



ACTUARIAL SOCIETY
S O U T H A F R I C A

Retirement funds guidance note on climate change

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(representing retirement funds climate change working group)

September 2024



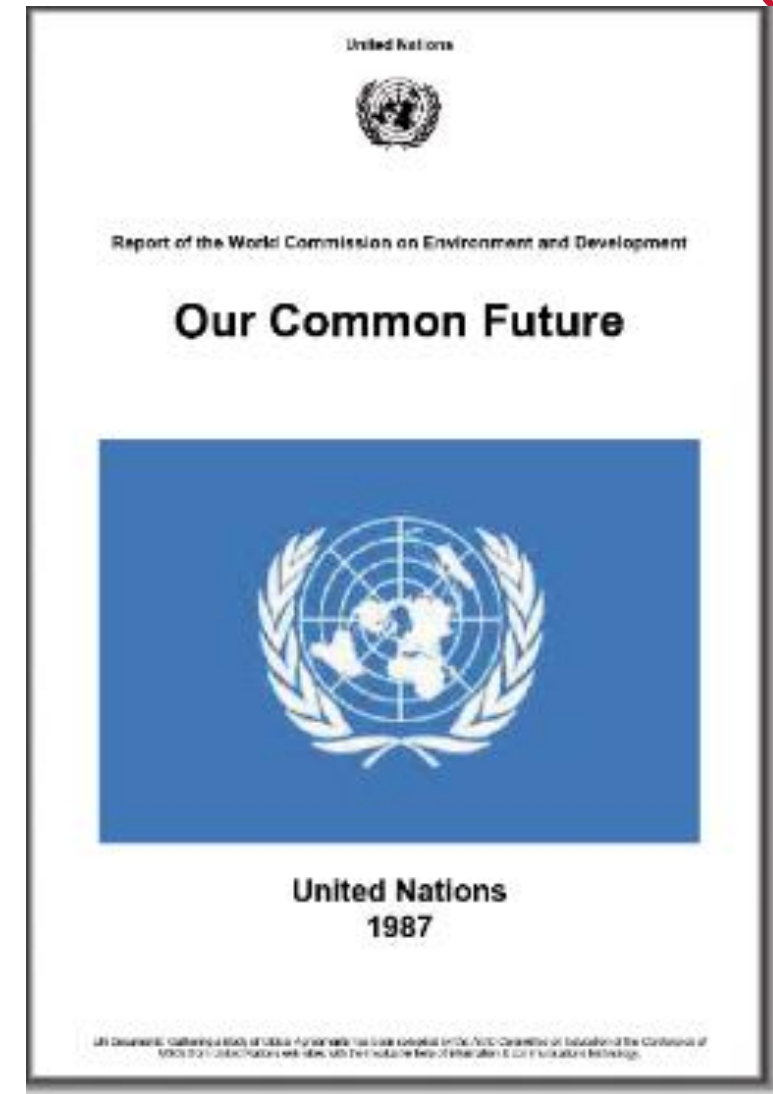
Sustainability defined as:

“...meeting the needs of the present
without compromising the ability of future
generations to meet their needs.”

Brundland Report, 1987

Brundtland Report, also called ***Our Common Future***

- publication released in 1987 by the World Commission on Environment and Development (WCED)
- introduced the concept of sustainable development and described how it could be achieved.



Trade-off between financial and social returns



	Philanthropy		Social Impact Investing		Sustainable and Responsible Investing ⁸	Conventional financial investing
	Traditional Philanthropy	Venture Philanthropy	Social Investing	Impact investment	ESG investing	Fully commercial investment
Focus	Address societal challenges through the provision of grants	Address societal challenges with venture investment approaches	Investment with a focus on social and/or environmental outcome and some expected financial return	Investment with an intent to have a measurable environmental and/or social return	Enhance long-term value by using ESG factors to mitigate risks and identify growth opportunities.	Limited or no regard for environmental, social or governance practices
Return Expectation	Social return only	Social return focused	Use of ESG metrics and methodologies		Financial market return focused on long-term value	Financial market return only
	Social impact		↔ Social and financial		↔	Financial returns

Retirement funds should seek to optimise the risk / return / impact characteristics of their strategy

Source: stylised adaptation from OECD (2019). "Social impact investment, the impact imperative for sustainable development, "based on earlier versions from various organisations: for illustrative purposes only

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			Use of ESG metrics and methodologies				
Expectation	Social return only		focused	sub-market financial return	Social return and adequate financial market rate	Financial market return focused on long-term value	Financial market return only
	Social impact		↔	Social and financial		↔	Financial returns

Given fiduciary duties, retirement fund investment strategies focus here

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Climate change not yet fully priced in markets



Sustainability criteria	SA average score	Leading SA funds	Leading global funds
Actuarial integration	53%	60%	80%
Climate change	11%	44%	88%

Very few funds in SA managing climate change as part of strategy / ongoing risk management

A reason for these low scores :
No funds in SA, explicitly or implicitly (based on publicly available information), allow for climate change in actuarial assumptions (DB or DC)

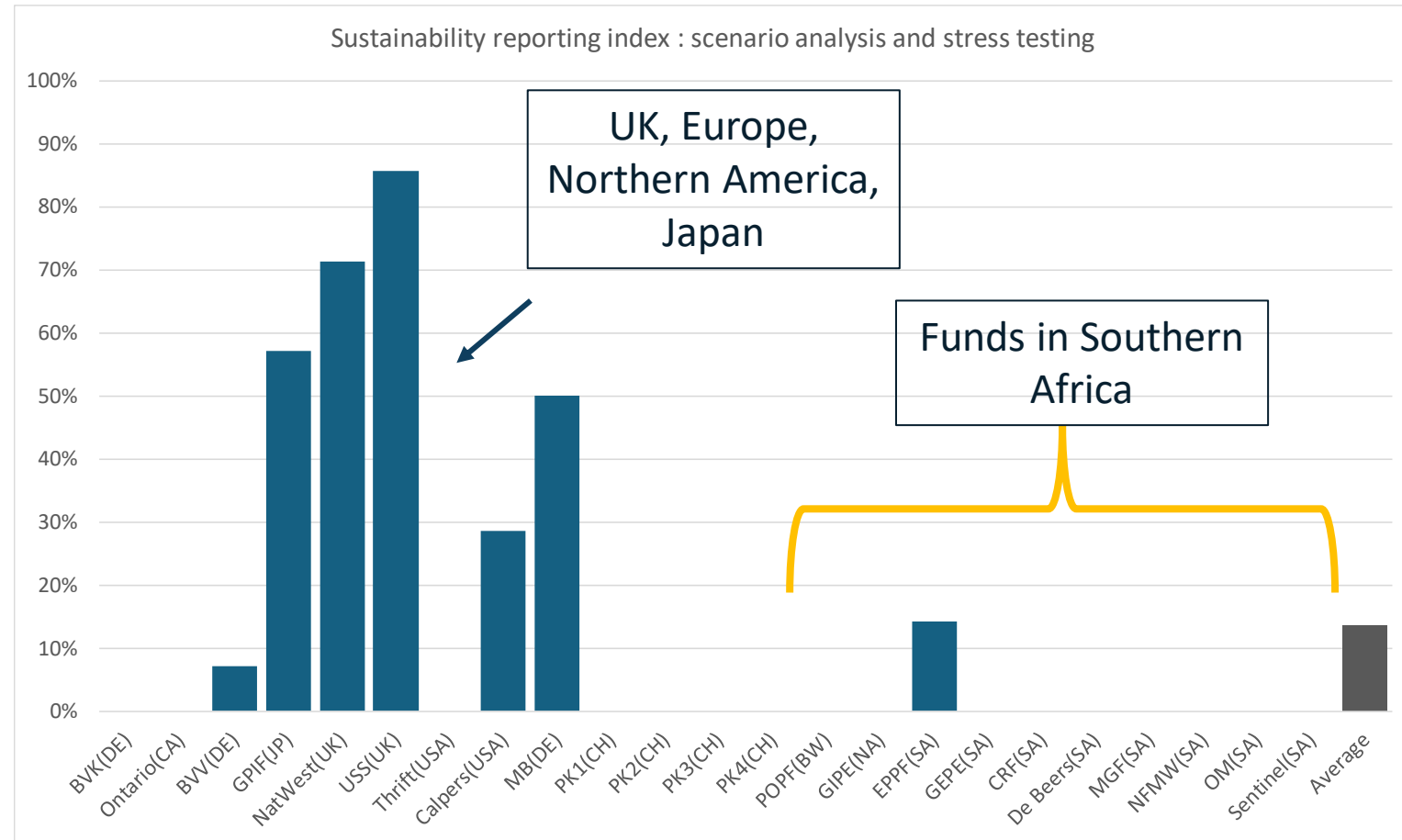
A 2023 report, “Loading the DICE against pension schemes”, shows the growing systemic risks to financial and institutional investment and pension markets from the under-pricing of climate change.

According to The Financial Markets Law Committee (2024), “...with climate-change related risks that are systemic, it is unlikely that diversification alone of a portfolio will be enough to avoid all the risks in the same way that non-systemic risks might be diversified away from”;

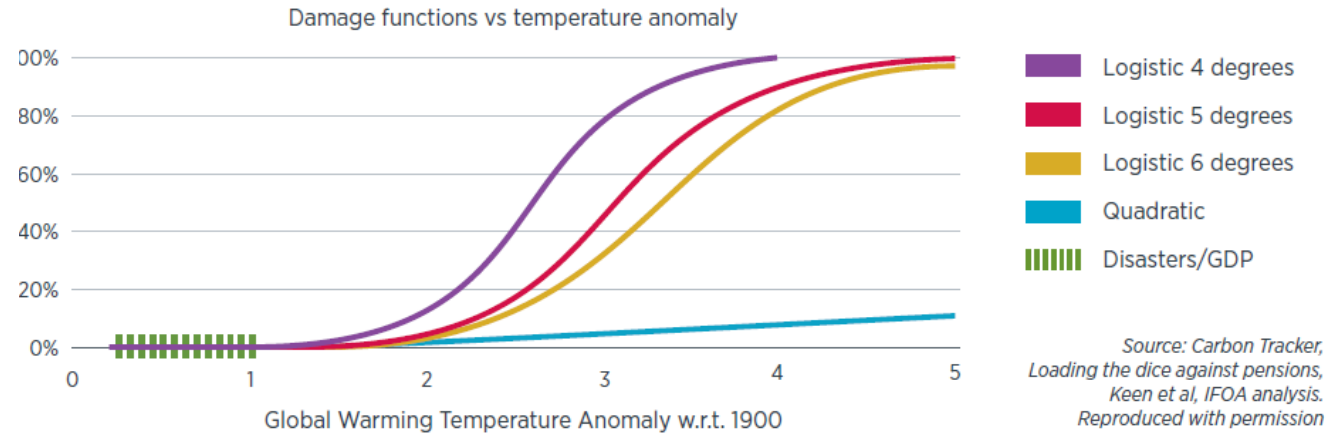
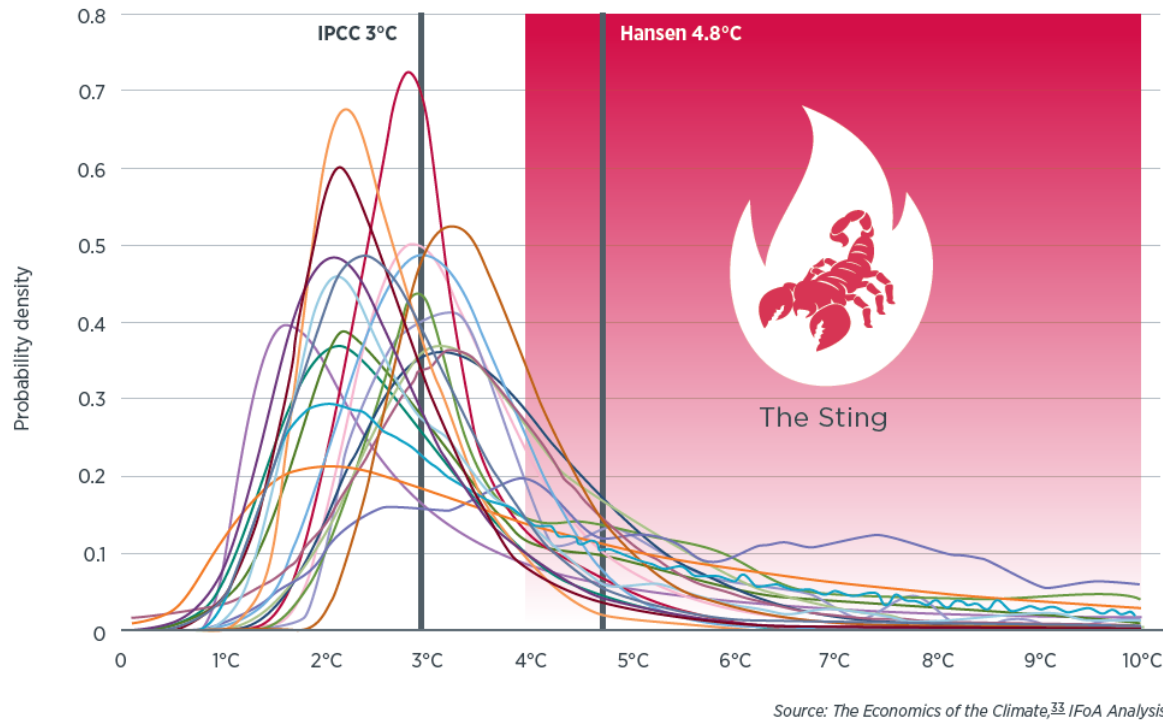
Funds in SA need actuaries to assist with scenario analysis and stress testing



- *In Southern Africa, virtually no reported level of incorporating scenario analysis and stress testing into the risk management of funds.*
- *It is likely that many countries and regulators will start including this as best practice recommendations in managing systemic risks such as climate change, nature & biodiversity risk.*



Research actuarial research indicates significant risk of loss in the long-term



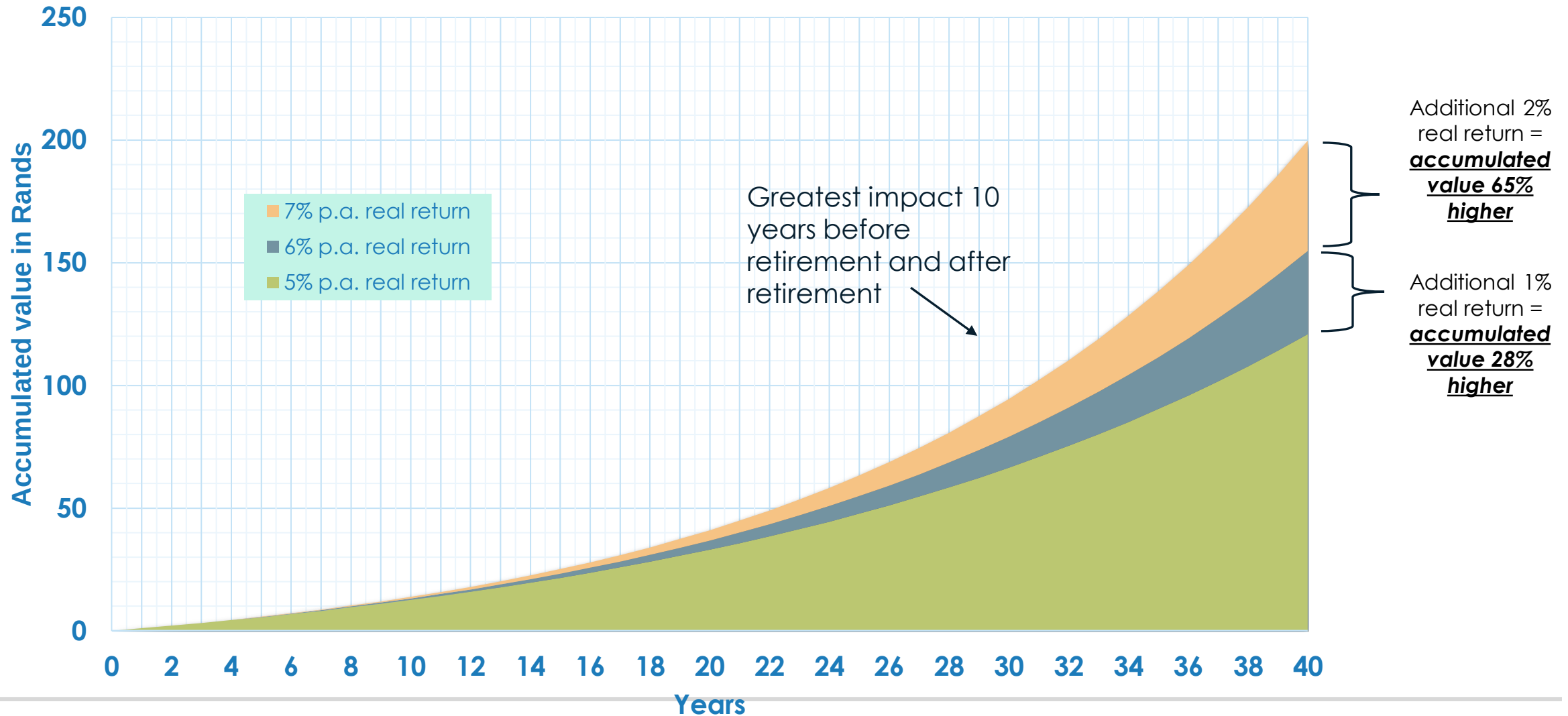
- Potential for significant variation in future temperatures.
- Planet may warm more quickly than expected for a given level of greenhouse gases.

- GDP could reduce 30% and 80% assuming global warming of 3 degrees above pre-industrial temperatures.

Every 1% reduction in returns from climate change reduces retirement income by ~28%



Accumulated value of contributions of R1 p.a. in today's money terms



To address this : a guidance note for retirement fund actuaries has been developed



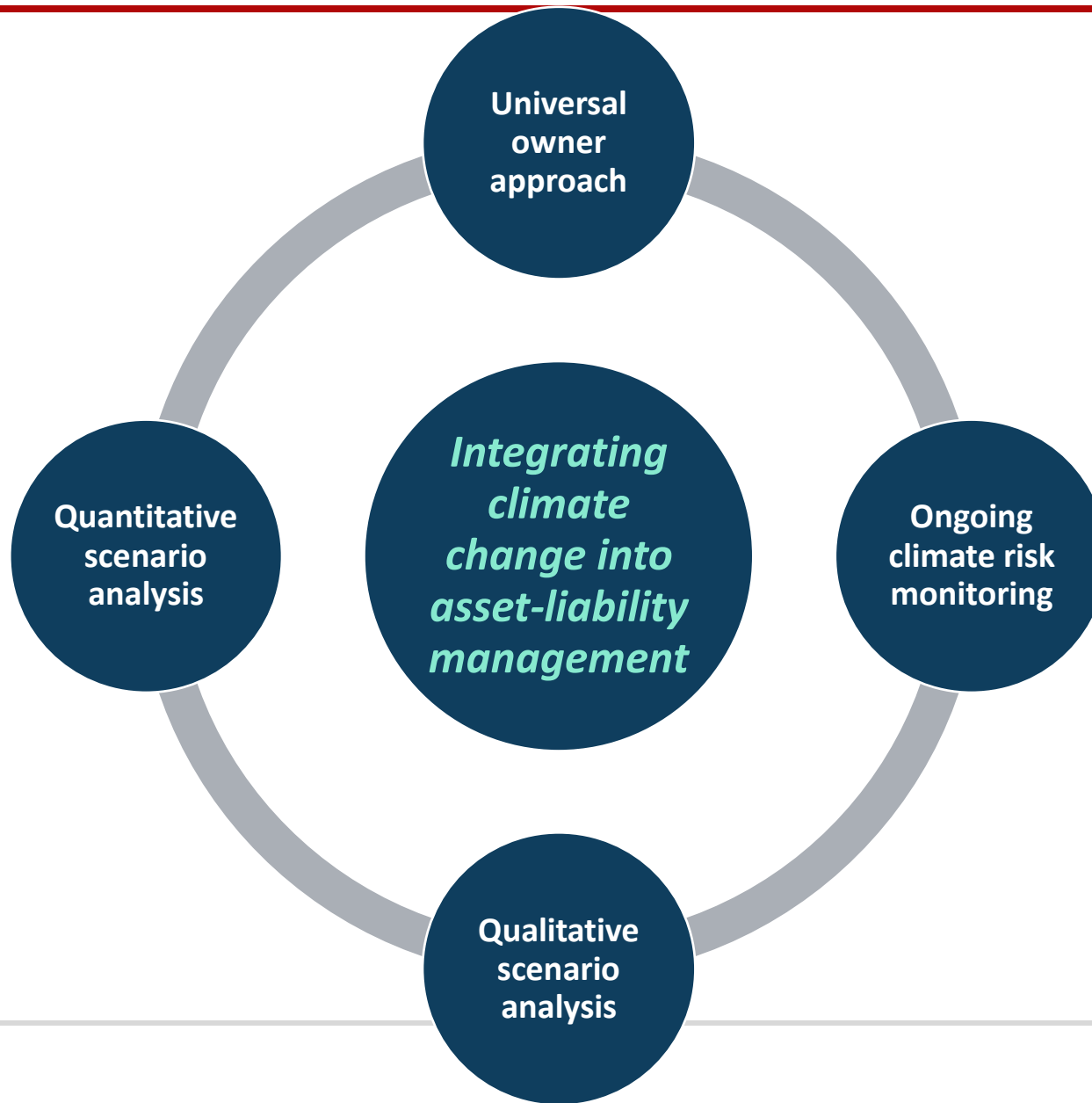
Climate Change Guidance for Retirement Fund Actuaries

- Sub-group of the ASSA Climate Committee (focusing on traditional practice areas)
- Includes investment actuaries, retirement fund actuaries, product development actuaries
- Informed by available research (including relevant notes issued by the IAA)
- Approach:
 - Arm retirement fund actuaries with a practical understanding of climate change
 - Encourage integration of climate change in existing practices with practical suggestions



- **Background information on climate change**
 - **Climate change basics**
 - **SA specifics**
 - **Importance and relevance for retirement funds**
 - **Universal ownership & ongoing monitoring framework**
 - **Qualitative scenario analysis – with worked example heatmap**
 - **Quantitative scenario analysis – with illustrative replacement ratio / funding levels**
 - **Key practical points for retirement actuaries to consider in each section**
 - **Key references and additional info as Appendix**
-

Summary of framework – 4 key areas



Encouraging a “Universal ownership” approach



	Shift from: Industry Current Position	Shift to: Industry Desirable Future Position
Portfolio construction	Portfolio creation has gaps in its approach to systemic risk and climate risk Limited appreciation of systemic risks in a market (systematic) risk paradigm	Portfolio creation is more robust and adaptable to change → Integration of systemic risk into the risk management paradigm
The problems with benchmarks, incentives, and time horizons	Benchmarks and incentives that produce ineffective practice	→ Long-term incentives and actions that are effective and aligned to goals
Universal ownership	Universal ownership is small scale Weakly resourced stewardship	→ Universal ownership becomes large scale Strongly resourced and focused stewardship
Transition finance	Traditional financing models Blended finance early in its maturity	→ Alternative and innovative financing models Blended finance develops in maturity and impact

Achieve real-world impacts to produce better long-term financial outcomes by:

- In listed markets, moving capital toward portfolios that face forward and anticipate developments in the transitioning economy.
- In unlisted markets, providing primary capital and transition finance to support the climate transition and climate solutions.
- Deepening the stewardship practices with respect to individual investments and industries and in public policy engagement through a systemic approach to stewardship.



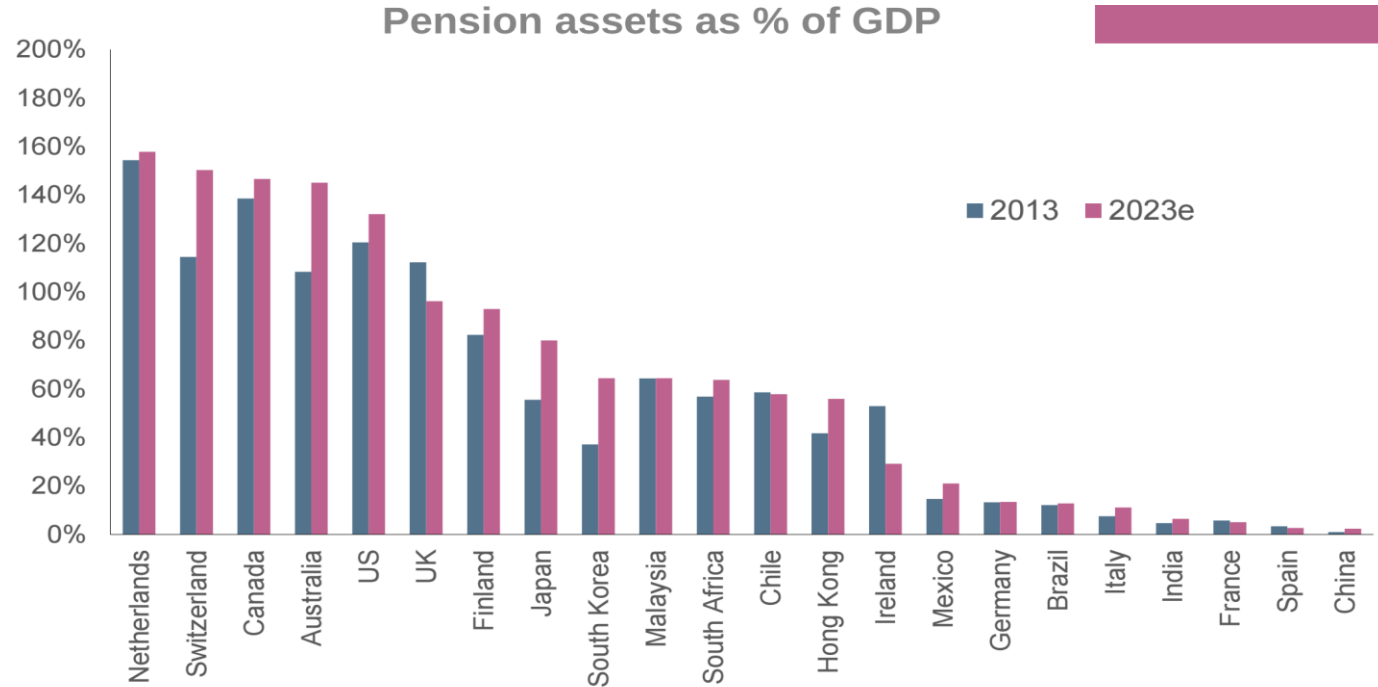
Supported by ongoing monitoring framework



Metric	Use
Weighted average carbon intensity (WACI)	Measure portfolio's carbon emissions and trends
Carbon footprint	Measure portfolio's carbon emissions and trends
Stranded assets	Assess how a portfolio is impacted by the transition to a low-carbon economy
Physical risk exposure	provide an insight into if / how investment managers are monitoring and managing the climate-related physical risks associated with their portfolios.
Climate opportunity	Measure exposure of investments to areas that benefit from the transition to a low-carbon economy.
Climate Value at Risk (VaR)	To assess the climate-related risks and opportunities facing an asset or portfolio.
Implied temperature rise (ITR)	Used to measure the environmental and social impact resulting from investments and whether engagement efforts are translating to real change in underlying investments. ITR metrics can be useful in communicating a portfolio's exposure to climate-related risks and opportunities.
Stewardship	Measure stewardship activities to support a transition to a low-carbon economy.

- *Understand / assess how an investment or portfolio is expected to be impacted by climate change.*
- *Encourage monitoring framework and recognise limitations (data / methodologies / assumptions).*

Role of pension funds: SCALE !



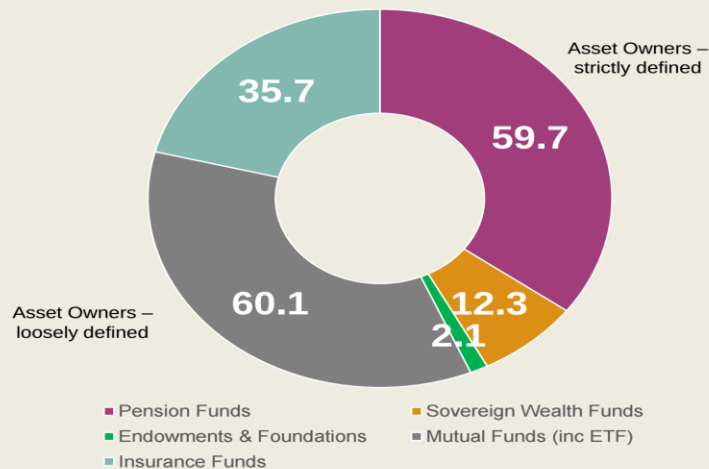
P22

The study covers 22 pension markets in the world (P22). They have pension assets of USD 55,688 bn

P22 markets

Australia, Brazil, Canada, Chile, China, Finland, France, Germany, Hong Kong, India, Ireland, Italy, Japan, Malaysia, Mexico, Netherlands, South Africa, South Korea, Spain, Switzerland, UK, US

Asset owners globally control USD 170 trillion



64%

The US is the largest market, with a share of 63.9% of P22 assets, followed by Japan and UK with 6.1% and 5.8% respectively

76%

The US, Japan and UK represent 75.8% of all pension assets

69%

Ratio of pension assets to GDP of these economies

KNOWING THE IMPACT



Nature ; environment; biodiversity

- Intensification and multiplication of current impacts
- Water scarcity
- Destruction of natural resources
- Terminal loss in bio-diversity
- Failure of ecological processes

Unknown Knowns

Upheaval in socio-economic value-chain

- Cultural & behavioural shifts
- Geopolitical conflict & fragmentation
- Disruption & shortening of supply chains
- Decline in economic output
- Disruption of financial services e.g. widening insurance protection gap/insurability
- **Transition risks**



Unknown Unknowns



Uncertainties & volatilities in adaptation and transition

- Manner in which transition & adaptation implemented (**JUST TRANSITION**)
- Organised, coordinated vs fragmented, regionalised, conflicted
- Decline in medical & health advances – e.g. pandemic containment
- Disrupted technological progress e.g. renewables; de-wasting

Tipping points

- **Sudden global scale changes in nature – e.g.**
 - Antarctic Ice Shelf; Permafrost melt; Monsoon disruption
- **Geo-engineering and consequences**
 - Carbon sequestration; dusting; space shielding

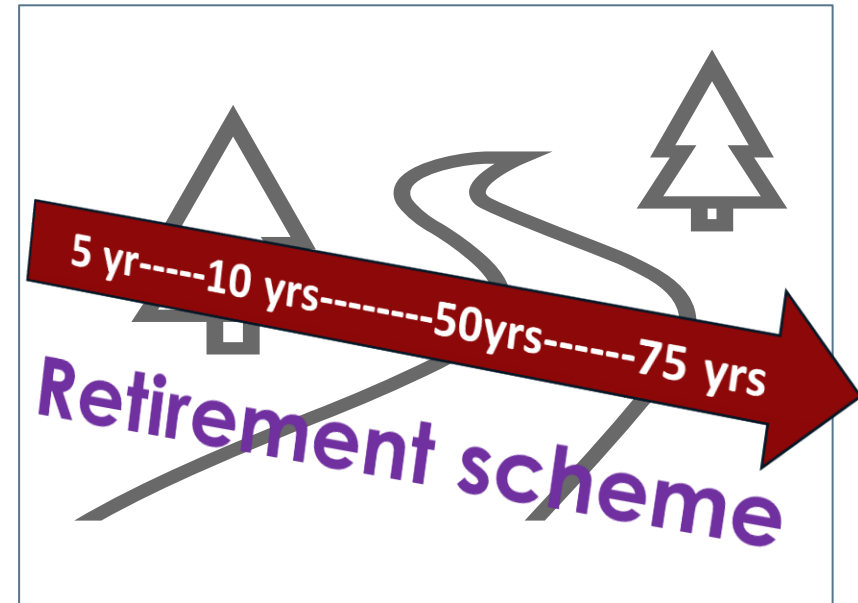
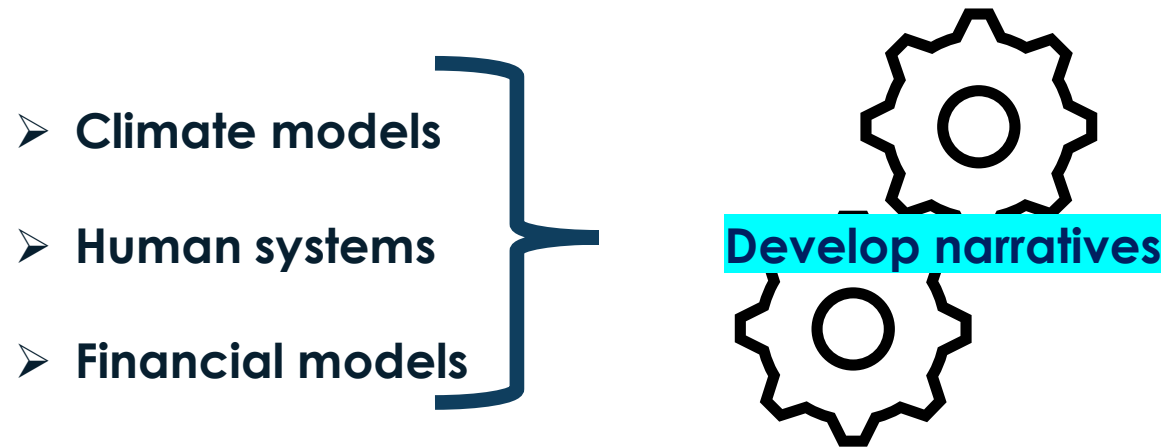
Known Unknowns





Why qualitative scenario analysis?

- Communicative power of the storyline
- Build plausible narrative(s) to capture evolving complexities, over different time horizons



Key Features of Qualitative Scenarios

- Plausible, coherent descriptions
- Quickly capture universe of information
- Touch-stone and sense-check
- Adaptable “working model” approach
- Tool to stakeholder communication



Qualitative scenario analysis: Developing Scenarios



Strategic tool for developing quick, critical, communicable understanding of future paths

- By assessing alternative assumptions, impacts, parameters, outcomes
- Integrating Climate models+ Socio-economic trajectories+ Adaptations & Mitigations
- Developing deep-textured, comprehensive narrative pathways

Positive change / "Low demand"

- Path of Significant Climate Action limit temperature rises,
- Rapidly reduce GHG & carbon emissions;
- Rapid transitions (technological, policy, financial, behavioural)

But.....3 Main Scenarios

Disorderly change / "Delayed transition"

- Delayed & divergent climate action (>2030), resulting in
- More severe short to mid-term impacts.
- But from 2030, rapid and stringent change – abrupt and disjoint socio-economic effects

Little change / "Hot-house world"

- Disunited fragmented efforts
- Insufficient to limit GW
- Critical tipping points are breached,
- Severe impacts from physical risks.
- High emissions, high-carbon economies,
- Severely damaged by climate change impacts

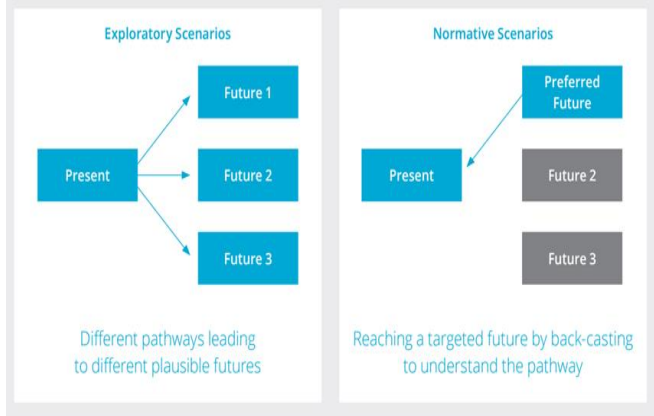
**Over 80 IPCC+NGFS
Scenarios!!**

Qualitative scenario analysis: Developing Scenarios in Practice

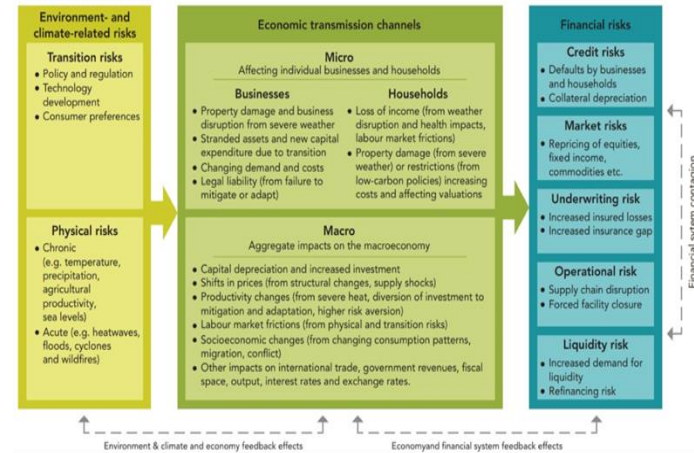


Scenario Development

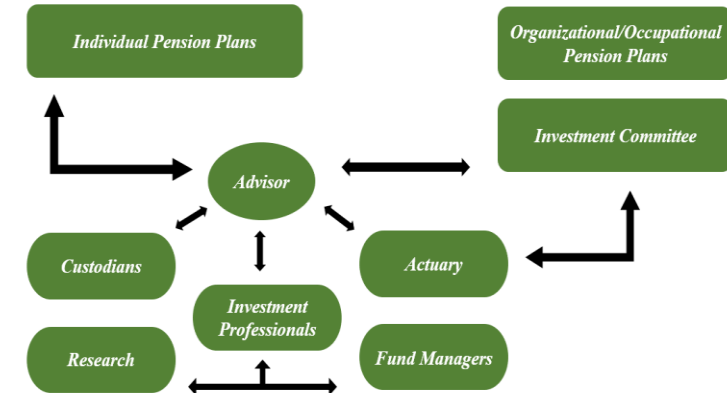
Exploratory versus Normative Scenarios



Transmission Channels



Fund features

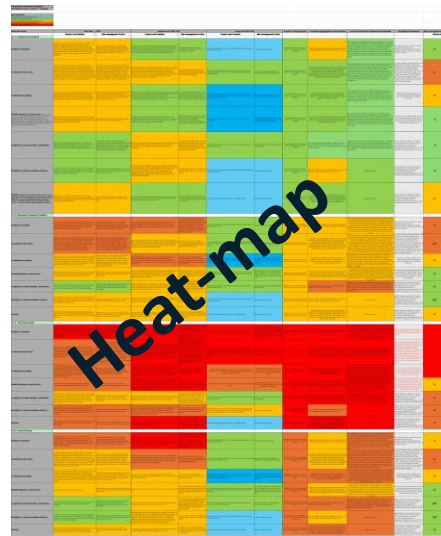


- Working backwards/ reverse stress testing approach
- Climate risk and opportunities assessment
- Transmission channels from CLIMATE LEVEL to FUND LEVEL in Financial Terms
 - Large-scale Global scenarios features linked to Fund features (granularity and timescales)
- Integrate with nature of pensions schemes, liabilities, and evolution
- **Embed findings and analysis using a Heatmap approach**

Qualitative scenario analysis –Heatmap development



- A complete picture - narrative scenarios – timescales & deepening knowledge



Control cycle

- Practical steps where complexities and uncertainties loom large
 - Describe financial health under Global Reference Scenarios
 - Mapping to nature of scheme asset & liabilities over time
 - Climate risks transmission to Scheme risks
 - Impact on valuation; design; parameters; costs
- Integrates/adds to ERM/ “PF130” Risk management framework
 - Heat map highlights important aspects –
 - Quantitative analysis
 - Communication to stakeholders
 - Learnings and information;
 - Ongoing investigation & management
 - Enhancement and monitoring

R-A-G Alert Key
immaterial or no adverse impact
low risk of adverse impact
low to moderate risk of adverse impact
moderate risk of adverse impact
high risk of severe impact

Heat signature,
bird's eye of
urgency and
severity, enables
stewardship &
decision making

Qualitative scenario analysis: Heat Map Scenario



Main Risk Levers	Short term < 2030	
	Feature and Evolution	Risk management Action
Hot-house world		
Employer Covenant	Covenant likely to be under moderate to severe stress. Acute physical and chronic climate hazards, increases cost of business, reduces revenue, increases cost of and viability of reinsurance. Adaptability and resilience to Climate change impacts reduced further increases uncertainty and volatility of sponsor groups ability to recover. While low transition risk costs, offset by hazard, adaptation and resilience costs	Trustees should engage Sponsor on their Climate change governance, and use of Catastrophe insurance. More stringent trigger points given greater volatility of impacts. Actuarial calculations may need to allow appropriate contingency funding costs. Eventually benefit reduction exercises may be required, but with clawback clauses on the sponsor covenant
Investments and Assets	Destructive climate change impacts will impact real economy (GDP; earnings, unemployment and wages), but equity and capital markets may not fully value climate risk impacts in their valuations, until the longer term risks start emerging and materialising. High risk that portfolio of investments will be overvalued. Property portfolio may directly feel impact of climate hazards, is illiquid, and face high costs of adaptation.	Board, to deal with severe hazards from developing risks, across all asset classes, needs to incorporate into risk-appetite and risk budgeting need. UNPRI Templates provide a good guide. Focus needed more on risk reduction and allowing for emerging climate risk impacts not yet priced in the markets. Property portfolio needs to be considered with regard to hazard risks and adaptation strategies on a cost-benefit basis. Actuarial valuation bases may need to explicitly allow for increased volatility, reduced returns environment, even if markets are not yet pricing in the impact. With solvency levels are increasingly at risk, cautionary bases increase demand on funding.
Contributions/Funding	PUC SCR's expected to be more volatile, increasing control periods towards AAM may not be prudent, given the mishmash of effects. Covenant stresses may need margins. Need to allow for higher health care and morbidity costs, and consider to what extent reinsurance would cover costs. Consider an element of catastrophe insurance, given increased vulnerabilities of plant & facilities to acute physical damage	Board may need to set-up more granular review processes, as the combination underlying drivers becomes more correlated towards adverse outcomes. Incorporate catastrophe insurance reviews.
Benefit adequacy and structure	Investment risk, covenant stress may leave fund in danger of maintaining a generous structure at greater solvency risk	Benefits may need to be reviewed, changes in pensionable salary levels, averaging periods considered
Longevity (i.e improvement)	Extent of impact of climate impacts over short term may be more marginal, but risk is they would be underestimated for future retirees, and contributions over priced. Greater uncertainty whether adequate reserves are held for retirees. With more stress human body, idiosyncratic health levels may become more prominent, hence longevity markers more difficult to assess	Assessing and understanding regional improvement experience around the world may be critical to assessing lag and underestimated gap. Experiential investigations.
Mortality (in-service members)	Over short term not likely much change -uncertain if distinct short term physical risks. But business disruption may be greater and more prevalent from physical hazards may lead to greater shift out of younger workers, hence mortality rates would increase due to age-shift	Margins for death and retirement reserves need to be considered. Experiential investigations may help
Morbidity	Higher morbidity rates and accompanying healthcare costs (mental health; disease, exposure to unmitigated hazards) and stress on health systems.	May need to reexamine ill health benefits and structure, reduce income element allow for lump sum elements,

Evolving impacts on fund features over time

- R-A-G assessment
- Feature (risk-driver) impact + risk action
- Qualitative description of parameters, assumptions, complex interactions
- Qualitative but rigorous step-by-step
- Hooks into scenario pathways
- Foundation for monitoring and sense-checking
- Allows for severity from uncertainty of impacts

Qualitative scenario analysis: Heat Map Scenario



Hot-house world	
Main Risk Levers	Investments and Assets
Short term < 2030	
Feature and Evolution	Destructive climate change impacts will impact real economy (GDP, earnings, unemployment and wages), but equity and capital markets may not fully value climate risk impacts in their valuations, until the longer term risks start emerging and materialising. High risk that portfolio of investments will be overvalued. Property portfolio may directly feel impact of climate hazards, is liquid, and face high costs of adaptation.
Risk management Action	Board to deal with severe hazards from developing risks, across all asset classes, needs to incorporate into risk-appetite and risk budgeting need. UNPRI templates provide a good guide. Focus needed more on risk reduction and allowing for emerging climate risk impacts not yet priced in the markets. Property portfolio needs to be considered with regard to hazard risks and adaptation strategies on a cost-benefit basis. Actuarial valuation bases may need to explicitly allow for increased volatility, reduced returns environment, even if markets are not yet pricing in the impact. With solvency levels are increasingly of risk, cautionary bases increase demand on funding.
Medium term 2030-2050	
Feature and Evolution	Markets across the board begin to suffer extreme impacts from climate change - breakdown in traditional correlations between markets, increases volatility, liquidity and credit risk. Flows between capital and equity markets disrupted - asset valuations will see severe declines. Real economies find loss of productive capacity, breakdown in supply chains, adaptation, disaster recovery, difficult and costly, still lower and potentially extended lower growth. Inflation risk premium widens impacting bond markets. Central banks struggle to balance growth and inflation. High uncertainty may fuel extreme risk aversion behaviour among investors will fuel global volatility across different regional markets.
Risk management Action	Investment strategy will need to allow for higher costs of portfolio management, and premiums for entry into pockets of viable markets. Allow margins for depressed asset valuations across portfolios. Need to engage with regulatory authorities regarding regulatory asset limits. Actuarial valuation bases will need to factor in long term decline impact. Solvency margins need to be assessed regularly, and will come under strain, as funding cost become increasingly onerous. As cashflow matching becomes increasingly important with active membership in decline, measures strategy to focus on LDI.
Long term 2050-2100	
Feature and Evolution	Over the long term GDP and real economy decline, markets will eventually follow suit, and struggle to deliver significant real returns over long periods. The focus will be on delivering cashflow matching for the pensioner cohort, meeting inflationary costs, with generalised decline where climate change impacts are not contained. Low growth, low inflationary world may emerge.
Risk management Action	Investment strategy needed to focus on cashflow matching, and managing solvency levels. Longevity risk may need to be explicitly funded and coded in a low growth, low inflation environment.
Impact of Tipping points	High, as multiple tipping points take hold and non-linear effects impact severely.
Correlation/Aggregation/Concentration	Largely uncorrelated with liability drivers - over medium long term liability drivers like longevity improve whereas investments and assets could decline in value. Increasing liability risk. Investment driver is correlated with employer covenant - sustained negative impacts on assets, likely to be amplified by weakening employer covenant over medium to long term. Likely to be quite significant.
Overall Climate/Risk Opportunity Assessment	In a hot house world, level of disruption to economy, technology, society makes it difficult to manage risk - requires granularity and continuous monitoring of how the emerging risks play out. Lack of global/policy driven environment, requires a conservative approach to high likelihood of downside risks. A strong risk management framework, needs to be self-regulated in the absence of global legislative and policy change.
Quantitative framework	Stochastic models incorporating liability model projections, ESG Models for testing claims measurement /compliance. Likely to be most sophisticated and complex modelling required. Use of Climate models (IAM, Econometrics etc) for input to more traditional models which work on measurements of market, credit, liquidity and other traditional risk buckets (likely to be data intensive, granular). Tail risk, and Extreme value modelling would be critical. Outputs such as Climate VAR, and range variations. Reverse stress testing.
Risk Heat Signature Scale	8

Bringing assessments together

- Tipping points (describe jump process/shocks)
- Important to consider correlative, snowballing impacts
- Bring in overall assessment-communicate to client
- Pathway to quantitative scenario analysis

Impact of Tipping points	High, as multiple tipping points take hold, and non-linear effects impact severely
Correlation/Aggregation/Concentration	Largely Uncorrelated with liability drivers - over medium long term liability drivers like longevity improve whereas investments and assets could decline in value- increasing liability risk. Investment driver is correlated with employer covenant - sustained negative impacts on assets, likely to be amplified by weakening employer covenant over medium to long term. Likely to be quite significant
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Quantitative scenario analysis – funding levels



DC funds

XYZ Retirement Fund - Projected Replacement Ratios (for illustration only)

	Base	Orderly net-zero 1.5°C warming	Disorderly net-zero 1.5°C warming	Limited Action 2.0°C - 3.0°C - <u>warming</u>	High warming >4.5°C warming
Standard mortality assumptions	76%	71%	58%	53%	50%
Reduced mortality improvements	76%	71%	58%	55%	53%
Reduced longevity (low)	76%	71%	58%	56%	56%
Reduced longevity (high)	76%	71%	58%	58%	63%

Source : Alexforbes proprietary calculations for illustration

DB funds

ABC Pension Fund - funding levels across various climate scenarios (for illustration only)

	Base	Orderly net-zero	Disorderly net-zero	Limited Action	High warming
Standard mortality assumptions	100%	96%	91%	87%	82%
Reduced mortality improvements	100%	96%	93%	89%	86%
Reduced longevity (low)	100%	96%	93%	91%	92%
Reduced longevity (high)	100%	96%	100%	104%	123%

Source : Alexforbes proprietary calculations for illustration

- Consider assumptions for range of scenarios
- Explore and illustrate uncertainty
- Compare asset and liability impact

Guidance note to be released following this seminar...



- Incorporating feedback from Retirement Matters Committee
 - Incorporating feedback from Investment Committee
 - Detailed sessional on practical use of Guidance Note & Heatmap
 - Thereafter, updates to be issued in future as research develops
 - Developing resource base for reference and use
-