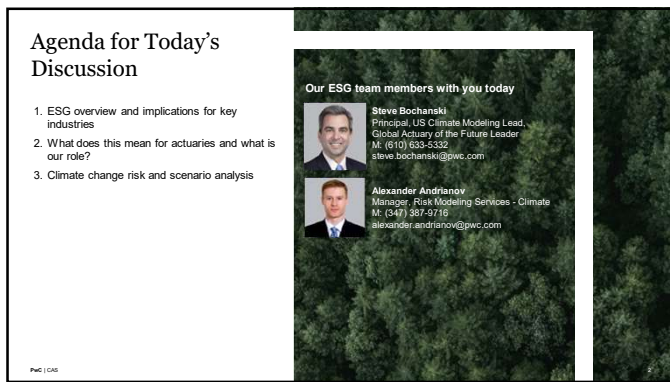
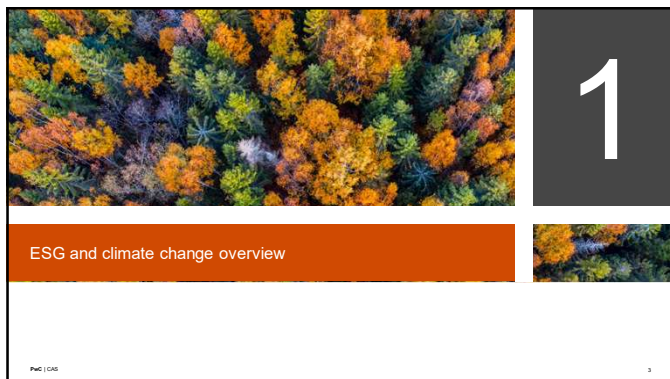




1



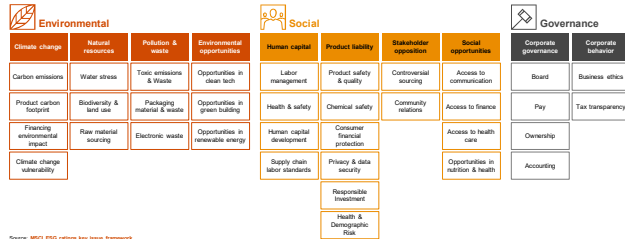
2



3

The three pillars of ESG

For many people, ESG brings to mind environmental issues like climate change and resource scarcity. These form an important element of ESG, but the term means much more. It also covers social and governance issues.



4

Social issues in insurance underwriting

Although the primary focus and main activities within ESG is within the environment pillar, there are significant social issues which should be considering within insurance underwriting. Specifically, emerging issues should be considered in products and services offered by insurers, in addition to considerations related to workforce culture, inclusion and diversity.

Proxy Discrimination	Bias in Insurance Product Value Chains	Climate Change Impact on Demographic Groups
Insurance companies increasingly access greater data and rating information about potential customers in order to appropriately segment the market, charge a fair price for risk and remain competitive. The risk rating process has expanded significantly to include multiple different rating factors to assess risk, ranging from location and occupation through to income and credit scores. Factors to consider include: • Identification of target markets for a product or service • Underwriting and risk classification • Pricing • Zip codes or other geofactors • Credit scores • Education and occupation	The insurance value chain includes: product conceptualization, target market identification, pricing, underwriting, sales, marketing and distribution, claims management, inforce management, and operations. There is a significant protection gap for insurance in the US today, especially for vulnerable communities who likely need such protection the most. Factors to consider include: • Systemic bias in the market segmentation/target market identification process • Prevalence of diverse representation in distributions channels, e.g., agents and brokers • Cultural barriers that make insurance less attractive to some groups, e.g., focus on funding college rather than paying a benefit • Key challenges that need to be addressed to overcome systemic bias within the insurance value chain	The impact of climate change will likely not be felt equally among various demographic groups. Impacting the health, longevity, and property of different groups unequally. Factors to consider include: • Impact on mortality based on changes in the frequency of severity of extreme weather events • Impact on morbidity based on changes in air quality due to higher temperatures / increasing frequency of wildfires • Impact on mortality and morbidity based on changes in customer behavior - e.g. increased walking rather than driving / dietary changes to reduce environmental impact • Impact on pension or wealth portfolios of individuals who are invested in industries potentially impacted by climate change

PwC | CAS

5

5

Poll 1

Which of the following transition and liability risks is the biggest in your opinion?

A: Policy and legal

B: Technology

C: Market

D: Reputation

PwC | CAS

6

Overview of climate risks and opportunities

Climate changes risks and opportunities are typically considered across the following categories:

Transition & liability risks as a result of transition to a low carbon economy	Physical risks resulting from changes in the climate	Opportunities
Policy and legal - Increased carbon policy/pricing of GHG emissions - Enhanced emissions-reporting obligations - Mandates on and regulation of existing products and services - Exposure to litigation Technology - Substitution of existing products and services with lower emissions options - Unsuccessful investment in new technologies - Costs to transition to lower emissions technology	Market - Changing customer behavior - Uncertainty in market signals - Increased cost of raw materials Reputation - Shifts in consumer preferences - Stigmatization of sector - Increased stakeholder concern or negative stakeholder feedback Acute - Increased severity of extreme weather events, e.g. - Floods - Wind storm - Storms and cyclones - Wildfire - Storm surge - Hail Chronic - Changes in precipitation patterns - Changes in extreme variability in weather patterns - Rising mean temperatures - Rising sea levels	Resource efficiency - More efficient resource use - Move to more efficient buildings and modes of transport Energy source - Use of lower emission energy sources - Use of supportive policy structures - Use of new technologies - Participation in carbon markets Products and services - Development/expansion of low emission goods and services - Climate adaptation and insurance risk services Markets - Access to new markets - Use of public sector incentives Resilience - Resource substitution/diversification - Renewable energy programs, efficiency initiatives

PwC | CAS

7

7

Poll 2

Which climate risk is currently in the focus of your organization's modeling attention?

A: Not modeling climate change risks yet

B: Physical risk

C: Transition risk

D: Both physical and transitional risk

PwC | CAS

8



2

What does this mean for actuaries and what is our role?

PwC | CAS

9

Developing a sustainable underwriting approach - the role of the actuary

There are a number of ways that actuaries can be involved in the development of a sustainable underwriting approach, including establishing new processes and augmenting existing activities.

Client onboarding and distribution	- Additional ESG data required and sources of data, including validation - New metrics and scoring derivation, and methodologies for their validation
Business planning, portfolio steering, and management information	- Setting appropriate ESG targets - Considerations related to management information required for monitoring of ESG targets - Additional qualitative ESG considerations as part of business planning
Underwriting and new product development	- Considerations of how underwriting processes and portfolio management factors can be updated to include ESG factors - Considerations of how existing business strategies can be updated to incorporate ESG factors - Additional focus on ESG and product innovation through new business - Underwriting integration (including exclusions and / or road map to future exclusion) - Updating existing underwriting standards to include ESG factors - Monitoring of existing and new relationships to be improved to reduce ESG related risks - Feedback loops to claims management of ESG factors and experience
Claims management	- Consideration of ESG factors as part of claims analytics process, to understand how new ESG-related risks are emerging - Alignment of the claims journey with new ESG products and customers
Risk management	- Validation of ESG integration into underwriting models, and or consideration of new modeling exercises in relation to ESG factors - Reinsurance coverage evaluation

PwC | CAS

10

10



3

Climate change risk and scenario analysis



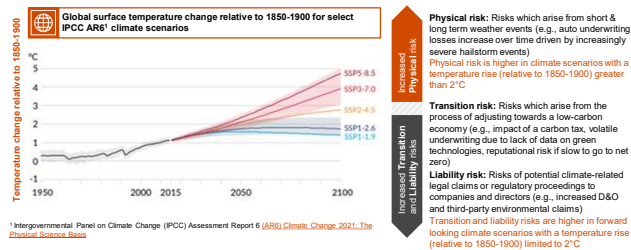
PwC | CAS

11

11

Climate change poses new business risks to insurance companies

Depending on future efforts to curb climate change, or lack thereof, insurers will be faced with a new set of risks to consider as part of ongoing operations.



12

12

Poll 3

What combination of climate change scenarios is the closest to the one that you are considering in your analysis?

A: Not analysing climate change scenarios yet

B: SSP1-2.6 ("sustainable development") and SSP5-8.5 ("fossil fuel-driven development")

C: The whole spectrum of the main climate scenarios (i.e., SSP1-1.9, SSP1-2.6, SSP2-4.5, SSP3-7.0, and SSP5-8.5)

PwC | CAS

13

Climate risk to insurers can be classified into three buckets

	 Underwriting Risks	 Investment Risks	 Operational Risks
Policy & legal	Increased climate-related litigation significantly increasing claim and defense costs for D&O coverages	Investment in sectors where bottom lines are impacted most by carbon taxes (e.g., parts of the energy sector) negatively affecting asset value.	Onerous enhanced reporting requirements leads to issues with adequately disclosing information required by regulators and investors
Market	Shifting demand on carbon assets lead to market movement away from fossil fuels, leading to reduced premiums from carbon intensive sectors.	Shift in customer preferences for climate friendly goods and services (e.g. electrical cars and transport vehicles) puts investments in producers of conventional, carbon-based goods and services under pressure.	Shift in customer preferences for sustainable companies diminishes demand for certain insurance products and services, as business strategies not sufficiently taking into account the long term impact of sustainability factors.
Technology	High claims ratios on new insurance products covering green technologies because of underpricing due to lack of data.	Investee companies or sectors invest in new low-carbon technologies, but some of those prove unsuccessful, depressing their asset values & creating credit risk.	Failure to take into account disruption of conventional industrial organization induced by technology-driven transition to low-carbon economy: new firms in the space demand insurance products/services where traditional players lack expertise, leading to a drop premium.
Reputation	PwC underwriting in economic sectors contributing to climate change damages the reputation of insurance carriers, making it difficult to attract and retain customers and staff.	Investments in certain companies perform poorly because of their reputation of contributing to climate change.	Insurees may prefer insurers who demonstrate climate risk awareness and have incorporated climate risk into their strategy publicly and in a way that aligns with their own values.
Acute	Properly underwriting losses increase over time due to increased severe weather events, if pricing not proactively adjusted.	Values of real estate portfolios decline due to properties being located in areas highly sensitive to the increase in extreme weather events.	Inappropriate strategy relating to acute physical climate risk mitigation reduces the insurer's competitiveness.
Chronic	Increase in temperatures may make some areas of the country uninhabitable, which can lead to reduced premiums.	Higher credit spreads on government bonds issued by countries that are highly susceptible to chronic physical risks.	Climate change-induced sea level rise renders office buildings and operations in vulnerable areas uninsurable.

PwC | CAS

14

14

General industry approach to climate change risk management and scenario testing

 Risk assessment	 Scenario testing	 Business integration
In the marketplace, we observe insurers conducting a comprehensive risk assessment of the risks to its business from climate change. This typically covers both transition risks and physical risks. Such a risk assessment may include: a. High/Medium/Low assessment of the business across risks types, investments, products and key assumptions b. Most often measured based on likely frequency and severity of the risk if it were to emerge c. Isolating the top 5 risks to the business and measuring their impact accordingly This risk assessment is used to inform the scenario testing exercise.	Insurers may perform scenario testing exercises after completion of the risk assessment; these typically focus on three specific areas of an insurer's business: 1.Asset portfolio – Calculate the impact of climate change on the investments held under different climate change scenarios and time horizons 1.Underwriting portfolio – Stress the key assumptions and processes used to understand and manage accumulations and exposure 1.Operational Impact – Assess the operational impact of extreme/intensifying weather events on corporate locations and employee homes Where possible, companies may seek to leverage existing scenario testing framework to streamline this process.	Insurers may assess how the results of the risk assessment and scenario testing exercise integrate into the business, specifically considering: a. Governance framework b. Risk management processes c. Business strategy d. Integration into ESG or other disclosures

PwC | CAS

15

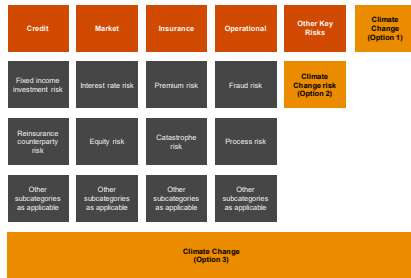
15

Ways to implement the risks of climate change into ERM framework

Option 1: Recognize climate change risk is a key risk similar to insurance, market and credit risks

Option 2: Recognize climate change could fit into a company's risk management framework as a new sub-risk category under an existing key risk category

Option 3: Recognize climate change affects financial risks as well as non financial risks such as operational risk



PwC | CAS

16

16

Poll 4

Where in the risk management framework do you place the climate change risk?

- A: Climate change risk is a key risk similar to insurance, market and credit risks
- B: Climate change is a new sub-risk category under an existing key risk category
- C: Climate change affects financial risks as well as non financial risks such as operational risk

PwC | CAS

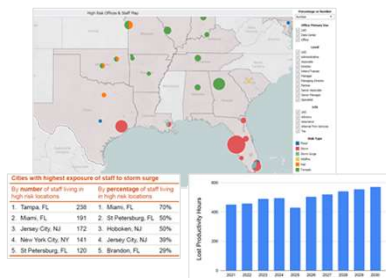
17

Operational stress testing approach

Potential operational stress testing approach

1. Use peril risk scoring datasets to assess office locations at High/Medium/Low risk of different perils
2. Use peril risk scoring datasets to calculate the number of employees at High/Medium/Low risk of different perils within each US zip code
3. Using climate change data trend forward these risk scores to understand how risk levels change under different time horizons and climate change scenarios
4. Reassess operational resiliency and business continuity plans under different climate scenarios

☒ Flood
 ☒ Storm
 ☒ Storm Surge
 ☒ Tornado
 ☒ Wildfire
 ☒ Heat

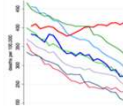


PwC | CAS

18

18

Approach to climate scenario risk modeling of a life underwriting portfolio

- 1 Analyze product data to understand **key driving assumptions**, e.g. mortality, morbidity, lapse etc.
 
- 2 Use climate scenario information and academic data to create realistic **stresses to key assumptions under different degree scenarios and time horizons**.
 
- 3 **Stress future product cashflows** and key product events (e.g. lapses) using updated climate adjusted parameters and cashflow model results and sensitivity analyses.
 
- 4 Recalculate key metrics by product line under stressed climate scenarios, including **estimated impacts to reserves and capital**.
 

PwC | CAS

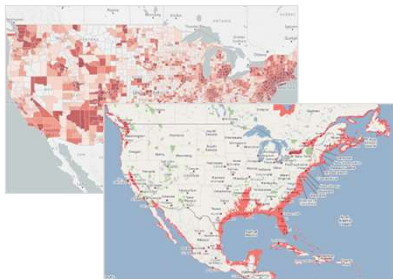
19

19

Key considerations for the integration of climate change into underwriting operations and scenario testing

Companies should consider the following questions:

- How do I expect climate change to **affect my key risk metrics in different locations** and what calculation mechanism should I use to assess this?
- What would my **current exposures look like when adjusted** to take into account the effect of climate change in a 2C or 4C global warming scenario at different time horizons?
- How should I **adjust my underwriting pricing today** to allow me to transition to my target portfolio incorporating climate change factors?
- How should I incorporate expected climate related change into my **reinsurance strategy** and reinsurance credit risk analysis?



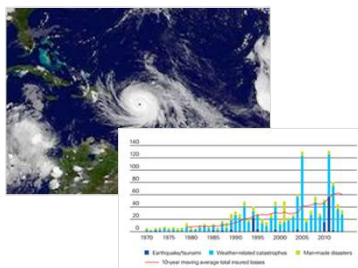
PwC | CAS

20

20

Physical risk example: Deep dive on changes to hurricane manifestations due to climate change

- Catastrophe models used by most insurers today are calibrated to generate losses expected over a 1-5 year time horizon (depending on the model/peril) and do not allow for the effect of climate change on the frequency and severity of weather events.
- Hurricanes are subject to three primary climate change related influences:
 1. Warmer sea surface temperatures could intensify tropical storm wind speeds, potentially delivering more damage if they make landfall. This could result in **more category 4 and 5 landfalling storms**, and lead to hurricane windspeeds increasing by up to 10%.
 2. **Sea level rise** is likely to make future coastal storms more damaging, as storm surge events occur more frequently as hurricanes push sea water inland.
 3. Hurricanes are expected to **track north more frequently** due to expanding tropics because of higher global average temperatures.



PwC | CAS

21

21

How can the results of catastrophe models be adjusted to allow for climate change impacts: "Bottom up adjustment" (1 of 2)

AIR has used a subsampling method to adjust the frequency of landfalling hurricanes and create a new collection of simulated hurricane seasons to reflect a future climate.

- Analyze literature to understand climate impacts on frequency and severity of landfalling events under different climate scenarios
- Use literature review to create landfalling event frequency targets
- Subsample by extracting seasons from the existing catalog that are likely to occur in a warmer climate, to hit landfalling frequency targets
- Recalculate aggregate loss statistics using pre simulated parent loss catalogue

Present-Day (1980-2006): 14 storms
 CSIRO (Late 21st Century): 19 storms

Annual Rate of Landfalling U.S. Events By Season and Intensity

Lead to an aggregate increase in modeled losses by 20% by 2050

PMC | CAS 22

22

How can the results of catastrophe models be adjusted to allow for climate change impacts: "Bottom up adjustment" (2 of 2)

RMS reweights the simulated years in its Year Loss Table ("YLT") for European Flood based on the seasonal change in the 95th percentile of daily maximum precipitation under climate change scenarios

- Derive projections of changes in the annual seasonal 95th percentiles of daily maximum precipitation under different climate scenarios and time horizons
- Reweight the years in the YLT such that the projected future distribution of precipitation for the scenario is suitably matched by the modeled distribution across the corresponding reweighted set of simulated years
- Recalculate aggregate loss statistics using pre simulated parent loss catalogue

Event ID	Rate	Mean	Std	Std	Exposure
1	10	500	500	500	10,000
2	10	200	400	800	5,000
3	50	200	300	400	4,000

Lower Bound (RCP2.6) AAL: 0.44% RFP 200: 0.31% RFP 200: 0.31%
 Upper Bound (RCP8.5) AAL: 1.75% RFP 200: 1.04% RFP 200: 1.04%

PMC | CAS 23

23

How can the results of catastrophe models be adjusted to allow for climate change impacts: "Top down adjustment"

UNEP FI calculates scaling factors based on available scientific data to scale the AEP curve at different return periods

Projected wind speed change for lower, middle and upper percentiles (%)

Power-law relationship between wind speed and economic loss (indicated by "value of a" showing the strength in relationship)

Projected tropical cyclone frequency change for lower, middle and upper percentile (%)

Scaling factors based on change in wind speed related damage due to climate change/climate change and socio-economic change (Ratio)

Future loss amount due to change tropical cyclone frequency and intensity (Financial Impact)

Loss amount from current AEP curve at different return periods (Financial Impact)

Key:
 Climate data input Insurance data input Analysis and output

Diagram shows illustrative calculation logic based on frequency/intensity only, for tropical cyclones

PMC | CAS 24

24

Poll 5

Which climate change risk will have the biggest financial impact on the world economy during the next 30 years in your opinion?

A: Physical risk

B: Transition risk

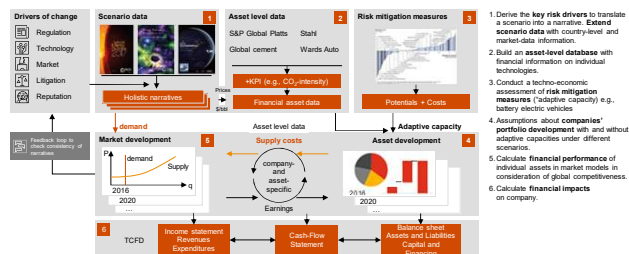
C: Both risks will have similar importance

PwC | CAS

25

Asset portfolio/climate change **transition risk** modeling approach

Example bottom-up model quantifies financial implication from climate scenarios:



PwC | CAS

26

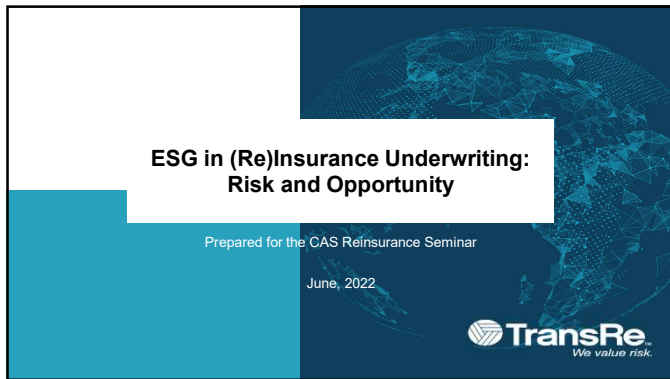
26

Thank you

pwc.com

© 2022 PwC. All rights reserved. PwC refers to the US member firm or one of its subsidiaries or affiliates, and may sometimes refer to the PwC network. Each member firm is a separate legal entity. Please see www.pwc.com/structure for further details.

27



28



29



30

... and Particularly in (Re)insurance/Finance

Marsh & McLennan Announces Carbon Reduction Commitments
Analysis: Buffett's ESG snub risks alienating Wall Street

FRANCE'S BIGGEST INSURER DUMPS GERMAN POWER GIANT OVER COAL
All Best Becomes Signatory to the ESG-Related Principles for Sustainable Insurance (PSI)

BEST'S SPECIAL REPORT
Insurers and Reinsurers: Ignoring ESG Factors Posing Reputational Risk

HANDING CLIMATE RISK IN THE U.S. FINANCIAL SYSTEM
Handing Climate Risk in the U.S. Financial System

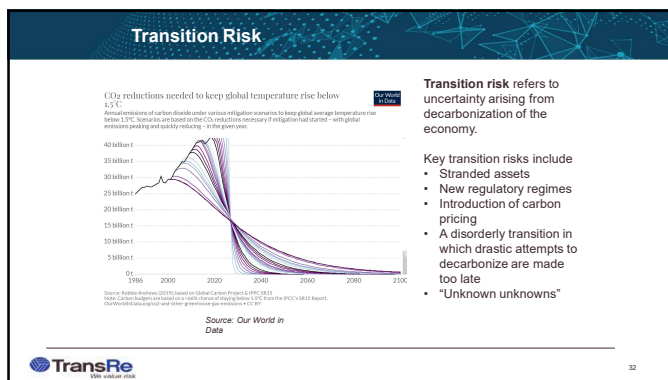
SUPERINTENDENT LACEWELL ANNOUNCES APPOINTMENT OF NINA CHEN AS FIRST-EVER DFS SUSTAINABILITY AND CLIMATE INITIATIVES DIRECTOR
Aligns sets climate targets for specific asset classes in the insured portfolio and strategically expands sustainability

Proposed Guidance for New York Domestic Insurers on Managing the Financial Risks from Climate Change
Aligns sets climate targets for specific asset classes in the insured portfolio and strategically expands sustainability

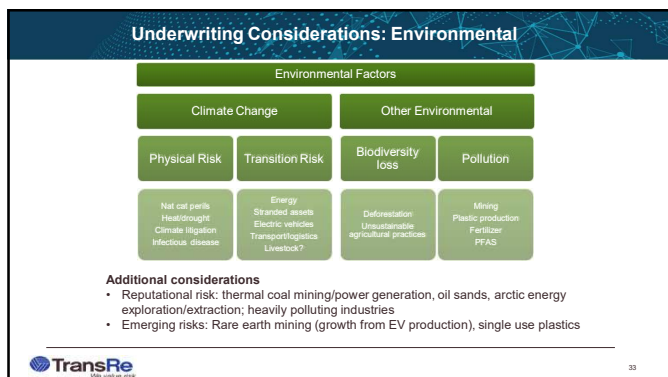
Investor Pressure Adds Momentum for Reinsurers to Integrate ESG Factors

TransRe
We value risk

31



32



33

Underwriting Considerations: Social

Social Factors

Human Rights	Human Capital	Privacy/Data Security	Health and Safety
Forced labor Child labor Human trafficking Indigenous rights	Worker safety DEI Employee treatment/development	Data governance Data protection Digital ethics	Firearms Controversial weapons (e.g., land mines) Tobacco products Opioids

Additional considerations

- Reputational risk: human rights violators, forced labor/unethically sourced materials in supply chains, unequal pay
- Emerging risks: DEI, workplace conditions (in "developed" countries)

TransRe
We value risk

34

34

Underwriting Considerations: Governance

Governance Factors

Bribery & Corruption	Management & Oversight	Ethics	Transparency & Disclosure
Illegal/unethical payments Money laundering	Director/auditor independence Board composition/structure Executive compensation/alignment Risk management	Anti-competitive practices Antitrust violations Unethical conduct Tax approach	Regulatory compliance Shareholder rights Transparent financial/public reporting

Additional considerations

- Accounting, fraud, critical incident risk management (e.g. Bhopal, BP/Deepwater Horizon, PG&E); new regulatory regimes

TransRe
We value risk

35

35

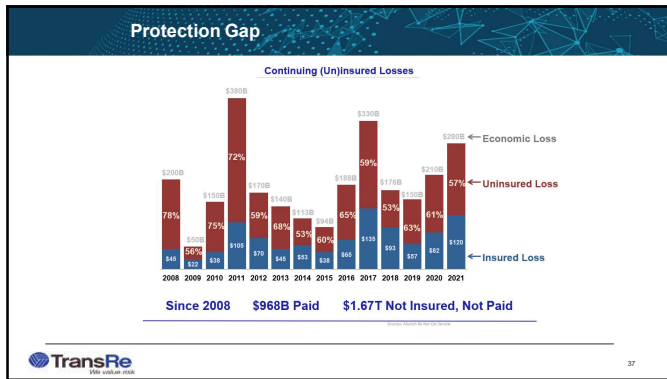
More Than Risk Management: ESG and Opportunities

- Decarbonization represents the biggest economic transformation since the Industrial Revolution
- \$23 trillion of investment required by 2030 to meet the 1.5 °C aspirational target of the Paris Agreement (WEF) – related assets will need (re)insurance
- "Climate is the biggest single opportunity I will see in my career in insurance, on both the underwriting and the investment side of the equation." – John Neal, Lloyd's CEO
- Scope: ESG insurance market is potentially \$100B+ and mostly untapped (large brokerage)
- What do ESG opportunities look like?
 - Renewable energy: construction, operation, guaranty, production hedging
 - Carbon offset/credit coverage \$50B market by 2030 (McKinsey)
 - Embedding offsets in current offerings (e.g., ILS, travel insurance)
 - Innovative financing products
 - Hydrogen; Nuclear/fusion?
 - Base case (reinsurers): renewables work their way into existing portfolios/treaties

TransRe
We value risk

36

36



37

On the Horizon

TNFD Taskforce on Nature-related Financial Disclosures Biodiversity

Accounting for insured emissions PCAF Partnership for Carbon Accounting Framework

NAIC Evolving disclosure requirements

TransRe
We value risk.

38

Thank you!

39
