the ORSA* (August 2022), available at [https://www.eiopa.europa.eu/sites/default/files/publications/other\\_documents/application\\_guidance\\_on\\_running\\_climate\\_change\\_materiality\\_assessment\\_and\\_using\\_climate\\_change\\_scenarios\\_in\\_the\\_orso\\_o.pdf](https://www.eiopa.europa.eu/sites/default/files/publications/other_documents/application_guidance_on_running_climate_change_materiality_assessment_and_using_climate_change_scenarios_in_the_orso_o.pdf).

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