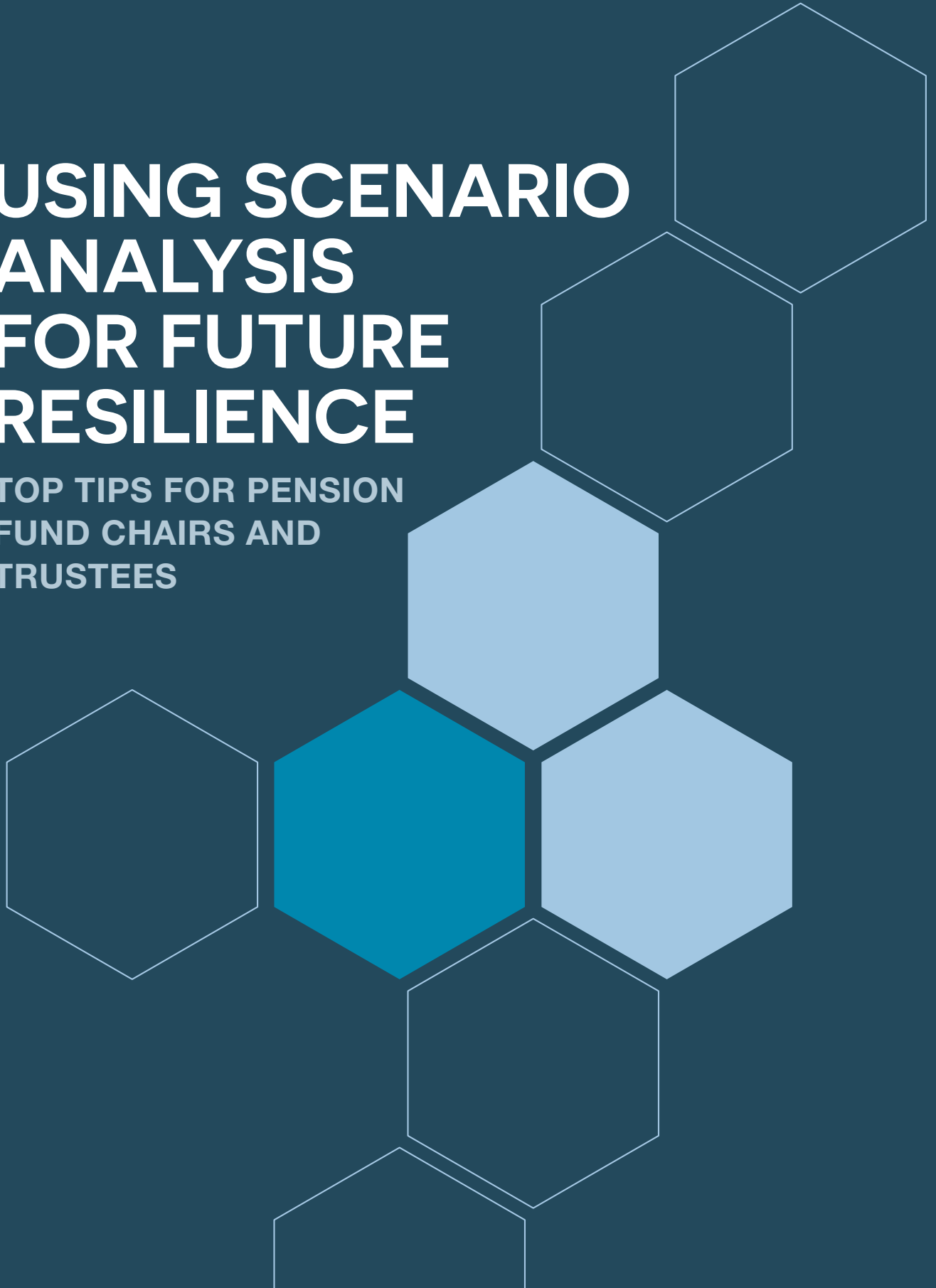




# USING SCENARIO ANALYSIS FOR FUTURE RESILIENCE

TOP TIPS FOR PENSION  
FUND CHAIRS AND  
TRUSTEES



# FOREWORD

Pension trustees are sharply aware of the major long-term risks threatening to undermine economic performance and so the prospects for investment returns. Clear evidence of climate change and of biodiversity loss concerns us deeply – but it can seem a daunting task to develop an appropriate response. The increasing use of scenarios to inform pension trustee decisions points a way forward.

However, as this guide makes clear, scenarios need to be increasingly sophisticated and move away from the tempting simplicity of linear modelling. Even then we are reminded that all modelling has its limitations. So the ‘top tips’ set out here are welcome practical suggestions – a checklist for those already embarked on this path, and a to-do list for those whose use of scenarios is less mature.

It’s good to see the approach taken by the Universities Superannuation Scheme (USS), where I chair the trustee, set out in this report. We have found our transition scenarios really informative as tests for the resilience of our portfolio, and we increasingly combine them with scenarios around geopolitical developments. Although we may be regarded as relatively sophisticated in our thinking, nevertheless this guide’s proposed list of questions for boards wanting to check investment teams’ approach merits careful consideration.

A couple of expressions really stand out in this guide. The first is ‘decision-useful’. Interesting and long-term scenarios may be of little purpose. We are seeking shifts to make our portfolios support resilience through the next couple of economic cycles. That’s why USS looked

at scenarios through to 2030 when we set off down this road in 2023. As the guide stresses, this means boards really must ask investment teams what has changed as a result of a scenario exercise – they cannot be simply enjoyable discussions.

The second expression is ‘mindset change’. These systemic challenges require different ways of thinking for trustee boards as well as their investment teams. We need to worry about a new set of risks, and to monitor new sets of data. The focus on developing uncomfortable possibilities is also important, otherwise there is a risk of fostering complacency – we cannot protect against all futures, but we must stretch our imagination about what those futures may be. My own past failures in making projections have usually been straightforward failures of imagination.

In short, I commend this guide. It will not all be relevant to every trustee body – but wherever we are on the journey towards embedding big risks successfully into our processes, this is a valuable stimulus to further action.

**Dame Kate Barker**  
Trustee Board chair, USS



# CONTENTS

EXECUTIVE SUMMARY	4
HOW TO USE THIS GUIDE	5
INTRODUCTION	6
BESPOKE SCENARIO APPROACHES: PRACTICAL EXAMPLES	9
TOP TIPS FOR CHAIRS AND TRUSTEES OF PENSION FUNDS	12
APPENDIX: QUESTIONS TO ASK YOUR SERVICE PROVIDERS OR IN-HOUSE TEAMS	18
GLOSSARY	20
FURTHER READING	22
ACKNOWLEDGEMENTS	23
ABOUT A4S	24



## IMPORTANT INFORMATION

This guide has been prepared for general guidance on matters of interest only and does not constitute professional advice. We recommend that you obtain specific professional advice before acting or refraining from action on any of the contents of this publication. Accounting for Sustainability accepts no liability for any loss occasioned to any person acting or refraining from action as a result of any material in this guide.

# EXECUTIVE SUMMARY

This guide is designed to support pension fund chairs and trustees to strengthen how scenario analysis is used at board level, moving it from a primarily analytical exercise to a practical input into strategic decision making. The guide has been produced in response to a growing gap between the increasing sophistication of climate and sustainability modelling in the market, and boards' confidence that scenario outputs are genuinely informing choices on strategy, asset allocation, default design, risk appetite and stewardship.

Many commonly used approaches rely heavily on simplified quantitative models that can give a misleading sense of precision and comparability, while masking important limitations and blind spots. This can make it difficult for boards to exercise effective challenge or to understand what scenario results mean for real investment and risk decisions.

The guide does not propose a single 'better' model. Instead, it sets out how boards can take greater ownership of scenario analysis by:

- Being clearer about its purpose
- Challenging underlying assumptions
- Combining quantitative outputs with narrative-led approaches that explicitly explore uncertainty, non-linear change and hard-to-model risks

Practical examples from the sector illustrate how different approaches are being used in practice, and how they have influenced real investment and risk decisions.

The guide argues that scenario analysis is essential to updating investment beliefs about market stability, diversification, efficiency, time horizon and risk. However, scenario analysis only becomes decision useful when it is explicitly linked to how a pension fund operates in practice.

This includes how:

- Strategic asset allocation and default strategies are set
- Mandates are designed
- Teams are structured
- Liquidity and resilience are managed
- Stewardship is escalated

Used well, scenario analysis should support informed and intentional risk taking under uncertainty, helping boards to balance downside resilience with the need to take sufficient long-term risk to achieve member outcomes, rather than reinforcing excessive caution.

Importantly, the focus of this guide is on governance and process rather than technical detail. It provides trustees with actionable tips, decision-focused questions to ask advisers and managers, and examples of how to structure board discussions so that scenario analysis informs judgement rather than replaces it. It also recognizes differing levels of resource across schemes and highlights essential actions that can be taken even where capacity is limited.

Overall, the guide is aimed at helping boards to use scenario analysis more confidently and critically – improving resilience testing, sharpening the oversight of advisers and managers, and supporting better-informed decisions in the face of deep uncertainty.



# HOW TO USE THIS GUIDE

This guide is written principally for pension fund chairs and trustees across both defined benefit (DB) and defined contribution (DC) funds. While examples may reference funding, asset allocation or risk management for DB schemes, the principles are equally applicable to DC funds through default strategy design, member outcomes and long-term retirement.

The guidance focuses predominantly on climate scenario analysis, while recognizing that wider systemic risks – particularly nature and biodiversity loss – must be systematically considered alongside climate impacts.

Some of the suggested actions may be more appropriate for larger or better-resourced funds. However, essential steps that can be taken even with limited resources are highlighted throughout. Although the guide is written for pension funds, many of the approaches described are transferable to other asset owners, financial institutions and corporates.



# INTRODUCTION

There is growing recognition that risks such as climate change, nature and biodiversity loss (referred to throughout this guide as nature loss), artificial intelligence (AI), and geopolitical instability are systemic and cannot be diversified away. Their complex interconnections mean that they can affect entire economic systems, creating cascading impacts across sectors and potentially disrupting long-term market stability. Although awareness of systemic risks is growing, their magnitude, trajectory and timing remain uncertain.

Many boards recognize their exposure to these risks – particularly those that are climate related – and understand that their fiduciary duty requires an appropriate response. But there is still a gap in understanding how to consider systemic risks and assess their potential impact on portfolios or default strategies. To effectively fulfil their fiduciary responsibilities, boards need to understand how these sustainability-related risks, as well as opportunities, could affect strategy, performance and long-term value.

Scenario analysis offers a practical way to help navigate this uncertainty, by breaking down multi-factor issues into more familiar components and providing a structured lens through which to explore a range of plausible futures. By considering how portfolios, default strategies or funding positions might respond under different scenarios, boards can deepen their understanding of systemic risks and opportunities and build greater resilience.

## CURRENT APPROACHES TO CLIMATE SCENARIO ANALYSIS

There has been a global uptick of pension funds using climate scenario analysis in the last few years. While scenario analysis has a wide range of applications – eg developing fund-level strategies, informing strategic

asset allocation (SAA) or default strategy design and funding decisions, and stewardship – it has most commonly been used by pension funds for risk assessments, setting net zero targets and meeting the disclosure expectations of the Task Force on Climate-related Financial Disclosures (TCFD).

Its broader potential as a dynamic tool to actively inform investment and strategic decision making remains underused. While scenario analysis is not a forecasting tool, it can be used to project plausible potential outcomes and should form a core part of resilience testing within strategic decision-making processes – rather than being treated as a compliance or box-ticking exercise.

## CHALLENGES TO CURRENT APPROACHES

Simplified quantitative approaches to climate scenario analysis, which are widely used in the market today and sometimes referred to as first-generation climate scenarios, have been effective in starting the conversation. However, because they often rely on models based on historical correlations and relationships, it is likely that they understate the true scale of future impacts, particularly in a world that will look very different from the past. Important drivers such as irreversible tipping points, widespread AI adoption, nature loss, conflict and climate-driven migration are rarely integrated into standard climate scenarios, despite their potentially significant and systemic implications.

Recent research by academics, institutions and pension funds<sup>1</sup> has highlighted that when the simplified quantitative approaches are used exclusively, they can lead to an underestimation of potential impacts. Table 1 details the challenges with first-generation approaches.

“

“Scenarios are not forecasts but descriptions of plausible futures that illuminate our understanding of the most impactful uncertainties.”

**Mark Cliffe, Visiting Fellow, Global Systems Institute, University of Exeter and Advisor to TREX Analysis**

1. See the [‘Further reading’](#) section at the end of the guide for details.

**Table 1: Simplified quantitative approaches to climate scenario analysis – characteristics and challenges**

Characteristic	Challenge: Many climate scenarios used to date ...
Long horizon (eg 2100)	... use linear modelling of global average temperatures (eg 2, 3, 4 °C) to assess the probability of associated financial risks.
‘Smoothed’ modelling (linear or overshoot) of global average temperatures (eg 2, 3, 4 °C)	... present a smooth trajectory of global warming (to the temperature degree selected). Not only is a smooth pathway unlikely (considering the implications of tipping points alone for global temperature), but it means assumptions have to be made on the interrelation between different impacts and the sequence of when these impacts will occur. These assumptions are unlikely to reflect reality.
Omission of complex interrelated real-world factors	<p>... do not account for how climate change interacts with broader macro drivers (eg geopolitics, economic growth, inflation, technological disruption, nature loss, financial market dynamics), nor do they incorporate potential tipping points, where small changes can trigger large and irreversible global effects.</p> <p>These limitations are particularly acute for nature-related risks, where ecosystem degradation, biodiversity loss and feedback effects are rarely modelled, despite their potential to accelerate climate impacts, disrupt supply chains and undermine economic productivity.</p> <p>As a result, modelled projections may not fully reflect the complexity and severity of future risks.</p>
Reliance on equilibrium macroeconomic models	... assume smooth adjustment, full employment and efficient, well-functioning markets. These assumptions exclude many relevant sources of transition and financial risk, as well as portraying policy interventions to accelerate decarbonization as costly and growth reducing, overlooking the stimulatory effects of innovation and increasing returns to scale in green technologies. <sup>2</sup> The Intergovernmental Panel on Climate Change (IPCC) has examined five very different socioeconomic pathways <sup>3</sup> to illustrate the point.
Underpinned by Integrated Assessment Models (IAMs)	... typically assume climate damage functions that drastically understate the potential output and welfare losses at higher warming levels, especially at temperatures above 3 °C. For example, some models suggest a 6 °C increase in global warming would reduce global GDP by less than 10%. <sup>4</sup>



“These underestimates arise from an economic modelling philosophy that assumes continued growth. Across climate scenarios, the economy is assumed to be, for example, 210% of today’s size by 2050. Climate damage is then modelled as a GDP reduction – say 9% – but this typically excludes tipping points, ecosystem damage, and health and social impacts. The result is an economy projected to be around 201% of today’s size. This approach is inconsistent with climate science, which recognizes many impacts as increasingly likely, and with sound risk management, as it systematically downplays the most severe and disruptive risks.”

**Sandy Trust, Planetary Solvency Lead, Institute and Faculty of Actuaries (IFOA)**

2. University of Exeter and USS Fund (2023), [No Time to Lose: New Scenario Narratives for Action on Climate Change](#) (page 23).

3. IPCC (2021), [The WGI Contribution to the IPCC Sixth Assessment Report](#) (page 232).

4. Giraud, G. and Valcke, P. (2023), [Macrodynamics and Climate: Reformulation](#).

## WHY PENSION FUND BOARDS SHOULD ENGAGE ON THIS

Scenario analysis is often limited to risk assessment and disclosure requirements, carried out by risk or sustainability teams, with the board receiving the ‘end result’ of the scenario exercise. This restricts the value that this tool can bring to strategic discussions at board level.

Key drivers for pension fund boards to strengthen their approach to climate scenario analysis include the following.

### Supporting strategic insights

Boards can derive significant value from scenario analysis if it is engaged with effectively and within board discussions. Done well, scenarios can support boards to drive meaningful future-focused conversations about the implications of different warming outcomes, decarbonization trajectories, technological change, geopolitics and other macroeconomic trends. If scenario analysis is treated solely as an ‘end result’ for risk or compliance purposes, boards risk missing critical insights on the adaptations needed in all plausible futures, not just extreme stress cases.

### Enhancing stewardship efforts

Using scenario analysis to drive stewardship priorities can give boards far greater clarity and control over how influence is exercised. For example:

- **Prioritization** – it can define, for all involved, which companies to engage first, by:
  - i. Identifying which companies, sectors and regions are likely to be most exposed to transition and physical risks, across different scenarios
  - ii. Identifying companies and sectors with high dependencies and impacts on nature
- **Mapping to system-level impact** – using scenario analysis to look at system-level factors (eg policy shocks, sector-wide transition pathways) ensures that stewardship efforts focus on, for DB funds, portfolio resilience rather than isolated entity improvements, and, for DC funds, how it supports long-term member outcomes and value for money (VFM).
- **Enhanced oversight** – it can provide a common framework for assessing whether stewardship activity done on the fund's behalf is genuinely addressing the risks identified.
- **Resource efficiency** – it moves would move stewardship activities from ‘broad coverage’ engagement lists to risk-based prioritization, with the ability to deploy resources proportionately.
- **Informing escalation and voting decisions** – it can help to set clear escalation criteria, eg for companies that consistently perform poorly across multiple scenarios or where financial risk exposure is increasing for a prolonged period of time.

### Addressing regulatory expectations

Policy and regulatory developments will increasingly require boards to articulate how they identify, assess and respond to climate and other sustainability-related risks and how these considerations are reflected in strategy, risk management and decision making. Across financial sectors, supervisory bodies are emphasizing the role of boards in setting and owning climate risk appetite, as well as understanding the limitations of the climate models they use, noting that “they may not capture the full range and scale of climate-related risks, such as non-linearities and potential tipping points, and they should account for these limitations in their use of the results”.<sup>5</sup>

Against this backdrop, pension fund boards must be confident in the assumptions underpinning their fund's scenario analysis, understand where model outputs may be incomplete or uncertain, and be able to explain how insights are being used to inform investment strategy, risk management and stewardship decisions.

As global sustainability and climate-specific disclosure standards continue to gain traction, investee companies are increasingly expected to publish decision-useful scenario analysis. This will create richer insights for pension funds while also raising expectations that they actively engage with these disclosures and integrate relevant insights into investment decisions and oversight processes.

### Optimizing governance

An enhanced approach to scenario analysis, led by the board, can strengthen fiduciary oversight, facilitate more transparency and accountability, and build organizational capabilities (in line with regulatory expectations). Upskilling will be needed across the entire organization on emerging scenario approaches, with structures in place to ensure that findings from scenario analysis become central to strategic decision-making processes. A direction from the very top will foster the culture needed to adapt to these changes.

5. Bank of England (2024), [SS5/25 – Enhancing Banks’ and Insurers’ Approaches to Managing Climate-Related Risks](#).

# BESPOKE SCENARIO APPROACHES: PRACTICAL EXAMPLES

## HOW THE INDUSTRY IS STARTING TO ADDRESS THIS

Some pension funds have started to address the limitations of using an exclusively model-driven approach.

### USS: Starting with a narrative

USS the UK's largest private pension fund, with £76.8 billion of assets under management, incorporates shorter-term, flexible 'narratives'<sup>6</sup> into its asset allocation process. With a baseline assuming material impact from near-term physical risks, the fund worked with a University of Exeter team led by Mark Cliffe, who developed four transition narratives to 2030.<sup>7</sup> These narratives described different ways in which the climate transition might interact with macroeconomic, geopolitical and technological developments and the priorities of policymakers rather than looking at these components in isolation.

To explore what the transition might look like by 2030, they developed a 2x2 matrix based on:

- **Policy coordination** – how effectively national and international policies will align to address climate change
- **Technological development** – how rapidly technology and the private sector will deliver competitive low-carbon solutions

The narratives were translated into inputs into the non-linear Cambridge Econometrics macroeconomic model,<sup>8</sup> enabling testing of assumptions about policies or new technology and then consideration of how the economy and the energy system might respond. This analysis revealed a wide range of possible outcomes for global growth, from negative scenarios to productivity-led booms, and persistent inflationary pressures across all scenarios. More details on how USS's investment decisions have been informed by this narrative scenario approach can be found in their latest [TCFD report](#).



**Figure 1:** Real world climate scenarios 2x2 matrix - used to explore the transition (source: University of Exeter and USS (2023), [No Time to Lose: New Scenario Narratives for Action on Climate Change](#), page 15.<sup>9</sup>)



“The findings from our new approach to scenario analysis suggested we should increase our exposure to assets providing inflation protection, and we’ve done that in a number of ways, through inflation-linked bonds, inflation derivatives and assets in our private markets programme that give exposure to inflation-linked cash flows.”

**Mirko Cardinale, Head of Investment Strategy, USS Investment Management Limited**

6. University of Exeter and USS Fund (2023), [No Time to Lose: New Scenario Narratives for Action on Climate Change](#).

7. Green Futures Solutions (2023), [USS and University of Exeter Develop New Climate Scenarios to Help Tackle Climate Change](#).

8. Cambridge Econometrics, [About E3ME](#).

9. The graph is an edited down version of the original.

### **NBIM: Taking a multi-method approach to quantifying climate risk**

Norges Bank Investment Management (NBIM), which manages the Norwegian Government Pension Fund Global, has developed an internal top-down approach to capture primarily chronic, economy-wide impacts of physical risk. It currently covers only US equities, given the superior data coverage and robustness in that market relative to others. It estimated losses of between 8 and 10% of relative equity value under a warming scenario equivalent to current policies, compared with a baseline with no climate change. Under a different scenario in which the world fails to follow through on climate policies, leading to significantly higher future temperatures than markets may have priced in under current policies, it estimates losses of 12% on US equities.

Using an alternative bottom-up approach, which focuses on direct damages to companies' assets and business interruption, NBIM estimates physical risk losses for global equities of between 1 and 8% of present value across a range of warming scenarios, and 1 and 5% for US equities only.

The spread across the two approaches reflects differences in scope: the top-down approach captures direct and indirect physical risk impacts from gradual-onset events

such as shifts in climate patterns, which are derived from the relationship between climate variables, the economy and asset prices. In contrast, the bottom-up approach focuses mainly on the impact of individual hazards.

To capture near-term risk, NBIM also stress-tested the fund's investments against a hypothetical extreme weather events scenario. It developed a plausible narrative in which acute weather events trigger simultaneous crop failures across two major staple food production areas already subject to chronic environmental degradation, causing global food supply shocks and price spikes amplified by disrupted supply chains that cascade through economies as markets anticipate higher inflation and lower growth. Under this scenario, NBIM estimates a total fund drawdown of 20%, with equities falling 24% and fixed income losing 10%, therefore providing no meaningful offset.

More details can be found in NBIM (2025), [Climate and Nature Disclosures 2025](#), NBIM (2025), [Stress Testing](#), and NBIM (2026), [Discussion Note: Economic Impacts and Pricing of Climate Risk](#).



**“To fully measure climate risk, you cannot rely on a single approach. Results from different methods create a fuller picture than any one model can provide. But we should be clear: all of these approaches likely underestimate long-term physical climate risk, particularly under higher levels of warming.”**

**Christopher Wright, Head of ESG Risk Monitoring, NBIM**



### APG: starting with uncertainties not probabilities

APG, one of the world's largest pension investors, with around €616 billion in assets under management, uses a mix of narrative-driven scenarios with probabilistic analysis to support strategic investment decisions. Working closely with pension fund clients, APG begins by looking at uncertainties rather than probabilities in order to keep the focus on the broader picture. Through workshops and surveys with senior stakeholders, it identifies concerns often absent from traditional, linear models, such as geopolitical tensions, policy U-turns, climate-related tipping points or disruptive technologies.

These uncertainties are then grouped into a small set of interconnected drivers, recognizing that real-world outcomes emerge from the interplay of macroeconomic, policy, technological, climate and geopolitical forces – not from one factor alone, such as temperature.

From these groups, APG identifies the most important dimensions for decision making – those with high uncertainty, high impact and often high discomfort – and builds a small number of distinct narrative 'worlds'. These narratives are developed before any modelling so that boards can test whether they are plausible, genuinely challenging and distinct. Only once this context is established are the scenarios converted into numbers and data.

For APG and its clients, this approach has turned scenario analysis into a strategic learning tool, helping them to uncover hidden assumptions and to better understand uncertainty, how different risks interact and where non-linear changes may occur, while still benefiting from quantitative analysis where it adds value.

“

“Questions like ‘What does my portfolio do in a 3°C world?’ are misleading as there is no single 3°C world but many. The aim is not to identify the most likely future, or to attach probabilities, but to build a small number of fundamentally different worlds to test robustness and trade-offs.”

**Charles Kalshoven, Expert Strategist, APG Asset Management**



# TOP TIPS FOR CHAIRS AND TRUSTEES OF PENSION FUNDS

Chairs and trustees are key to driving an approach to scenario analysis whereby its outputs are translated into strategic, investment and stewardship decisions.

This section sets out practical actions that chairs and trustees can take across governance, agenda-setting, recruitment and oversight to ensure scenario analysis is used strategically in board discussions and moves beyond the limitations of simplified quantitative approaches.

While many of the actions below are transferable to funds of all sizes, some are more suitable for larger funds. However, the box on [page 16](#) sets out essential actions that chairs with limited resources can take that will also be impactful.

## 1. REFRAME SCENARIO ANALYSIS AS A STRATEGIC INPUT, NOT A TECHNICAL OUTPUT

Scenario analysis is often approached as a technical, compliance-driven task for reporting purposes. If it is embedded into the board's governance and fiduciary processes as well as service provider engagement, it can become a strategic tool that informs capital allocation, risk management, transition planning and overall risk appetite.

For example:

- Set an expectation, both internally and with service providers, that the board will use scenario analysis to inform strategic discussions and decisions.
  - For DB funds, this will include informing SAA and asset return assumptions, transition planning, inflation hedging and contribution discussions with sponsors.
  - For DC funds (as well as independent governance committees and group personal pensions), this will include default strategy design, asset return expectations, transition planning, inflation sensitivity and consideration of member outcomes. It can also support VFM assessments by testing whether default strategies remain resilient across a range of scenarios relative to the costs borne by members.
- Be explicit about what may need to change, eg a reliance on benchmark-relative performance as the primary success metric, or teams – such as strategy, risk and stewardship – operating separately.
- Review the selection of scenarios presented and used within the fund in order to satisfy the board that the 'scenario menu' presented is genuinely stress testing the investment strategy and not simply validating it. A checklist could be used to sense check this, noting eg the inclusion of third-party, independent assessment of scenarios selected, the diversity of scenario sources used and the inclusion of genuinely uncomfortable scenarios.
- Assess the capabilities of current and future service providers to use scenario analysis to inform investment decisions, eg where they have changed investment decisions on the back of scenario analysis ([see Appendix: Questions to ask your service providers or in-house teams](#)).
- Make simple changes to board session agendas and format, eg ask to see how return / risk assumptions change when different climate scenarios are used; ask fund managers to present on what decisions could change if a given scenario emerged and what they would monitor to assess the likelihood of this happening. Change the questions you need answers to, eg:
  - What does this scenario tell us about resilience, flexibility and where we could be wrong?
  - Do our scenarios reflect a wide enough range of plausible futures? Have we included uncomfortable but plausible scenarios? Are we overly reliant on a small set of scenarios?
  - As well as downside risks, are we considering the risk of underinvesting in growth or system transitions and the implications of this for long-term member outcomes?
  - Can we identify where misplaced reliance on financial optimization is influencing our judgement?
  - What are the different types of uncertainties we should consider?
  - What decisions would we make differently as a result of this analysis?

## 2. CHALLENGE LINEARITY AND FALSE PRECISION

It is important to recognize the limit to which ‘smoothed’, linear, long-horizon model-driven scenarios can adequately capture systemic risks. Regulators, including the Prudential Regulation Authority (PRA) and the Network for Greening the Financial System (NGFS), explicitly warn that standard scenarios may omit non-linearities and tipping points. While the NGFS and others work to enhance the range of tools available for scenario analysis, your service providers or in-house investment team need to demonstrate how they are addressing these limitations now.

For example:

- Push back on the exclusive use of simplified quantitative approaches and demand consideration of ranges, uncertainty bands, non-linear methods and narrative scenarios, taking inspiration from others who are already developing new approaches. Use the example questions in [Appendix: Questions to ask your service providers or in-house teams](#) to help frame discussions with your scenario providers.
- Ask for comparison tables to be provided and used as part of board discussions. This could show, eg, where different scenario analysis conclusions diverge and why.
- Ensure the scenario analysis approaches you adopt allow for ‘on-the-ground’ insights from managers on what they are observing, as smoothed (often linear) models can miss sector-specific dynamics and behavioural responses.
- Acknowledge the limitations of any scenario approach, especially around physical climate impacts and indirect / spillover effects on nature and biodiversity, supply chains, inflation and tipping points.

## 3. USE NARRATIVE SCENARIOS FOR REGULAR BOARD DISCUSSIONS

Developing narrative scenarios is proving to be a useful mechanism for boards to counter assumptions of a smooth trajectory and to understand why certain outcomes might occur and how different macro drivers interact, rather than looking at climate and the energy transition in isolation. Some larger funds have already developed examples of these narratives and made them publicly available, and other funds can leverage this work to avoid having to start from a blank page.

Considering geopolitical, macroeconomic and technological factors through different transition ‘narratives’ will help you and your trustees to get a better understanding of the breadth of systemic risks.

For example:

- Carve out protected board time (eg annually) for a narrative scenario session focused on the next five to ten years. Going beyond climate and capturing other key dimensions such as geopolitics, nature, AI disruption and macroeconomics will help you to examine the assumptions underpinning scenarios. Bring in a third-party provider to run the session, helping you to articulate a small number of narratives to use in discussion. If this is less feasible, ask peer pension funds to share how they structured their sessions, or arrange a joint workshop with other funds.
- Use a small number of clearly articulated narratives to explore how climate policy, geopolitics, technology, nature loss and ecosystem degradation interact with macroeconomics, assessing the implications for key economic and financial variables, eg GDP, real interest rates and inflation.
- Sequence board discussions so that trustees first engage with the logic and plausibility of each of the narratives before revealing any quantitative outputs. Framing discussions around questions such as those below can help to increase the strategic value of scenario analysis, making it a tool for thinking and not just reporting:
  - What events or sequence of events could lead to a particular scenario unfolding, and what signposts should we watch out for?
  - If this world was emerging, what would worry us most about the portfolio / default strategy?
  - How might domestic and international political shifts affect energy markets, sustainability-related policy and technological choices?
  - Which current exposures would we want to review first?
  - Where might opportunities arise?
  - What decision would we make differently as a result of this analysis?
- Regularly use and refine these narratives as it becomes more obvious which ones are likely to play out, building a shared understanding, testing the resilience of companies and integrating the output from the analysis into decision making.
- Select specific early-warning indicators (eg policy announcements, technology cost milestones, geopolitical events) associated with chosen narratives, which can be monitored between board meetings.

#### 4. DIRECT SCENARIO ANALYSIS TO SHORTER, DECISION-RELEVANT HORIZONS

Focusing entirely on long-term horizons and global temperature averages means that short-term risks and specific risks faced by individual funds are not included. In addition, such a focus greatly underplays the increasingly severe and very geographically diverse impact of extreme weather events.

While long-term scenarios remain important for certain asset classes, to inform general direction and guide minimum risk appetite, the uncertainty surrounding them must be recognized. Prioritizing shorter-term horizons, typically up to five years, better aligns scenario analysis with the decisions trustees actually need to make, including on risk, resilience and asset allocation. Shorter-term scenarios help to clarify sequences of events and interactions between the climate transition and macro drivers. Markets can often recognize, reprice or overreact to these interactions, so short-term scenarios can help to highlight short-term volatility and loss risks, avoiding the false confidence created by assuming smooth economic and market adjustments. The outputs of short-term scenarios can then be considered and reconciled with any long-term scenarios used. For example:

- Shift emphasis from 2100 or 2050 endpoints to nearer milestones with specific, time-bound reference points, such as:
  - Short term (eg three to five years) – covering current crisis and interaction with climate and nature
  - Medium term (eg ten years)
  - Governance scheduling (eg triennial valuation, VFM assessment)
  - Investment processes (eg SAA / default strategy design)
- Check that assumptions used in short-term scenarios are consistent with those used in long-term scenarios, recognizing that they are complementary.



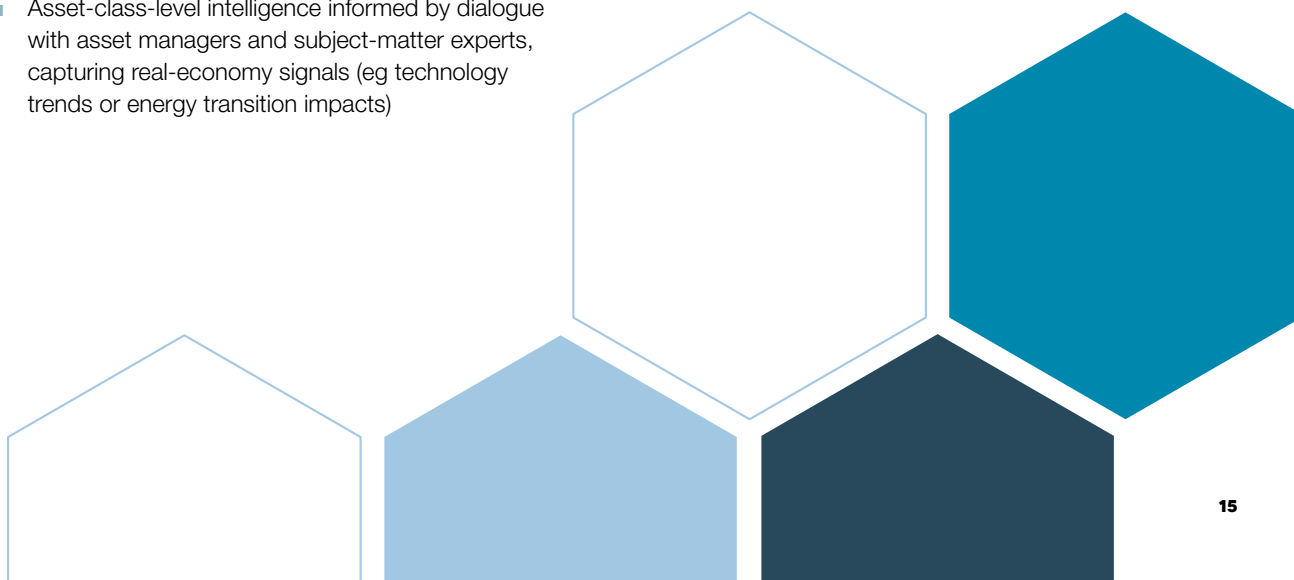
## 5. EMBED SCENARIO INSIGHTS INTO DECISION MAKING AND ENGAGEMENT

Scenario analysis delivers the greatest value when its insights are integrated into decision making. It needs to help with decision clarity for boards.

An intentional operating model ensures that scenario insights simultaneously inform SAA or default strategy design, portfolio resilience, liquidity management and stewardship escalation. For example, disorderly transition scenarios should trigger not only asset allocation or glidepath decisions but also predefined actions to maintain liquidity, manage member outcome risks, and escalate stewardship with systemically important holdings.

Chairs and trustees can take practical steps to ensure this happens, such as:

- Begin with board-level narrative discussions to identify the uncertainties, risks and opportunities that matter most ([see top tip 4](#)).
- Combine a top-down with a bottom-up approach. For example, use narrative discussions to inform top-down analysis for SAA / default strategies, alongside a bottom-up approach within asset classes and sectors.
- Ask your in-house team or service providers to demonstrate how the narrative discussion compares with the quantitative scenario outputs and what investment or stewardship decisions this has informed.
- Use scenario analysis to identify opportunities that sit between traditional asset class definitions, such as industrial decarbonization solutions, transition infrastructure or adaptation investments that will not fit neatly under 'growth', 'infrastructure' or 'private markets' labels.
- Ask in-house teams or service providers to evidence how judgement is systematically incorporated into SAA or default strategy design, including:
  - Macroeconomic implications (eg growth, inflation, real interest rates) within the investment outlook process
  - Qualitative insights alongside quantitative modelling (eg geopolitical factors and known modelling limitations)
  - Asset-class-level intelligence informed by dialogue with asset managers and subject-matter experts, capturing real-economy signals (eg technology trends or energy transition impacts)
- Require relevant papers to clearly demonstrate:
  - How scenario insights have influenced asset allocation decisions (eg inflation persistence, growth dispersion, regional and sectoral divergence)
  - How asset choices perform across a range of plausible futures, rather than a single central forecast
  - How portfolio flexibility (liquidity, rebalancing capacity and optionality) is being maintained in the face of uncertainty
  - How different scenarios affect funding-level / member outcome volatility and contribution requirements, aligned with trustees' core risk metrics
- Ask those responsible for your stewardship activities to explain how scenario analysis is currently used to:
  - Inform stewardship prioritization with regard to both climate and nature
  - Map stewardship activities to system-level impact
  - Assess progress in addressing risks identified
  - Inform escalation and voting decisions
- Request visibility on how scenario insights are being used in other areas, such as macro positioning risk management themes.



## TRANSLATING SCENARIO OUTPUTS INTO INVESTMENT DECISIONS

Common investment changes that pension funds have made on the back of scenario analysis include:

- Where persistent inflation appears across multiple scenarios – review the inflation hedging approach.
- Where transition scenarios suggest disorderly repricing – assess liquidity needs and resilience buffers.
- Where physical risk scenarios highlight concentrated exposures – prioritize stewardship and engagement with affected sectors.

## INVESTMENT IMPLICATIONS OF USING A NARRATIVE SCENARIO APPROACH

In using a narrative approach, USS mapped out what the investment implications would be. Specifically, these were:

1. **Inflation protection** – as all scenarios indicated elevated inflation, USS increased allocations to inflation-linked bonds, derivatives and private market assets with inflation-linked cash flows.
2. **Diversification and resilience** – given uncertainty around growth outcomes, USS adopted a more balanced portfolio, combining resilient companies with those positioned for technology-driven growth.
3. **Flexibility in market cycles** – recognizing potential boom–bust dynamics, USS focused on ensuring portfolio flexibility to withstand market shocks and seize opportunities during downturns.

## INVESTMENT IMPLICATIONS FROM SCENARIOS

### Investment insights

Higher and more volatile inflation

Wide range of outcomes for GDP growth

Potential for large drawdowns or boom / bust cycle

### Impact on USS strategic allocation

We have increased exposure to assets providing **inflation protection**

We focused on building a **balanced portfolio** allocation sufficiently **robust** to alternative scenarios

We assessed **portfolio resilience** and **flexibility** to avoid forced selling and enable counter-cyclical actions

Figure 2: Investment implications from scenarios (source: USS unpublished presentation, 2025).



## 6. LEAD A MINDSET SHIFT

The aim of moving beyond simplified climate scenario approaches is to view climate change within a broader macroeconomic context and in connection with broader systemic risks (ie nature and society), potential tipping points and significant uncertainties. To do this, a cultural change is needed in how systemic risks and opportunities are assessed and managed. Upskilling will be needed across the entire organization on emerging new scenario approaches, with structures in place to ensure that findings from scenario analysis remain central to strategic decision-making processes. Although management has a significant role to play, ultimately this needs to be led by the board of trustees, which sets the tone for the fund.

While a cultural change seems daunting, there are some simple actions that chairs and trustees can take to facilitate this.

For example:

- Invest in both board and wider capabilities, eg through commissioning teach-ins by academics, peers of large pension funds or specialist teams. Depending on size of fund, the focus could be on understanding scenario analysis as a strategic tool, an overview of challenges to the current scenario approach or how to engage service providers on their approach.
- Assign explicit responsibility for climate scenario literacy to a suitable sub-committee (eg risk or investment) and ask for regular updates on how scenario insights are being used in decisions.
- Ask service providers / in-house teams to:
  - Participate in scenario analysis workshops to improve techniques and knowledge, eg moving beyond performance benchmarks and historic risk metrics, rethinking mandate design and bottom-up process integration, and incorporating more forward-looking tools into the investment process
  - Report back on how this has impacted on their work and advice
  - Run an all-staff annual session on macro changes in the next five, ten and twenty years
- Treat scenario analysis as a living process, not a one-off exercise. For example, ask for regular updates to narratives as policy, technology and geopolitics evolve, and encourage experimentation with new tools (including AI and real-time indicators) to track changing probabilities.

## ESSENTIAL ACTIONS WITH NO OR LIMITED RESOURCE REQUIREMENTS

Recognizing that many of the proposed tips in this guide assume a large and resourced fund, this box outlines key actions that chairs with limited resources can take while still remaining impactful.

- Ask your adviser how their scenario analysis changed their advice to you in the last year, and how their advice does or does not reflect global regulators' focus on the limitations of climate models and on the scale of potential impacts, especially non-linearities and tipping points.
- Ask for one genuinely uncomfortable, short-term scenario to be included.
- Dedicate one hour of regular board sessions to discussing narratives before seeing the numbers, asking 'What decision would we make differently as a result of this analysis?' (see top tip 3).
- Ask for scenario analysis outputs to be compared across at least two methodologies or providers (or if this is not available to you, ask how your scenario analysis outputs compare with those from pension funds such as USS and APG).
- Identify three early-warning indicators to monitor between board meetings, such as food inflation, rising insurance withdrawal from nature and climate-exposed regions, or global adoption of renewable energy.

## ADDRESSING THE DOUBLE MATERIALITY CHALLENGE

Trustees face a dual challenge: first, to manage the sustainability-related financial risks to the fund's investments, funding position and long-term member outcomes; and second, through decisions on capital allocation, stewardship and policy engagement, to influence how the wider, global economy responds to these risks, which in turn shapes the future investment environment that the fund will face.

Scenario analysis can help trustees to bring these two perspectives together by testing investment and stewardship strategies against a range of plausible scenarios. This enables trustees to assess whether, for example, current net zero strategies are aligned with plausible global pathways.

This supports more joined-up decision making, helping trustees to protect financial outcomes today while contributing to the more resilient long-term system on which those outcomes ultimately depend. It encourages trustees to ask whether today's decisions would still make sense if the world develops differently than expected.

# APPENDIX: QUESTIONS TO ASK YOUR SERVICE PROVIDERS OR IN-HOUSE TEAMS

The following questions can help boards and management to understand whether the scenario analysis process currently used for their fund is robust and decision useful.

These questions complement existing questions you may pose to service providers or in-house teams around the scenario process.

Use the questions to elicit a discussion rather than sending this as a checklist to be completed. Use the suggested approaches in the A4S [‘Enhancing Stewardship](#)

[Engagement through Your Asset Managers](#)’ guide to ensure responses are useful and enable a fuller discussion. Encourage the inclusion of specific examples to bring the response to life rather than a focus simply on the frameworks used.

Use the answers to develop discussions on scenario analysis approaches as well as to help to shape future mandates, reporting expectations and adviser selection.

Approach to scenario analysis
What are the various purposes of your scenario analysis approach (such as SAA / default strategy design, risk management, transition planning)?
How do you ensure the scenario approach matches the intended use case, including time horizon, intensity, scope and granularity?
What models, data sources and processes form your scenario analysis approach?
Who is involved in developing, reviewing and approving scenarios before we see the final results?
To what extent do you use published scenarios (eg NGFS, IEA) versus bespoke or internally developed scenario sets?
How are other systemic risks (eg biodiversity, geopolitical, AI / tech) incorporated into your scenario analysis?
Is your analysis based on sector-level assumptions, company-specific data or precise location-based data?
Do you stress test at the sector level and share the results with our asset managers / in-house teams?

Using narrative scenarios and qualitative data
At what stage do you introduce narrative scenarios (before modelling or after quantitative outputs)?
How do you reflect narrative assumptions on the quantitative parameters used in the selected models?
How do you ensure narrative scenarios are plausible, consistent, and grounded in economic, political and technological realities?
What conditions would invalidate a narrative, and how quickly would it be revised?
How are narrative scenarios reviewed, challenged and refreshed?

Time horizons
How do scenario time horizons align with the scheme’s investment strategy, funding and liquidity needs?
How do near-term transition risks interact with longer-term physical risks?
How do assumptions about front loaded versus deferred costs affect asset valuations today?
What triggers for stranded assets have you identified?

Macroeconomic integration
How do the scenarios incorporate assumptions about inflation, real rates, growth dispersion and market volatility?
Where might climate-related risks amplify existing macroeconomic vulnerabilities?
How are nature-related risks and dependencies (eg water stress, land use, biodiversity loss) incorporated alongside climate assumptions?
How would macro assumptions change if policy coordination weakened or broke down?
What would a disorderly transition mean in practice for our portfolio / default strategy?
How are climate variables translated into macroeconomic shocks?
What simplifying assumptions are required in translating climate outcomes into economic effects?

Non-linearity and tail risks
How do the scenarios capture abrupt policy shifts, market repricing or political backlash?
Do the scenarios include rising non-linear physical risks, eg extreme weather?
How are feedback loops (eg inflation, insurance withdrawal, credit stress) reflected?
Are tipping points or threshold effects reflected in the scenarios? If so, how?
Which risks are skewed to the downside, and how is this reflected in portfolio construction / default strategy design?
Do you include both direct physical risks and indirect value-chain impacts?

Model limitations
Do the models capture the necessary variables with appropriate frequency and granularity?
Where are the scenarios most likely to be wrong, including areas that assume smooth adjustment when reality may be abrupt?
Where are risks, tipping points, feedback loops and second-round effects not captured in the analysis and why?
How do you avoid false precision and assess sensitivity to key assumptions?
Which risks do you explicitly overlay with judgement because the scenario model cannot capture them?

Stewardship
How are you using scenario analysis to inform stewardship prioritization and to shape stewardship activity with investee companies?
How are scenarios helping you to identify investee companies and sectors with high dependencies or impacts on nature and biodiversity?
How do scenarios help to reconcile potential conflicts between financial returns and impact (double materiality)?
Can you provide examples of where scenarios have led to escalated engagement with investee companies, voting changes or capital reallocation?
What additional questions can scenarios help us to ask investee companies?
How are investee company transition planning efforts incorporated into scenario analysis?
Where do you see the biggest gap between company disclosures and scenario-based analysis?

Governance and continuous improvement
How do you support the scheme's board to understand and approve the scenarios?
Who challenges the scenario results before they are presented to the board, and how independent is that challenger?
Are processes and resources in place to ensure that the scenarios are monitored and reviewed at least annually?
How have past inaccuracies or blind spots shaped current scenario approaches?
How do insights from scenario analysis feed into portfolio / default strategy performance review and future decision making?



# GLOSSARY

<b>Systemic risks</b>	Risks that affect the entire economic or financial system rather than individual assets or sectors, and that therefore cannot be diversified away. Climate change, nature loss and geopolitical instability are examples of systemic risks.
<b>Narrative scenarios</b>	Qualitative, story-based descriptions of how the future might unfold. Narrative scenarios focus on cause and effect, the sequence of events, and how different drivers (such as policy, technology, geopolitics and climate impacts) interact. This guide advocates for these to be developed <i>before</i> quantitative modelling, to frame thinking and challenge assumptions.
<b>Quantitative scenarios</b>	Scenarios that express future outcomes using numbers and models (eg impacts on GDP, inflation, asset returns or funding levels). Their results depend heavily on underlying assumptions.
<b>Probabilistic analysis</b>	An approach that assigns probabilities to different scenarios or outcomes. While this can be useful in some contexts, probabilities can give a false sense of precision when uncertainty is deep and future outcomes depend on complex, interacting forces.
<b>Non-linear versus linear</b>	Linear climate scenario models assume that climate impacts, economic effects and financial risks change gradually and proportionally over time (eg a smooth increase in temperature leading to steadily rising costs). Non-linear models allow for sudden, disruptive and potentially irreversible changes, where small shifts (such as policy shocks, extreme weather events or tipping points) can trigger large and rapid impacts on markets, economies and asset values.
<b>Tipping points</b>	Critical thresholds beyond which changes become abrupt, irreversible or self-reinforcing. Crossing a tipping point can lead to rapid shifts in climate systems, ecosystems, markets, or social and political conditions.
<b>Feedback loops</b>	Processes where an initial change sets off a chain of responses that reinforce or amplify the original effect (eg climate impacts increasing inflation, which tightens financial conditions and slows investment).
<b>Integrated Assessment Models (IAMs)</b>	<p>Complex computational frameworks used to link climate change, energy systems and the economy. IAMs are widely used in climate scenario analysis but do not reflect key complexities and therefore may understate the scale and speed of future impacts. For example, they typically:</p> <ul style="list-style-type: none"> <li>• Assume that everything happens in the most efficient and coordinated way</li> <li>• Are unable to capture real-world politics, social behaviour or institutional constraints very well</li> <li>• Work at broad global scales rather than local levels</li> <li>• Struggle to represent uncertainty, sudden changes (such as tipping points) or real-world barriers (eg dependencies and existing infrastructure lock-in)</li> </ul>

<b>Equilibrium macroeconomic models</b>	Economic models which assume that markets adjust smoothly, resources are efficiently allocated and the economy tends toward balance. These assumptions can limit how well such models reflect disruption, instability and crisis, particularly in the context of climate transition and systemic risk.
<b>Double materiality</b>	The concept that sustainability issues can be material in two ways: <ul style="list-style-type: none"> <li>• Financial materiality – how sustainability-related risks and opportunities affect the fund's financial outcomes (inbound risk)</li> <li>• Impact materiality – how the fund's investment and stewardship decisions affect the wider economy, society and environment (outbound risk)</li> </ul>
<b>Universal owner</b>	An institutional asset owner that, through their portfolio or default strategy design, owns such a representative portion of the economy as to find it impossible to diversify away from large system-wide risks.
<b>Service providers</b>	External organizations supporting the fund, including data providers, investment consultants, actuaries, scenario analysis specialists and asset managers.



# FURTHER READING

## REPORTS

University of Exeter and USS (2023), [No Time to Lose: New Scenario Narratives for Action on Climate Change](#)

UKSIF (2025), [UKSIF Report: Systemic Risks: A Framework for Portfolio Resilience](#)

Carbon Tracker (2023), [Loading the DICE against Pensions](#)

Institute and Faculty of Actuaries (IFoA) (2024), [Climate Scorpion – the Sting Is in the Tail](#)

Institute and Faculty of Actuaries (IFoA) (2026), [Planetary Solvency: Tipping into the Wild Unknown](#)

## BOOKS

Sharpe, S. (2023), *Five Times Faster: Rethinking the Science, Economics, and Diplomacy of Climate Change*. Cambridge: Cambridge University Press.

Lenton, T. (2025), *Positive Tipping Points: How to Fix the Climate Crisis*. Oxford: Oxford University Press.

## A4S RESOURCES

[Asset Owners Network](#)

[The Sustainability Toolkit for Pension Chairs and Trustees](#)

[A4S Scenario Analysis Resources and Guidance](#)

[Enhancing Stewardship Engagement through Your Asset Managers](#)



# ACKNOWLEDGEMENTS

We would like to thank all external parties who reviewed the guide, contributed background information and/or provided examples.

A special thanks to **Dame Kate Barker**, Trustee Board chair, USS, for writing the foreword.

- **Clara Barby CBE**, Senior Partner, Just Climate
- **Joel Benjamin**, Financial Policy and Advocacy Manager, Carbon Tracker Initiative
- **Sebastien Betermier**, Executive Director, International Centre for Pension Management, and Associate Professor of Finance, McGill University, Desautels Faculty of Management
- **Mirko Cardinale**, Head of Investment Strategy, USS Investment Management Limited
- **Mark Cliffe**, Visiting Fellow, Global Systems Institute, University of Exeter and Adviser to TRES Analysis
- **Daniel Godfrey**, Non-Executive Director and Independent Governance Commission (IGC) member, Legal & General
- **Amy Owens**, Financial Policy Analyst, Carbon Tracker Initiative
- **Nick Spencer**, Sustainable Investment Adviser, Gordian Advice
- **Sandy Trust**, Planetary Solvency Lead, Institute and Faculty of Actuaries (IFOA), and Director of Sustainability Risk, Baillie Gifford

## AUTHOR

- **Kerry King**, Executive Director, Capital Markets and Partnerships

## A4S TEAM

- **Natalie Jackson**, Technical Consultant
- **Warda Al-Jawahiry**, Senior Manager



# ABOUT A4S

Established in 2004 by HM King Charles III, when he was The Prince of Wales, A4S's mission is to harness the power of finance to accelerate the transition to a sustainable economy. We work with the global finance and accounting community to:

- **EMPOWER:** Build finance leadership capabilities
- **EMBED:** Integrate sustainable value creation into financial decision making
- **ENGAGE:** Connect and engage decision makers across the financial system

To achieve these goals, A4S runs the following strategic programmes:

- **Building capacity:** Providing tailored guidance, learning materials and programmes to build finance and accounting leaders' skills and confidence in sustainability
- **Cultivating peer networks:** Connecting CFOs, their teams, pension fund chairs, and the accounting community and creating trusted spaces
- **Mobilizing action:** Bringing leaders together in areas where our communities can drive the greatest change, focusing on sector transformation, finance in the age of AI and next-generation accounting

## THE A4S ASSET OWNERS NETWORK

Bringing together chairs of pension funds, the network provides a confidential and commercial-free space for candid conversations, shared learning and decision-useful information, all in order to strengthen the long-term resilience of funds.

The Network offers:

- A confidential, chair-only environment for frank conversations, sharing experiences and exploring emerging approaches to long-term sustainability challenges
- Regular virtual and in-person meetings, with agendas set and co-chaired by members and contributions from leading experts, policymakers and regulators
- Peer-led learning, grounded in real practice and tailored to the strategic issues faced by pension fund chairs

To find out more please email [capital.markets@a4s.org](mailto:capital.markets@a4s.org)

## GET IN TOUCH OR FIND OUT MORE

 [ACCOUNTING FOR SUSTAINABILITY \(A4S\)](#)

 [ACCOUNTING FOR SUSTAINABILITY \(A4S\)](#)

 [INFO@A4S.ORG](mailto:INFO@A4S.ORG)

 [WWW.ACCOUNTINGFORSUSTAINABILITY.ORG](http://WWW.ACCOUNTINGFORSUSTAINABILITY.ORG)

