

ABSTRACT OF THE LONDON DISCUSSION

## Practical guides to climate change for insurance practitioners

[Institute and Faculty of Actuaries, Sessional Event, London, 18 November 2019]

**The Chairman (Mr S. R. Jones, F.F.A.):** Good evening everybody. Welcome to Staple Inn for tonight's Sessional research event which is considering climate change for insurance practitioners. I am the current chair of the Resource and Environment Board which was established in 2013 and has had a mission to bring the consideration of resource and environmental issues, particularly climate risk, into mainstream actuarial thinking. We continue to believe that this subject is highly relevant given the growing regulatory focus on climate risk and green finance policy initiatives.

One of the key actions of the board has been to progress a series of practical guides to climate change. We have previously produced guides focused on defined benefit and defined contribution pensions and more recently have produced documents targeted at both life and general insurance actuaries. These are going to be the focus of tonight's meeting. A guide targeted at investment actuaries is forthcoming.

The purpose of the practical guides has been not to tell actuaries what they must do but rather to highlight how and where climate risk interacts with actuaries' day-to-day work and give suggestions as to how these issues can be considered.

With that in mind, and to start this evening with a recap of the evidence and a focus on general insurance, I am pleased to introduce Mark Rothwell. Mark (Rothwell) has worked in general insurance (GI) for 26 years. He is a member of the Resource and Environment Practice Board. He is chair of the Board's research and CPD committee. Mark (Rothwell) chaired the working party that wrote a practical guide to climate change for GI practitioners which was published in August.

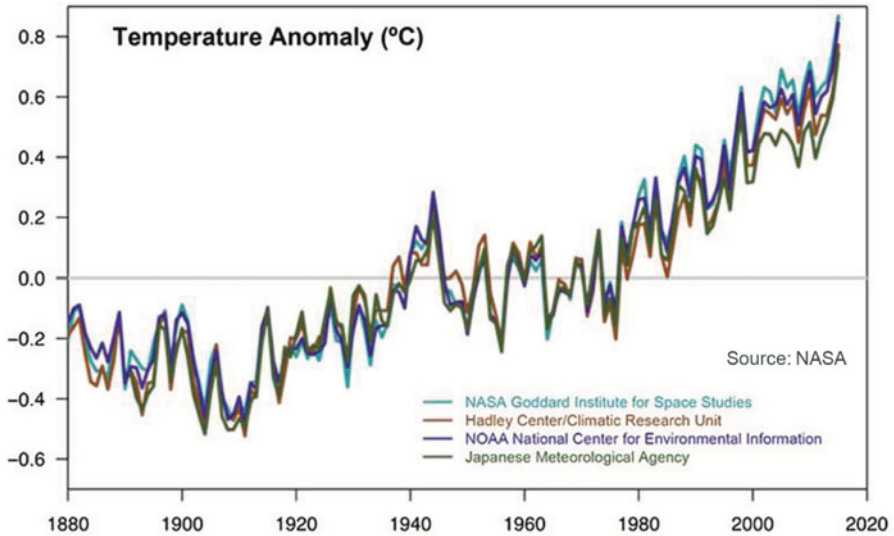
**Mr A. M. Rothwell, F.I.A.:** I am going to start by giving you a brief overview of what we are intending to discuss today. We will start with a reminder of the evidence.

I will then discuss some of the key things that we found within the general insurance practical guide. David (Ford) and Yvonne (McLintock) will then discuss some of the content of the life insurance practical guide.

David (Ford) will then lead us through a session talking about future technical needs. You will be asked to participate in some polls. Finally, there will be an opportunity for questions and closing comments.

Moving on to a reminder of the evidence, temperatures continue to rise. Figure 1 shows the temperature anomaly over the past 140 years showing a steady rise in temperature. The anomaly has been measured by four different institutions, and the figures are very consistent. These findings cannot be disputed.

Carbon dioxide in the atmosphere continues to increase as shown in Figure 2. The data goes back several hundred thousand years. We can see rises and falls in the concentration of carbon dioxide in the atmosphere. The range has typically been between about 140 ppm and about 270 ppm. The low points have coincided with ice ages. The peaks have coincided with interglacial periods.



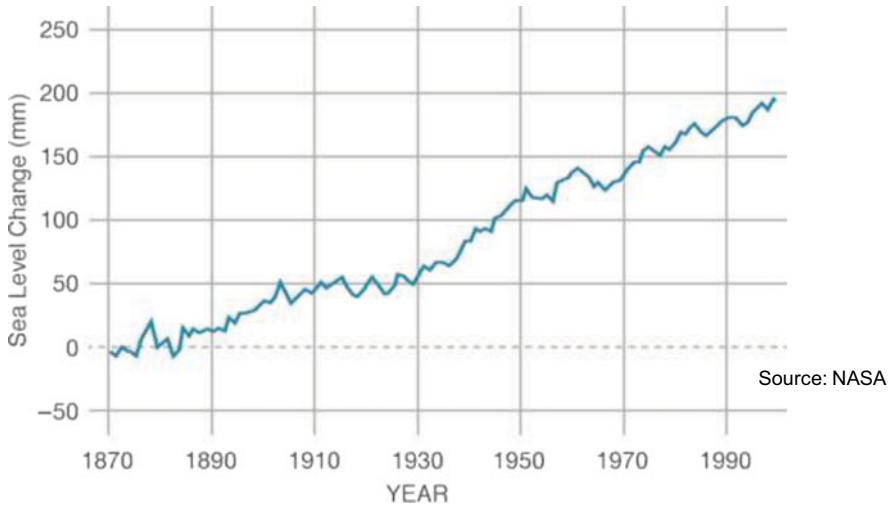
“Earth is now as warm as it was during the prior (Eemian) interglacial period, when sea level reached 6–9m higher than today” (Hansen, et al., 2017)

Figure 1. Temperatures continue to rise.



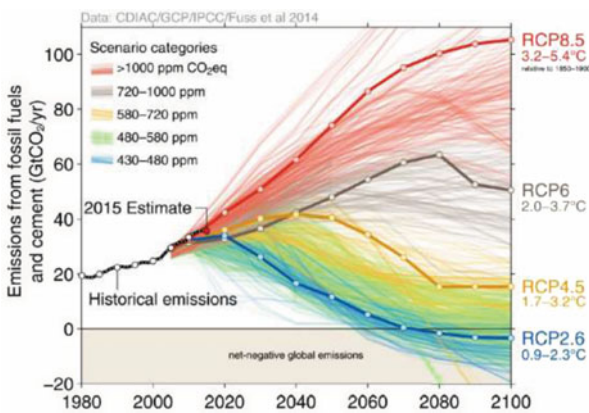
“The last time the Earth experienced broadly comparable levels of atmospheric carbon dioxide was during the mid-Pliocene, 3-5 million years ago. To find levels consistently above those of today you have to look much further back to the mid Miocene some 15 million years ago.” (British Antarctic Survey, 2018)

Figure 2. Carbon dioxide in the atmosphere continues to increase.



Lloyd's estimated that sea-level rises contributed c. 30% extra to the cost of storm surge claims in New York from Hurricane Sandy (2012)

Figure 3. Sea levels continue to rise.



“Four pathways have been selected for climate modelling and research, which describe different climate futures, all of which are considered possible depending on how much greenhouse gases are emitted in the years to come. The four RCPs, namely RCP2.6, RCP4.5, RCP6, and RCP8.5, are labelled after a possible range of radiative forcing values in the year 2100 relative to pre-industrial values (+2.6, +4.5, +6.0, and +8.5 W/m<sup>2</sup>, respectively).”  
(Moss, et al., 2008)

Figure 4. Wide range of possible future pathways.

You will note that the current figure is over 400 ppm. Anyone looking at these figures will draw their own conclusions as to whether they think that the current situation is due to coincidence. Sea levels continue to rise. Figure 3 shows the change in sea levels since the 19<sup>th</sup> century sourced from NASA. Lloyds estimated that the effect of sea level rises constituted about 30% extra costs to the storm surge claims that came from Hurricane Sandy in 2012. So that gives an indication of the magnitude of the issue. You will see that the rise in sea level at the point was about 200 mm. However, the last time temperatures were where they are now was during the last interglacial period and sea levels were about 6–9 m higher than they are now.

There is a wide range of possible future pathways as shown in Figure 4. The numbers down the right-hand side of the graph are representative concentration pathways (RCP). These numbers

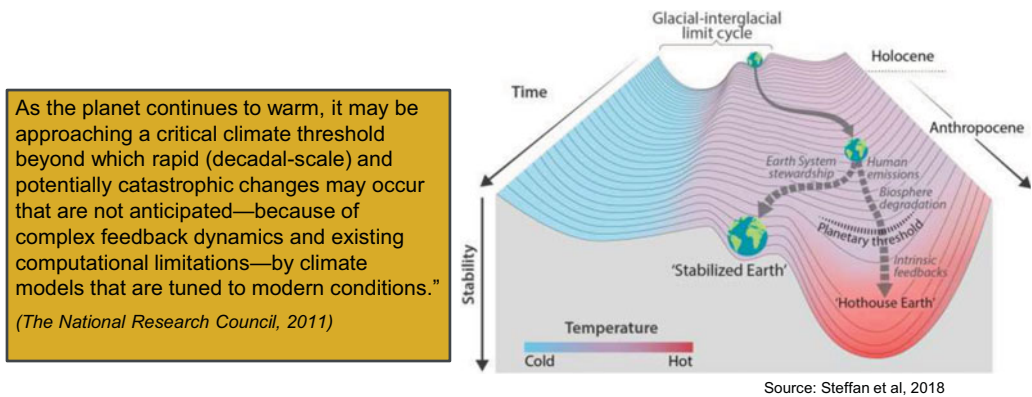


Figure 5. Tipping points might exist.

measure radiative forcing. For example, a RCP of 8.5 means an extra 8.5 W per metre squared of solar energy hitting the Earth’s surface.

Against each of the RCP numbers there is an estimate of the temperature rise that results from it. In the Paris agreement countries around the world agreed that they would aim to keep a temperature rise below 2°C of pre-industrial levels. That was with the hope of a rise of less than 1.5°C.

You will see even the blue line at the bottom of the screen is estimated to result in a rise of between 0.9°C and 2.3°C. So even the blue pathway does not guarantee a rise of below 2°.

The left-hand side of the graph shows the emissions from fossil fuels. You will see that to keep to the blue line and meet the Paris agreements, we have to start cutting fossil fuels very quickly. If we do nothing, then by 2100 we will be looking, on this estimate, at between 3.2° and 5.4° of warming. These are unthinkable outcomes.

There might also be tipping points in the future that are not factored into those graphs. Figure 5 shows, historically, a stable interglacial position. Periodically, we have tipped over into ice ages, as represented in blue, and back again. The worry is that we will hit a point of no return, if you like, and feedback loops start forcing the temperatures to be warmer and warmer.

So, how certain are we about climate change? According to the Intergovernmental Panel on Climate Change (IPCC), there is unequivocal scientific consensus that the climate is warming and that human activities, particularly greenhouse gas emissions, are “extremely likely to have been the dominant cause of the observed warming since the mid-20th century”. At the last count, roughly 90% of scientists were in agreement that climate change is caused by human activity. That is roughly equivalent, if you like, to the proportion of scientists who think that there is a link between smoking and lung cancer.

If you come across anyone that is still not convinced of the evidence and points to the 3% of scientists that are not certain, think of it as similar to them denying the link between smoking and lung cancer.

All this has a wide range of impacts for society as shown in Figure 6. We are at a level of about 1° of warming at the moment. We see impacts in terms of water and the eco system as shown on the left of the Figure.

In the worst-case scenarios, we discussed earlier we were looking at increases of somewhere between 3.2° and 5.4°. At these temperature levels, you start to see huge impacts on food, on water, on the eco system and so on.

The political response to what has happened may be relevant with elections on their way. In 2008, the UK government introduced the Climate Change Act. Then, more recently, in 2019, it declared a climate emergency setting a net zero emissions target by 2050 and launched a green finance strategy.

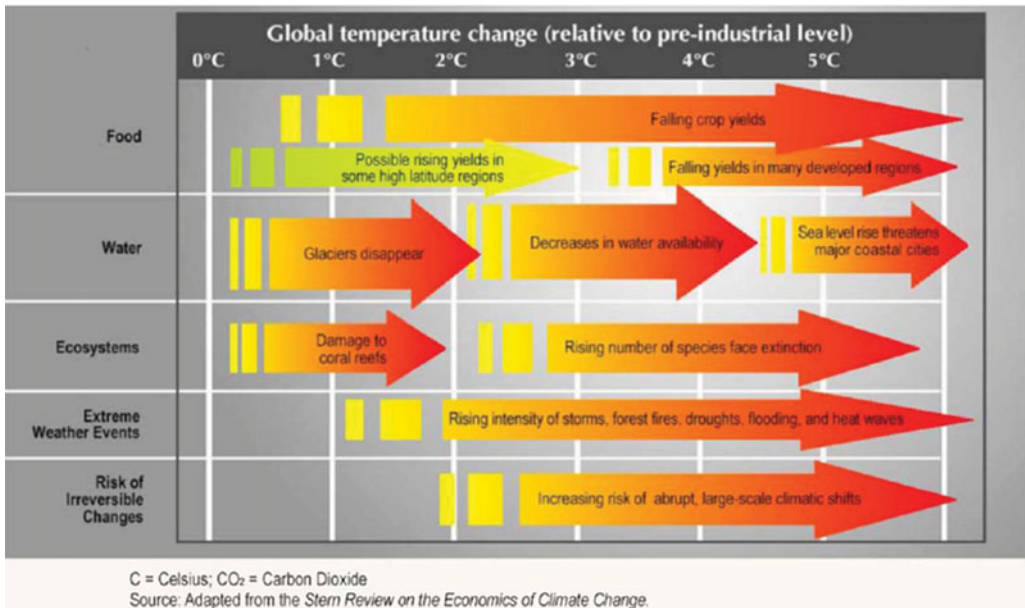


Figure 6. Wide range of impacts for society.

Next year, in 2020, Conference of the Parties (COP) 26 will be hosted in Glasgow. COP is a UN climate change gathering which happens periodically; five years ago it was in Paris. They have been held every subsequent year.

In 2015, we had the Paris agreement. In 2016, the G20 green finance study group was established. In 2017, the Task Force on Climate-Related Financial Disclosures (TCFD) came up with a recommended framework for financial disclosures on climate change. That was sponsored by the Financial Stability Board at the request of finance ministers.

Three types of risk arise from climate change. The first is physical risk. This is the direct impact from climate change. Examples of this are increased frequency of heavy localised rainfall, resulting in flood events, or rising sea levels, or warmer, drier weather that increases the risk of subsidence and wildfires, etc. Relevant to the UK might be changing Atlantic conditions which would alter the frequency, size and intensity of Atlantic storms.

The second type of risk is transition risks. These are the risks that might arise from the efforts to combat climate change. They could come from changes in government policy or changes in legal frameworks. They could be due to technological advances such as renewable energy and battery storage. They could come from changes in demand from the public such as changes in demand for fossil fuels and so on. They could also come from reputational risk, particularly where companies are going against the wishes of shareholders, investors, or customers.

The third type of risk is liability risk. Liability risk may tend to arise from physical and transition risks but is related to the related legal issues. For example, these could occur because of a failure to mitigate climate change by companies which are contributing to such change. In general, legal liabilities could arise from a failure to adapt to climate change.

Other legal issues might arise from a failure to disclose appropriately. For example, a failure of a company to disclose to their shareholders the risks from climate change, or of an individual professional to highlight the risks of climate change in their advice.

I hope I have given some useful background. Next I will talk about general insurance and the advice within the general insurance practical guide. In the guide we discussed a number of areas of

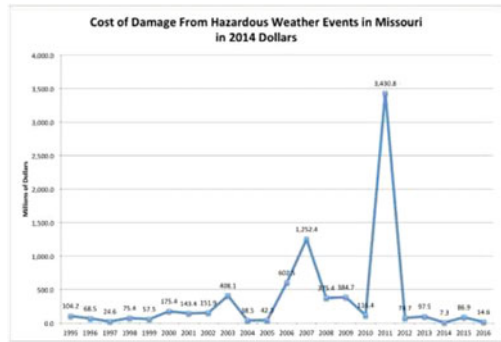


## Experience and exposure rating are both reliant on extrapolating past trends...

“It may be tempting to assume that slow gradual changes in the climate will be experienced and only small differences in premiums will be needed to reflect these changes. However, acute physical risks include changes in the frequency of large cat events, where trends are difficult to identify.”  
*(Practical Guide to Climate Change for GI Practitioners, August 2019)*

Pricing practitioners may need to think about:

- how climate change influences past data,
- the likely impact it has on trends, and
- the outlook for the future



Source: mogreenstats.com

Figure 7. Pricing needs to think beyond the annual renewal.

focus for general insurance actuaries around pricing and underwriting, reserving, catastrophe modelling, reinsurance, investment, risk management and capital management.

The areas I am going to concentrate on today are pricing, catastrophe modelling, and risk management. Investment will feature to a certain extent in the life practical guide. There is also a specialist practical guide on its way for investment actuaries.

In terms of pricing, I should like to mention that while it can be tempting to think of the climate as something which is slowly changing so annual renewable policies can be repriced each year and the prices are not going to be too far out. There are some challenges with this approach. When we think about physical risk, we are considering things like catastrophe events that can be low-frequency/high severity events.

It can be difficult to spot trends and some of those trends are non-linear. The example graph you can see in Figure 7 shows costs of damage from hazardous weather events in Missouri. It would be very difficult to draw a trend line through this data. It would be even more difficult if what you thought was a one in a 50 year event a number of years ago is now a one in 10-year event. You may not have the necessary data to spot the trend.

So in our work we need to think about how climate change influences the past data that we are using, the likely impact that climate change has on the trends in that data and about the outlook for those trends for the future.

We also need to think about the new risk that might arise with climate change. We will need to think about new risk that arises from transition risks. As an example, we need to consider the implications for motor insurers of the increased storing of energy in batteries. Do we know, say, which types of batteries are the ones that are going to catch fire? Do we wait for the claims data before we make the relevant decisions or do we want to try to look at some external advice and work out where we think those risks are before the claims arise?

We also need to consider liability risk. There is an increasing number of lawsuits. We have highlighted US municipality lawsuits against fossil fuel companies. That is clearly not the only source of litigation risk. The growth in litigation looks more exponential than linear.

When we turn to catastrophe modelling, we are considering a framework for setting impacts for physical climate change. A relevant paper was published by the Prudential Regulation Authority (PRA, 2019) with input from a working party across the industry. The paper outlines a framework that recommends six steps. The first step is to identify the business decision. To give

some examples, are you aiming for a short-term objective such as next year's stock price or a longer term objective? What are your strategic decisions, and so on?

The second stage is to define the materiality of the climate change risk. The third stage is to do your background research: what outside information could you use? The fourth stage is to assess the available tools for the analysis. The sorts of things that are relevant are the external catastrophe models that you might be using within your organisations.

Stage five is where you calculate the impacts. Then in stage six, you report on it and action it. For more information please read the wonderful PRA paper.

The final things I wanted to discuss were around risk management and capacity building. The PRA's recent supervisory statement did talk a little bit about risk management as one of the areas of focus for them. They talk about identifying, measuring, managing, monitoring and reporting on the risk from climate change.

In the practical guide we also draw on the area where risk management teams may need to help build capacity in organisations where knowledge of risk-related climate change is limited. It talks about provision of training, guidance, case studies and supporting research with the aim of building up carbon literacy within organisations.

What does all the foregoing mean for a risk management response? A risk management function may respond by assessing the potential climate change impacts, not just short-term, but medium and long-term as well. The impact on the firm's viability, strategy and capital requirements should be considered.

Should we be incorporating climate risks within the risk register, including classification and quantification and thinking about the potential mitigants and recommended actions?

Should we be carrying out forward looking stress and scenario tests to check the insurer's resilience to physical risk, transition risk and liability risk? Should we be thinking about making appropriate disclosures of current and future risks, perhaps under a framework such as the TCFD recommendations?

Perhaps we should be defining and assessing key performance indices and key risk indices to monitor exposures and emerging trends?

Those are the key areas we have pulled out for you today.

**The Chairman:** Our next speakers, covering life insurance will be David Ford and Yvonne McLintock. David (Ford) spent most of his working life at life insurers originally in the UK, but he now works internationally for Zürich Insurance. His current role involves supporting business units across the globe in optimising and enhancing profitability from in-force life insurance portfolios.

His interest in the effects of climate change on life insurance therefore links the need to understand the risk profile with the capital needs for those portfolios. David (Ford) chaired the working party for the guide to climate change for life insurance actuaries which has just been published.

Yvonne (McLintock) has spent most of her career working in the life insurance industry and has both first and second line experience with insurance, reinsurance and consultancy. Her interest in climate change comes from a fascination with difficult to quantify areas of risk and the associated challenges. Yvonne (McLintock) was also a co-author of the guide to climate change for life insurance actuaries.

**Mr D. W. Ford, F.I.A.:** To continue the presentation, I will take you through some of the aspects of climate change that we want to consider in life insurance. I am pleased, as was mentioned, that the life insurance guide has just been published.

This evening I will look at the considerations relating to regulation, disclosure and enterprise risk management frameworks for life actuaries allowing for climate change. Yvonne (McLintock) will go into more depth on mortality considerations which are particularly relevant to life insurance.

To start, here are some questions that we pose as part of our thinking about what is relevant to life actuaries considering the impact of climate change. First, why should you do it? To what extent

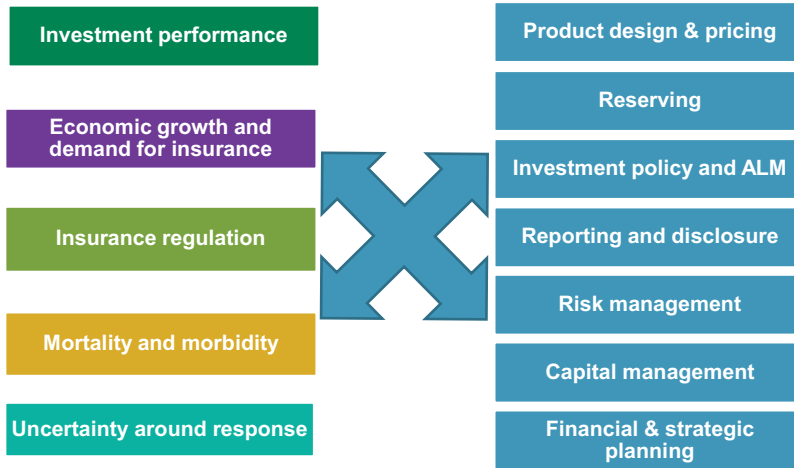


Figure 8. Climate change and life actuaries – who?

and over what period will climate change have an impact? What will society's response be? How effective will the response be? What will the financial impacts be?

Then there are questions of requirements: are you doing it because you must do so? What are your professional and regulatory responsibilities and those on your firm? Finally, the questions of practicality: what can we do as actuaries in our day-to-day work?

To help with these, we started by summarising some of the key areas of climate change or responses to it. These can help us consider which specific aspects of climate change are relevant to life insurance actuarial work. The five key areas are shown on the left side of Figure 8.

Changes to economic growth and performance in wider economies can lead to changes in the demand for insurance products and their pricing.

As long-term investors and providers of investment vehicles to customers we need to consider how climate change will affect investment performance, noting also the effects on regulation or the potential for long-term investment opportunities which arise.

We need to consider changes to mortality and morbidity and the uncertainty about them. We also have the question of changes to the insurance regulatory environment. Clearly, life insurance specific regulation will be important. That could include changes to capital stress testing or other solvency-related requirements. Or it could relate to changing product disclosure requirements on investment products.

Ultimately, we need to consider the overall uncertainty about timing, magnitude and response to climate change. That is going to be a key component of risk considerations and understanding possible ranges of outcomes.

Thus we have five key areas as shown in Figure 8. Here we are drawing out that there is a question as to how these areas link to some of the key topics with which we might be involved as actuaries in life insurance companies. You can see a list of those possible topics on the right-hand side of the Figure.

Considering the arrows in the middle of Figure 8 is basically left as an exercise for you although we have shown some relevant examples in the paper. We suggest that it is appropriate for people to start considering those elements of climate change on the left side of the Figure and how they might relate to particular types of activity on the right-hand side.

I will now discuss some aspects of regulation and disclosure. Much of this is common to both general and life insurance. I would note that research and activity and the consequent regulation around climate change is rapidly developing. Requirements will change over time and as actuaries we need to keep aware of this development.



The level of regulation explicitly and specifically related to climate change for life insurance actuaries and companies is developing. In terms of the current status we can consider:

- **Explicit, Current Requirements:** for actuaries - IFOA Risk Alert. For firms - increasing explicit references to climate change in pensions law and regulation may have an impact for some product lines. PRA expectations in SS3/19
- **Implicit, Current Requirements:** since actuaries and firms have explicit obligations to assess financial and strategic risks as a whole, are they adequately including consideration of climate change risk? What are their implied obligations to disclose climate change related risk / approach as part of wider shareholder reporting or to customers?
- **Current recommended / best practice:** eg TCFD disclosures, wider best practice around (non) investment in coal related industries. Firms' practice and disclosure here may be impacted by external lobbying

*...and regulators continue to engage on climate change risk*

Figure 9. Regulatory development and disclosure: where are we today?

SS3/19 sets out the PRA's expectations on banks and insurers' approaches to managing the financial risks from climate change. They see this as requiring a strategic approach and set out four key areas of expectation:

- embed the consideration of the financial risks from climate change in the firm's **governance arrangements**;
- incorporate the financial risks from climate change into **existing financial risk management** practice;
- use **(long term) scenario analysis** to inform strategy setting and risk assessment and identification; and
- develop an **approach to disclosure** on the financial risks from climate change



*How has your firm responded? How should you respond?*

Figure 10. UK regulation is setting out expectations for firms.

To consider the potential scope of regulation and disclosure and how climate change might impact it we can consider three groupings as shown in Figure 9. There are going to be those current requirements that explicitly mention climate change as a consideration either for actuaries or firms. But there are also implicit current requirements. For example, areas which require consideration and identification of key financial risks. They may not mention climate change, but it might need to be included because it might be a key financial risk in that context.

Finally, of course, we have current recommended or best practice, for example, around disclosures. The main point is that when considering climate change, we need to think about all three types of requirements.

I now move on to summarise some of the latest regulation and disclosure activity relevant to UK insurance firms. Figure 10 describes the latest PRA supervisory statement. This is the latest in a series of publications from the PRA and the Bank of England around their expectations relating to financial firms, not purely life insurers or purely insurers, in relation to considering the financial risks from climate change.

The bullet points in the Figure note the key four areas of expectation that they set out: governance, financial risk management, using scenario analysis and requirements around developing an

FS19/6 sets out the FCA's actions and next steps following a discussion paper on climate change and green finance. The actions and next steps are to:

- consult on new rules to improve climate-related disclosures by certain issuers and clarifying existing obligations
- finalise rule changes requiring Independent Governance Committees (IGCs) to oversee and report on firms' ESG and stewardship policies, and separate rule changes to facilitate investment in patient capital opportunities
- publish a feedback statement in response to a joint Discussion paper with the Financial Reporting Council (FRC) on Stewardship setting out actions to address the most significant barriers to effective stewardship
- challenge firms on potential greenwashing, clarifying expectations and taking appropriate action to prevent consumers being misled



Figure 11. The latest FCA feedback statement is also of relevance to life insurers.

approach to disclosure. I pose the questions at the bottom of the Figure: how has your firm responded to this supervisory statement? What can you do to help in responding to it?

The other PRA activity which is currently in train is the 2019 insurance stress tests. This year the PRA have added to their stress test the request to carry out exploratory climate change scenarios and for firms, in addition, to describe some of their work on climate change. These requests have gone to a small number of life and general insurers.

This time, for general insurers, the requested stresses include shocks both to investment assets and to claim events. For life insurers, for this exercise, only assets are being shocked.

Responses have now been provided to the PRA and those are currently under evaluation. A summarised response is expected to be forthcoming from the PRA.

We should also note the activity of the Financial Conduct Authority (FCA) in relation to climate change. The scope of the paper that I have highlighted in Figure 11 is in relation to climate change and green finance. It is therefore going to be of relevance to insurers, and particularly life insurers, in relation to their investment strategies. This applies whether they are investing for long duration insurance liabilities, or where they are providing retail investment products.

Those were some of the aspects of the UK regulation and how that it evolving. The TCFD has already been mentioned with respect to disclosure. Figure 12 summarises the four pillar approach that has been set out by the TCFD.

Just to reiterate, the TCFD is an international body. The idea is that it is proposing best practice and a common structure for voluntary disclosures related to climate change for companies. Their proposals apply to all types of companies, not just financial services companies. The guidance that they provide includes sector specific guidance. These proposals are gaining traction globally as a template for providing for disclosure.

As noted at the bottom of the Figure, actuaries might want to consider the information in the disclosures both in relation to the insurer for which they are working but also in relation to companies in which those insurers are investing.

Moving on, one of the further areas that we covered in the life insurance guide is in relation to enterprise risk management. We see this as important because in life insurance, even if as actuaries we are not yet ready or able to carry out detailed financial assessments of climate change impacts, we can use enterprise risk management frameworks to help the business to understand the risks related to climate change.

We will need such management systems to be flexible and responsive to emerging practice and thinking. In Figure 13, we have simply drawn together some of the key components that any

- At an international level, the Financial Stability Board (FSB) has created the Task Force on Climate-related Financial Disclosures (TCFD)
- The TCFD’s goal is to promote voluntary, consistent, comparable, reliable and clear disclosures around climate-related financial risk using a four pillar approach:

Governance	Strategy	Risk management	Metrics and Targets
Disclose the organisation’s governance around climate-related risks and opportunities	Disclose the actual and potential impacts of climate-related risks and opportunities on the strategy and financial planning of the business	Disclose how the organisation identifies, assesses, and manages climate-related risks	Disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities

- Supplemental guidance is issued at a more granular level, broadly categorised into financial and non-financial, with the financial sector further sub-categorised into banks, insurance companies, asset owners, and asset managers.

TCFD recommendations may be relevant both for life insurer’s own disclosures but also for the companies they invest in

Figure 12. How is practice evolving on disclosure?

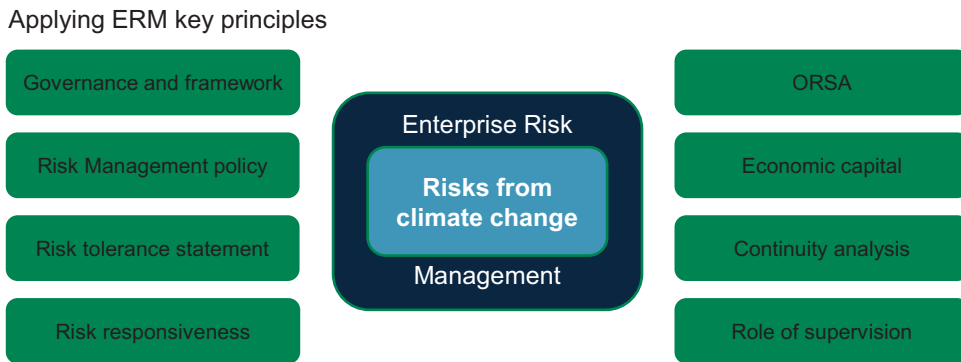


Figure 13. Developing risk management.

enterprise risk management framework would typically have. For example, it will have requirements around governance. A firm will need an articulated risk management policy. It will potentially use an Own Risk and Solvency Assessment (ORSA) and it will need to think about aspects such as economic capital and continuity analysis.

So for each of these areas the life guide sets out how that particular area might include consideration of climate change.

The key point here is to take climate change alongside other risks and build it into an existing framework rather than try to treat it in isolation in a stand-alone structure.

Figure 14 shows an extract from the guide. The blocks on this Figure give some examples which you can see in the guide about how climate change considerations would work for some of the capital components.

Finally, one of the key aspects of the enterprise risk management framework in which actuaries will typically be involved is economic capital management. Initially, you may want or be able to carry out detailed financial assessments. But even if you are not ready to do such assessments what you could do is try to map the relevant risks. Figure 15 illustrates this approach. The categorisations of risks along the top: physical, transition and liability risks, are typically associated with

ERM Component	Potential Climate Change Considerations
<b>Governance and an Enterprise Risk Management Framework</b>	The governance framework should enable climate change risk to be appropriately and proportionately assessed and included
<b>Risk Management Policy</b>	The policy needs to outline how the firm manages each relevant and material category of risk and describe how it brings together tolerance limits, capital requirements, processes, and monitoring and managing risk. Policies need to be flexible and extensive enough to incorporate climate change risk based on current understanding and as thinking evolves
<b>Risk Tolerance Statement</b>	Appropriately include climate change in the Risk Tolerance Statement, for example considering its impact on product types offered or not offered, the firm’s investment strategy for its shareholder investments or on behalf of clients, or climate change implications for its tolerance of demographic exposures
<b>Risk Responsiveness and Feedback Loop</b>	Appropriately include climate change consideration in forward looking emerging risk assessment, current Key Risk Indicator (KRI) assessment and backward looking ‘lessons learned’ from unexpected losses or control failures

Figure 14. Components of ERM – examples.

Example: A simple risk framework to combine climate risk factors with common insurance framework risks. This can help with ORSA and Economic capital considerations. **Actual ratings will vary by firm and business model...**

Risk Class	Physical	Transition	Liability
Market	Yes	Yes	Yes
Longevity	Yes	Less material	No
Mortality/Morbidity	Yes	Less material	No
Lapse	Less material	Yes	No
Counterparty	Yes	Yes	Yes
Operational	Less material	Yes	No
Strategic	Yes	Yes	Yes
Reputational	n/a	Yes	Yes

Figure 15. Risk identification.

climate change. We can try to map those against the risk components that you might see in an economic capital model for an insurer which are shown on the left hand side of the Figure.

We are aiming to obtain some qualitative views as to which of these things are most material. Is physical risk going to have a particular impact on longevity or on operational risk, and so on? This ranking and identification of the key areas will help serve as a guidepost as to where to develop and focus further activity.

The ratings in the figures are purely an example. The exact ratings will depend on the firm and its business model. We recommend that an exercise like this can help insurers and actuaries in moving towards modelling and climate change.

I will now handover to Yvonne (McLintock), who will talk to us about mortality considerations.

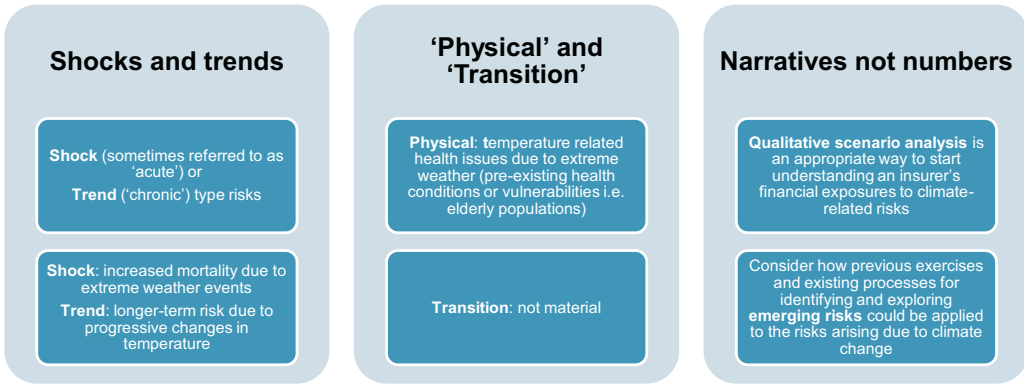


Figure 16. Considerations – examples for mortality.

**Ms Y. McLintock, F.I.A.:** I am going to talk about some of the material in the modelling section of the life practical guide. As it is a practical guide, I will do this by way of an example. I will begin with a question: how can we start to understand the impact of climate change on insurance liabilities that are contingent on demographic factors such as mortality?

One way to begin exploration is by scenario analysis. We will look briefly at some of the practical steps to consider. We start with multiple scenarios. With significant uncertainty, considering a wide range of possible outcomes could allow a more considered direction later. The message is not to narrow your options too early.

**In regard to time horizons:** is there a tendency to focus on the immediate period? Do we need to look at projected scenarios beyond our immediate planning period? If we can paint a picture of what might be on the horizon that can inform earlier action.

In regard to internal and external sources of information: can we ensure that climate change considerations are on the agenda of any internal research and development teams, and that they are given the right level of priority? Is the budget there? Can we contribute to and utilise industry-wide thinking? What academic papers already exist and are being worked on that contain relevant data or guidance?

**In regard to management actions:** we might want initially to think of a scenario without management actions but then consider what mitigations are already in place that will alter the outcome of the scenario. As an example: is the product development team considering how existing products are exposed to climate change, and do they have an action plan to monitor exposure and reduce it when and if appropriate?

**In regard to limitations:** we might not have all of the tools in our toolbox to achieve a perfect analysis first time around so we need to try to identify the drivers of change on demographic factors of interest including morbidity, mortality and longevity.

In the context of a mortality example, I will consider shocks and trends, physical versus transition and narratives not numbers as shown in Figure 16. Beginning with shocks and trends, is our exposure primarily shock based or trend based or a mixture? Mortality shock risk could be due to an exposure to extreme weather events, catastrophe type events, whereas mortality trend risk could arise from exposure to increasing mortality rates linked to longer term temperature changes.

The balance between physical and transition might be different for different firms, so it would be important to consider whether the risks and liabilities on your balance sheet are physical or transition. This can help you identify possible pathways and the climate future where your balance sheet is most exposed.

Sometimes considering narratives rather than numbers can be very helpful. As actuaries, it can be very tempting to try to dive straight into the numbers in order to try to size the risk.



## Linking emissions to levels of warming.....

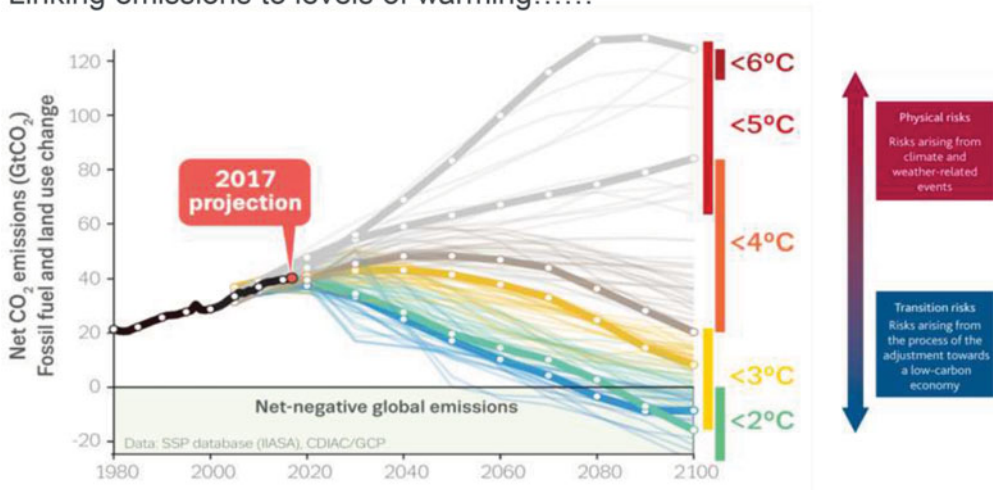


Figure 17. Representative concentration pathways.

In emerging fields, however, it could work better to build up the picture gradually and this can also help senior management to feel part of the journey.

Figure 17 is a reminder of the sort of RCP that were discussed earlier.

With those pathways in mind, let us say that the mortality risk at my company is all sitting under physical. So I would consider the RCPs with high physical risk from climate change rather than high transitional risk. Once I have identified the relevant RCPs, I would ask myself: what will the operating conditions look like under each of those? What will the government look like? What will climate change regulation look like? Will my customer base look different to what it looks like today? Who will see value in my products? Will my company's risk appetite change?

Once I have articulated that, I could then identify the future states that my company is most exposed to. At this point, I could explore possible impacts on my mortality contingent liabilities. For example, in my future state, will the government be funding the NHS? Will there be a focus on preventative healthcare initiatives and wellness? As well as health, I think about my products. How will my products have changed to meet the evolving needs of customers while still offering those customers value and returns aligned with my company's risk appetite?

This approach would leverage the internal R&D teams and other functions plus external research which I touched on earlier. The outcome will be an informed, qualitative analysis that can be used to start discussions with senior management about climate exposure.

It can also be used as a first step towards quantitative risk assessment. I want to use the assessment to broadly segment my in-force portfolio by risk exposure. So I could perhaps segment by age, location or impairment. I can then sensitivity test my in-force liabilities by stressing my mortality assumptions in the segments that I have identified as being most exposed to physical risk. I might even uncover some natural diversification benefits.

Over time, I can keep up-to-date with the modelling techniques and approaches in the area and refine my quantitative analysis to take advantage of advances in approaches.

Overall, my final objective is to ensure that my pricing, reserving and capital resources are sufficient to cover the risk.

Now I will discuss some of the modelling barriers. Figure 18 shows a few examples. There are various aspects to consider regarding the data: what can I infer from my historic mortality data? How long is the data history? What about data by region? Would I need to use various sources? Are those sources consistent? Are they compatible? Are they even credible?

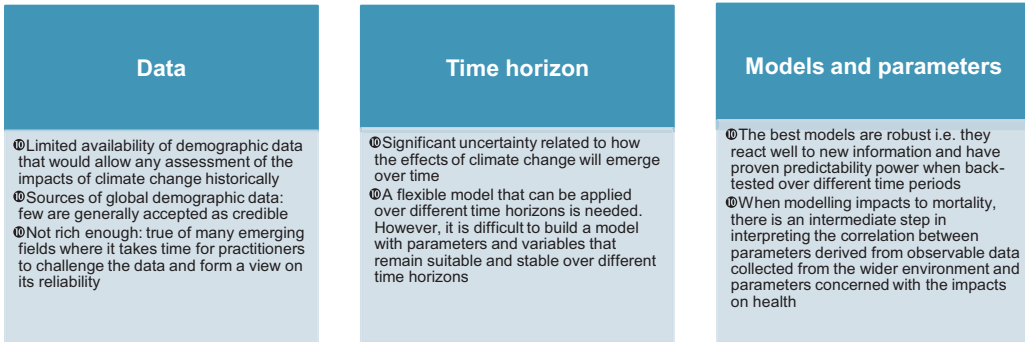


Figure 18. Modelling barriers.

## Questions on technical support

1. What are the most significant barriers to developing a narrative for the potential impacts of climate change?
  - A. I don't know where to start!
  - B. Lack of a framework within which to develop this
  - C. Lack of case studies from other firms or external providers
  - D. Insufficient time and resource
  - E. Insufficient internal engagement

Figure 19. Barriers to developing a narrative.

How would I distinguish the impacts from climate change from other drivers of change? For example, if I suspect a loose correlation between increasing mortality rates within a year and the number of days that fine particles in the atmosphere exceed the legal limits within that year, do I attribute this to climate change or could it be explained in a number of other ways?

I would need a lot more granular data in order to answer such questions.

There are also various aspects to consider regarding the time horizon. There is significant uncertainty in how the effects of climate change will emerge over time. My model needs to be flexible so that it is possible to set assumptions so that the model remains stable, regardless of the horizon that I choose to use.

There are a number of factors to consider regarding models and parameters: is my model going to behave? As new data emerges, I want to update my model. Am I going to have jumps in my results with unnecessary volatility until my model settles down?

I will leave you there with not many answers, but many things to think about. Thank you.

**The Chairman:** We are now going to move into an interactive element of the evening. David (Ford) and Mark (Rothwell) are going to take us through some questions to try to gain some feedback from you as to your preferred technical support.

**Mr Ford:** We are hoping to pose three questions and we are presenting a range of options for each. It is essentially going to be a multichoice exercise.

The first question is shown in Figure 19.

**Mr Rothwell:** The clear winner amongst the responses appears to be C: lack of case studies from other firms or external providers with a figure of 35%. There are also significant votes for B and for E.

**Mr Ford:** We do have Questions and Answers at the end. It would be helpful for those people have given particular responses to each of these questions to make some comments on them.

## Questions on technical support

2. What are the most significant enablers needed for you to be able to quantify the potential impacts of climate change?
  - A. Knowing where to start...
  - B. Availability of relevant underlying research
  - C. Sufficient time and resource to engage with the underlying research
  - D. Availability of solutions from external providers
  - E. Time and resource to apply this to our business model and risk profile
  - F. A consensus view on the potential impacts of climate change

Figure 20. Enablers for quantification.

## Questions on technical support

3. How might the IFoA help you in identifying and assessing the potential impacts from climate change?
  - A. Provide a digest and links to relevant research
  - B. Establish working parties to consider specific risk factor impacts
  - C. Create discussion forums around specific risk factors
  - D. Commission research from relevant experts

Figure 21. How might the IFoA help?

The next question that we want to ask is what would be the enablers to allow you to start to quantify the potential impacts of climate change in your firm? The alternative answers are shown in Figure 20.

**Mr Rothwell:** The most popular answers, with about 28% each, are B and E. There are also significant responses for C and F, but very little for A and D.

**Mr Ford:** The final question is about how the IFoA might help in this area. The question and the answers are shown in Figure 21.

**Mr Rothwell:** The most popular answer with 35% is B. The other answers all have responses of over 20% so there is fairly broad support for all the alternatives.

**The Chairman:** Mark (Rothwell) is going to outline how we can communicate the climate risks to stakeholders.

**Mr Rothwell:** Communication can be challenging when we are talking about climate change. Broadly, there tends to be a number of different ways of influencing the people with whom we talk. As actuaries, we rely very much on a logical and numerical approach.

That does not necessarily work with everyone. We can think about whether we have rapport with the other person so they can trust our advice or whether we are appealing to their own belief systems or even to their self-interest. These are perhaps important approaches when it comes to thinking about issues like climate change.

There was a lot of misinformation in the press or on social media about climate change 10, 15 or 20 years ago. People have often put themselves into a camp of believing climate change or not. It is very difficult to move away from something that you have built into your own belief system.

It is like persuading someone to change which football team they support. You can provide all the evidence that you like as to why they should pick Manchester United and not Liverpool, but it is not going to happen.

Climate change is what we might call a wicked problem. Wikipedia defines a wicked problem as “a problem that is difficult or impossible to solve because of incomplete, contradictory and changing requirements that are often difficult to recognise. Moreover, because of interdependencies, the efforts to solve one aspect of a wicked problem may reveal or create another.”

We see these characteristics with climate change. We might try to solve one aspect of climate change but we do not know whether it is causing another problem somewhere else. For example, we believe electric vehicles may be the way forward to prevent fossil fuel emissions, but in the future there are climate risks associated with the production of the batteries and in the manufacture of the vehicles.

There are all sorts of similar complex issues. For example, we could say that we should avoid too much beef or dairy but one of the things that I scratch my head about is do I put butter or margarine on my toast? I have a choice between dairy or palm oil but I do not know the right answer. Those are the sort of things that crop up and people do not necessarily know all the right answers. Therefore it is very easy to deny the underlying issue.

The IFoA published a paper back in March, “Climate Change Factors – an Introduction” (IFoA, 2019) which is a very good read. It says stakeholders may have hugely different views of the problem. They all think of different issues and solutions. The problem may never be solved definitively and may require changing resources through time to be addressed. This means that it is hard to define, understand and predict the risk before suggesting possible solutions. These solutions then are unlikely to last forever. At some point new solutions may need to be found.

The things we can do today to solve climate change may not be the eventual best practice. I guess an important issue is whether this observation stops people acting. Generally, best practice has to evolve over time. We have to set ourselves out on a course of action but there needs to be a feedback loop which checks that we are on the right track.

When we are talking about climate change, we need to think about what helps people to be engaged and what stops engagement. The March paper that I mentioned talks about five things that stop engagement. They call them the five Ds: Distance, Doom, Dissonance, Denial and Identity. There is some licence on the last one with the second letter being used.

Distance refers to the idea that climate change is not immediate and it is going to affect the next generation not mine.

Doom refers to the idea that if the world is going to end that stops people from acting. Dissonance refers to the idea that people feel that they cannot make a difference. There is clearly a close link between doom and dissonance.

Denial refers to the idea that people may feel that climate change is not their problem or that they might even benefit from it. Some politicians, for example, may take this view.

Identity refers to links to people’s belief system. Climate change may contradict their own belief system.

Denial happens when climate science rubs people up the wrong way and is a threat to someone’s world view. That could be personal or institutional. Social media supplies opportunities to spread disinformation.

The five Ss describe how engagement can be encouraged. Social is about building rapport and talking about the issue. Support is about emphasising opportunities to do something about the issue. Simple refers to using simple nudges to keep people moving in the right direction. Signal refers to showing visual evidence of progress. If someone can see over time how their carbon footprint has fallen, for example, it helps build positive feelings. Story refers to telling positive stories about what has been done.

Dealing with denial may involve appealing to different aspects of a denier’s own values and beliefs and not just relying on logic.

**The Chairman:** That concludes the presentational element of this evening. A questioner has asked whether the responses to the polls indicate that the majority of actuaries are waiting for someone else to tell them what to do.

I mentioned in my introduction that some of the practical guides are meant to try to stimulate thinking rather than provide direction.

**Mr Ford:** I hope those actuaries who are still waiting for somebody to help them on this are seeing some ways of thinking and structuring their first steps. It means thinking about the risk

management framework that you have seen from the GI guide or thinking about that mapping of physical transition and liability risks to economic capital as we have highlighted in the life guide. That might help you to engage with senior management.

**Mr Rothwell:** From my perspective, I guess that there is a lot to be gained from building your own awareness of the materials that are out there and things that can help you. The practical guides provide some relevant assistance. As David (Ford) said, they are not intended to be prescriptive but they are an aid to help you develop your own knowledge. There are links within them to some of the things that we have found most useful in terms of building our knowledge. This is moving forward apace and it is worth keeping up to speed.

**The Chairman:** Maybe I could pose a slightly different question to Yvonne (McLintock). One of the barriers that was cited was the lack of case studies. You started to talk through a practical example of how longevity could be considered. Do you want to expand on how that could be developed into an example that might help others to begin thinking about how they could start stress testing their assumptions, building climate risk into their thinking?

**Ms McIntock:** It came out in the answer to one of the survey questions that there is caution around whether there is enough research and data available. One practical step would be understanding what your internal risk and development and data analytics teams are planning to do over the next 12–18 months, really pushing that and agenda making sure it has visibility.

That relies on a lot of senior management engagement as well. There is a good opportunity if your company has set up a climate change committee, making sure that the chair is a suitably accountable person who really believes in this and wants to do it correctly.

**The Chairman:** We are ready to open up to questions from the floor.

**Mr M. G. White, F.I.A.:** I would regard a consensus view as dangerous if it stops thought. In other words, a continuation of scenarios, especially financial scenarios, would, I think, cause people to lose sleep and review their approaches.

**Mr Rothwell:** That seems a fair comment. I guess we talked a little bit about how best practice might evolve over time. A diversity of views will help to create a sort of genetic discovery of where best practice might lie. It is dangerous to coalesce around one view too soon.

**The Chairman:** David (Ford), do you have any thoughts on the relevance of investment returns within this particular framework?

**Mr Ford:** Clearly, the risk of long-term investment returns being disappointing could be an issue here. I think that was picked up in the life guide when it discussed the five key categories where climate change might impact. I suggest that people should be looking at that and appropriate roles in order to understand those investment performance aspects. I would also note that enterprise risk management and economic capital are part of the framework in which you will pick up these aspects.

As regards the specific detailed points about modelling investment returns, I would say that there is an element of “watch this space” in relation to the practical guide for investment aspects. When you look at the life guide, and maybe the general insurance guide as well, you will not find massive amounts about investment, although we do pick up some of the aspects, because of the three-way split by discipline.

**Mr N. S. Spencer, F.I.A.:** One thing I was trying to think of as kind of potential transitional issue might be air pollution. Does the panel think we have done enough work thinking about what the consequences of transitional change are for air? For example, the consequences if we move to electric cars and away from the internal combustion engine. Should this be an area of focus for the IFoA in thinking about impacts on mortality and morbidity?

**Ms McIntock:** We have not investigated any of those potential spin-off research areas in great detail. Our guide concentrates more on breadth of thinking. Air pollution, however, would be a good contender for a long list for consideration as one of the next areas of research.

**Mr Rothwell:** I think in a sense, in the climate change practical guides, we have tended to draw a distinction between air pollution and climate change. Within air pollution, you might, for example, think of diesel emissions within London.



Clearly, the sorts of issues we discussed in terms of transition risk for climate change apply in the field of air pollution as well.

Things like the transition to diesel-free emissions or banning diesel emissions within city centres are transition risks just as much as some of the transition risks that are specifically linked to climate change.

**The Chairman:** It is probably worth adding that a number of spin-off guides were written to supplement one of the previous practical guides to defined benefit pension schemes. One of these supplementary guides focused on mortality and longevity issues and associated issues, such as air pollution, were also covered within that guide.

**Mr R. W. Baird, F.F.A.:** With so much uncertainty, surely the biggest issue is that we do nothing? While we are talking about financial risk, for which we are well qualified, are we not also talking to experts in wider fields where we can help to generate greater risk awareness? We do not want to leave this until it is too little too late. We could certainly help in supporting risk analysis for other wider field's analysis of climate risk.

**Mr Ford:** I agree that understanding and, as appropriate, working with other disciplines and other fields is important. I would say that within the actuarial profession we are trying to do this. For example, we have just mentioned that there is a very good paper on mortality considerations produced in relation to the guidance for pensions actuaries. I would certainly say to look at that.

Equally, we should be looking at considerations for investment managers and some of the relevant documentation, where they are providing frameworks, say, for trustees and investment managers, about how they might consider aspects of climate change.

**The Chairman:** I think that it is worth adding that one of the initiatives that the resource and environment board has undertaken is to look to work in partnership with a number of other organisations. We run webinars in conjunction with the likes of the Principles for Responsible Investment (PRI), with environmental managers, plus a couple of other organisations, looking to leverage the expertise that has been developed by other professional bodies.

Are there any other questions?

**Miss T. Zalk:** My first three questions are more on the general insurance guide.

I did not see mention made of the purpose of insurance or actuaries. To put it another way, will insurance still have a reason and a social licence to exist? Realistically, the observance of norms which all insurance relies upon, for example, manageable levels of insurance fraud, may disappear.

Although nonlinearity was mentioned, and also the issue of whether data would be used appropriately, I did not note any systems dynamic thinking, or this approach mentioned as a potential way of approaching the issue.

Has the role that insurance as an industry has played to date been considered? What I mean by that is insurers have been insuring a number of industries and activities that have been contributing to climate change. We can consider the impact, for example, of a relatively recent policy decision to stop insuring coal plants.

Then I have a specific question for Yvonne (McLintock) and David (Ford). Has their guide included a reference to the global resources observatory project? I have seen in this presentation and other analyses an approach where people look at the IPCC report and try to get a handle on climate change. Then they look at their business model and their products. They try to do a mapping exercise, missing out the middle part of what does the world look like. They do not consider how fragile certain places are already. They then take the perspective of considering how climate change risk and potential events can impact a business model.

**The Chairman:** Mark (Rothwell), I am going to come to you first to answer the questions on nonlinearity, the social licence of actuaries and conflicts within the insurance industry.

**Mr Rothwell:** Some of those points highlight just what a big topic climate change is for insurance. We can talk of climate change in terms of two different overlapping aspects. One is around understanding the financial risks that arise from climate change. The other is related to the social good, public interest and what we should do from a moral standpoint.

I guess many of the guides consider aspects that are very specific to the role that actuaries play within companies. There is also a whole world out there in terms of what is socially good. Each individual company should be taking its stance with respect to social issues.

As actuaries, we can still point to the relevant risks that can arise from that such as reputational risk. In addition, we can still play our own roles within companies in terms of pushing for the social good.

**The Chairman:** Yvonne (McLintock), I will come to you to pick up on Tracey (Zalk)'s question. Please could you think about the idea of nonlinearity and the idea that climate change sits within a complex global system and what impacts might be felt in multiple dimensions?

**Ms McIntock:** David (Ford) will correct me if I am wrong, but I do not think we quoted the global resources observatory project you mentioned. I should be very interested to look at that study. I completely agree that there is an important middle step to tackle as part of the analysis.

There are examples of modelling where we try to break down the correlating factors and that analysis is moving in the direction of the machine learning area. In theory, if the data and research were there to support expert judgement setting of parameters, you could apply something similar. I do not think it is necessarily a new technique. It is a new application of existing techniques. In other areas of mortality modelling, trying to model longevity trends, for example, we have seen benefits for early advocates of certain ways of doing things. The early studies are published and benefit from academic and wider critique. Then shortcomings in the models are fixed by other people and you have a nice evolution of practices. In my view, that is ideally what should happen with climate change research, although I am also cautious about the possible shortcomings of people converging on one way of doing things which were mentioned earlier.

**Mr Rothwell:** I believe that the General Insurance Board is setting up a new working party on general insurance for social good. If you have an interest in the area, then consider volunteering for the working party.

**Mr Ford:** I would confirm Yvonne (McLintock)'s point. We have not specifically picked up the global resources observatory project in the paper. I think, necessarily, we have had to put a disclaimer in the paper and the life guide that there is a close off date. Things keep changing in this area, and one of the things that I did mention in my slides is that, as actuaries, we need to try to keep abreast of ongoing developments, whether it is to do with regulation, modelling, or other aspects relevant to climate change.

**The Chairman:** I will address one final question to the panel myself.

If there was an Extinction Rebellion within the actuarial profession, what radical things would it be doing?

**Mr Rothwell:** I do not think there is an easy answer to this question. I tend to think that the Extinction Rebellion is a response to a frustration that not enough is happening. Maybe we should be challenging ourselves. Are we doing enough? Are we highlighting enough? Is there enough focus being placed on the financial risks, both in the short term and the long term that arise from climate change? Are we understating it?

That ought to be the challenge for us. Let us not reach the stage where a degree of frustration forms an actuarial extinction rebellion.

**The Chairman:** David (Ford), what is your one radical suggestion for the actuarial profession?

**Mr Ford:** As Mark (Rothwell) says a body like Extinction Rebellion is perhaps motivated by frustration. It is a body that is pushing for very radical, high speed, change. From the actuarial viewpoint it maybe does come back to the question of how quickly are we looking to support or respond or anticipate change and to take action in relation to climate change?

**The Chairman:** Yvonne (McLintock), being radical, what do we need to do?

**Ms McIntock:** Being radical would be not accepting "No" within your company. If you do not have sufficient buy-in, to push something forward, organise a grass roots movement to force your voice to be heard.

**The Chairman:** Thank you very much. I will just sum up what we have heard this evening, Mark (Rothwell) started with a recap of the evidence of climate change. To my mind it is

significant. It points to an increasing likelihood that environmental limits, in this case in the form of climate change, are going to impinge directly on our social, environmental and financial systems. Therefore the work that we, as actuaries, do is not just going to be related to physical impacts but also to policy and regulatory responses. Mark (Rothwell) and David (Ford) both touched on the responses of the regulators.

Mark (Rothwell) also discussed the general insurance perspective. He noted the historic trends have seen much change, and if we are reliant on historic data we may need to adjust that data. He also reminded us that new sources of risk may emerge. That is something to which we are used but we need to be aware that the pace of change may well accelerate whether due to climate stress or through the transition to a lower carbon economy.

David (Ford) highlighted the issues affecting life insurers and started to draw out some of the connections between the underlying environmental, social and economic and regulatory drivers of change and how they can feed through to different areas of the work of actuaries.

The important thing to my mind is that regulatory change is heading in only one direction. As knowledge is gained, so regulatory standards are likely to be raised. It is also going to affect all areas of actuarial work.

Yvonne (McLintock) talked about considerations of climate change within the mortality context. She highlighted that practitioners can perhaps start with simple, qualitative approaches before moving on to quantitative scenario analysis, particularly as data becomes more available and the understanding of climate change evolves.

Finally, Mark (Rothwell) talked about how to communicate with clients about climate change. This to me is the biggest challenge. Climate change is something new for actuaries. It is not something that we were taught within our educational syllabus. We are having to become used to discussing it with clients.

But how do we learn? We learn by doing. We learn through discussion with our peers and our clients. Through that discussion, and through that shared knowledge and the case studies as they emerge actuarial methodology is going to continue to improve. Consequently, we can perhaps contribute meaningfully to the debate and the response to climate change.

May I close by saying that the Resource and Environment Board is very active in this space. We are sponsoring tonight's sessional event. We are continuing to add to the discourse on this topic, holding more events in the future.

It remains for me to say thank you all for your time this evening and for your input, both through the online polls and questions from the floor. Thanks to the staff of the IFoA for making sure that everything runs smoothly. Most importantly, thanks to our three speakers and the members of their respective working parties for all the effort that went into producing both the life and the general insurance practical guide.

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