IFT Macro | WG 4 – pre-reading

Thursday 28th September 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 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

New WG4 additional pre-reading

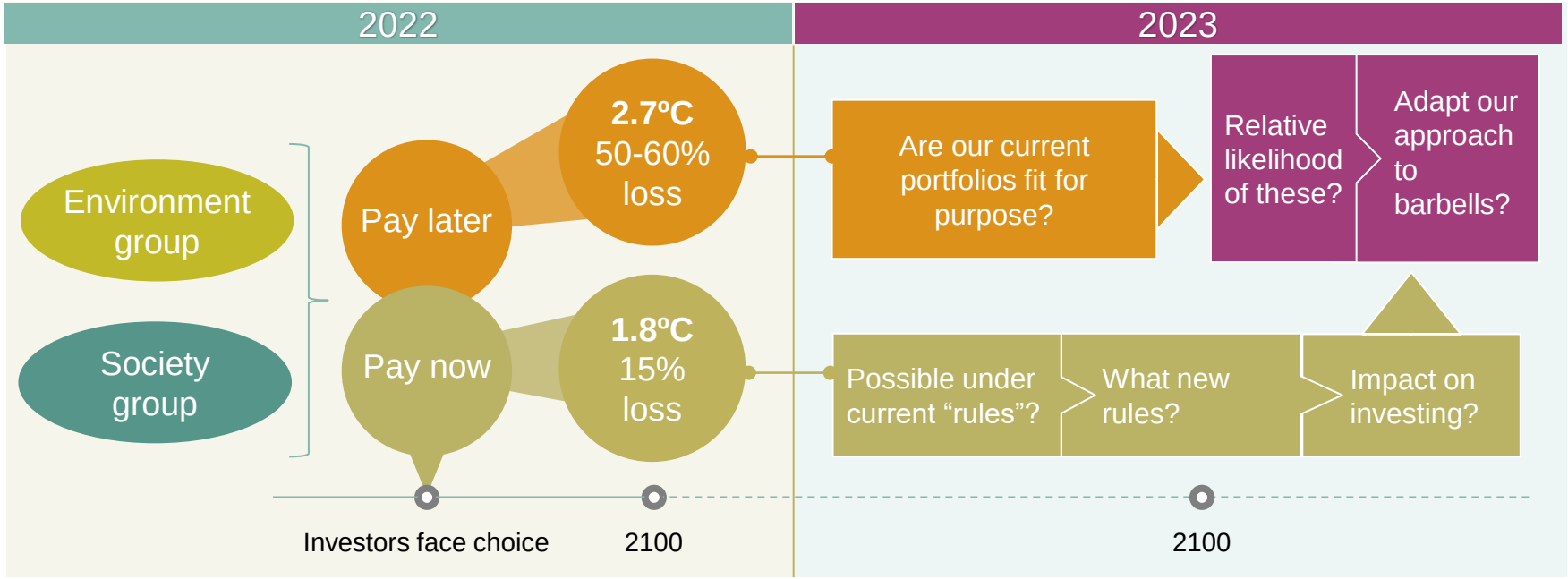
Type	Resource	Details
Research report	Loading the DICE Against Pensions	Pension funds are risking the retirement savings of millions of people by relying on economic research that ignores critical scientific evidence about the financial risks embedded within a warming climate
Research report	No time 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

Agenda for WG4 | 28 September 2023

East start 16:00 AEDT / 07:00 BST on 28 September
West start 10:00 EDT / 15:00 BST on 28 September

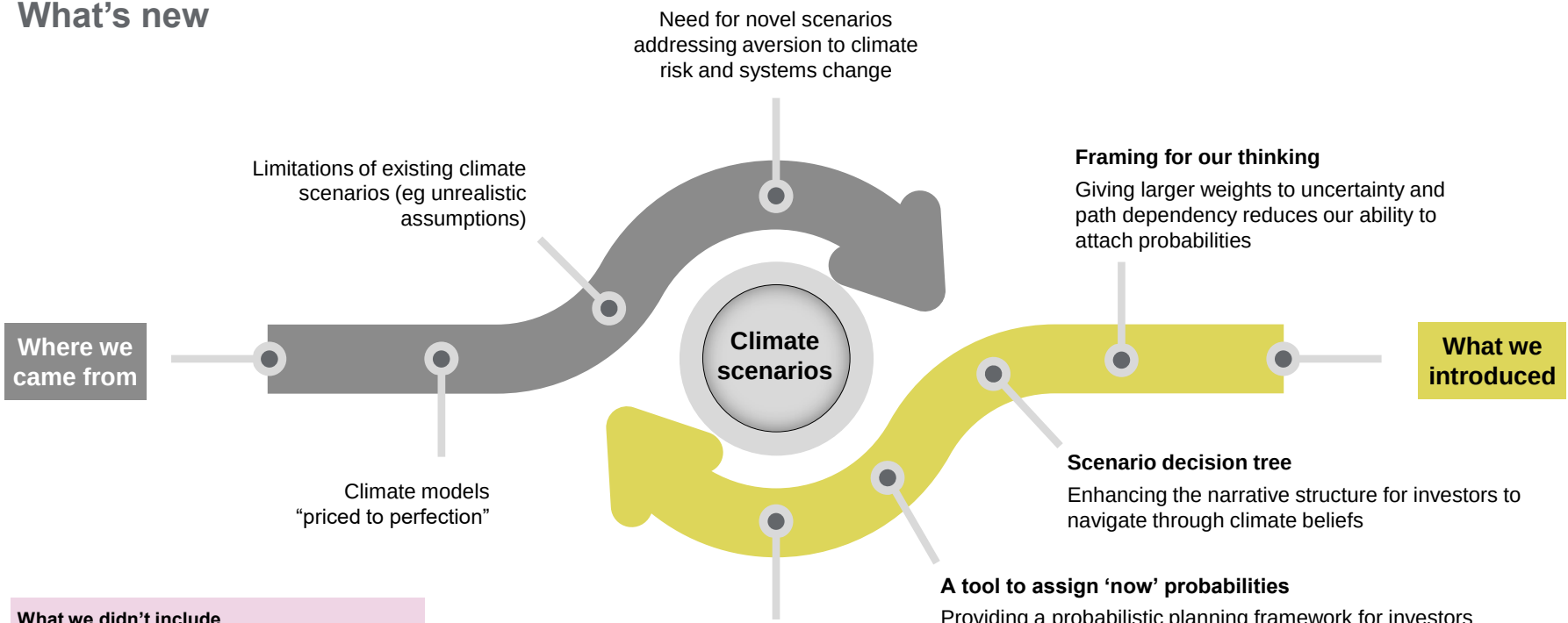
Time (mins)	Agenda Item	Description	
-10	Coffee prequel	▪ Please join for a pre-meeting catch-up if you are able	
5	Welcome, recap, agenda for this call	▪ A reminder of where we have come from, and the work of the executive after WG3 (s7)	AC
10	Part 1 – framing our thinking	▪ We propose that the climate transition requires us to shift our thinking (s10-11) ▪ Does the working group agree?	AC
15	Part 2 – scenario decision tree	▪ We have developed the decision tree idea from WG3 (s13-27). Clicking on the yes/no boxes will (via hyperlinks) get you to one end point (equivalent to the cells in the matrix) ▪ Working group to provide feedback	TH
30	Part 3 – tool to assign probabilities	▪ We propose one way to assign probabilities (s29-32) and provide explanatory narrative (s33-35) ▪ Working group to provide feedback	TH
10	Part 4 – investor actions	▪ Working group to provide feedback on the spreadsheet tool	IM
15	Review and next steps	▪ Tim summarises discussion, suggests possible next steps	TH
5	Close	▪ Thanks for your participation ▪ Next meeting scheduled for 29th of November	

Investing for tomorrow – macro view



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

What's new



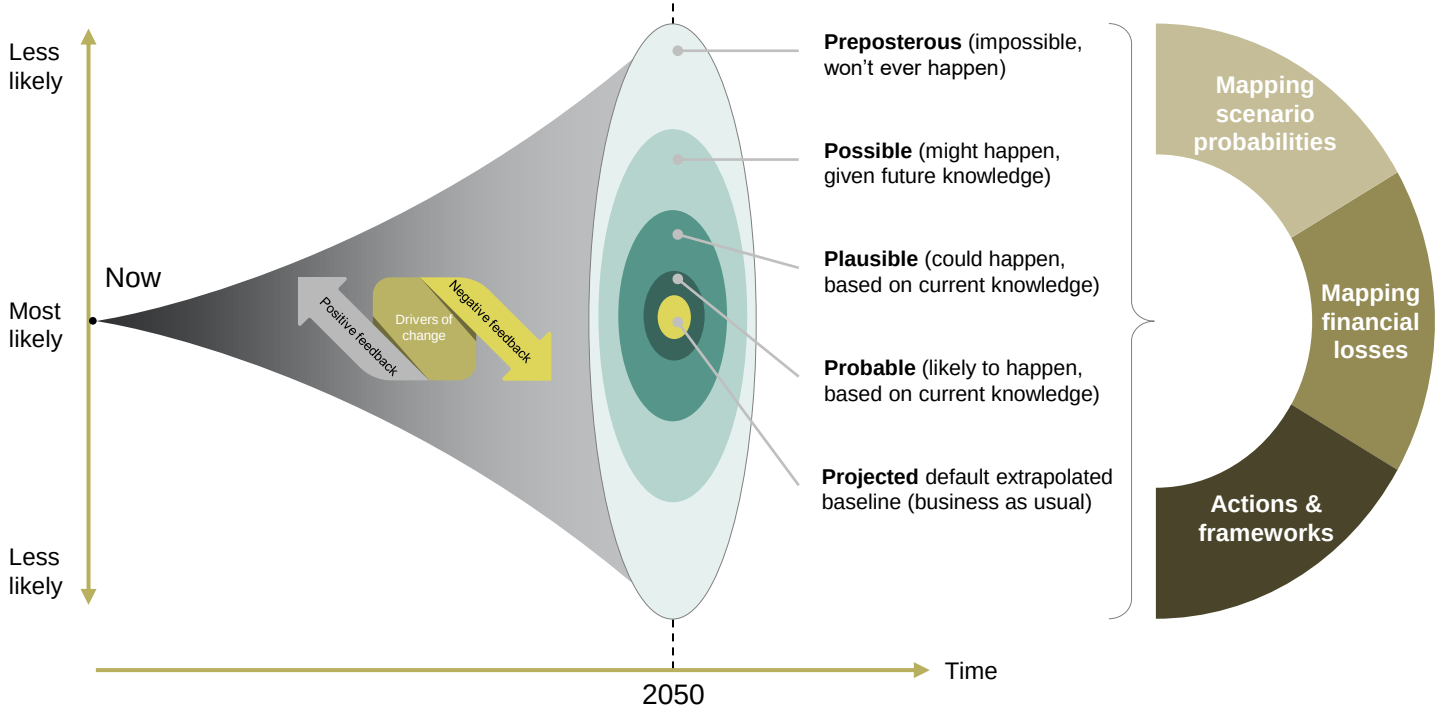
What we didn't include
We have not provided a heatmap (eg displaying potential risk-return outcomes for selected asset classes) given our beliefs that it would be (a) too subjective and speculative and (b) too unstable with respect to path dependency

How to navigate this deck

- **Part 1 | framing our thinking about the future pathway**
  - Investor dynamic adaptation to evolving 2050 climate scenarios
- **Part 2 | expanding the scenario decision tree from WG3**
  - Enhanced narrative-rich crib sheet added to previous polling tree
- **Part 3 | a tool to assign 'now' probabilities to 2050 scenarios**
  - Mapping scenario probabilities and financial asset losses
- **Part 4 | connecting investor actions and frameworks to scenarios**
  - Providing a catalogue of solutions for investors based on scenarios
- **Appendix**

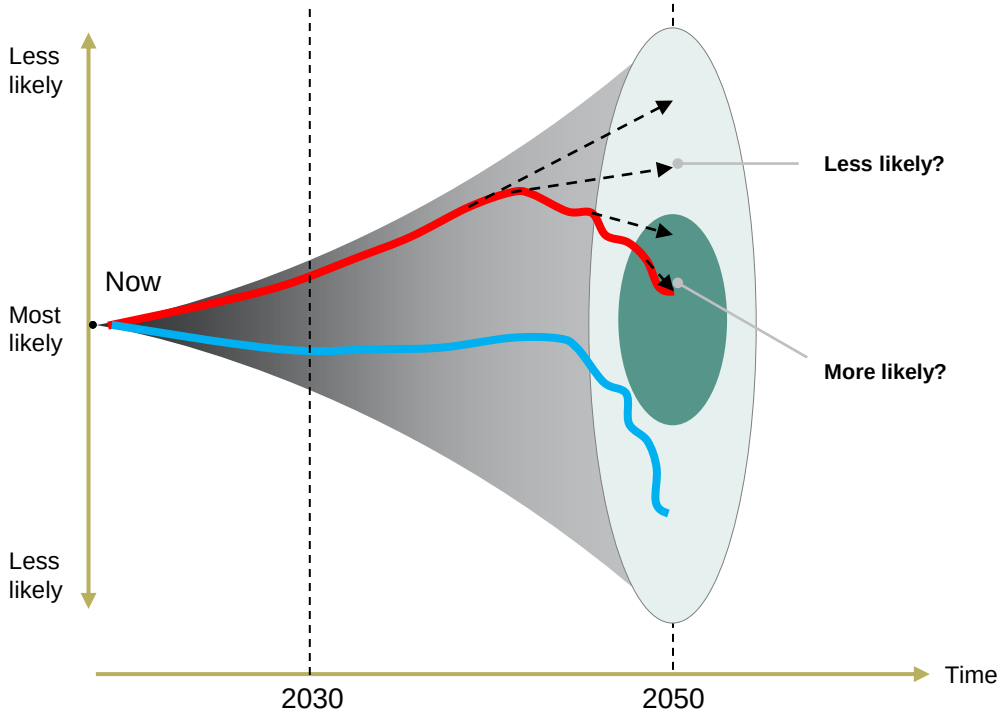
Part 1 | framing our thinking about the future pathway

Framing our thinking about the future pathway



This is the standard approach – uncertainty grows with the passage of time, but pathways are 'well-behaved' and we can say reasonable things about the likely distribution of outcomes in the future

Framing our thinking about the future pathway



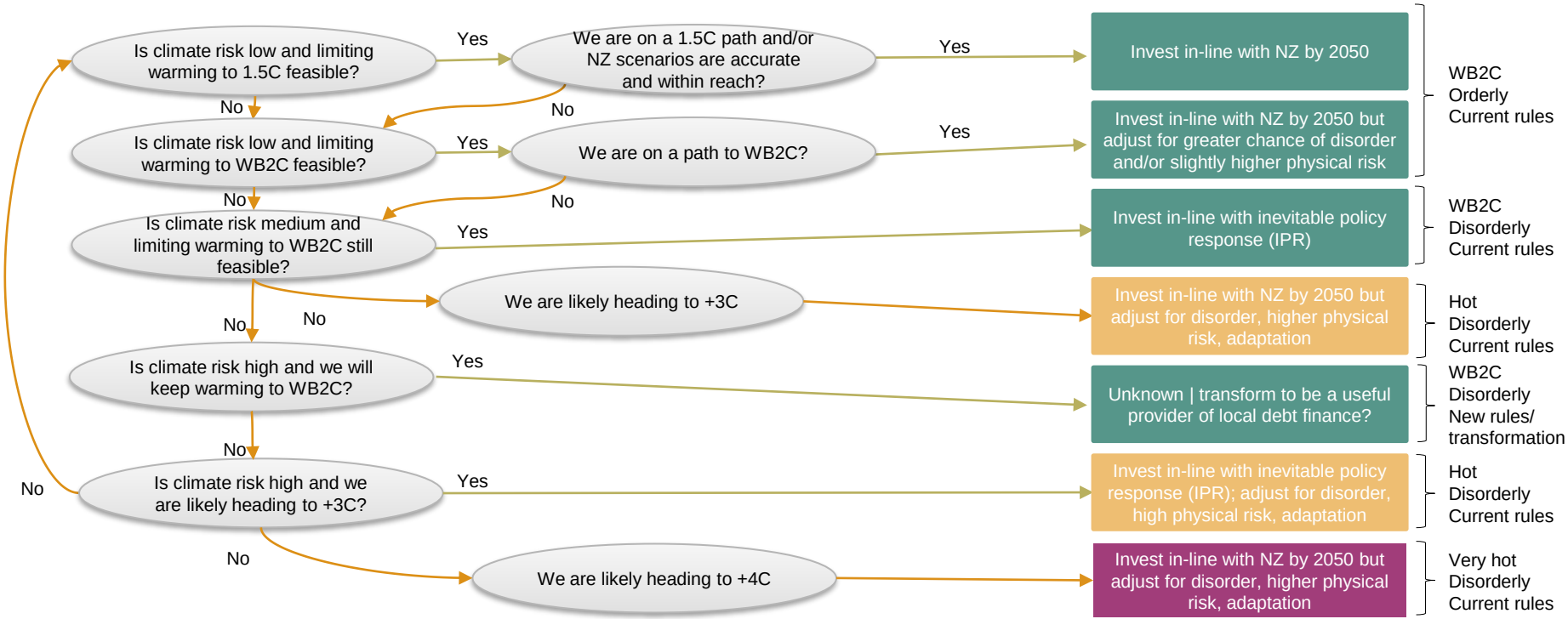
We believe this is the better framing for our thinking – either policy response or temperature rise is inevitable and, therefore, pathways are contingent on future developments. We can very little about the likely distribution

- 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
- We have no way to predict that an initially 'rogue' red path will end up in the more likely set; or that a 'central' blue path suddenly deviates to an unlikely outcome
- Strategic **adaptation over time**, therefore, becomes key and inevitable for investors navigating through the future cone

Part 2 | expanding the scenario decision tree from WG3

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 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

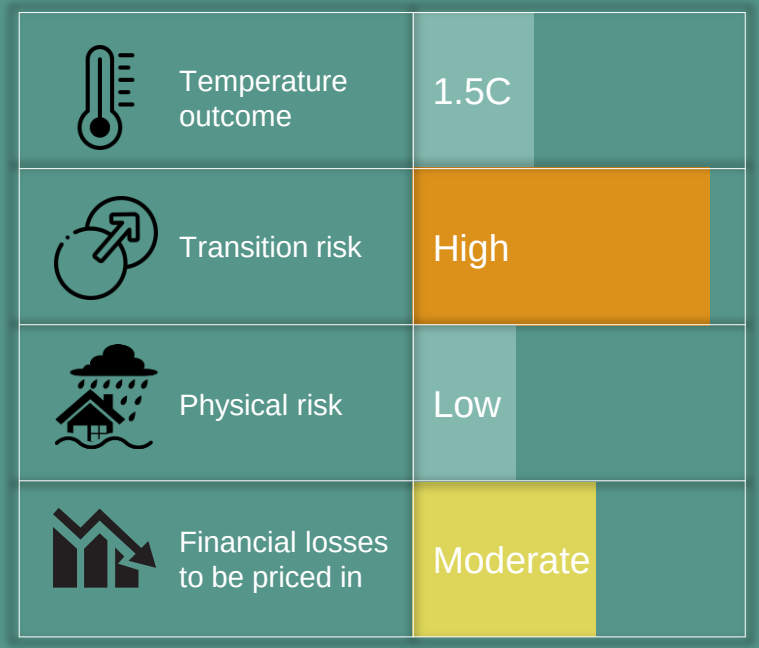
Click ‘no – we are heading for +4C’

Click ‘no’ – let me start again

WB2C 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

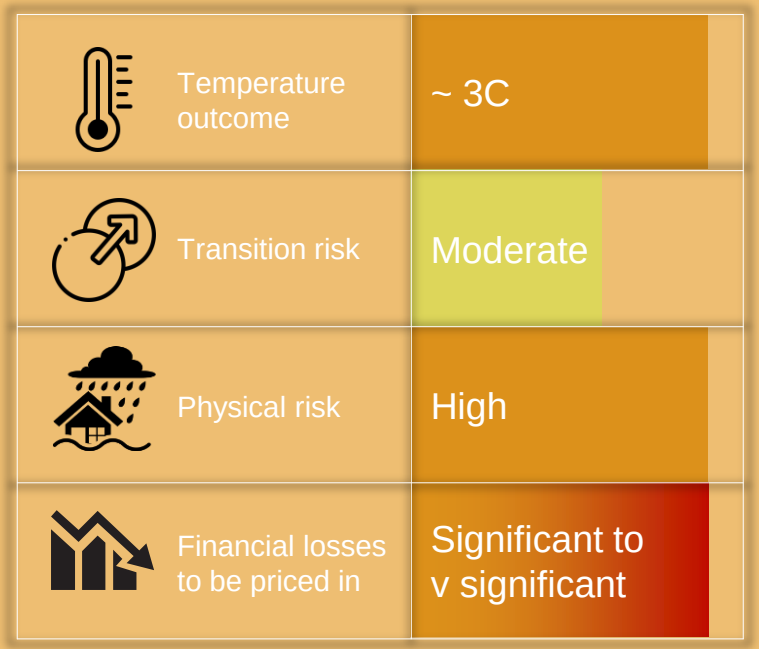
- Focus on identifying “winners and losers” from the transition – likely to be sectoral and intra-sectoral vs across asset classes
- Use NZE2050 scenario as an initial guide, eg monitor timing and level of introduced carbon prices to adjust value of heavy emitters
- New primary investment in key technologies 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

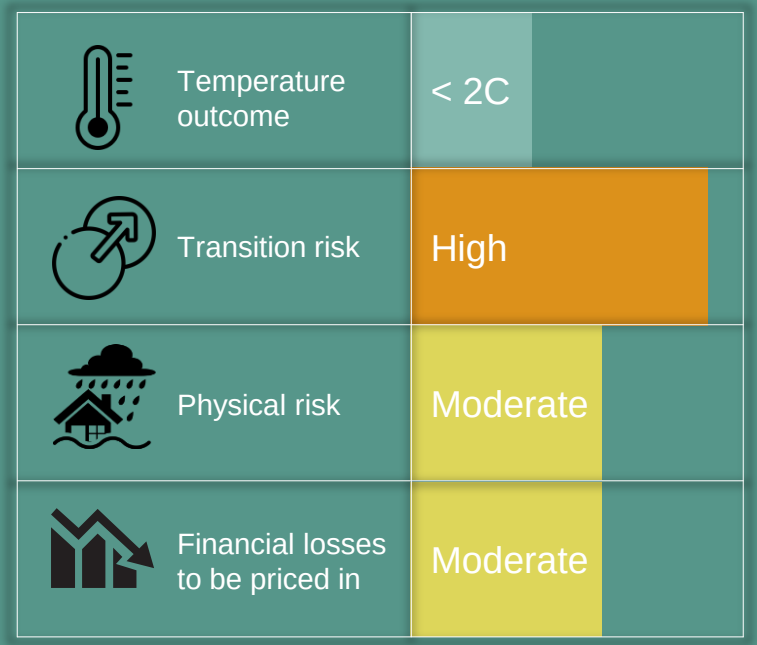
- The majority of financial assets likely to be negatively impacted, trying to identify winners vs losers likely less productive than focussing on resilience
- Use NZE2050 scenario as a starting point; assume carbon budget will be exceeded and/or earth system behaviour more extreme than predicted; adjust for greater spend on adaptation / resilience, harming profits relative to history
- Investment in EMs in particular should be highly selective (favour greater distance from equator and governance strength)
- 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
- Scope to invest in EMs – their need for capital (high return) to be balanced against 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 EMs not viable as uninhabitable, consider negative impacts of climate migration

  (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

Investment implications

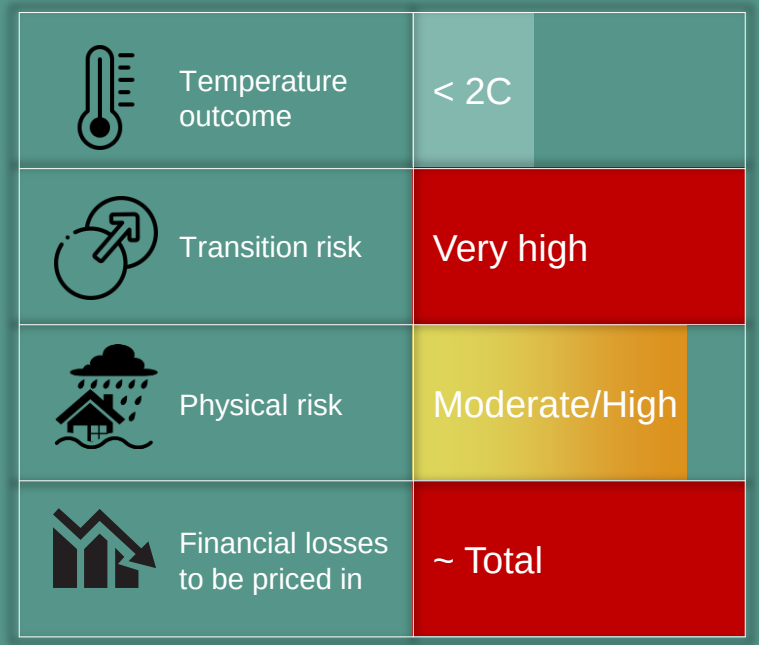
- The majority of financial assets likely to be negatively impacted, trying to identify winners vs losers likely less productive than focussing on resilience
- Use IPR scenario as a start; assume carbon budget will be exceeded and/or earth system behaviour more extreme than predicted; adjust for greater 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
- Investment in EMs should be highly selective (favour greater distance from equator and governance strength)
- Probability of success assumes pace and nature of transition/ transformation will keep cumulative emissions within a carbon budget of ~0Gt

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

WB2C Disorderly Transformed rules

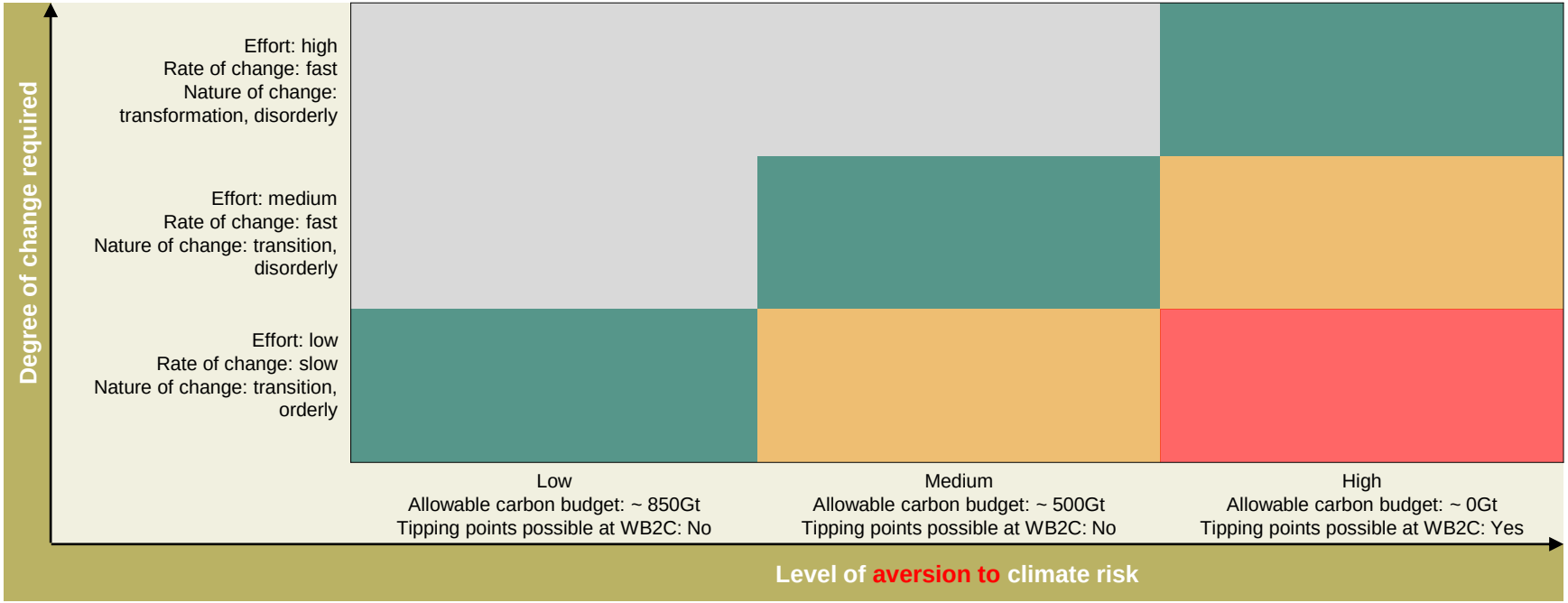
Investment implications

- 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

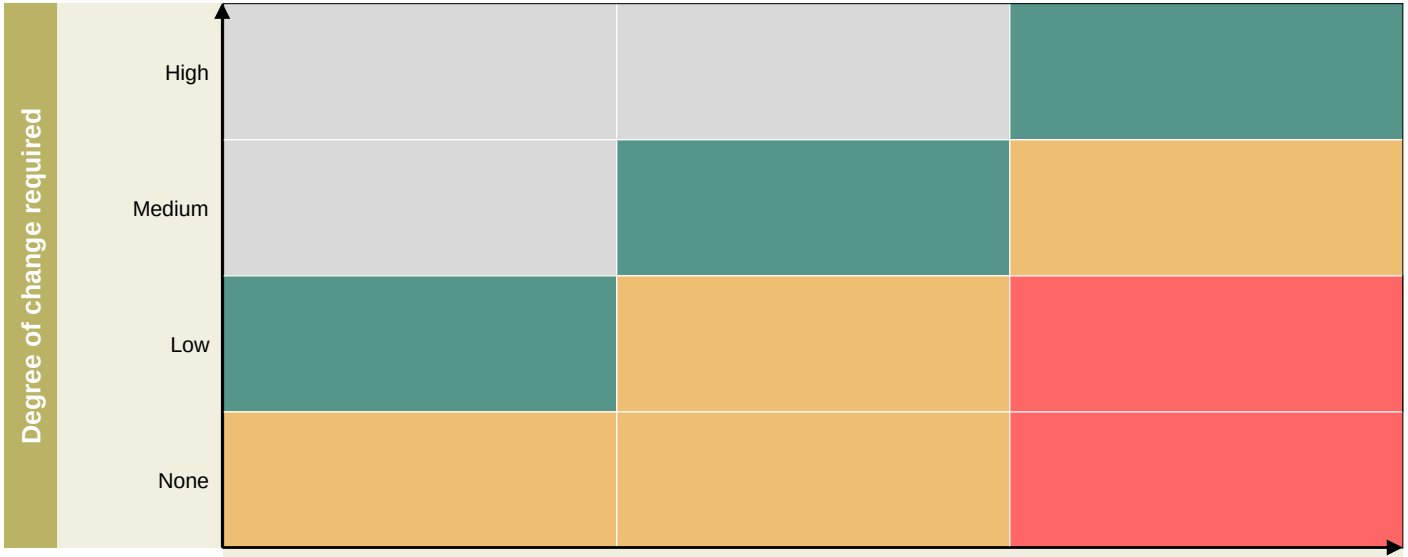


Part 3 | a tool to assign ‘now’ probabilities to 2050 scenarios

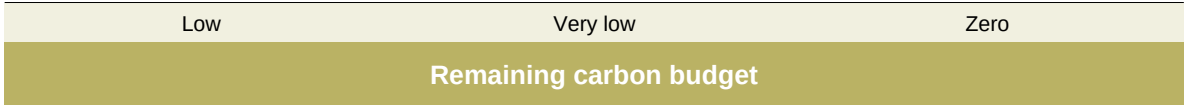
Scenario framework from WG3



Probability of scenario (cell) delivering WB2C by 2050 (and associated financial losses)



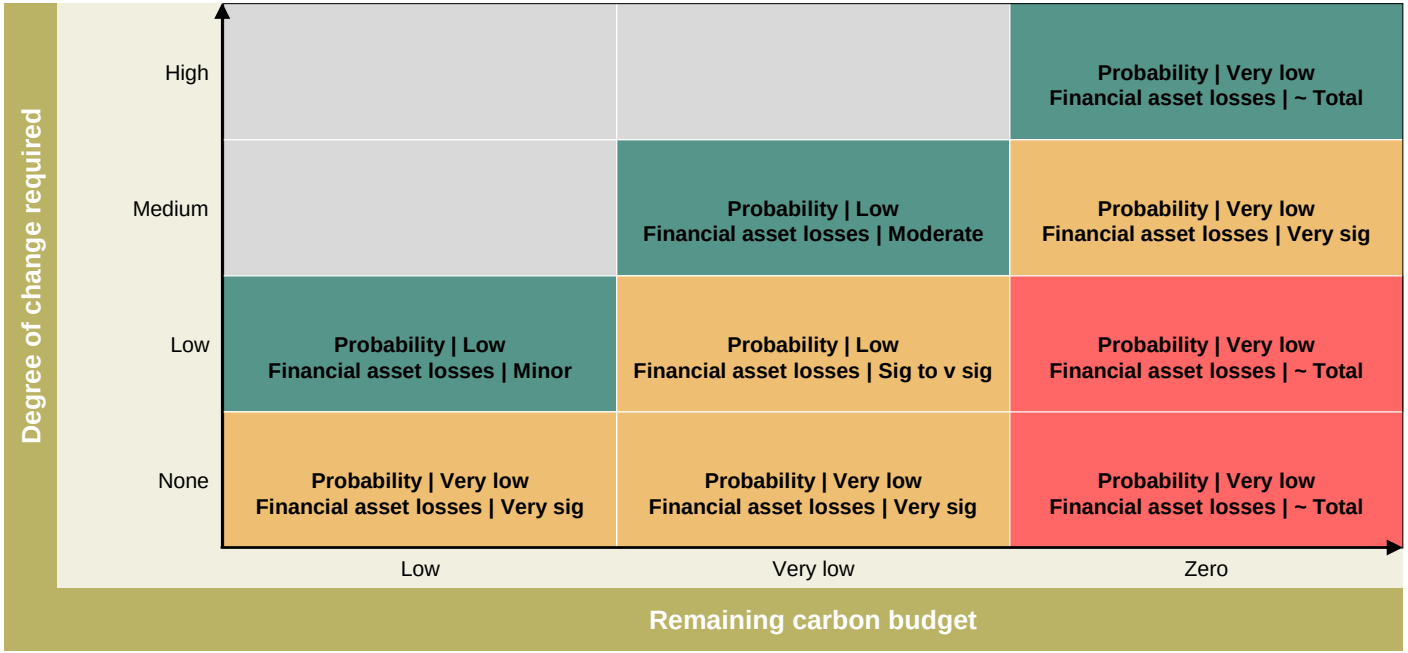
OR



Is one version of x-axis better than other?

Or a personal choice?

Probability of scenario (cell) delivering WB2C by 2050 (and associated financial losses)



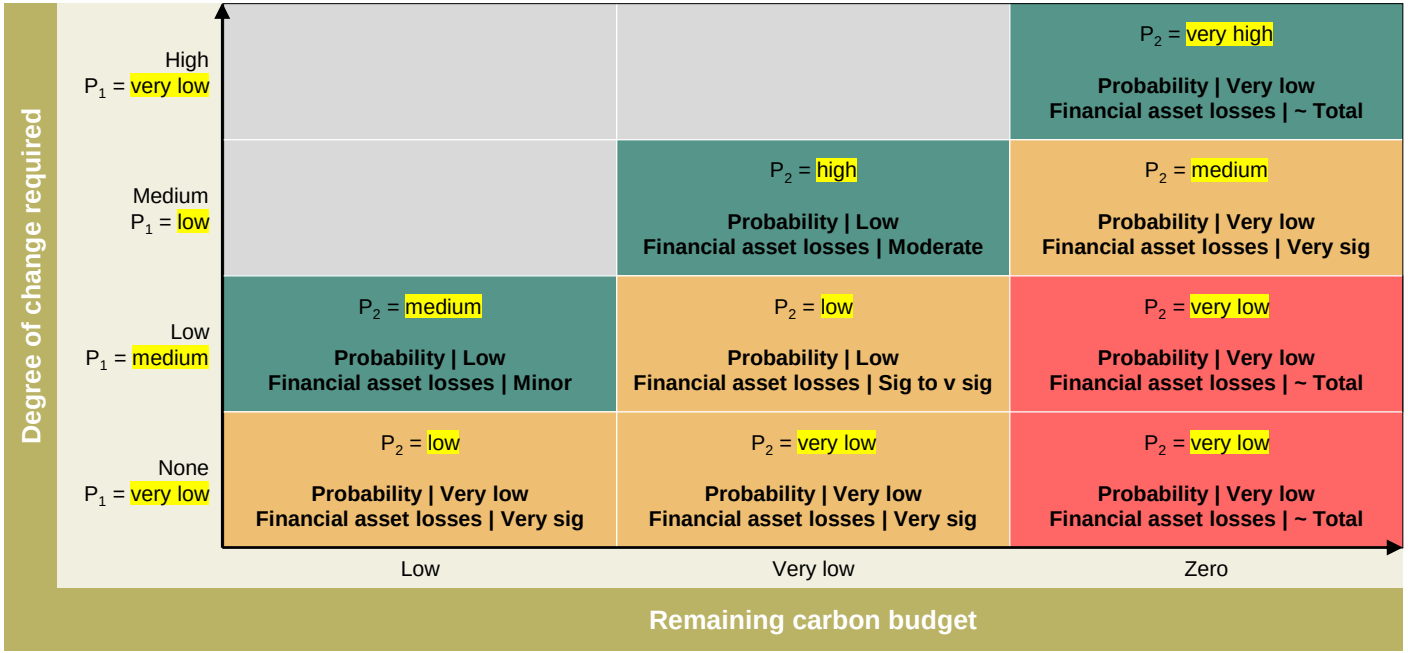
Key

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

Derivation of probabilities



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

P1 = probability of level of change occurring

P2 = probability of warming remaining <2C given economic change

Probability of scenario / cell (level of change and warming <2C) = P1 * P2

Scenario framework | delivering WB2C by 2050

What does this matrix show?

- Each cell of the matrix can be considered a scenario, which combines a different level of change and a different remaining carbon budget
- The ‘change’ is a combination of political, social, likely legal, and economic changes
- The level of change is currently undefined and subjective. If we believe the system is complex and adaptive then, technically, no change (‘none’ on the y-axis) is not possible. At the upper end of the y-axis, we have defined ‘high’ within this working group to be transformational change, which could include the replacement of capitalism etc
- All scenarios aim to limit warming to **well below 2C by 2050**. Our probability of the success of achieving this aim is given in the cell, and is calculated by multiplying two underlying probabilities:
  - **P_1**: assessment of the probability of the level of change
  - **P_2**: assessment of the probability of keeping warming to below 2C supposing the level of change happened
- Users can / should substitute their own probability assessments for P_1 and P_2. We suggest that the P_1 probabilities should sum to 100% (the middle points of our ranges sum to 100%). The P_2 probabilities are conditional (on the level of change) and so will not / need not sum to 100%
- Investors with higher aversion to climate risk should act as if they believe in a lower remaining carbon budget, so for the same level of change P_2 is lower for higher levels of aversion (lower remaining carbon budget)
- We also show **our expectations of financial asset losses** for each transition scenario

Scenario framework | delivering WB2C by 2050

Reasoning for our selected P_1, P_2 and financial asset losses

- P_1, High change | Very low (0%-20%)
  This is a transformational degree of change, including an overhaul of regulations, fiscal policy, international cooperation and investors' mindsets. We see very little evidence of this occurring – even the most significant climate action proposed by countries remains within the current 'rules of the game'

- P_1, Medium change | Low (20%-40%)
  This is the most ambitious pace and degree of transition in current policy proposals. We think there is a low probability that there will be the requisite political support and institutional capability to deliver it. However, as technology and the transition advance, this degree of change may become more achievable

- P_1, Low change | Medium (40%-60%)
  This degree of change is both feasible and could bring the global economy to, or very close to, NZE by 2050. Although current plans do not reach NZE by 2050, future policy commitments should make up the gap in required emissions reductions. Technological advances in energy storage and generation will support this change.

- P_1, No change | Very low (0%-20%)
  This degree of change sees no further action taken towards a low carbon transition. We believe this is very unlikely because of the cost and strategic benefits of renewable over non-renewable energy, and because of political pressure due to increasingly apparent climate change.

Investor action planning framework (timeframe: 2050, warming: <2C)

Reasoning for our selected P_1, P_2 and financial asset losses (cont)

- Our chosen P_2 are subjective assessments – how likely we believe it will be to achieve WB2C given the level of change contemplated. For the same degree of change (y-axis), the probability decreases as we move right along the x-axis given the smaller remaining carbon budget

- Our P_2 increases as the extent of transition increases (moving up the y-axis). Given the temperature goal is the same for all scenarios, more extensive change makes achieving the temperature goal more likely

- Financial asset losses are affected by two climate risks:
  - Physical risk: the impact of changes to climate (eg heat or changed rainfall patterns affecting harvests or consumption patterns) and natural catastrophes on financial asset valuations
  - Transition risk: the impact of adaptation towards a low-carbon economy on financial asset valuations (eg currently valuable assets become 'stranded')

- The financial asset losses figures are expected values, and are extrapolated from TAI's work in *Pay now or pay later?* given our beliefs. The losses are contingent on the characteristics of the individual scenario (how hot is it likely to get, how wrenching the change etc). In general, the losses increase the lower the remaining carbon budget is assumed to be (moving across x-axis), and reduce as the degree of change increases (moving up the y-axis). As an exception, the transformational change in the top right of the matrix results in such severe transition-related losses to financial assets (eg potential replacement of capitalism) that we expect losses would be close-to-total

Part 4 | connecting investor actions and frameworks to scenarios

Investor actions and frameworks based on the scenarios

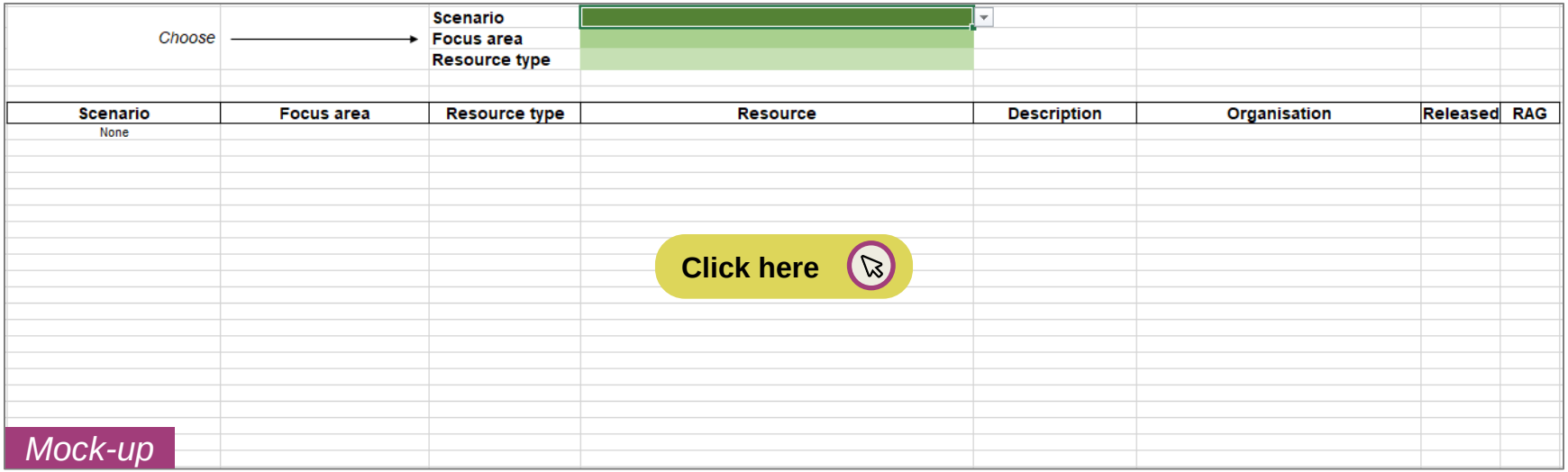
- The work carried out by the IFT Environment working group in 2021/2022 defined a series of actions that investors could take in order to implement a net zero pledge – these can be categorised using the following four dimensions:
  - Ambition level – incremental vs transformational
  - Focus area – mitigation (reduce likelihood of physical risks) vs adaptation (reduce magnitude of physical risks if they happen)
  - Portfolio actions – capital allocation (change what is in the portfolio) vs stewardship/engagement (improve what is in the portfolio)
  - External action – new primary investment (eg climate solutions) vs policy advocacy (change the system)
- The **next step** we took was to use the framework described above to identify which categories of actions would be most appropriate for investors based on the planning scenario most appropriate to their beliefs/priors – an example list is presented below and a link to the spreadsheet containing the full catalogue of solutions can be found on the next slide:

Scenario	Focus area	Resource type	Resource (not exhaustive list)	Organisation (not exhaustive list)
• WB2C, orderly, current rules • WB2C, disorderly, current rules • Hot (3C?), disorderly, current rules • Very hot (4C+?), orderly, current rules • WB2C, disorderly, transformed rules	• Risk management – Transition risk • Risk management – Physical risk • Investment opportunities/new primary investment • Alignment • Stewardship/engagement • Policy advocacy • Just transition	• Guidance • Example Tool • Framework • Benchmark • Research paper • Tool • Toolkit • Collaborative initiatives	• The 2023 Climate Risk Landscape • Climate VaR • Proposed Climate Resilience Investment Framework • Net Zero Investment Framework Implementation Guide • Net Zero Company Benchmark • Sectoral Pathways for Financial Institutions	• UNEP-FI • WTW • MSCI • IIGCC • Climate Action 100+ • GFANZ • Thinking Ahead Institute

Catalogue of solutions

Click on the button below to start interacting with the catalogue of solutions

- We have arranged a catalogue of solutions based on the **scenarios** described in this deck, the **focus areas** indicated in the previous slide (risk management, alignment, just transition, etc.) and each corresponding **resource** pointing to the investor actions and frameworks
- To interact with the catalogue, simply click on the table/image below and start choosing the parameters (‘resource type’ is not mandatory)
- Each resource listed is colour-coded using the RAG (Red, Amber, Green) system to reflect its status in accordance with the specific scenario and focus area. Green means the specific resource is particularly relevant given the scenario choice; red means the opposite; amber mid-way



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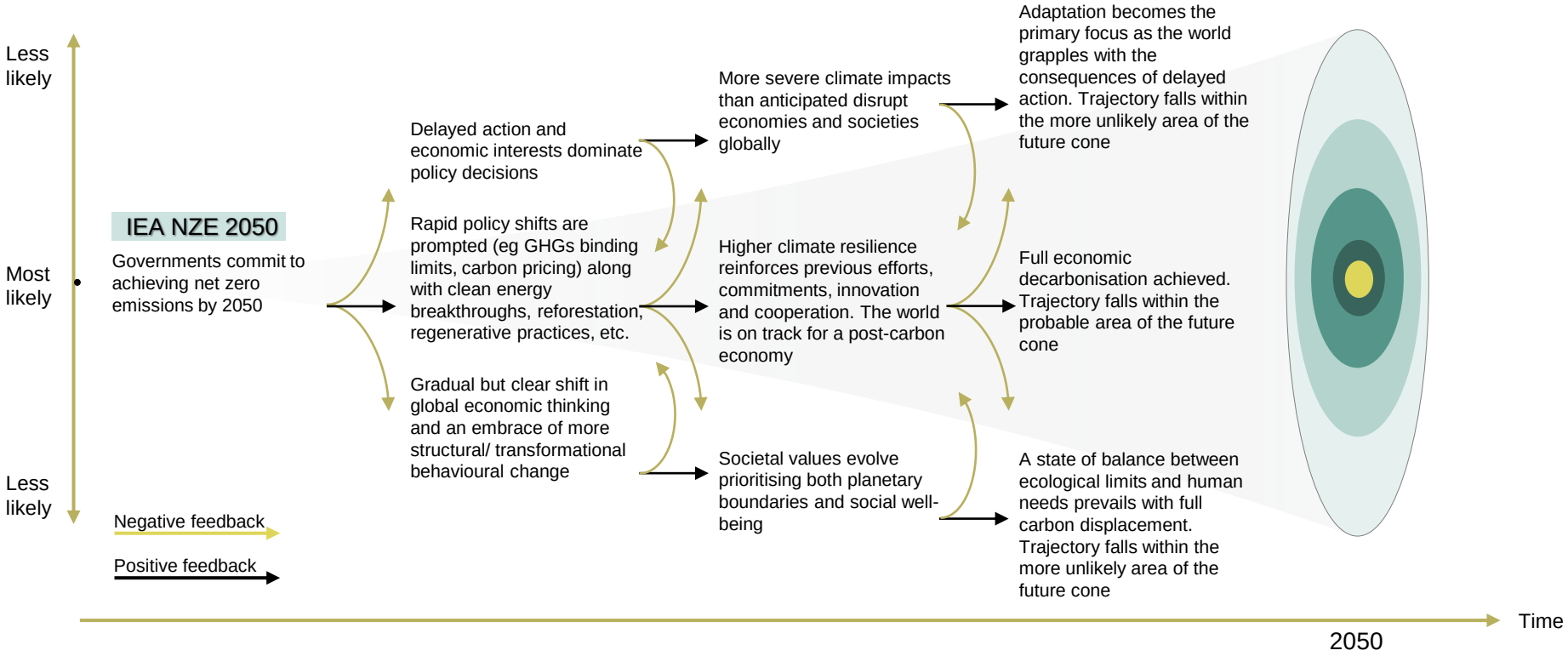
Appendix

Framing our thinking about the future pathway | IEA NZE 2050 scenario



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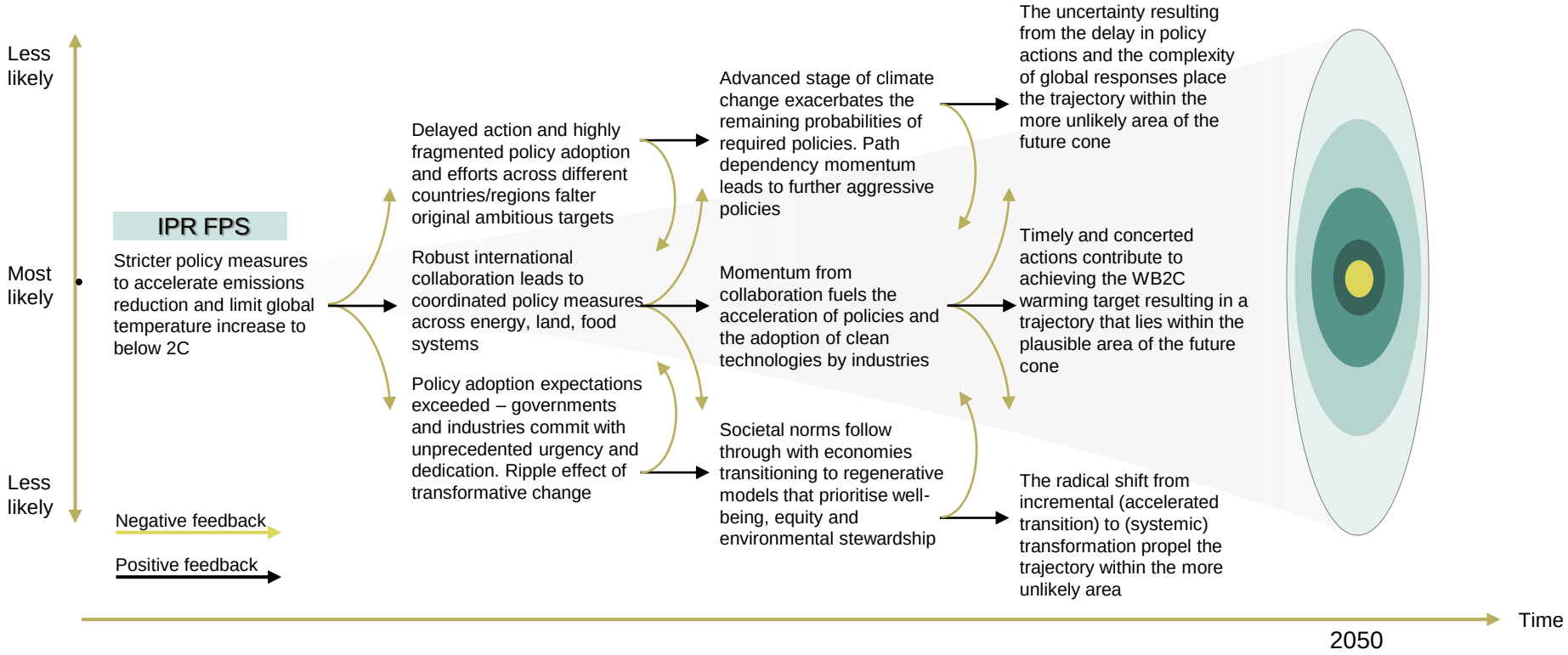
Framing our thinking about the future pathway | IPR Forecast Policy Scenario



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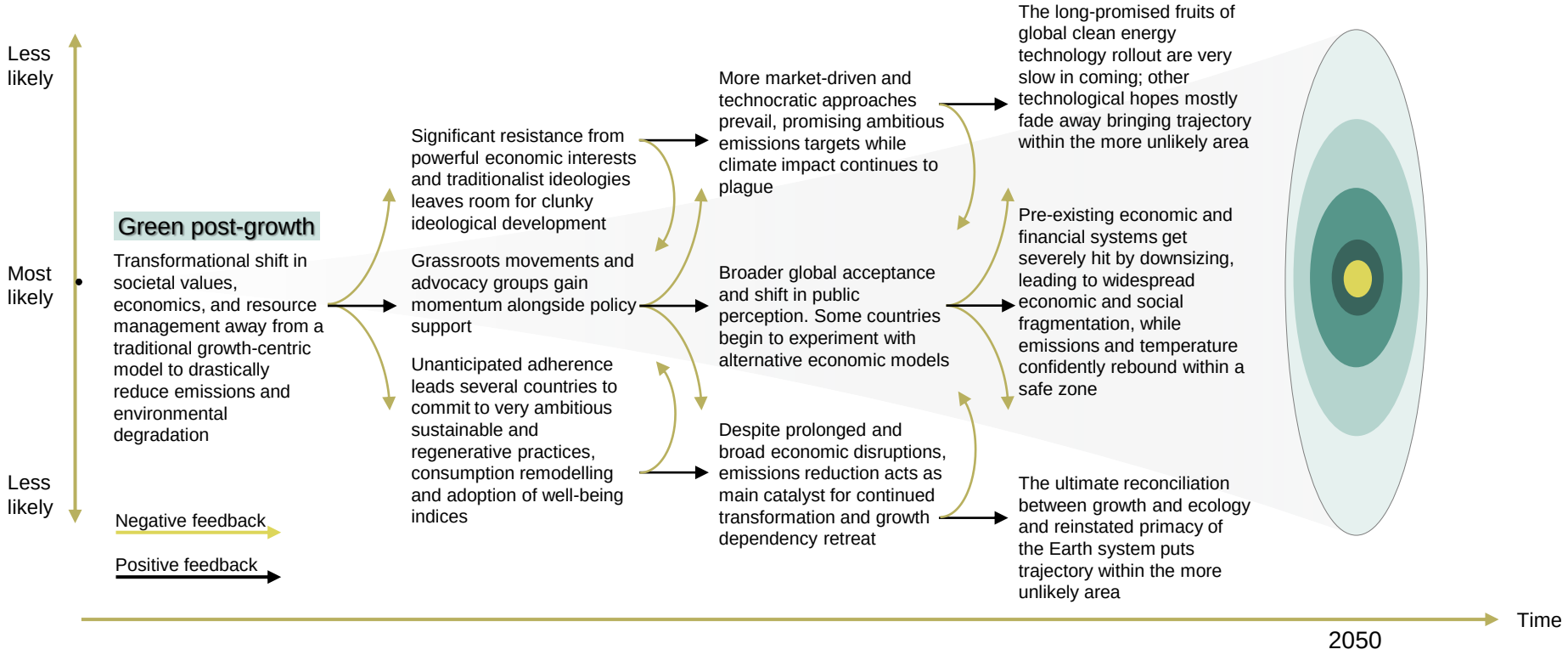
Framing our thinking about the future pathway | Green post-growth



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