

The Last Generation?

A CII research report

The Paris climate change conference and its implications for insurance



“

We are the first generation to feel the effect of climate change and the last generation who can do something about it.

”

President Barack Obama

August 2015 (In the run-up to the Paris Conference)

- 2 Executive summary**
- 4 CII introduction**
- 5 Foreword by Maurice Tulloch, Chairman of ClimateWise**
- 6 The conference and what it means for insurance**
 - Background
 - What is COP21?
 - Main debates
 - The Warsaw International Mechanism
 - Risks of climate change
- 14 Implications of climate change for insurance**
- 17 Following the conference and what it means for insurance**
- 23 About the author**
- 24 References**

The Chartered Insurance Institute (CII) Professionalism in practice

As the premier professional body for the financial services profession, the CII promotes higher standards of integrity, technical competence and business capability.

With over 117,000 members in more than 150 countries, the CII is the world's largest professional body dedicated to this sector.

Success in CII qualifications is universally recognised as evidence of knowledge and understanding. Membership of the CII signals a desire to develop broad professional capability and subscribe to the standards associated with professional status.

The CII works with businesses to develop bespoke, company-wide solutions that ensure competitive advantage by enhancing employees' technical and professional competence.

Individually, CII's members are able to drive their personal development and maintain their professional standing through an unrivalled range of learning services and by adhering to the CII's Code of Ethics.

www.cii.co.uk



If you have any queries regarding the content in this brochure please contact Customer Service.

The CII is committed to delivering a first-class service and, to this end, we welcome feedback on any aspect of your relationship with our organisation.

Please forward any views you may have on the service you receive, whether they are positive or otherwise.

We take all such comments seriously, answer them individually, and use them to help ensure that we continually improve the service we provide.

Policy & Public Affairs, The Chartered Insurance Institute, 20 Aldermanbury, London EC2V 7HY

tel: +44 (0)20 8989 8464

email: customer.serv@cii.co.uk

website: www.cii.co.uk

2 Executive summary

Issues going into the conference

- Climate change has important implications for us as insurers and individuals. The impending world summit in Paris on climate change known as COP21 therefore merits our attention.
- The most important issue is whether there will be a new international deal to succeed the abortive Kyoto Protocol, limiting greenhouse gas emissions (GHG's) to a safe level, consistent with a 2°C rise in temperature. The preparatory draft text is inadequate, and the potential pledges by countries on their own GHG's are insufficient.
- There are hopeful signs, since China and the USA the world's largest emitters, have both expressed the wish for a successful COP21, leading to decarbonisation in the longer term.
- However, a large number of issues remain to be resolved. Finance for developing countries to adapt to climate change and adopt clean energy is a prime one.
- The issue of direct interest to non-life insurers is the Warsaw International Mechanism on Loss and Damage, due to make an interim report at COP21, and for asset managers the discussions around finance.

The outcome: what does it mean for insurance?

COP21 achievements

- It delivered the Paris Treaty, supported by every country in the world, to hold the global average temperature to well below 2°C above pre-industrial levels and if possible to limit the temperature increase to 1.5°. This was an unexpected, most welcome goal.
- Each country is to reach a peak in its greenhouse gas emissions as soon as possible, and then reduce them rapidly. Overall, the long-term aim is to reach zero net emissions in the period 2150–2200.
- There will be a 'global stocktake' every five years, in the light of climate science and progress on emissions cuts, with a preliminary stocktake in 2018, and the first 'Paris' review in 2023. Countries must update their 'intended nationally determined contributions' prior to these reviews using the 'highest possible ambition'. Their plans will follow a uniform system and be independently vetted.
- To help developing countries adapt to climate change and adopt clean energy, the treaty promises at least \$100 billion a year finance by 2020, and to raise that from 2025 onwards. There will be a specific mechanism to address the 'loss and damage' that vulnerable countries face from climate impacts such as extreme weather, without assigning blame to any party.

Reality check

- The treaty does not come into effect until 2020, and many important details are still to be agreed. Progress on the Warsaw International Mechanism for Loss and Damage is already behind schedule, and the resources entailed in designing and administering the Paris Treaty are orders of magnitude greater. The issue of emissions from international transport was ducked.
- It is impossible to avoid reaching 1.5°C by about 2035. 2015 was the warmest year recorded, more than 1° above pre-industrial levels, and the rate of increase is 0.2° per decade. To develop new technologies and mass-produce them takes decades. Furthermore, fossil fuels are priced very cheap. Thus emissions will continue to rise, though perhaps not accelerate, for decades.
- For those reasons, it may be difficult to avoid exceeding 2° also. The only viable pathway may be to remove emissions from the atmosphere, for example by large-scale afforestation, *after* the thresholds have been passed.

4 CII introduction

As a professional body, the Chartered Insurance Institute is committed to guiding the profession with, and we recognise the critical importance of engaging the insurance industry and wider economy on the risks and implications of climate change. We joined ClimateWise, a group of insurance organisations committed to taking action to reduce the risk of climate change, in 2008 as one of its first non-corporate members. We believe that this is an issue which affects each and every one of us, and the insurance industry has the unique potential to shape not only corporate response and action, but global policy decisions as well.

As part of that thought leadership agenda, we published in 2009 our third major study into the effects of climate change for the insurance sector, building on previous works in 1994 and 2001. Designed to help insurance practitioners consider and quantify the risks associated with climate change across all lines, it was edited by Dr Andrew Dlugolecki, an insurance practitioner himself who was also a member of the Intergovernmental Panel on Climate Change that shared a Nobel Peace Prize in 2007. The report comprised eighteen chapters on various subjects around the topic, including the background science, flood risks, implications for SMEs, financial markets and sustainability.

Over the seven years since we published that report, record-breaking extreme weather events seem to have become the norm. 2012 alone was the wettest year on record in the UK, and many regions experienced major flooding not just once but several times through the year. We have just come back from the warmest Christmas in recorded history, and whole swathes of the country are battling floods once again. Something is clearly happening to our climate.

We believe that further increases in temperature are inevitable. Global warming will have an increasing and significant effect on the environment and the economy, with implications for virtually all aspects and lines of the insurance industry. And with those thoughts in mind, we have asked Dr Dlugolecki to cast his expert eye over some of the issues on the table at the crucial Paris Climate Change Conference and the implications of what was agreed. Maurice Tulloch, Chief Executive of Aviva UK General Insurance has also kindly agreed to provide a Foreword in his capacity as Chairman of ClimateWise.

Laurence Baxter
Head of Policy & Public Affairs
The Chartered Insurance Institute
January 2016

Foreword by Maurice Tulloch, ClimateWise 5

A portrait of Maurice Tulloch, a man with short brown hair, wearing a dark suit, white shirt, and a red patterned tie. He is smiling slightly and looking towards the right of the frame. The background is a blurred, light-colored setting.

Maurice Tulloch

Chairman, ClimateWise
Chairman, Global General Insurance
and Chief Executive Officer,
UK General Insurance, Aviva
January 2016

If the landmark COP21 climate change conference in Paris has not been enough to underscore the importance of climate change for all parts of the economy, the UK's warmest Christmas holiday on record just two weeks later certainly has. And observers looking for examples the physical evidence that our climate is changing beyond recognition need look no further than the floods across whole swathes of northern England and Scotland this winter.

Climate change is no longer a theoretical abstract discussion confined to scientists. Many have used the word 'unprecedented' to describe this winter's weather. What have been conventionally categorised as 'once-in-one-hundred-year' events are starting to happen ever more frequently. The threat is only going to increase and we can no longer ignore what is becoming common place. In the UK, five of the top six wettest years on record have happened since 2000.

The insurance sector is at the forefront of the response to these events. I prefaced our ClimateWise annual report this year by saying that given the continual growth in exposure to natural catastrophes, insurance cannot simply rely on a strategy of assessing and repricing risks. Our sector needs to become more systematic in its thinking: understanding the specific negotiations that went into the Paris Conference, and the outcome of that dialogue, are key to this.

Therefore, I believe this research from the Chartered Insurance Institute (a ClimateWise member since 2008) is a timely and vital component as we organise our thinking. It's hard to look further than Dr Andrew Dlugolecki (FCII and Chartered Insurer) when pulling together insight from both an insurance and climate change perspective and I am very thankful to both the CII and Dr Dlugolecki for bringing us this work. I look forward to their continuing contributions to our efforts in the crucial years to come.

6 The Conference and what it means for insurance

Background

International political efforts to tackle climate change started with the United Nations Framework Convention on Climate Change (UNFCCC), which was adopted during the Rio de Janeiro Earth Summit in 1992. This recognised the existence of human-induced climate change due to greenhouse gas (GHG) emissions, primarily from industrialised nations. However, the subsequent process has been dogged by major disagreements between power blocs and individual nations.

Kyoto

The first official conference under UNFCCC, Conference of the Parties Number 1 (COP1) took place in Berlin in 1995. A major step appeared to be taken in 1997 with the adoption of the Kyoto Protocol. This set out for the first time GHG emissions reduction targets for industrialised countries. It also created three 'flexibility mechanisms': Emissions Trading, the Clean Development Mechanism (CDM), and Joint Implementation to promote technology transfer from advanced economies, and also to take advantage of the cheapest 'low hanging fruit' opportunities to reduce emissions. The Protocol came into force only in 2005, and covered the period 2008–2012. The fact that the United States, the then largest GHG emitter, did not join up meant that all later negotiations had to be duplicated between signatories and others.

In some senses the Kyoto Protocol was successful. The flexible mechanisms did deliver emissions reductions, and overall the industrialised signatory nations reduced their GHG emissions in 2012 by nearly 23%, from the base year 1990, compared to their aggregate target of just 5%. However, global GHG emissions in 2010 were 23% higher than in 1990, because much industrial production moved to countries like China. At a technical level,

- Emissions Trading flopped in the EU, due to inadequate caps on the GHG's which industry could release;
- CDM projects were often misused to capitalise on the fact that some GHG's were already due to be phased out, and local communities were disadvantaged by some CDM projects.

The facts that Japan only met its targets by buying emission 'offsets' from other countries, and another major signatory, Canada, reneged on its targets without any penalty gave the impression that rich countries would rely on other countries to act on emissions, rather than inconvenience their own citizens.

Currently a small number of countries, including the EU, have signed up for a second term under the Protocol which terminates in 2020, with the decision on the commencement of a new system on the agenda at the upcoming Paris conference. However it is clear that any new agreement will have to be radically different. Countries will not accept a situation where other nations have no explicit domestic policies to reduce GHG emissions.

Copenhagen

Expectations were high that COP15 in Copenhagen in December 2009 would deliver a new agreement. Early drafts included an aim to restrict the future temperature rise to 1.5°C, and specified a global target for emission cuts by 2050. The outcome was disappointing: in order to generate a result which was proving impossible with very different negotiating positions in the hall, the few big GHG emitters excluded other countries from the discussions, and limited the actual content of the final communique. The outcome was the Copenhagen Accord which UNFCCC 'took note of'. The Copenhagen Accord:

- recognised the scientific basis for avoiding a temperature rise above 2°C.
- gave an undertaking that developed countries would provide additional funding to fund climate-related actions by developing nations: US\$30bn for the period 2010–2012, and to mobilize long-term finance of a further \$100bn a year by 2020 from a variety of sources; and
- added four new bodies to administer technical discussions and the deployment of funds, adding to the complexity of the entire process.

However, no new targets were set for future GHG emission reductions.

From Copenhagen to Paris

Subsequent negotiations have aimed to recover from that unsatisfactory situation stemming from Copenhagen. At COP16 in Cancun, it was accepted that deep cuts in emissions would be needed to meet a 2° target. Next, COP17 set a new goal, to bring all countries, both developed and developing, to the table to develop “a protocol, another legal instrument or an agreed outcome with legal force” applicable to all countries in the UNFCCC, to be adopted in 2015 and implemented from 2020.

At COP19 in Warsaw in 2013 Parties initiated the Warsaw International Mechanism on Loss and Damage associated with Climate Change Impacts (WIM), which is of interest to non-life insurers, and the Warsaw Framework for REDD+ (sustainable management of forests, particularly in respect of their inherent carbon content) which is of particular concern to developing countries.

In preparation for the next session in Paris, the countries have been asked to submit their intended nationally determined contributions (INDCs) towards meeting the overall objective of stabilising GHG concentrations to avoid dangerous climate change. These INDC's should represent “a progression beyond the current undertaking of that Party”, follow a similar methodology, be justifiable, and also cover adaptation to climate impacts.

Ominously, the preparation of the draft text for COP21 has been problematic, and the co-chairs openly stated that the draft was not good enough. The troubles were not limited to the burgeoning text and loss of consensus, the procedures were also plagued by procedural wrangling. Even if COP21 delivers an agreement on goals, it is likely that a large amount of the detail will be left for experts to finalise over the following years.

What is COP21?

COP21 is the twenty-first meeting of Parties to the UNFCCC. It will run from 30 November to 11 December in Le Bourget, near Paris. The conference is expected to attract close to 50,000 participants including 25,000 official delegates from government, intergovernmental organisations, UN agencies, NGOs and civil society. As well as addressing the question of a new international agreement on climate change, the proceedings will involve a number of ancillary workstreams, where sub-committees report back to the main Committee and membership.

The thousands of non-negotiators will try to engage the official negotiators, respond to their requests and inform other interested attendees about their own views, achievements on climate change issues, or products. These discussions will happen at fringe events, conference kiosks, and in any other way that seems likely to grab attention.

Main aims

- **A safe climate:** this Conference is crucial because it must result in an international climate agreement to limit global warming to below 2°. That is the overarching aim: an ambitious, binding agreement on climate change that applies to all countries. It must be said, that in the light of the untidy draft text, it is likely that COP21 will deliver only a framework agreement setting up requirements and tools, with a complementary agreement (detailing how the decisions in Paris can be put into operation) being approved before 2020.
- **Adequate INDCs:** the second aim is to ensure that every country has submitted its intended nationally determined contribution, and that it represents truly their best effort.
- **Climate finance:** will also be a crucial component. The Green Climate Fund has now commenced operations with nominal capital of US\$10m, but much remains to be done, particularly in terms of building trust among potential recipients of the funds.

- **Civil society:** local and regional initiatives developed by local governments, civil society organisations and businesses will be showcased to mobilise society at large, and supplement the contributions made by states.

Main debates at COP21

Adequacy of national actions to reduce greenhouse gases

As noted above, parties (i.e. countries) have been asked to submit their INDCs. These should represent “a progression beyond the current undertaking of that Party”, follow a similar methodology, be justifiable, and also cover adaptation to climate impacts. These are voluntary and non-negotiated, meaning that the process now relies on peer pressure to generate emission reductions.

As at 10 November 2015, 131 submissions from 158 countries had been received. These covered around 89% of global emissions in 2010 (excluding land use, land use change and forestry: LULUCF) and 88% of the global population. About two-thirds of these submissions also included an adaptation component. Independent analysis by Climate Action Tracker suggests that this will result in a concentration of GHGs that will produce a rise of 2.7° by 2100. This is a considerable improvement on the situation before INDCs, which corresponded to a rise of 3.6°, but is still uncomfortably above the preferred threshold of 2°.

According to the Intergovernmental Panel on Climate Change (IPCC), the total global cumulative emissions since 2011 that are consistent with a global average temperature rise of less than 2° above pre-industrial levels at a likely (>66%) probability is 1,000 gigatonnes (Gt: billion tonnes) of CDE (carbon dioxide equivalent). The aggregate effect of the INDCs means that global cumulative GHG emissions are expected to equal about 54% by 2025 and about 75% by 2030 of that 1,000Gt limit. The current annual rate of emission is around 50Gt CDE. Therefore, we can only continue at the present rate of GHG emissions for 20 years.

On the positive side, Climate Action Tracker has praised 25 of the key INDCs for the ambitiousness of the national target in the light of their current emissions and capability. Four small emitters have good or excellent targets. 10 countries (including some within EU, plus Brazil, China, India, and USA) are below par, and 13 (including Australia, Canada, Russia, and New Zealand) are inadequate. This could mean that there is scope for politicians to offer more in the negotiations in Paris. There are also very good economic and precautionary arguments for earlier cuts: since GHGs remain in the atmosphere for many decades, not creating them avoids that period of prolonged warming, and the consequent need for more drastic action later.

Many Parties identified conditions for the full implementation of their INDCs, such as: the level of effort undertaken by other Parties; the availability of market-based mechanisms; and access to enhanced financial resources and technology transfer. The main focus is on action in the energy sector, agriculture and forestry. Policies to be used included renewable energy targets, environmental taxes, subsidy reforms, fuel economy and energy conservation standards, programmes for low-emission agriculture and waste management, and measures to promote forest conservation and reduce deforestation. Looking at specific INDCs for China, USA and the EU:

China:

- puts forward important new goals for 2030. It reduces CO₂ emissions per unit of GDP (known as carbon intensity) by 60–65% below 2005 levels, increases its forest carbon stock volume by around 4.5 billion cubic metres from 2005 levels, and reaching a peak for CO₂ emissions in 2030 at latest.
- the new carbon intensity target builds on China’s existing goal of reducing intensity 40–45% by 2020. The increase in forest cover of 50–100 million hectares (124–247 million acres) of forest, or about three times the size of the United Kingdom.
- this would create a carbon sink, equivalent to taking 770 million cars off the road. Adaptation is given

some attention, particularly water management and the health sector. The afforestation policy is aimed at stemming desertification, as well as being for carbon storage.

United States:

- reduces net GHG emissions by 26–28% below 2005 in 2025, including LULUCF (equivalent to 24–31% below 2005). A major element is the Clean Power Plan issued in August 2015, which aims to ensure that fossil fuel-fired power plants operate more cleanly and efficiently while expanding the capacity for zero- and low-emitting power sources. When the Clean Power Plan is fully in place in 2030, carbon pollution from the power sector will be 32% below 2005 levels. An interesting feature is that emissions trading will be permitted between power operators; however
- the US will need to implement additional policies to reach its 2025 pledge, which embodies a faster reduction rate than before 2020. In addition, adaptation is not mentioned.

European Union:

- sets a binding, economy-wide target of at least 40% domestic greenhouse gas emissions reductions below 1990 levels. There is virtually no information on specific policies, yet observers consider that current policies are insufficient to deliver this, and there is no mention of adaptation.

Finance

This is one of the most contentious issues of the deal, especially considering that several developing countries have submitted INDCs that include actions conditional on the provision of climate finance resources, technology transfer and capacity building.

There are no specific goals post-2020, apart from the implicit one that the US\$100bn per year will be maintained and probably increased. Developed nations still feeling the pinch of the financial crisis and subsequent economic depression, and facing other issues too, are reluctant to provide substantial new finance. On the other hand, developing countries do not have the financial or economic strength to raise the funds needed, in particular, for climate related projects, e.g. clean energy requires greater upfront capital, before the benefits of lower fuel costs accrue. Potentially, the private sector could help to fill this gap, but the risk is much higher than for conventional projects, and would require a public sector backstop.

According to IPCC calculations, global investments in low-carbon generation, energy efficiency across sectors, and additional energy-related R&D all need to increase by as much as \$1.1trn per year between 2010 and 2029. Over the same time, annual investments in fossil fuel power generation (without carbon capture and storage) and fossil fuel extraction will need to decrease by over \$530bn (in constant 2010 dollars).

A recent OECD report claimed that mobilised climate finance in the context of the \$100bn a year goal for 2012–20 reached \$57bn in 2013–14. Of this aggregate, 77% addresses climate change mitigation only, 16% climate change adaptation only, and 7% consists of activities designed to address both adaptation and mitigation. Just one-quarter of the funds came from the private sector, essentially bank loans. This figure excluded ‘clean coal’ projects, as well as the Green Climate Fund (GCF) of the UNFCCC. The GCF only started in 2014, and made its first disbursements in 2015. Its objective is to support a transformational shift towards low-emissions and climate-resilient development pathways, by supporting developing countries to limit or reduce their greenhouse gas emissions and to adapt to the impacts of climate change at scale. Over \$10bn was promised but, to date, donors have delivered under 60% of the funds.

However, there is considerable scepticism among developing nations concerning promises of finance. Under the ‘fast start’ initiative announced at Copenhagen, developed countries were to provide \$30bn for 2010–2012. While the funders claimed to have over-fulfilled this promise, the recipients disagree. Climate finance flow is mandated under the UNFCCC to be new and additional, primarily grants and concessional

flows. Issues raised included double counting, mis-description of purposes, and recycling of official development assistance (ODA) items as climate finance. In addition, many of the projects proposed to the Least Developed Countries' Fund remain unfunded, and the Adaptation Fund is struggling to finance projects due to the depressed state of the carbon market from which it derives much of its funding.

Long-term goal: decarbonisation and greater ambition

The climate responds to cumulative emissions, so any pathway that does not bring emissions close to zero will result in risk continually increasing over time. The draft Agreement gives three alternative formulae for a collective long-term goal: to peak emissions, to achieve zero net GHGs or to reduce emissions by a reference year.

The text also suggests that such commitments could be adopted 'in pursuing decarbonisation of the global economy over the course of this century'. Agreeing on the decarbonisation goal would be a strong signal for oil and coal-dependent countries. The same section also notes that poorer countries have over-riding priorities to pursue social and economic development and eradicate poverty. The likelihood of this appearing in the final Agreement was raised by the joint statement of USA and China on September 25 about "the importance of a successful agreement that ramps-up ambition over time, pointing toward a low-carbon transformation of the global economy this century."

Ratchet and Review

INDC pledges submitted to date cover approximately 90% of world emissions and have lowered projected warming to 2.7°C from the 3.6° under currently implemented policies. Despite representing a progress, such results underscore the importance of further improving the Parties' pledges through a definite cyclical process of progress reviews and re-targets.

Scope

- **Bulk international transport:** GHG emissions from international aviation and marine transport currently account for over 5% of global emissions and, in view of their rapid increase, could be double that figure over the next decade. The issue is difficult to resolve since trading partners often have different views, and this item may not even feature in the final agreement that emerges.
- **Sustainable forestry management:** is a key issue for many developing nations. Poor practice is currently responsible for nearly 20% of global greenhouse gas emissions; more than the entire global transportation sector and second only to the energy sector. However, it has proved difficult to devise a way in which good management can be recognised through carbon credits. This issue will likely be left unfinished at COP21.
- **Pre-2020 ambition:** while COP21 focuses on GHG emission cuts for the period 2020–30, the gap between the first term of the Kyoto Protocol and 2020 also needs attention. Workstream 2 of the Conference addresses this, but there is little evidence that Parties are giving it much time. Several participants in 'Kyoto 1' have declined to join 'Kyoto 2' and even the EU's ambition for Kyoto 2 is rather weak: a reduction target of 20% for GHG emissions relative to 1990, whereas current expectations are for a decrease of 22.5%. In fact, the EU indicated it would be willing to set a target of 30% if other countries also raised their ambitions.
- **Market mechanisms:** there is still considerable interest in the use of 'market mechanisms' like Emissions Trading to help countries (and other actors, e.g. businesses) to interact and consequently reduce GHG emissions in the most economical way. However, in view of the various problems encountered with the Kyoto Mechanisms (see above), and the crowded agenda for Paris, it seems unlikely that there will be any material progress on the design of these tools for application between Parties. They can continue to be used internally, or within the EU.

Technology Transfer

Many developing countries state that the achievement of their INDC is conditional on getting better technology, particularly in the energy sector, and this in turn is dependent upon adequate financial support.

Loss and damage

The focus of UNFCCC has been on emissions reduction. However, it is clear that the climate is already changing, and this will disadvantage many Parties, often developing nations. While adaptation can reduce the adverse effects, there will still be economic loss and damage. A decision was taken at COP 19 in Warsaw to establish a Loss and Damage Mechanism termed the Warsaw International Mechanism for Loss and Damage' (WIM).

One option at COP21 is to allow the WIM workstream to continue. However, many vulnerable countries consider that omitting the issue from the high-profile nature of the Paris agreement would weaken its status.

The Warsaw International Mechanism on Loss and Damage (WIM)

Associated with Climate Change Impacts, WIM has a two-year workplan, and is due to report progress at COP21. The majority of the work on risk management is scheduled for 2016, so there is an opportunity for non-life (and even life and health) insurers and reinsurers to engage with the process. The aim is to consider how to address loss and damage to vulnerable populations associated with the adverse effects of climate change. The committee will make recommendations on risk management approaches (assessment, reduction, transfer, retention), including the use of financial instruments such as risk pooling and transfer, catastrophe bonds, and public sector disaster funds.

Reporting

It is likely there will be considerable debate about the reporting requirements under the Agreement. Similarly, there will be intense discussion about the specific arrangements for a periodic 'global stock-take' or review of progress towards meeting the goal of avoiding dangerous climate change.

Adaptation

The draft Agreement for COP21 embodies the importance of international support for adaptation efforts, due particularly to the vulnerabilities of the Least Developed Countries and Small Island Developing States. As well as requiring countries to submit adaptation plans ('communications'), the draft also suggests a periodic stock-take to assess progress. Since many countries that need to step-change their adaptive capacity to climate change lack the necessary financial resources, the adaptation issue is linked to the issue of international climate finance.

There are three smaller funds: the Least Developed Countries Fund (LDCF); the Special Climate Change Fund (SCCF); and the Strategic Priority on Adaptation (SPA); plus the Green Climate Fund (GCF). The GCF is meant to channel investment from public and private sources to developing countries to help them tackle climate change. Although the GCF mandates that the funds be split equally between adaptation and mitigation, adaptation received less than 10% of overall climate finance as recently as 2013. This reflects the rather complicated nature of adaptation needs, which are very specific to local situations, and cannot be easily replicated.

Developing country parties emphasised the "crucial" nature of adaptation and wanted it to be explicitly mentioned under the pre-2020 ambitions, noting the need to inject a sense of urgency.

Risks of climate change

Society is already vulnerable to climate variability, and extremes will exacerbate these effects and add new ones. The focus on 2° as a risk threshold arises because expected impacts increase rapidly if global temperatures rise by more than 2°, to a level at which adaptation is considered more challenging. Moreover, keeping within a 2° increase is considered a feasible target. There is also a possibility that scientists have not captured some critical aspect of the climate system in their models, and that expected change is greatly exceeded with catastrophic consequences (e.g. melting ice-caps). Many countries such as small island states that face the possibility of inundation consider 1.5° to be a more appropriate target.

The IPCC Fifth Assessment Report (AR5) considered future impacts at 2° and 4°. Even at 2°:

- there is predicted to be a significant risk of feedback effects (such as forest dieback, peat loss, tundra thaw-out) that could release carbon from natural storage, and so accelerate global warming.
- many unique species will face extinction below this temperature, and the productivity of staple crops in some regions will fall.
- human productivity will fall due to excessive heat.
- many settlements and conurbations will be seriously disrupted by flooding or lack of water.
- coastal flooding and land loss will displace hundreds of millions of people.

Often the effects can be overcome by adaptation, which is the case for Europe. However, in many low-latitude regions adaptation may not be possible, particularly for already vulnerable populations. The key sectors facing change are tourism, agriculture, and energy.

For climate change, it is particularly important to consider the outlier events and not just the most likely scenarios. As the average temperature or precipitation rises, the extreme values change much faster. Already the frequency of a hot month in the UK has risen eight-fold, from once in 100 years to once in 12.5 years and is expected to be once every three years by 2040. Similar trends are taking place in rainfall intensity, and are mirrored across the world, with clear implications for human health and economic damage. Sea level is also rising due to climate change. AR5 considers that the risk of extreme events becomes high at a global temperature rise of 1°. It is sobering to realise that 2015 is on track to break through that barrier (Met Office, November 2015), and that Hurricane Patricia in October 2015 was the strongest storm ever in the Western Hemisphere, with peak sustained winds of 320kph.

The climate system does not respond in a uniform way to warming either: continental interiors and high latitudes are likely to see much higher temperature changes, since the oceans cover a large part of the Earth's surface, and pull the global average temperature down.

Putting a value on the global costs of climate change is problematic for various reasons: assumptions about the science, judgments about the value of human life and non-monetary assets, as well as the weight to be given to future generations. It is also hard to include 'surprises'.

Examples of types of costs relevant to insurance.

It is estimated that the increased level of storm surge in Hurricane Sandy in New York in 2012 increased the damage by up to 30%;

In the UK, Expected Annual Damages (EAD) from flooding are projected to increase by 50% in the 2080s under the 2° climate change projection, 150% under 4° climate change projection, and up to 600% under a more extreme projection. The number of residential properties exposed to flood-risk increases from 860,000 today to 1.2 million by the 2080s under a 2°C increase, and to 1.7 million with 4°;

A recent study of future climate risk in the USA estimates that by 2030 coastal property damage from storms will increase by 20% due to more extreme wind speeds and sea level rises. Also, higher temperatures are likely to necessitate the construction of up to 95 gigawatts of new power generation capacity over the next 5–25 years [the equivalent of 200 coal or natural gas-fired power plants] costing up to \$12bn per year.

Finally, a study by the Economist Intelligence Unit considered the relevance of climate change to the asset management industry. The study looked at the value at risk (VaR) to the total global stock of manageable assets, up to the year 2100, as a result of climate change. Assets can be directly damaged by floods for example, but portfolios can also be harmed indirectly, through weaker growth and lower asset returns. Over such a long time horizon, there is also a wide range of possible future temperatures. The world's current stock of manageable assets is estimated to be \$143trn. The resulting expected losses to these assets (in discounted, present value terms) are valued at \$4.2trn: on a par with the total value of all the world's listed oil and gas companies. This is the average expected loss, across a wide range of possible future temperatures, duly weighted for their likelihood. With warming of 5°, the VaR could result in \$7trn in losses – more than the total market capitalisation of the London Stock Exchange – while warming of 6° could lead to a present value loss of \$13.8trn of manageable financial asset. These calculations take a private sector 'commercial' view of future money; a lower discount rate would create much higher VaR losses. It is worth noting that mitigation consistent with a warming of 2° reduces the average losses by two-thirds.

14 Implications for insurance of climate change

Climate change presents the insurance industry with new challenges in two dimensions:

- adaptation to changing weather patterns and other environmental effects. As discussed earlier, global warming has already changed the behaviour of extreme events, and this trend will accelerate; and
- mitigation policies to reduce GHG emissions. The UNFCCC process will transform the technologies that underpin our mode of life with consequent shifts in economic power between countries, and companies.

Both aspects create new risks and opportunities. The insurance industry can play an important role in both areas, but it needs to take on a more proactive role and collaborate with other stakeholders to prevent some risks becoming uninsurable, to safeguard its assets under management, and to take advantage of new markets. This applies to general insurance and life insurance with pensions and personal finance, though the issues are somewhat different for the three branches.

Non-life insurance

The 2009 CII study of climate change and insurance identified the key issues for general insurance, and subsequent reports (e.g. by CERES in the USA and the PRA in the UK) have elaborated or contextualised some of the points. However, these reports have not materially altered the messages.

- **Property underwriting:** estimates of future risk need to incorporate climate as a dynamic component. Climate change is already happening and major changes are anticipated in the future. Risk management should consider a range of climate projections, not rely on the output of a single model. Business interruption risks may be particularly affected, due to the global nature of business, and the reliance on public utilities.
- **Liability classes:** climate activists and lawyers have proposed that the providers of carbon-based energy could be held liable for the damage due to climate change. This line of reasoning is exceedingly weak, since 'attribution' (i.e. linking individual events to climate change) has proved almost impossible, apart from within the context of a few heatwaves. There are numerous other barriers to prosecuting such claims too. Nevertheless, Insurers should still be alert to whether their industrial clients are behaving in a responsible way.
- **Products:** non-indemnity products like weather derivatives and cat bonds offer a way to deal with climate variability in many sectors. Large elements of society are vulnerable to weather variability, but unprotected by insurance. Simplified products supported by easier regulation could assist large elements of society to deal with climatic risks, in the UK and also in developing countries.
- **Reinsurance and solvency:** underwriters need aggregate cover (to cope with recurrent events) as well as greater single-event cover. Often there is a mismatch between the calendar-year form of reinsurance and the underlying insurance (various inception dates). Such a mismatch between assets and liabilities proved fatal for banks in 2008. It is worth noting the convention is for risk assessments to be based upon retrospective data, without allowance for changes since the midpoint of the historical data. For example, Standard & Poor's suggested catastrophic losses could be undervalued by as much as 50%.
- **Claims handling:** insurers need to plan the capacity to handle a mountain of claims in a short period, as happened in France 1999 or the United States in 2005. The UK has not faced such a situation since 1990.
- **Risk management:** insurers should press for better public information about climatic hazards and exposure. Insurance products could be designed more effectively to encourage risk management by at-risk policyholders. Restitution after loss is an effective time to implement risk improvements. Claims-handling can provide valuable 'field' experience to determine future product design.
- **Product design:** insurers and advisers can guide clients towards climate-friendly products and processes through pricing and other features. They can assist the growth of clean energy through innovative risk transfer solutions developed in collaboration with the energy sector. Sectors particularly affected by

climate change like tourism, energy or farming may offer opportunities for innovation.

- **Procurement:** insurers could influence manufacturers, retailers and other bulk buyers towards climate-friendly products.

Life insurance and pensions

Physical risks are likely to become increasingly relevant over time, particularly for investments in real estate. Apart from material damage, which might in some scenarios become uninsurable, property will face more rigorous requirements on energy and water use, and accessibility may become an issue. In some countries, public sector bonds may be more risky; some American insurers already avoid coastal municipal bonds for example.

Health and death risks will shift as the climate changes. This may not be a great concern in the UK, but other countries and in southern British cities this may be a material issue for underwriters

The possibility of more near-term impacts through rapid changes in investor sentiment or market expectations relating to climate risk, and questions

Correlations between previously unrelated risks may appear, for example several countries or asset classes may be affected by the same event or policy.

Stranded assets may appear e.g. when changes in public policy, regulation or technology lead to changes in market sentiment. According to estimates by the Asset Owners Disclosure Project, only 7% of asset owners calculate the carbon footprint of their portfolios, and only 1.4% have an explicit target to reduce it.

Climate change may offer opportunities in some sectors such as like water treatment, clean energy and construction. There are also a number of alternative investment avenues, like carbon funds and catastrophe bonds.

Mortgages and housing

Mortgage finance is likely to be affected by climate change. In broad terms, mortgage lenders require security (the borrower's home) that is likely to maintain or increase its value over a 20-year period. This is long enough for climate change to be relevant, either from direct impacts, or from changes in house market sentiment.

A particular concern is the significant mismatch between the term of property insurance contracts and mortgages. Regarding flood risk, it is worth noting that Flood Re in the UK is intended to be phased out over 25 years, resulting in much higher premiums for flood risk areas.

Internal temperature control will become a much greater issue, to cope with heatwaves. This will affect older, high-rise property and cities especially, due to the 'heat island' effect.

Strategic Questions after COP21

- **Global/strategic:** is the overall result of COP21 good enough? Does it maintain underwriting risks at an insurable level? A 2°C rise would be highly desirable.
- **National/strategic:** does your country have a good plan, both to reduce emissions, and to adapt to climate change? If so, how does the national plan affect your own business plan? If not, can you do anything to improve it, collectively or individually?
- **Business opportunities/non-life:** does the WIM workstream that could provide an opportunity to do more business?
- **Business opportunities/life and pensions:** is there anything in the field of finance for mitigation (and perhaps adaptation) that gives an opportunity for unconventional investment as a diversification strategy? A second strand is that by working collectively, insurers as investors can influence the corporate sector towards climate-friendly products and processes, and real estate developers towards sustainable design, and at the same time improve their own returns.

Following the conference: 17 a commentary on the key issues

Overall

The crucial achievement for the Paris Treaty was that an Agreement supported by every country, that aims to handle the risk of climate change by:

- Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5° above pre-industrial levels;
- Increasing countries' ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development; and
- Directing finance flows to be consistent with a pathway towards low greenhouse gas emissions and climate-resilient development.

There are several reasons for the welcome outcome. UNFCCC learned valuable lessons from the fiasco at Copenhagen in 2009, and made considerable efforts to develop a shared understanding among negotiators over the following period. The USA and China, the two largest emitters, also developed a mutual common approach. Underlying this was the Structured Expert Dialogue (SED), an update of the IPCC's Fifth Assessment Report, which gave a stark warning to the policymakers of the risks of climate change, and described the emerging technology options.

Pre-2020

Recognising that the Paris Treaty does not start until 2020, and that emissions are already approaching dangerous levels, all countries are urged to strengthen (or submit) their 'Intended Nationally Determined Contributions' (INDC's) for reducing emissions and adapting to climatic impacts before then. Two high-level champions shall be appointed to act on behalf of the UNFCCC to facilitate this process.

Adequacy of national actions to reduce greenhouse gases by 2030

The current INDC's lead to a projected global emissions level of 55 gigatonnes of CDE (carbon dioxide equivalent) in 2030. To hold the increase in global temperature to less than 2°C above pre-industrial levels implies an aggregate of 40 gigatonnes. This huge gap means that the INDC's are far too weak.

UNFCCC stresses that Parties (i.e. countries) need to have progressively stronger INDC's for any hope of meeting the overall targets. They need to start reducing their missions as soon as possible. China is a key player. Already its emissions per capita are higher than the UK; with a population 20 times the size of the UK, it emits the equivalent of 100 years of UK emissions in just 5 years.

Co-operation

The Treaty envisages that Parties might 'share' achievements e.g. excess emission cuts, or upstream flood control, but the mechanism for doing this is unclear. In the light of the unhappy record of the Kyoto Mechanisms, this seemingly does not have a high priority. Tools like emissions trading can continue to be used internally, or within the EU.

Long-term goal: decarbonisation and greater ambition

The IPCC's Fifth Assessment Report found that a threshold of 1.5°C could only be achieved after overshooting the target, essentially by taking emissions out of the atmosphere, and even then only if policies for a low-carbon economy were introduced immediately.

Ultimately, the Paris Treaty aims to see a balance between global emissions and removals into 'sinks' such as forests before 2100. From the IPCC's analysis, even this bold aim is probably insufficient for a target of 1.5°. Nevertheless it sends an important signal to markets and policymakers.

Finance

To avoid problems with ratification in the USA, the Paris Treaty does not specify an amount for climate-related finance. Instead the accompanying text (‘the Decision’) impresses on developed nations that they need to enhance the provision of urgent and adequate finance, technology and capacity-building support to other Parties, with a concrete roadmap to achieve the goal of \$100 billion annually by 2020 for mitigation and adaptation, and increasing after 2025.

The Treaty notes the particular importance of finance for the preservation and extension of forests, and the need for a much stronger capability to facilitate the transfer of low-carbon technologies to developing countries.

Thankfully, no new UNFCCC funds were established, there already being a number in existence. As noted later, other actors also made important pledges under finance, mainly for clean energy.

Stock-taking (Ratchet and Review)

Another important provision is that Parties shall review their commitments every five years, with the intention of strengthening them. In view of the urgency, the first review will be in 2018, before the Paris Treaty takes effect, with subsequent reviews starting in 2023.

Technology transfer

The Treaty recognises the need to support the adoption of renewable energy, particularly in Africa, where Parties are less developed, and seeks to strengthen the ‘Technology Mechanism’ (the process and systems which will accomplish this, including training, regulation, institutions and technology transfer).

Loss and damage

The Paris Treaty includes the creation of a ‘mechanism’ to handle Loss and Damage, i.e. the financial losses vulnerable countries face from climate impacts such as extreme weather. It stipulates that this “does not involve or provide a basis for any liability or compensation”, in other words there is no claim against emitters.

The Treaty also envisages the Warsaw International Mechanism for Loss and Damage associated with Climate Change Impacts (WIM), as a key step towards in the process. Sadly, this is well behind with its research, which covers various issues of interest to insurers:

- Early warning systems;
- Emergency preparedness;
- Slow onset events;
- Events that may involve irreversible and permanent loss and damage;
- Comprehensive risk assessment and management;
- Risk insurance facilities, climate risk pooling and other insurance solutions;
- Non-economic losses; and
- Resilience of communities, livelihoods and ecosystems.

Again, there was a valuable development outside the UNFCCC process (see below).

Adaptation

UNFCCC undertook to support developing and vulnerable countries design and implement appropriate action plans to address the adverse effects of climate change. In particular, there will be a Technical Examination Process on adaptation (in parallel to one on technology transfer), which will try to identify concrete opportunities for strengthening resilience, reducing vulnerabilities and increasing the understanding and implementation of adaptation actions through best practice.

Reporting

Another key confidence-building step was the agreement that there will be a common methodology for reporting Parties' INDC's, with independent verification, to confirm that they are "fair and ambitious, in the light of ... national circumstances".

Reality check

Current climate

The global temperature is going to be about 1.1°C above pre-industrial levels in 2015. The trend in recent decades has been an increase of 0.2° per decade, so that we will cross the 1.5° threshold around 2035. Given the inertia in the climate system, this is inevitable; new policies or actions cannot affect the trend before then.

Some research suggests that ice sheets may be more sensitive to warming than was previously thought, which means that a strategy of 'overshoot, then reverse' on emissions may not avoid the risks of exceeding the thresholds, even if they are only crossed for a few decades.

Emissions trend

Figure 1 shows how many years we can continue at current emission levels before we cross the 1.5°, 2° and 3° thresholds relative to the 'natural' climate. The Table does not allow for the fact that emissions cannot be suddenly cut to zero, so it gives an over-optimistic view. For example, we could continue for 6 years at today's levels, and have a 66% chance of meeting the 1.5° target, but only if emissions miraculously fell in the seventh year to a sustainable level.

Figure 1: Number of years at current emission levels remaining in the global carbon budget for a given probability of meeting the specified temperature threshold:

Probability	For 1.5°C threshold	2°C threshold	3°C threshold
66 %	6 yrs	21 yrs	56 yrs
50 %	10 yrs	28 yrs	66 yrs
33 %	17 yrs	33 yrs	77 yrs

Calculations by Carbon Brief based on data contained in the IPCC AR5 Synthesis Report.

Even to meet the 2° target would require major changes to the economy in the next twenty years. We can only afford 21 years at current emission levels and still be fairly sure (66%) of staying under that target.

So, although there is unanimous agreement on the temperature thresholds, it will mean enormous changes if we are to achieve them.

Government policy

Many governments and industries are dependent on fossil fuel, and changing to clean technology will require a transformation, even a disruption, of current mindsets. Even in the UK, the Westminster and Edinburgh administrations are still supportive of oil exploration, despite the clash with emissions policy and the prospective fierce competition from cheaper producers wishing to maximise their revenue before alternative technologies and emission targets close their markets.

Often other objectives are given priority over emissions reductions, as with the recent UK decisions to weaken the insulation standards for new homes, and reduce incentives for clean energy.

Intrinsic weaknesses

Our carbon footprint

The conventional way of measuring a nation's emissions is by calculating the emissions produced domestically. However, this is not a sound method when patterns of trade are shifting enormously, particularly through the off-shoring of manufacturing and extractive industries. Thus, the Committee on Climate Change reported that whereas the UK's domestic emissions had fallen by 21% between 1990 and 2010, partly through positive emission-reduction policies, but also through industrial restructuring, imported emissions more than offset this, such that the UK's carbon footprint grew since 1993 by an estimated 10%. In fact the UK is one of the world's largest net importers of greenhouse gas emissions. At a time when business is being asked to review its supply chain for sustainability, the government could be accused of ignoring this in its trade policy.

The true (social) cost of carbon (SCC)

Many governments (including the UK) give subsidies to fossil fuel producers or consumers. Further, the market price of fossil fuel generally carries no surcharge to reflect the probable cost of the damage it will impose through its emissions while they remain in the atmosphere (its social cost). Naturally there are different views on what it should be. Current UK Government guidelines are that the SCC is £30 per tonne of CO₂e, although some research suggests the value could be several times that level. This compares with the current price of around £6 in the EU Emissions Trading Scheme, which is clearly too low to stimulate significant changes in business practice, and far from the real value.

International bunkers

There is no mention of international transport i.e. aviation and shipping in the Paris Treaty, yet by some estimates these sectors could produce around 10% of global emissions by 2050, which would impact seriously on the goal of zero net emissions after 2050.

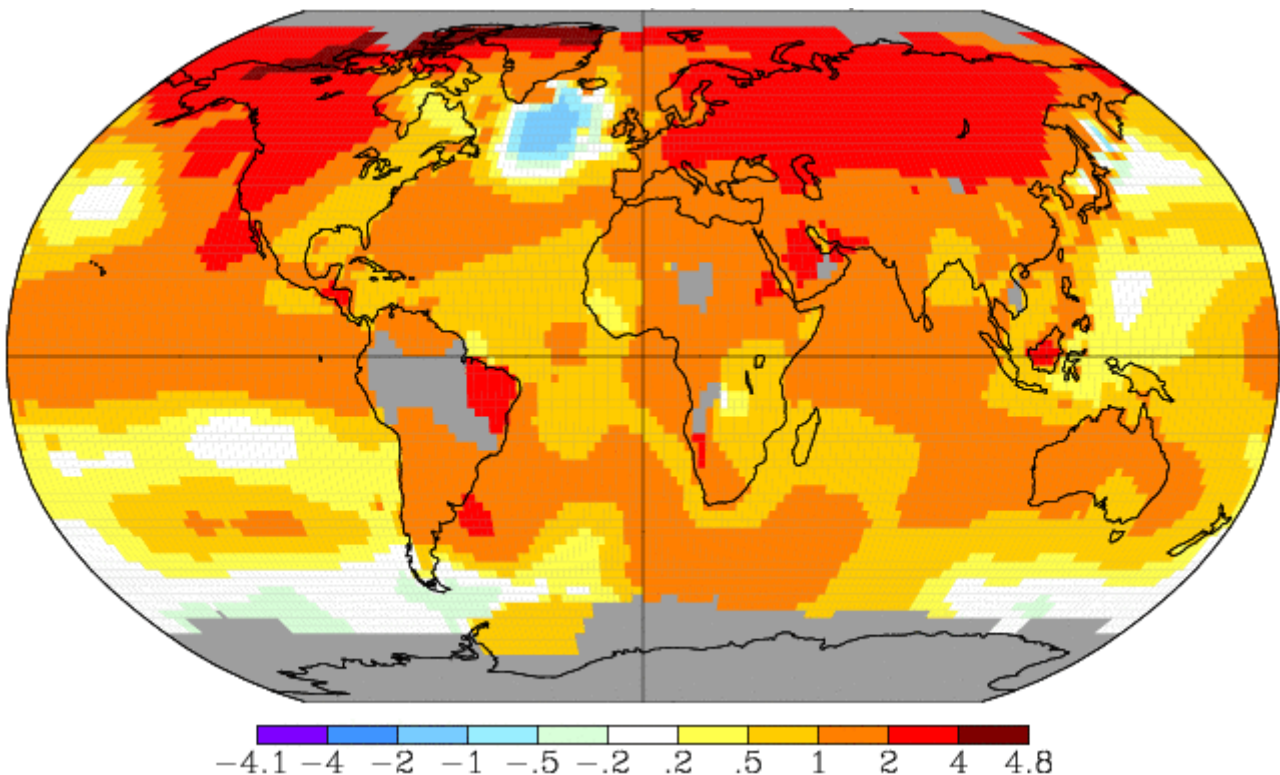
Prospects for insurers

Recent weather events confirm the predictions of the 2009 CII report on climate change; the weather will become more extreme. The UK record for the amount of rainfall in a 24-hour period was broken in Cumbria over Friday–Saturday 4–5 December 2015. That month also smashed the record for average temperature since 1659.

The prospects are for more erratic, even freakish weather in the UK. Figure 2 shows that, while the climate around the world has been warming, sometimes very significantly, it has actually fallen quite markedly in the Atlantic, between Canada and the UK, placing us on the boundary of two divergent patterns.

The basis of the Flood Re system may need to be revisited, since flood risk may be changing faster than was anticipated.

Figure 2: Temperature change 2015 versus early industrial period (1881–1910)



Period is 12 months ending November. Grey areas represent insufficient data. Source: NASA.

One noteworthy insurance initiative publicised at COP21 was the G7 Initiative on Climate Risk Insurance, which aims to increase access to direct or indirect insurance coverage against the impacts of climate change for up to 400 million of the most vulnerable people in developing countries by 2020. According to recent estimates, only about 100 million people in developing countries and emerging economies are currently covered by climate risk insurance. Also known as “InsuResilience”, the initiative is to be implemented in close partnership between the G7 states, developing countries and emerging economies. The G7 intends to share risk with the private sector to the tune of several billion USD. The Munich Climate Insurance Initiative, a collaborative think-tank sponsored by the German government with seed funding from Munich Re, has played an important part in this development.

As noted earlier, the Paris Treaty has helped insurers, by refusing to link loss and damage from climate change with liability or blame from emitters. On the other hand, the WIM has been very slow to address the issue of how to manage the risk of loss and damage.

Implications for Investors

Thousands of pledges of action and hundreds of billions of dollars in commitments to emission reductions and resilience measures were articulated at COP21, ranging from electrification in Africa to emission cuts in forest countries and climate risk insurance.

Two key ones came from government, business, and mega-entrepreneurs, aimed at stimulating R&D into clean energy and delivering low-carbon technologies.

Twenty countries, including the UK, the US and Saudi Arabia, launched Mission Innovation to double investment in clean energy R&D from current levels of about \$10 billion. New investments would be

focused on transformational clean energy technology innovations that can be widely applied in the real world, and that would appeal to private investors.

The programme will be complemented by the Breakthrough Energy Coalition, backed by high-profile philanthropists such as Bill Gates (who has committed \$2 billion), Mark Zuckerberg, Richard Branson, and India's industrialist Mukesh Ambani. The intention is to bridge the 'Valley of Death' between promising concept and viable product, which neither government funding nor conventional private investment can do. This collective failure can hopefully be addressed by a dramatically scaled-up public research pipeline, linked to a different kind of private investor with a long term (patient capital) commitment to new technologies. The fields of interest include electricity generation and storage, transportation, industry, agriculture and energy system efficiency.

To develop new technologies and mass-produce them takes decades. Furthermore, fossil fuels are priced very cheap. Thus emissions will continue to rise, though perhaps not accelerate, for decades.

Asset managers should be alert for gradual shifts, affecting specific industries (e.g. mining, utilities, oil) and countries (e.g. Australia, South Africa, Middle East). Already some investors screen their portfolios for carbon intensity, using data from CDP and other sources. Research by Averchenkova suggests that this should be complemented by analysing the country/policy risk. Within G20 they identified three types of country, according to the credibility of their climate policies. This was overlaid by trade-dependencies, in that one major country can affect other nations by its own policy.

Some climate risk 'solutions' like nuclear power, carbon capture and storage and genetic modifications introduce other risks. Many of these risks are actually uninsurable, being too difficult to quantify, or too great in potential liability, or introducing moral hazard. Insurers and investors can play a valuable role in exploring such issues and communicating them to policymakers, so that the world does not end up with a new set of unintended consequences.



Dr Andrew Dlugolecki FCII Chartered Insurer

Dr Andrew Dlugolecki FCII, Chartered Insurer is an accomplished insurance expert on climate change. He began his association with scientists on the issue in 1987, building on his experience since 1974 of rating UK motor and household business for the influence of weather. In 2009 he was recognised by the Intergovernmental Panel on Climate Change as one of those who contributed significantly to their winning the Nobel Peace Prize. He has chaired three studies on climate change and insurance for the CII (the most recent being *Coping with Climate Change* published in 2009), and has served on numerous influential committees about the problem.

24 Reference

Averchenkova, A. and S. Bassi, *Beyond the targets: assessing the political credibility of Intended Nationally Determined Contributions (INDCs)*, ESRC Centre for Climate Change Economics & Policy, Grantham Research Institute on Climate Change and the Environment, December 2015.

Bloomberg et al, *Risky Business: The economic risks of climate change in the United States*, Risky Business Project, June 2014.

Carbon Brief, *International Policy, Six years' worth of current emissions would blow the carbon budget for 1.5 degrees*, 11 November 2014.

Ceres, *Insurer climate risk disclosure survey report & scorecard: 2014 findings & recommendations*, October 2014.

Climateactiontracker.org – website. Independent scientific analysis produced by four research organisations tracking climate action and global efforts towards the globally agreed aim of holding warming below 2°C.

Davis, S. and K. Caldeira, “Consumption-based accounting of CO₂ emissions,” *Proceedings of the National Academy of Sciences of the United States of America*, vol.107 (12), pp.5687–5692.

Dlugolecki, A. et al, *Coping with Climate change: a changing climate for insurance*, London: The Chartered Insurance Institute, 2009.

Earth Negotiations Bulletin COP21 Final. vol.12 (663). International Institute for Sustainable Development (IISD), December 2015.

Economist Intelligence Unit, *The cost of inaction: recognising the value at risk from climate change*, 2015.

Hansen, J. et al., Ice melt, sea level rise and superstorms: evidence from paleoclimate data, climate modeling, and modern observations that 2°C global warming is highly dangerous. *Atmos. Chem. Phys. Discuss.*, 15, 20059–20179, 2015.

International Institute for Sustainable Development (IISD), “Summary of the Bonn Climate Change Conference,” *Earth Negotiations Bulletin*, vol.12 (651), 26 October 2015.

King, D. et al, *Climate change: a risk assessment*, Cambridge University: Centre for Science and Policy, 2015.

Komanoff, C. and M. Gordon. *British Columbia's Carbon Tax by the numbers*, New York: Carbon Tax Center, December 2015.

Leifert, H., “Sea level rise added \$2 billion to Sandy's toll in New York City,” *Eos*, 96, 16 March 2015.

Meteorological Office (United Kingdom), *Time series of Central England average monthly temperature*. Updated daily, accessed 21 December 2015.

_____, “Did climate change have an impact on Storm Desmond?” Blog, 7 December 2015.

_____, “Global temperatures half way to 2°C,” Press Release, 9 November 2015.

Nakhooda, S., *Climate finance: what was actually agreed in Paris?* London: Overseas Development Institute, December 2015.

Organisation for Economic Co-operation and Development, *Climate finance in 2013–14 and the USD 100 billion goal: a report by the in collaboration with Climate Policy Initiative (CPI)*, 2015.

Organisation for Economic Co-operation and Development, Nuclear Energy Agency, *Carbon pricing, power markets and the competitiveness of nuclear power*, Paris, 2011.

Price, R., Thornton S. and S. Nelson, *The social cost of carbon and the shadow price of carbon: what they are, and how to use them in economic appraisal in the UK*, London: Defra Economics Group, 2007.

Prudential Regulatory Authority (United Kingdom), *The impact of climate change on the UK insurance sector*, 2015.

Sayers, P. et al, *Climate change risk assessment 2017: projections of future flood risk in the UK*, London: Committee on Climate Change, 2015.

Standard & Poor's, *Are insurers prepared for the extreme weather climate change?* May 2014.

Surminski, S. and J. Eldridge. *Flood insurance in England: an assessment of the current and newly proposed insurance scheme in the context of rising flood risk*, Grantham Research Institute on Climate Change and the Environment Working Paper 144, 2014.

United Kingdom, Department for Food and Rural Affairs, Committee on Climate Change, *Reducing the UK's carbon footprint*, April 2013.

United Nations Framework Convention on Climate Change, *Report on the structured expert dialogue on the 2013–2015 review*. FCCC/SB/2015/INF.1.

United Nations, Intergovernmental Panel on Climate Change, *Fifth assessment report*, 2014.

The Chartered Insurance Institute
42–48 High Road, South Woodford,
London E18 2JP

tel: +44 (0)20 8989 8464

fax: +44 (0)20 8530 3052

customer.serv@cii.co.uk

www.cii.co.uk

 Chartered Insurance Institute

 @CIIGroup

© The Chartered Insurance Institute 2016
CHARTERED FINANCIAL PLANNER, APFS, DipPFS,
CertPFS and Cert CII are registered collective
marks and THE CHARTERED INSURANCE
INSTITUTE, CII and the CII logo are registered
trade marks of The Chartered Insurance Institute.