# IFT Macro | WG 5 – pre-reading

Wednesday 29th November 2023



Thinking Ahead Institute
An innovation network founded by WTW

## Useful additional pre-reading

(no change from WG1)

| Type | Resource | Details |
|---|---|---|
| Research report | Pay now or pay later | Provides evidence and analysis to support the climate beliefs required to drive increased action on climate. To demonstrate to the industry that we must pay now to address climate risks, or we will be required to pay more later. |
| Investment insight | Phase down or phase-out \| is there a difference? | A thought piece considering the winding down of fossil fuels at a high level. |
| Investment insight | To explore, or not to explore | A thought piece considering whether it is now time to stop exploring for new fossil fuel sources. |
| Research report | Systemic risk paper |  A draft paper by the Thinking Ahead team on the theory of systemic risk. An application paper for institutional risk management will follow. |
| Book summary | *Post Growth, Life after Capitalism* by Tim Jackson |  A slide deck summarising the book chapter by chapter. |
| Articles | Best case scenario 2050<br>Worst case scenario 2050 | Articles based on the book, *The Future We Choose*, by Christiana Figueres and Tom Rivett-Carnac which offers two contrasting visions for how the world might look in thirty years. |

## WG3 additional pre-reading

(no change from WG3)

| Type | Resource | Details |
|---|---|---|
| Research report | The Emperor's New Climate Scenarios | Limitations and assumptions of commonly used climate-change scenarios in financial services. A call for actuaries to focus on climate risk |
| Research report | This is the way…or is it? | The impact of climate scenario choice on stress-test outcomes across 5 climate scenarios |
| Research report | Robust management of climate risk damages | Parameter uncertainty in the DICE model affects economic outcomes. Optimal actions depend on uncertain model aspects. Gradual abatement is preferred, but steeper abatement becomes viable with uncertainty in the damage function |
| Research report | The impact of climate conditions on economic production | How weather shocks and climate changes impact economic output and growth rates using a stylized growth model and extensive subnational data |
| Research report | Warming the MATRIX: a Climate assessment under Uncertainty and Heterogeneity | Explores the potential impacts of climate change and mitigation policies on the Euro Area, considering the uncertainty and heterogeneity in both climate and economic systems |

## WG4 additional pre-reading

(no change from WG4)

| Type | Resource | Details |
|---|---|---|
| Research report | Loading the DICE Against Pensions | Pension funds are risking the retirement savings of millions of people by relying on economic research that ignores critical scientific evidence about the financial risks embedded within a warming climate |
| Research report | No time to lose | A set of narrative climate scenarios jointly formulated by the UK's USS and the Uni of Exeter to counter the significant limitations of the scenarios currently used by investors, governments and business |

## WG5 additional pre-reading

(New from WG4)

| Type | Resource | Details |
|---|---|---|
| Research report | Assessing the size and uncertainty of remaining carbon budgets | New RCB assessment: 250 Gt for 50% probability of 1.5C<br>The new figure is half the size of the budget estimated in 2020 and would be exhausted in six years at current levels of emissions |
| Research report | Global warming in the pipeline | Equilibrium climate sensitivity now estimated at 4.8°C ± 1.2°C for doubled CO2.<br>“Thus, under the present geopolitical approach to GHG emissions, global warming will exceed 1.5°C in the 2020s and 2°C before 2050” |
| Research report | The 2023 state of the climate report | We are entering an unfamiliar domain regarding our climate crisis, a situation no one has ever witnessed firsthand in the history of humanity |
| Research report | A sector progress tracker for the net-zero transition | Interactive tracker from McKinsey aiming to measure the progress and preparedness of ten key sectors (agriculture, forestry, O&G, transport, etc.) on the path to achieving global net-zero emissions by 2050 |
| Research report | State of climate action 2023 | Assessment of global progress toward 2030 targets across specific targets and indicators |

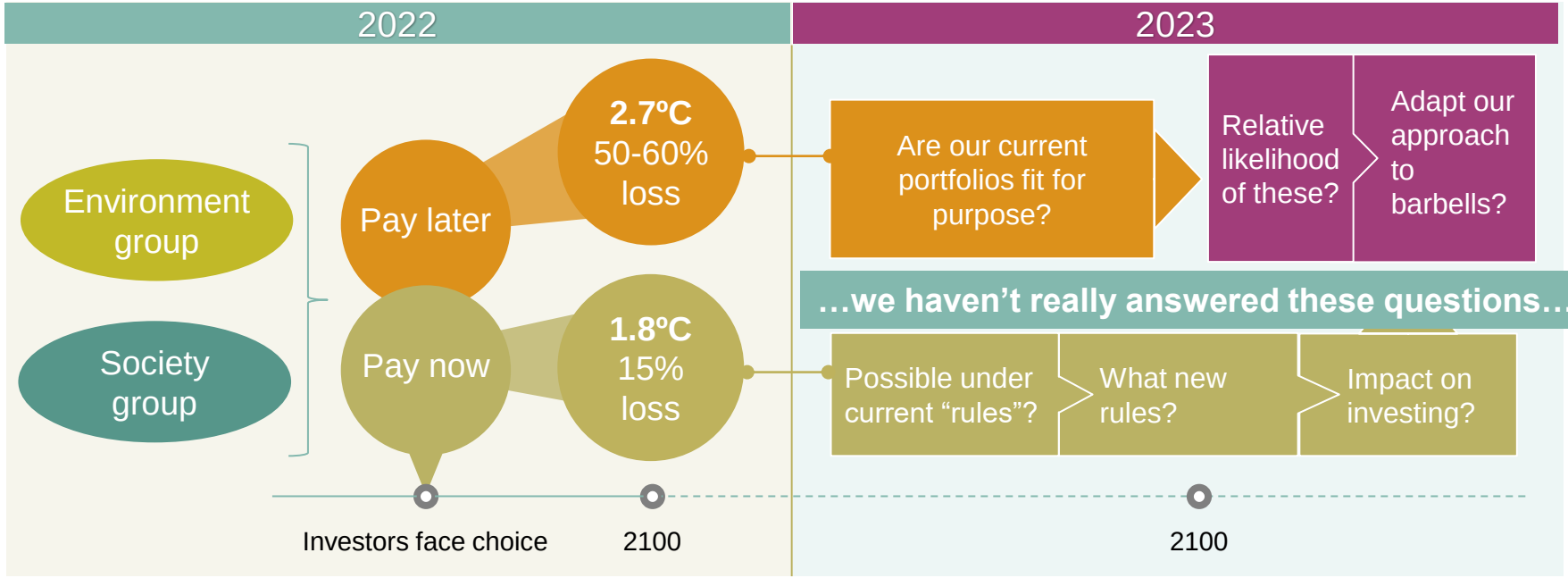
# Agenda for WG5 | 29 November 2023

East start 18:00 AEDT / 07:00 BST on 29 November
West start 10:00 EDT / 15:00 BST on 29 November

| Time (mins) | Agenda Item | Description | |
|---|---|---|---|
| -10 | Coffee prequel | ▪ Please join for a pre-meeting catch-up if you are able | All |
| 5 | Summary of WG1-WG5 | ▪ Additions or objections from working group members | AC |
| 30 | The next 7 years | ▪ We lay out our thinking which seeks to bridge the short term, in which we decide and act, and the long-term outcomes described by the matrix<br>▪ We propose organisations should adopt a 'hypothesis testing process'<br>▪ All to discuss | TH<br>AC<br>All |
| 20 | Straw-model workshop | ▪ Would your organisation see this as a valuable exercise?<br>▪ Does the outline explore the correct areas?<br>▪ What changes would you make? | AC |
| 30 | Conclusion – where has our work left us? | ▪ Do you agree with these conclusions?<br>▪ Go around the 'room' to collect reflections from everyone on the WG experience, output etc | TH |
| 5 | Close | ▪ Thanks for your participation<br>▪ Feedback polling<br>▪ Testimonials | TH |

# Part 1 | a summary of the working group journey so far

# We started here…




| | |
|---|---|
| **Time commitment:** | 5 x 1.5 hours MS Teams calls, plus pre-reading and reviewing |
| **WG call dates:** | Mar, May, July, Sep, Nov |
| **Output:** | Co-created paper. Possibly, scenarios |

## Working group 1

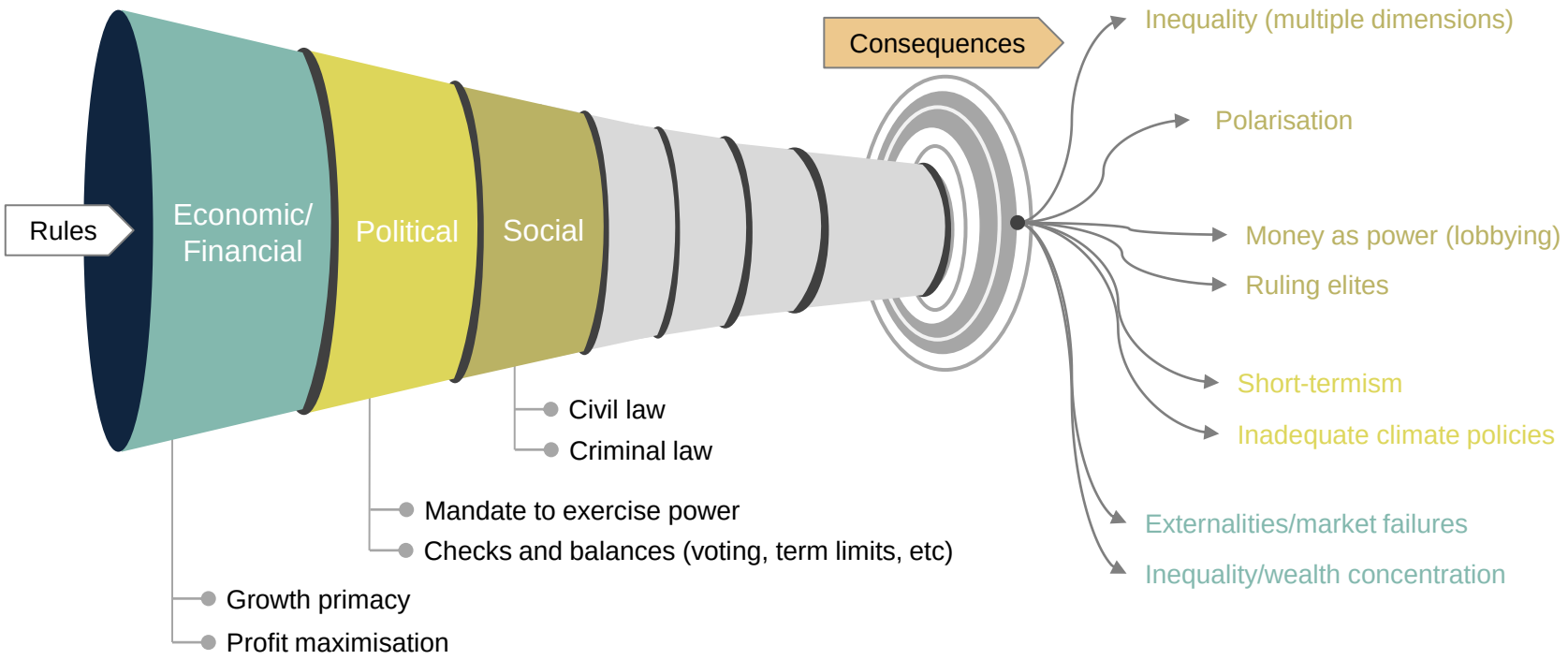
### We started by exploring the rules of the game and by thinking right to left

- **The rules of the game:** These are the laws, policies, and regulations that govern how we interact with each other and the environment. We explored how the rules contribute to the crises the world faces, including the climate crisis, and how they limit our ability to take decisive [effective?] action to mitigate climate change. We asked whether limiting warming to 1.8C is possible under the current rules.

- **Thinking right to left:** We asked participants to imagine themselves in net-zero emissions world in 2050. What does this world look like? We highlighted some key factors that would determine how this world reached net-zero emissions:
  - The energy- and cost-efficiency of carbon capture and storage
  - The extent of remaining fossil fuel burning / the extent of shrinkage of fossil fuel financial value, and size of workforce
  - The extent to which the ideology of GDP growth has been challenged
  - The extent to which capitalism has been reformed
  - The extent to which insurance is still available for more frequent and more severe physical risks
  - The extent of climate migration
- We emphasized that the path from today to that future world ultimately depends on beliefs about the key factors above.

- We finished by asking participants if they believe that a future net-zero emissions world is compatible with the current rules of the game.

# The rules of the game and their consequences



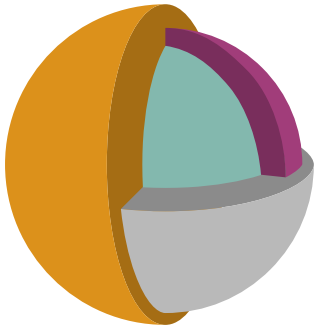
# Working group 2

## We examined the beliefs underlying standard climate scenarios and whether they bear scrutiny

- **The implicit and explicit beliefs in the main climate scenarios:** Continuing our focus on beliefs, we explored those that comprise the IEA and NGFS's scenarios that are widely used in finance and policymaking. We drew attention to the following explicit beliefs:
  - There is a carbon budget of 500 GtCO2e remaining.
  - We understand the relationship between atmospheric GHG concentration and temperature rise.
  - Advanced economies move first and fastest to achieve net-zero emissions.
  - There is an orderly transition, minimising volatility and stranded assets.
- We also drew attention to the implicit beliefs:
  - Some degree of perfect competition and perfect foresight.
- And highlighted concerns about how these scenarios are used:
  - A lack of understanding about the variability of the results
  - Insufficient understanding of the narratives and simplifications in the scenarios.
- Considering the points above, we provided our own opinion on these scenarios:
  - The carbon budget they rely on is arguably already spent.
  - They are unrealistically orderly.
  - The scenarios' probability of limiting warming is imprudently low.
- We put it to the Working Group that without a nuanced understanding of these scenarios, they are not appropriate for financial stress testing or investing.

# The feasibility of net-zero investing

## Summary of qualitative assessment of IEA NZE scenario

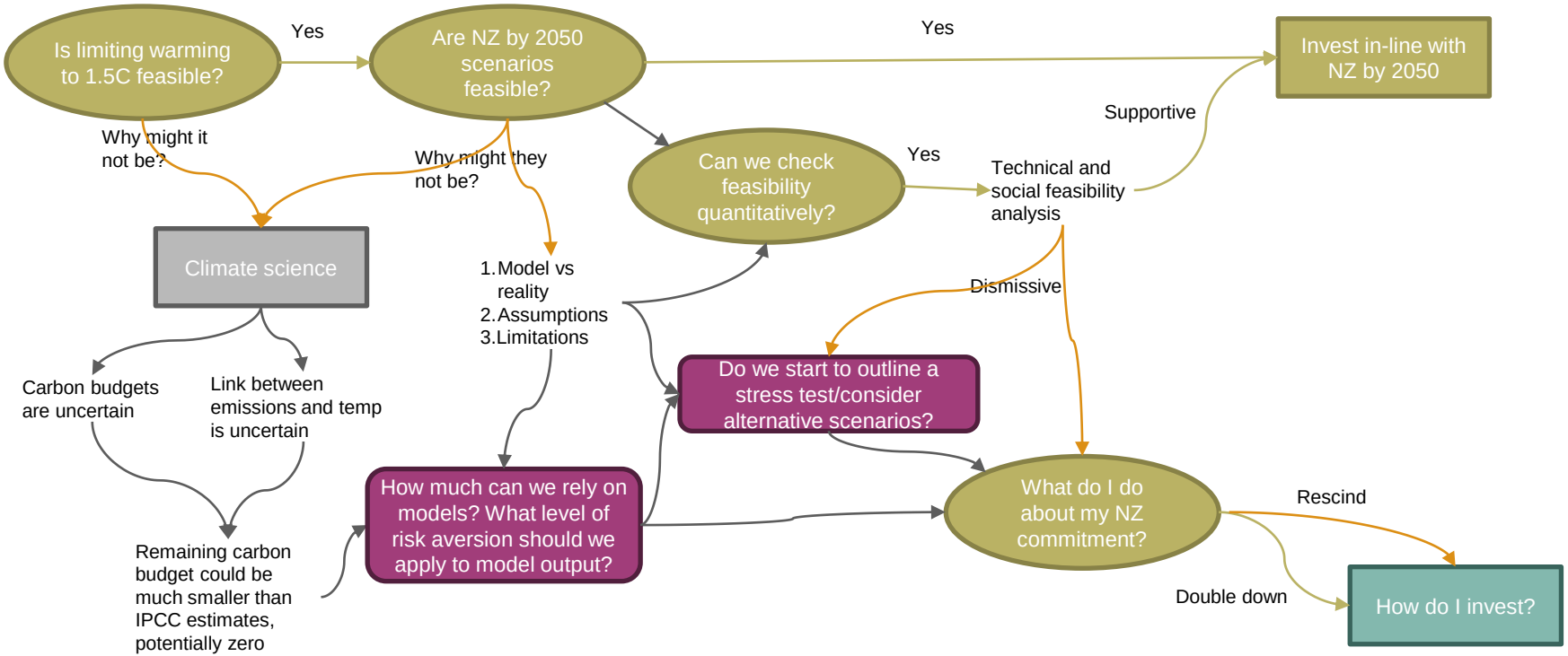


- An arguable carbon budget is fully spent
- Unnatural orderliness
- No risk buffer
- ‘Priced to perfection’

- NZE is a partial real-world scenario, not a financial scenario. It is built by the energy industry, for the energy industry. It is NOT a financial stress test

| Context | Key item | Implicit assumption/ limitation |
|---|---|---|
| Climate science | Carbon budget | ▪ Wide error ranges<br>▪ Based on subjective assumptions<br>▪ Not acceptable chance of failure (50%) |
| | GHG concentration and temperature rise | ▪ Equilibrium climate sensitivity (ECS) is uncertain<br>▪ Earth system sensitivity (ESS) is greater, implying >3C warming at current GHG levels |
| General commentary on NZE scenario | | ▪ Role of government in scenario differences<br>▪ Differential pace of NZE by economies<br>▪ Orderly transition assumptions |
| Open questions on climate policies and strategies | | ▪ Fossil fuel prices, carbon price, biofuels, emissions removal |
| Model assumptions assessment | Basic assumptions (on some modules of the IEA GEC model) | ▪ Perfect competition<br>▪ Perfect information, atomic agents<br>▪ Price signalling -> rational decision making<br>▪ Perfect foresight: complete market knowledge |
| | Variability | ▪ Lack of transparency and comparability in model assumptions and outcomes, and difficulties in assessing likelihood and financial risks of scenarios |
| | Understanding of transition narrative | ▪ Assumptions of frictionless transition and absence of feedback mechanisms<br>▪ No adequate capture of the complexity of the transition to a low-carbon economy<br>▪ Lack of understanding of the potential severity and timescales of climate-related risks |
| | Model oversimplifications | ▪ Limited capacity to incorporate complexities (non-linearity, tipping points, uncertainty)<br>▪ Neglected climate events and links between climate, ecosystems and natural resources often excluded<br>▪ Insufficiently capture acute physical risk shocks<br>▪ Rational expectation assumptions don't reflect reality |
| | Information loss along the climate scenario modelling chain | ▪ Scenario modelling may result in information loss<br>▪ Insufficient passthrough of extreme tail risks and variation<br>▪ IAMs lack sub-sectoral and country-specific breakdowns<br>▪ Lack of scenario and model granularity |

# The feasibility of net-zero investing



# Working group 3

## We proposed a framework for exploring a broader range of potential scenarios

- Two key (and related) questions are:
  - Are the scenarios on which the majority of net zero pledges based feasible in practice, and if they are realised will they actually keep global average temperature increases well below 2C (WB2C)?
  - If the answer to the above is no, what should investors be doing in response while still acting in a financially rational way?
- A way of approaching the above is to think about the problem through two dimensions
  - X-axis: what should be the “allowable” carbon budget to support a transition to a WB2C world?
    - This will reflect the investor’s level of aversion to climate risk (or, the probability of success of remaining WB2C), as well as their views on the degree to which allowance needs to be made for the challenges to climate scenarios highlighted in WG2
  - Y-axis: what degree of change is possible/likely to be supported by system participants?
    - This will in part reflect the views of the broader market on the same issues above and in part the degree to which the system itself can/will be changed
- An interpretation of the above is that:
  - The position on the x-axis reflects the degree of transition that an investor believes “needs to happen” in order to achieve a WB2C outcome and limit the magnitude of physical climate risks
  - The position on the y-axis reflects the type of transition that is likely to happen (eg fast vs slow, orderly vs disorderly, current vs transformed “rules of the game”) which in turn will determine the magnitude of transition risks and the types of scenarios an investor should use in order to “follow the money”
  - The intersection between the x and y axis positions will then inform the likely degree of overshoot of the “allowable” WB2C carbon budget and therefore the physical climate risks that an investor should be planning for

# Exploring a broader range of scenarios (cont)

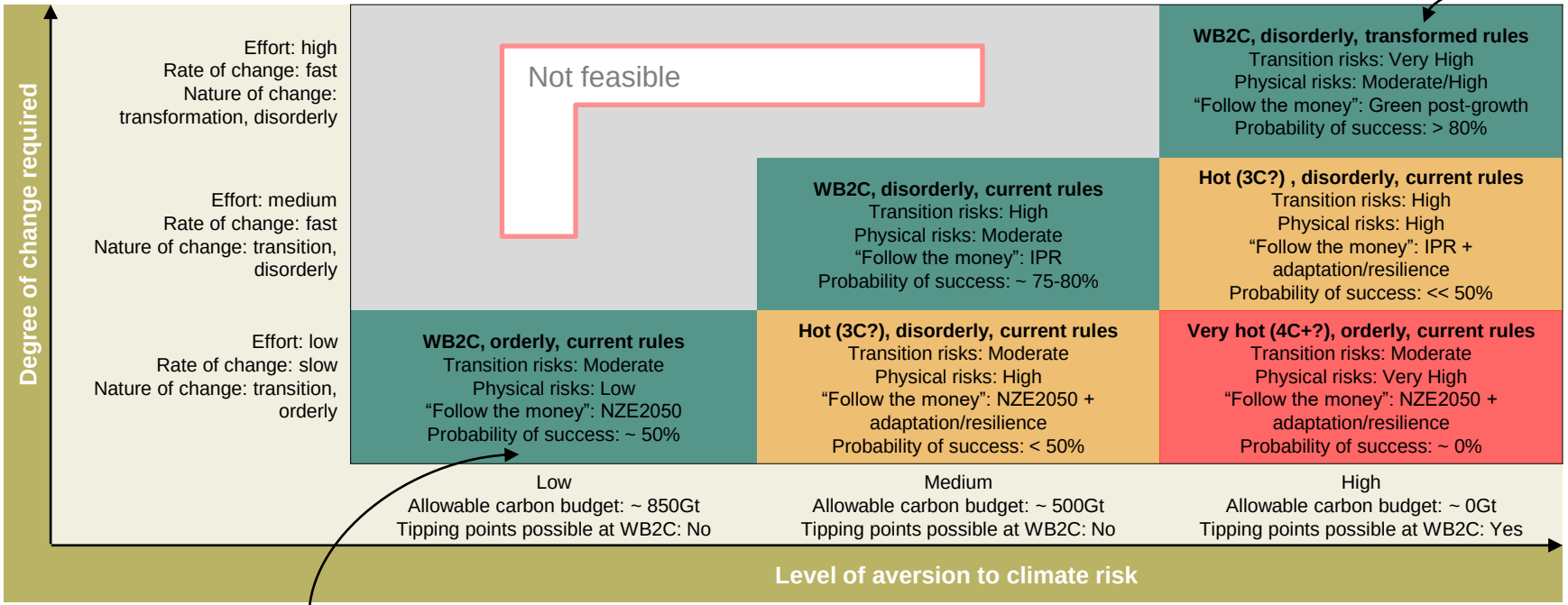
- The above can then be used to define scenarios that investors could use to determine the actions that are both in line with existing net zero pledges as well as fiduciary duty/acting in a financially rational way
- On the following slide we apply this framework and show a matrix that sets out potential positions that an investor could take on both the x and y-axes
- At each intersection point the category of scenario that would be appropriate for investor action planning is then defined as a combination of:
  - Expected temperature outcome – WB2C, hot, very hot
  - Nature of transition – orderly vs disorderly
  - Degree of system change – current rules vs transformed rules
- Further information is then provided about the characteristics of each category of scenario:
  - Magnitude of transition risks due to degree, speed and nature of change that occurs
  - Magnitude of physical risks due to overshoot of allowable WB2C carbon budget
  - Representative scenario for determining capital allocation activities ("follow the money") based on the above*
  - Probability of success – defined as keeping global temperature increases to WB2C
- One important implication of the scenario framework is that, in contrast to frameworks typically used in practice, there are a number of categories of scenarios that exhibit both high transition and physical risk

* at this stage we have deliberately avoided being too specific on which scenarios/pathways an investor should focus on at each intersection point in the matrix. This is in large part because even within a particular category of scenarios (e.g. WB2C, orderly, current rules) there are a number of potential pathways which can give rise to quite different "winners and losers". As an example, the analysis set out in This is the way…or is it? shows different versions of a WB2C, orderly, current rules scenario

# Working group 3

## Scenario definitions

**Question:** does a scenario that will realistically keep temperatures at WB2C inevitably require transformation (ie new rules) rather than just transition?




**Question:** does adopting this scenario create too much exposure to climate risks/should allowable carbon budget be much smaller than is typically assumed?

**Question:** do current net zero frameworks place too little emphasis on adaptation/resilience?

Note: carbon budgets based on IPCC, but reduced by 150Gt representing 3.5 years of elapsed time and around 40Gt of emissions pa



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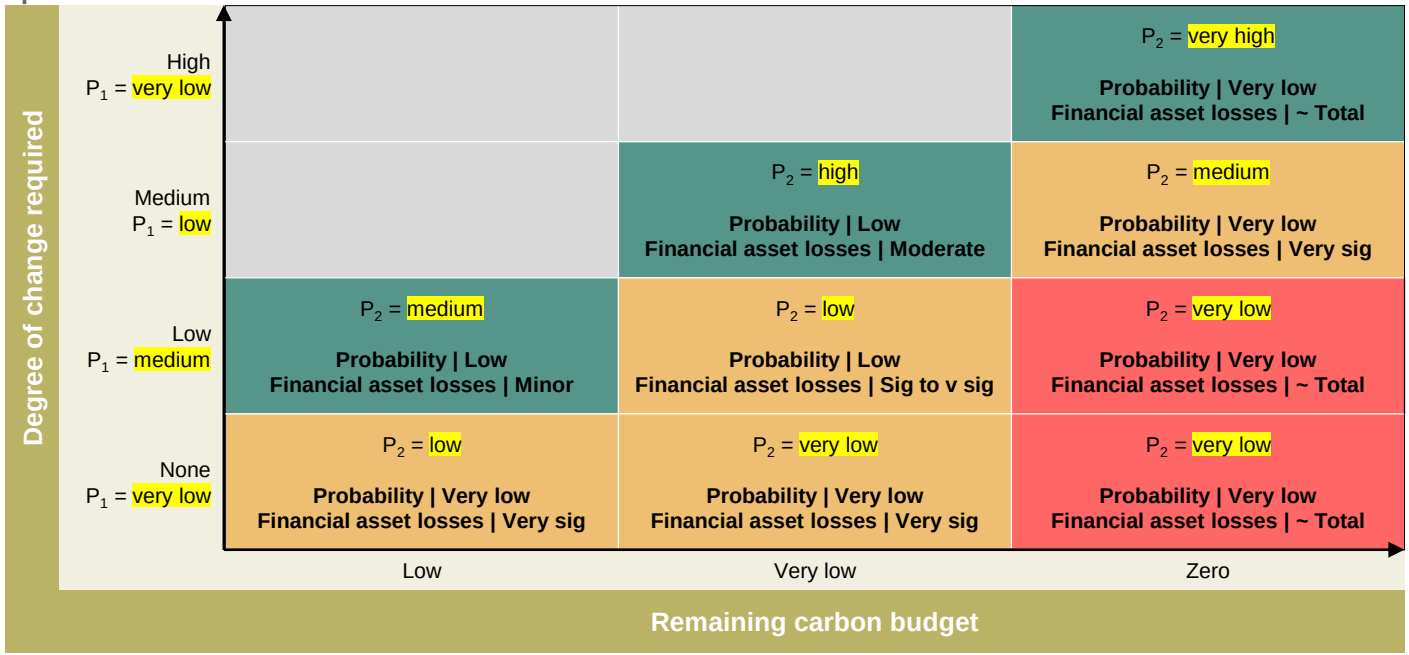
# Working group 4

## We developed a framework for using beliefs to derive probabilities for scenarios, and showed the probabilities that follow from our beliefs




**Key**

| Probability | |
|---|---|
| Very low | 0-20% |
| Low | 20-40% |
| Medium | 40-60% |
| High | 60-80% |
| Very high | 80-100% |

| Financial asset losses | |
|---|---|
| None | <10% |
| Minor | 10-25% |
| Moderate | 25-50% |
| Significant | 50-75% |
| Very significant | 75-90% |
| ~ Total | >90% |

| Carbon budget | |
|---|---|
| Low | ~ 850Gt |
| Very low | ~ 350Gt |
| Zero | ~ 0Gt |

xyz = user input

$P_1$ = probability of level of change occurring

$P_2$ = probability of warming remaining <2C given economic change

Probability of scenario / cell (level of change and warming <2C) = $P_1 * P_2$



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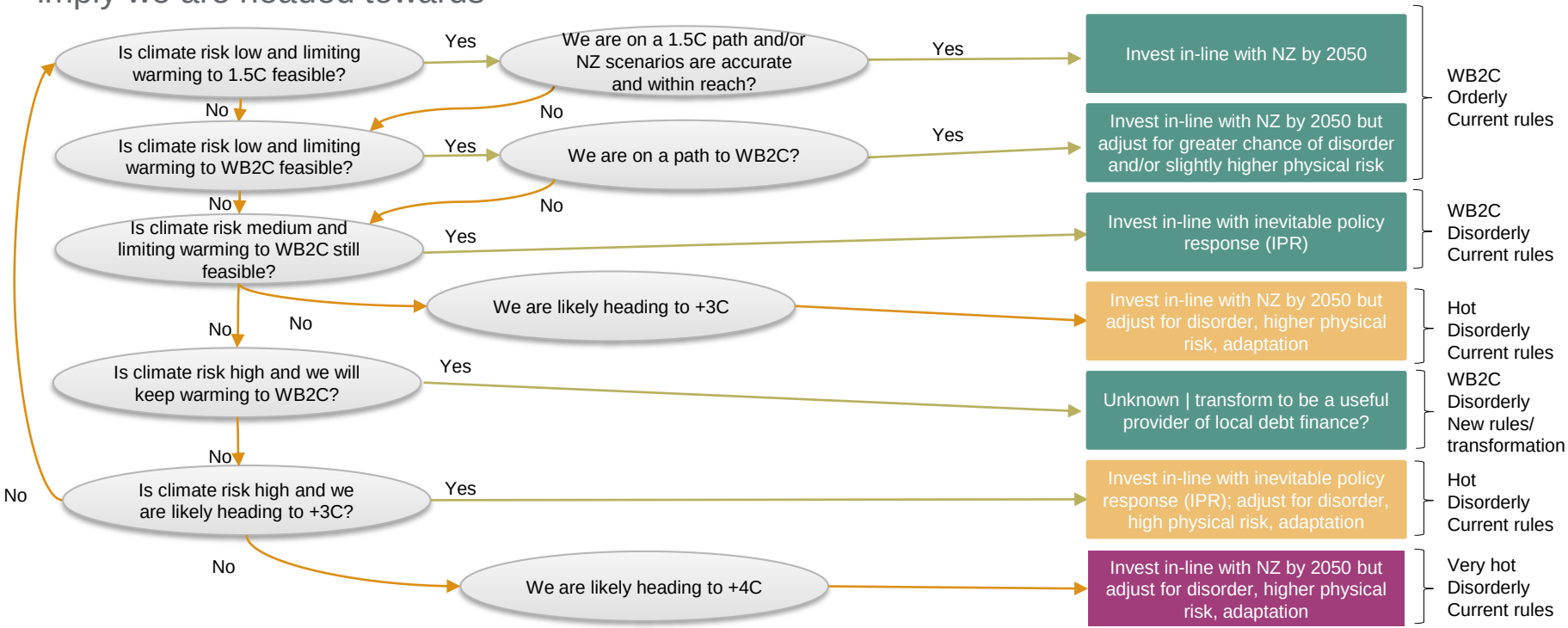
## Working group 3 and 4

We made a map (decision tree) to show investors what scenario their or the markets' beliefs imply we are headed towards



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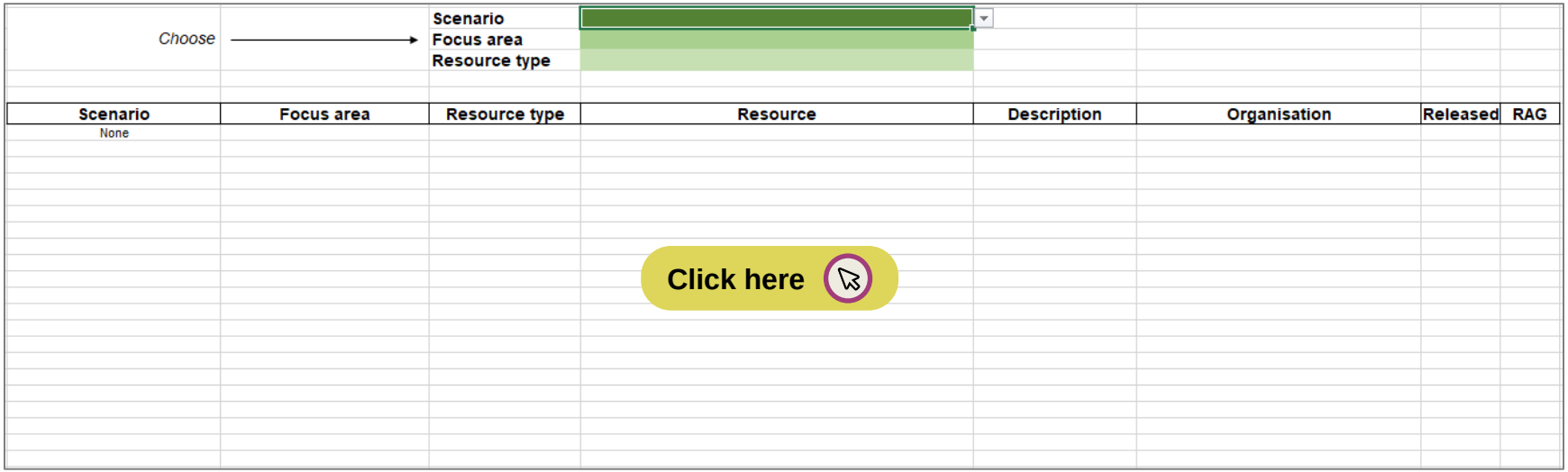
# Working group 3 and 4

## We produced a catalogue of solutions linking working group insights to actions for investors

- We put it to the Working Group that without a nuanced understanding of these scenarios, they are not appropriate for financial stress testing or investing.



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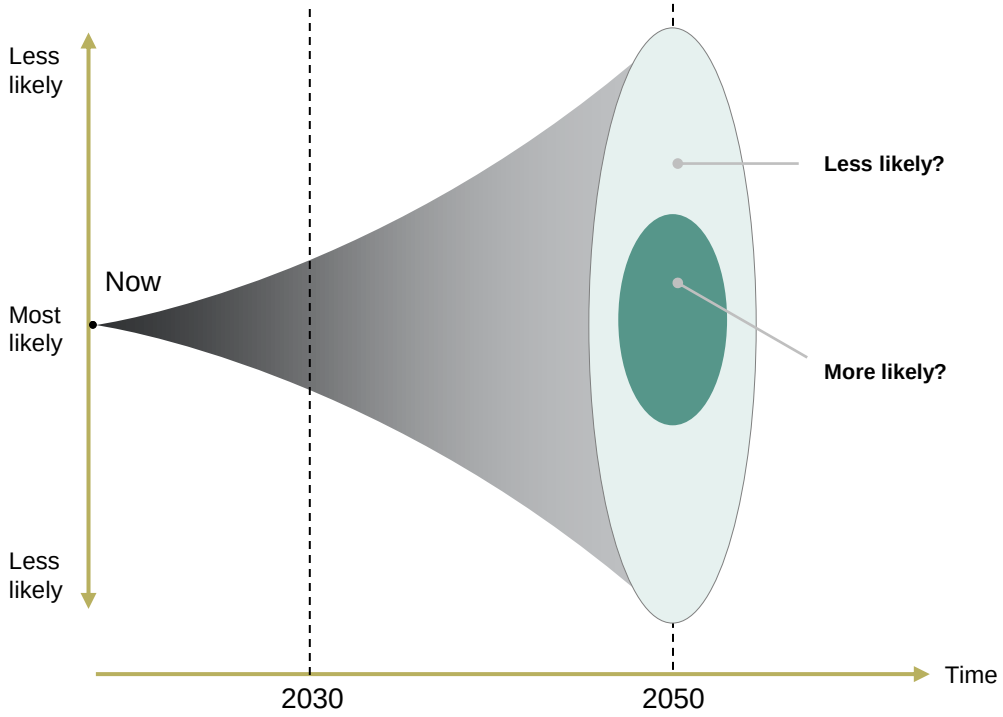
# Part 2 | thinking about the next 7 years in the light of the longer term

# What are we thinking about?

- We are thinking about the evolution of a complex adaptive System, comprised of multiple complex adaptive systems, into the future
- We know that the future is 'radically uncertain' – it is not known, or knowable
- We know a reasonable amount about the past and the present, including the forces acting on the system
- We can make reasonable forecasts for whether those forces will continue, strengthen or dissipate over time
- We know that at the present time, an infinite number of potential futures fan out (over multiple dimensions) ahead of us
- We also know that we (the System) will only travel through time down one of those potential futures
- If we imagine that we have already travelled one time step into the future (from $T_0$ to $T_1$), we notice 2 things: (1) the potential paths for the current time step disappear and are replaced with the single actual path, and (2) the fan of infinite potential futures shifts forward but, importantly, some of the potential futures available at $T_0$ are no longer available at $T_1$ because the actual path we took means they are no longer available; AND we now have some paths available to us at $T_1$ that weren't available previously [this is 'path dependency']
- There is therefore a responsibility within current decision making, to be mindful of the future paths that will be shut down and opened up by taking the current decision [this is 'strategic adaptation over time', see next slide]
- We need to navigate a difficult truth: in the short term, the initial conditions (current context) will matter more to (short-term) outcomes than the path (which doesn't have time to deviate much), but in the long term, the path will matter more (to long-term outcomes) than the initial conditions.
- In general in investment, individuals and organisations are measured and rewarded in the short term. However, our true purpose and value creation (societal wealth and well-being) occurs over the long term. We should be much more concerned than we are about the path, but our incentives cause us to major on managing current conditions.

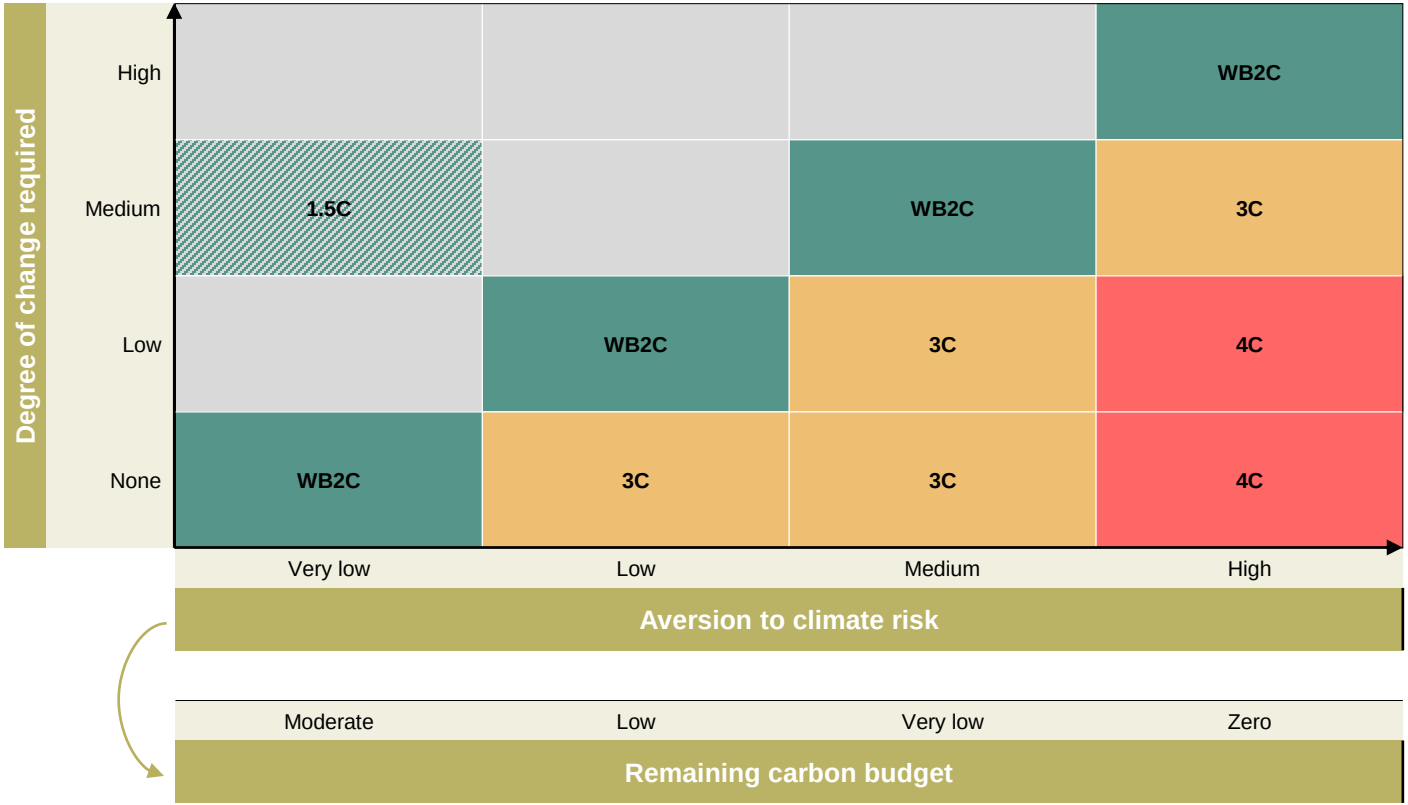
# Thinking about the long term




**Either policy response or temperature rise is inevitable and, therefore, pathways are contingent on future developments. We can know very little about the likely distribution**

- We need to be careful about any claim that the future might be ‘more uncertain’ now. The future has always been, and always will be ‘radically uncertain’ (ie unknowable). And yet, the ideas of thematic investing, dynamic asset allocation and market timing all imply an attempt at knowing the future
- We believe we can claim that the system **may be less stable** than it typically is. This would be compatible with the idea that we are near or at a ‘regime change’ (which, arguably, translates as ‘a more-rapid-than-typical change in the behaviour of the system’)
- Two things follow: (1) it is more important to hold the notion of **path dependency** in our thinking, and (2) **abrupt and non-linear** change becomes more likely
- Our ability to assign **probabilities** to 2050 outcomes is reduced. The graphic suggests we may be able to distinguish between ‘more’ and ‘less’ likely, but not more granular than that
- Strategic **adaptation over time**, therefore, becomes key and inevitable for investors navigating through the future cone

# The long-term scenarios




## Key

| Carbon budget | |
|---|---|
| Moderate | |
| Low | ~ 850Gt |
| Very low | ~ 350Gt |
| Zero | ~ 0Gt |



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## The next seven years start today (duh!)

- Given that, for the next 7 years, the initial conditions will matter more to outcomes than the path, we need to identify the initial conditions
- For our purposes, this entails deciding which cell of the previous matrix best describes the present and/or the average conditions for the next 7 years. What is the average societal belief about the level of change required? Low or none? What is the average societal positioning on the x-axis (whether expressed as a belief about climate aversion or remaining carbon budget)? We suggest that one of the bottom-left cells best describes current conditions
- Among the forces that we can reasonably forecast into the future is the current state of inertia or momentum. If we conclude that the current average societal belief about the level of change required is low or none, then we are in a state of inertia. While this can change over a 7-year period, our initial expectations should be that (1) we may not do enough over the next 7 years to achieve a halving of emissions, and (2) this will materially affect the paths that are feasible for the subsequent 7 years (or decade).
- We can think of the remaining carbon budget as the bridge between the short and long terms. For as long as the level of change remains below that necessary to stabilise temperature rise, we will run down (or push negative) the remaining carbon budget. This pushes us to the right of the matrix as time passes. In other words, a greater proportion of the potential futures take us to a hot or very hot world – making ever more urgent the need to take and maintain a lower temperature path as early as possible
- Three thoughts follow
  1. We can also be pushed to the right through a change in our own, or society's, belief about climate risk / remaining budget
  2. There is such a thing as "too late". In a path dependency context this refers to a point in time where paths to a desirable state are no longer available
  3. The only decision-making window available to us to address climate change is now / the next 7 years. So, while the physical risk and investment returns for the next 7 years is largely determined by current conditions, it is decisions taken in the next 7 years that will determine long term physical risk, investment returns, etc

# Aside | the irreversibility of time

- While the irreversibility of time appears to be a statement of the blindingly obvious, most of economics (therefore finance, therefore investment) essentially assumes that time is reversible. Either we calculate ensemble average returns (rather than time average returns), or we fail to account for entropy increasing.
- TAI has produced extensive work on extreme risks (climate change qualifies), which matter precisely because time is irreversible. If a path can 'kill you' (could be literal, or could be a portfolio loss > 90% etc), the only rational thing to do is to minimise the chances of going down that path – irrespective of how attractive the other paths may be. We choose to define 'but everyone else dies too' as not rational
- The system will traverse the next 7 years only once. If we don't like where we end up, we will not be able to rewind and try again
- Slides, papers and even a Youtube video is available on request

**Summary of our thinking about the short vs long term:**

- **There is a time lag between decisions and the consequences of those decisions (even in China, which can build more quickly)**
- **The decarbonisation over the next 7 years will be largely determined by decisions already taken**
- **The decarbonisation over the 2030s will be largely determined by decisions taken in the next 7 years**

# We suggest investment organisations should have a ‘hypothesis testing’ process

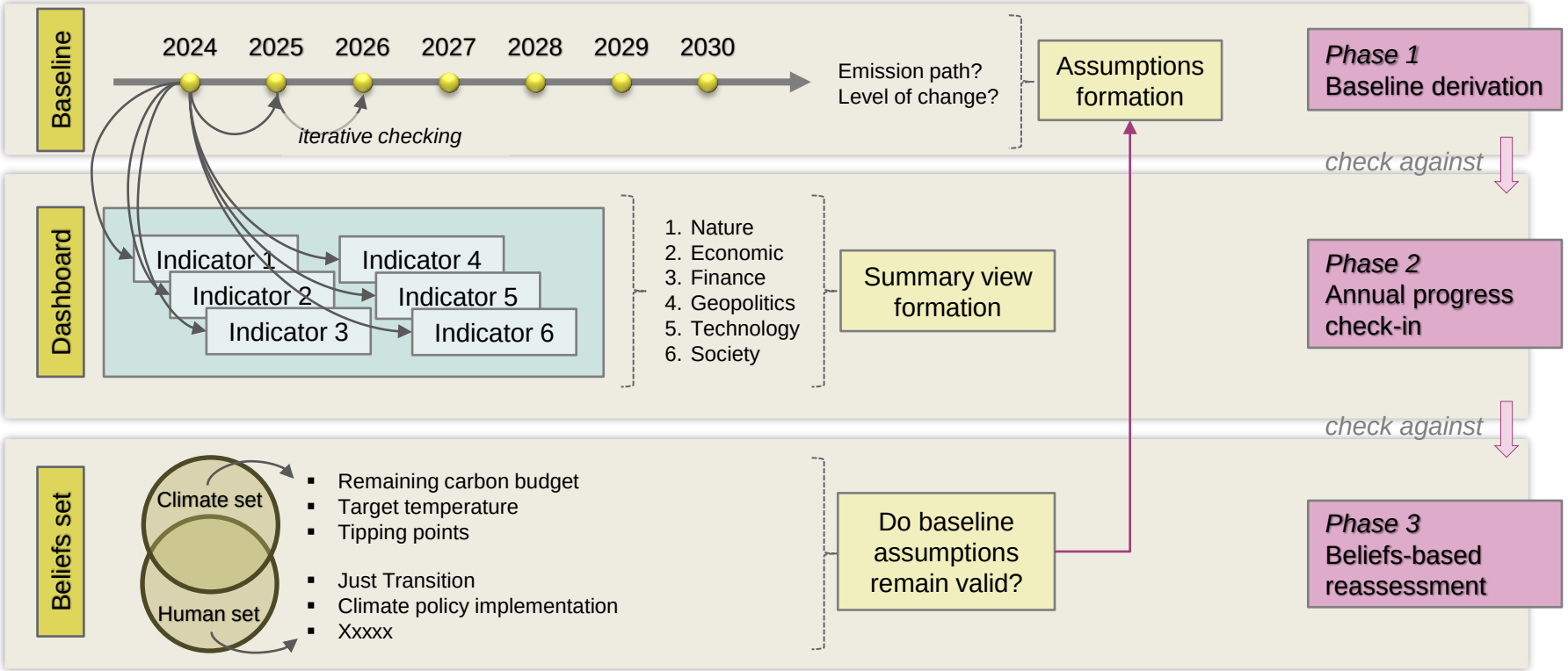
1. **Choose baseline path / scenario**
   - This is the working hypothesis regarding the long-term path we are on
2. **Develop check-in process**
   - Design dashboard – to include only decision-relevant data points
   - Design set of beliefs to be confirmed / rejected by dashboard
3. **Amend baseline if required**
   - The review of dashboard and beliefs should conclude with a decision to retain, or replace, the working hypothesis

**Examples of dashboard construction**

A sector progress tracker for the net-zero transition
Interactive tracker from McKinsey aiming to measure the progress and preparedness of ten key sectors (agriculture, forestry, O&G, transport, etc.) on the path to achieving global net-zero emissions by 2050

State of climate action 2023
Assessment of global progress toward 2030 targets across specific targets and indicators

# Annual check in process layout



# Part 3 | a straw-model climate scenarios workshop

# Climate scenarios workshop agenda

| | |
|---|---|
| 1 **Context** | ▪ Pre-reading |
| | ▪ Pre-polling |
| | ▪ Workshop |
| 2 **Understanding** | ▪ Deepening understanding of:<br>  ▪ climate science<br>  ▪ climate models<br>  ▪ climate scenarios |
| 3 **Exploring** | ▪ Report back on member polling results<br>▪ Collective explorations of possible climate futures (decision tree, beliefs and matrix) |
| 4 **Discussion** | ▪ Discussion on the way forward:<br>  ▪ Changes needed within the organisation<br>  ▪ Hypothesis testing process |
| 5 **Wrap up and conclusions** | ▪ Possible next steps<br>▪ Actionable takeaways |

## More about TAI workshops

### Number of workshops

- Approx. number of TAI workshops carried out historically:
  **35 workshops**

### Time commitment

- Requirements for WG participants:
- Pre-reading:
  **30 minutes (min)**
  **- 2 hours (max)**
- Polling:
  **10-30 minutes**
- Workshop:
  **1.5 (single)**
  **- 3.5 hours (multiple)**

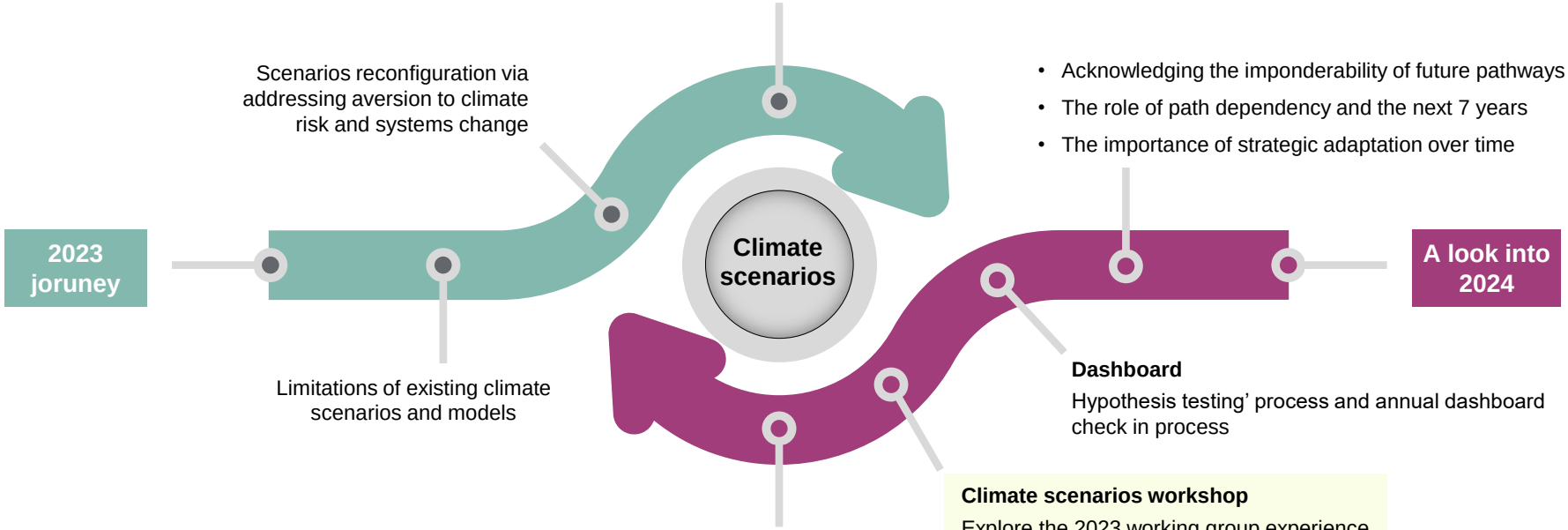
### People

- Number of people involved, on average:
- Surveyed:
  **5- 25 people**
- In workshop:
  **5- 15 people**

# Part 4 | where has our work left us?

# Transitioning into 2024

- Enhancing the narrative structure for investors to navigate through climate beliefs
- Providing a probabilistic planning framework for investors



# What has this working group done for me?

- Working group members have hopefully deepened their understanding of climate science, scenarios, and carbon budgets
- We have produced a thorough analysis of current net-zero scenarios (‘priced to perfection’)
- A decision tree to explore beliefs and possible consequences, that can be used within our organisations
- A scenario framework derived from intuitively accessible start points: (i) what level of change is society willing and able to deliver? And (ii) how big is your aversion to climate risk (or, how big is the remaining carbon budget)?
- A straw-model process for setting and reviewing the working hypothesis regarding which scenario we are currently tracking
- A workshop proposal to explore climate scenarios with your colleagues in a safe space

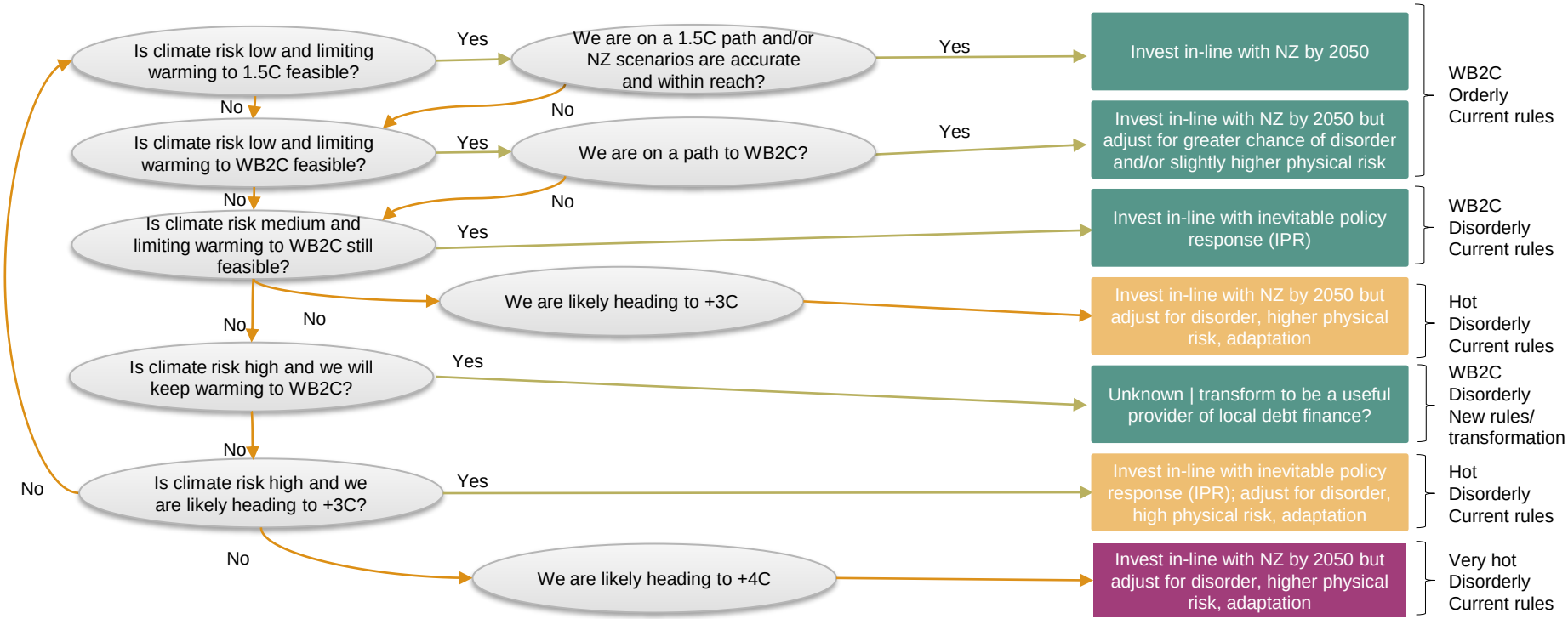
Some conclusions you may, or may not, share

- There is uncertainty within the climate science: (a) carbon budgets have wide error bands, meaning the remaining budget could already be zero; (b) the behaviour of the earth systems with respect to greenhouse gas concentrations can only be estimated (the equilibrium climate sensitivity (ECS) is assumed to be 3C from a range of 2.5-4C (IPCC); a recent paper from James Hansen et al, suggests ECS is 4.8C)
- Fiduciary duty includes the requirement to exercise prudence, which has implications for risk management
- Assuming a carbon budget that gives a 50% chance (coin toss) of remaining below a level of warming is not prudent risk management (let alone allowing a haircut for the above uncertainty)
- 2024 is the year for your organisation to grapple with climate scenarios
- And to revisit any NZ pledge

# Appendix | the scenario decision tree (amended)

# Scenario decision tree

## Answer twice – for the market and for you



# Is climate risk low and limiting warming to 1.5C feasible?

## Yes

- The Paris Agreement has been ratified by 195 (of 198) countries, therefore efforts to keep temperature increase well below 2C are binding and guaranteed
- It is universally accepted that 1.5C is the preferred upper limit
- ‘Net-zero by 2050’ was designed to achieve the 1.5C limit and is the agreed global framework – signed into law by countries, targeted by corporations, and pledged by financial institutions

Click ‘yes’

## No

- Climate science has moved on since the Paris Agreement. The situation is more urgent and the changes more difficult
- The currently announced commitments and policies by countries imply a level of warming between 2.4C and 2.7C
- There is a lack of political will to enact known and necessary policies that might disrupt current economic performance

Click ‘no’

# We are on a 1.5C path and/or NZ scenarios are accurate and within reach?

## Yes

- Net-zero by 2050 scenarios illustrate the changes that need to be implemented, and are feasible
- The scenarios are based on remaining within IPCC-sourced carbon budgets
- Renewable energy is already cheaper than fossil energy, so will grow rapidly from here
- Governments will introduce new policies in order to comply with their own net zero laws
- Carbon removal technologies will improve and scale up dramatically over the next 30 years

Click ‘yes’

## No

- Net-zero by 2050 scenarios are ‘priced to perfection’ and unlikely to be achieved in practice
- The IPCC notes that wide error ranges means carbon budgets could be zero
- The NZ scenarios use carbon budgets with only a 50% chance of remaining below 1.5C. This is not appropriate for risk management
- The scenarios imply an unnaturally orderly transition
- The underlying climate science is open to revision
- We could cross climate tipping points at lower-than expected temperatures

Click ‘no’

# We are on a path to WB2C?

## Yes

- Net-zero by 2050 scenarios provide a useful guide to the changes that need to be implemented
- Renewable energy is already cheaper than fossil energy, so will grow rapidly from here
- Governments will introduce new policies in order to comply with their own net zero laws
- Carbon removal technologies will improve and scale up dramatically over the next 30 years
- WB2C carbon budgets give us more room for action / allow for some mistakes, relative to the smaller 1.5C budgets

Click ‘yes’

## No

- We are currently on a business-as-usual path with a likely temperature outcome between 2.7C and 3C
- We would need to see more aggressive actions, policies and falling emissions to conclude we were on a path to WB2C

Click ‘no’

# Is climate risk low and limiting warming to WB2C feasible?

## Yes

- The Paris Agreement has been ratified by 195 (of 198) countries, therefore efforts to keep temperature increase well below 2C are binding and guaranteed
- The lack of emissions reduction so far this decade makes a 1.5C limit unlikely, but we can remain within the carbon budget associated with 1.7C or 1.8C, say
- ‘Net-zero by 2050’ is the agreed global framework – signed into law by countries, targeted by corporations, and pledged by financial institutions – and this will guide and co-ordinate actions to limit warming to WB2C

Click ‘yes’

## No

- Climate science has moved on since the Paris Agreement. The situation is more urgent and the changes more difficult
- The currently announced commitments and policies by countries imply a level of warming between 2.4C and 2.7C
- There is a lack of political will to enact known and necessary policies that might disrupt current economic performance

Click ‘no’

# Is climate risk medium and limiting warming to WB2C still feasible?

## Yes

- We haven't acted to reduce emissions quickly enough, so the window for acting slowly and in an orderly manner has closed
- The consensus understanding that temperature increases above 2C would be disastrous is rock solid
- Therefore we will see government policies that will force more urgent private actions. We should expect the transition to be disorderly, but we will keep temperature below 2C

Click 'yes'

## No

- Economists have called for a carbon price since the 1970s. So far less than 5% of global greenhouse gas emissions are covered by a direct carbon price at or above the range recommended by 2030 [World Bank. 2023. State and Trends of Carbon Pricing 2023. © http://hdl.handle.net/10986/39796 License: CC BY 3.0 IGO.]
- I do not believe governments will act fast enough to secure WB2C

Click 'no – we are heading for +3C'

- I believe the remaining carbon budget is smaller than the consensus believes, so even if we do get government action it will not be enough

Click 'no – climate risk is high'

# Is climate risk high and we will keep warming to WB2C?

## Yes

- The world is heating, and the adverse effects have generally surprised by occurring sooner, or with bigger impact than expected. Climate risk is high
- This will shortly be recognised by the majority of people and governments. Current actions will be seen as utterly inadequate. We will enter a period of transformational change as every possible avenue to securing a WB2C outcome is pursued

Click ‘yes’

## No

- Climate risk is high, but the recognition will either not occur, or will come too late. There will be no transformation and a WB2C outcome will not be possible

Click ‘no – we are heading for +3C’

# Is climate risk high and we are likely heading to +3C?

## Yes

- The world is heating, and the adverse effects have generally surprised by occurring sooner, or with bigger impact than expected. Climate risk is high
- My role as a fiduciary requires me to preserve capital, as well as seek to grow it. Therefore, from a risk management perspective I should assume there is less carbon budget left (or climate risk is higher) than the current consensus believes
- This means consensus actions could fail the WB2C objective, and +3C of warming becomes likely

Click ‘yes’

## No

- Climate risk is high. But consensus actions are geared to achieving WB2C assuming climate risk is low (there is a large remaining carbon budget). More effort than this would be required to stay within +3C
- Consequently, at current (and foreseeable) levels of effort and a zero carbon budget we are heading for +4C

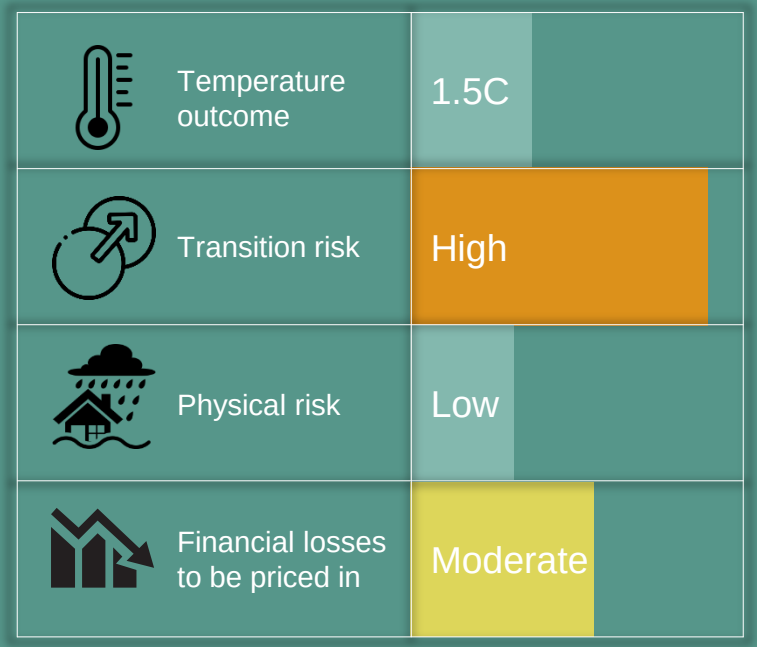
Click ‘no – we are heading for +4C’

Click ‘no’ – let me start again

**1.5C**
**Orderly**
**Current rules**

**Investment implications**

- Use NZE2050 scenario as a guide
- Eg monitor timing and level of introduced carbon prices to adjust value of heavy emitters
- Large scope to invest in EMs
- Probability of success assumes pace and nature of transition/ transformation will keep cumulative emissions within a carbon budget of ~350Gt (consensus budget less what already spent)



## WB2C Orderly Current rules

**Investment implications**

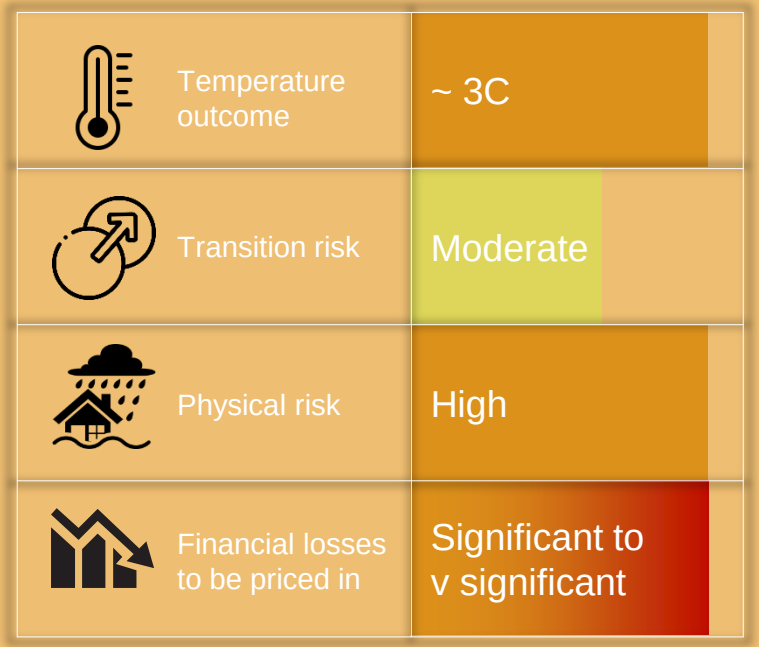
- Focus on identifying “winners and losers” from the transition – likely to be sectoral and intra-sectoral vs across asset classes
- Use NZE2050 scenario as an initial guide, eg monitor timing and level of introduced carbon prices to adjust value of heavy emitters
- New primary investment in key technologies underlying climate mitigation solutions
- Be aware that different transition scenarios can give quite different answers on winners vs losers
- Adjust for greater chance of disorder and/or slightly higher physical risk
- Large scope to invest in EMs
- Probability of success assumes pace and nature of transition/ transformation will keep cumulative emissions within a carbon budget of ~850Gt

| | |
|---|---|
| Temperature outcome | < 2C |
| Transition risk | Moderate-plus |
| Physical risk | Fairly low |
| Financial losses to be priced in | Minor |

**Hot (3C?)**
**Disorderly**
**Current rules**

**Investment implications**

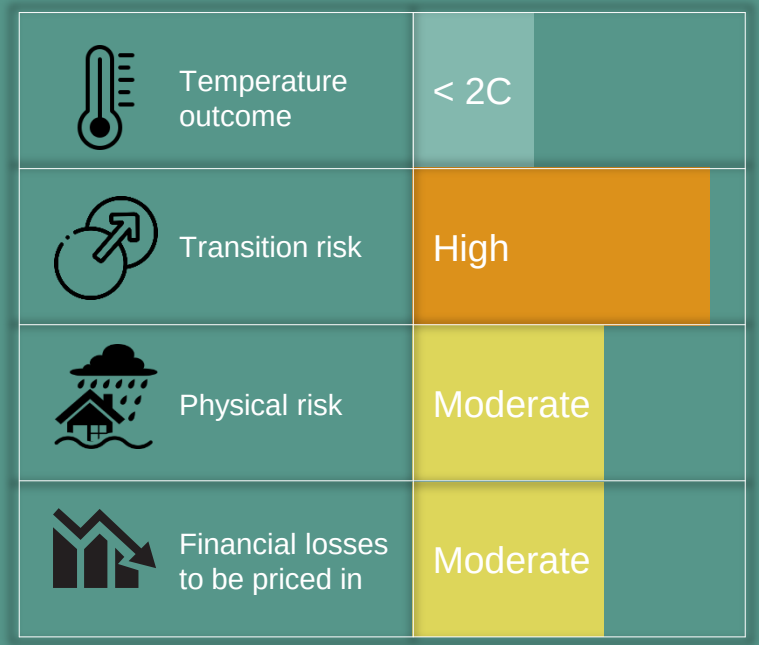
- The majority of financial assets likely to be negatively impacted, trying to identify winners vs losers likely less productive than focussing on resilience
- Use NZE2050 scenario as a starting point; assume carbon budget will be exceeded and/or earth system behaviour more extreme than predicted; adjust for greater spend on adaptation / resilience, harming profits relative to history
- A focus on resilience is likely to favour countries that are (i) further from equator, (ii) already richer, and (iii) well governed. A likely large increase in climate migration will complicate the analysis
- New primary investment in climate solutions still required to avoid even greater physical risk impacts
- Probability of success assumes pace and nature of transition/ transformation will keep cumulative emissions within a carbon budget of ~500Gt



## WB2C Disorderly Current rules

**Investment implications**

- Focus on identifying “winners and losers” from the transition – likely to be sectoral and intra-sectoral vs across asset classes
- Use IPR scenario as a starting point but adjust for greater degree of change (smaller carbon budget) and therefore degree of disorder
- Monitor timing and severity of introduced policies to adjust value of assets
- Fossil fuel exclusions/significant underweight potentially underperform over a 5-10 year horizon, payoff from new climate solutions delayed and volatile as energy demand/supply imbalances resolve themselves
- EMs will have a high demand for capital (high return), but risk will be higher according to the degree of disorder
- Probability of success assumes pace and nature of transition/ transformation will keep cumulative emissions within a carbon budget of ~500Gt



**Very hot (4C+)**
**Orderly**
**Current rules**

| | |
|---|---|
| Temperature outcome | ~ 4C |
| Transition risk | Moderate |
| Physical risk | Very high |
| Financial losses to be priced in | ~ Total |

**Investment implications**

- All financial assets are likely to be negatively impacted, attempting to identify winners likely not a useful exercise
- Use NZE2050 scenario as a starting point; assume carbon budget massively exceeded and/or earth system behaviour more extreme than predicted; adjust for greater spend on adaptation / resilience; adjust for massive migration
- New primary investment in climate solutions potentially (likely?) does not deliver a financial return
- Investment in the majority of countries will not be viable as they become increasingly uninhabitable

  (Source: Nomad Century, Gaia Vince. At 4C of warming only land above 45th parallel will be habitable – Patagonia, New Zealand and Antarctica in the south, Canada, Greenland, Iceland, Scotland, Scandinavia and Siberia in the north)
- Probability of success assumes pace and nature of transition/ transformation will keep cumulative emissions within a carbon budget of ~0Gt

**Hot (3C?)**
**Disorderly**
**Current rules**

| | |
|---|---|
| Temperature outcome | ~ 3C |
| Transition risk | High |
| Physical risk | High |
| Financial losses to be priced in | Very significant |

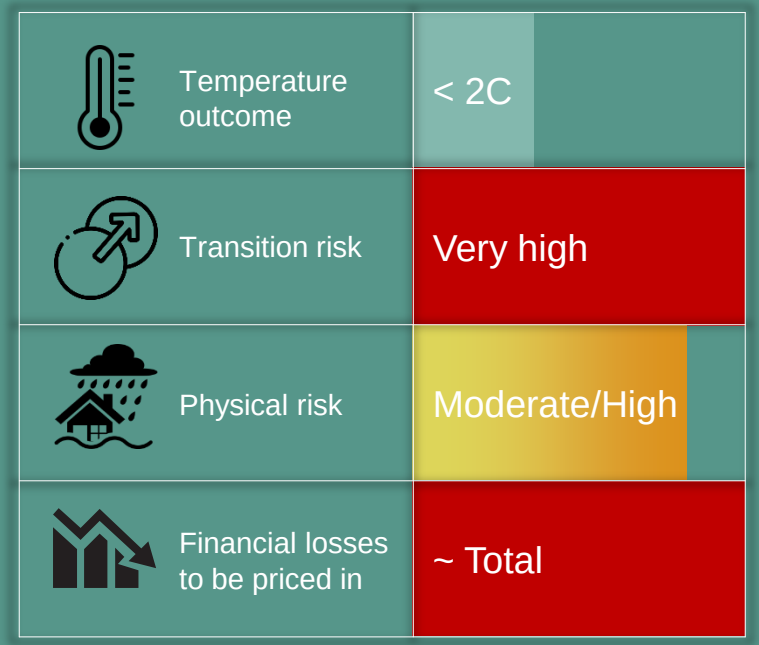
**Investment implications**

- The majority of assets likely to be negatively impacted; identifying winners vs losers less productive than focussing on resilience
- Use IPR scenario as a start; assume carbon budget will be exceeded and/or earth system behaviour more extreme than predicted; adjust for greater spend on adaptation/resilience, harming profits relative to history
- Also adjust for greater degree of change (smaller carbon budget) and therefore degree of disorder
- Fossil fuel exclusions/significant underweight potentially underperform over a 5-10 year horizon, payoff from new climate solutions delayed and volatile as energy demand/supply imbalances resolve themselves
- Focus on resilience likely to favour countries that are (i) further from equator, (ii) already richer, and (iii) well governed. A likely large increase in climate migration will complicate the analysis
- Probability of success assumes pace and nature of transition/ transformation will keep cumulative emissions within a carbon budget of ~0Gt

## WB2C Disorderly Transformed rules

**Investment implications**

- The post-transformation scenario is best described as ‘green post-growth’
- It is not clear that capitalism or private ownership would have a role in such a scenario; there could be a role for debt finance to local, small, circular economy businesses
- Probability of success is conditional on early-enough introduction of sufficiently transformed rules to (a) stop all GHG emissions and (b) establish regenerative practices



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