

3rd Webinar on Climate Risk

18th March 2026

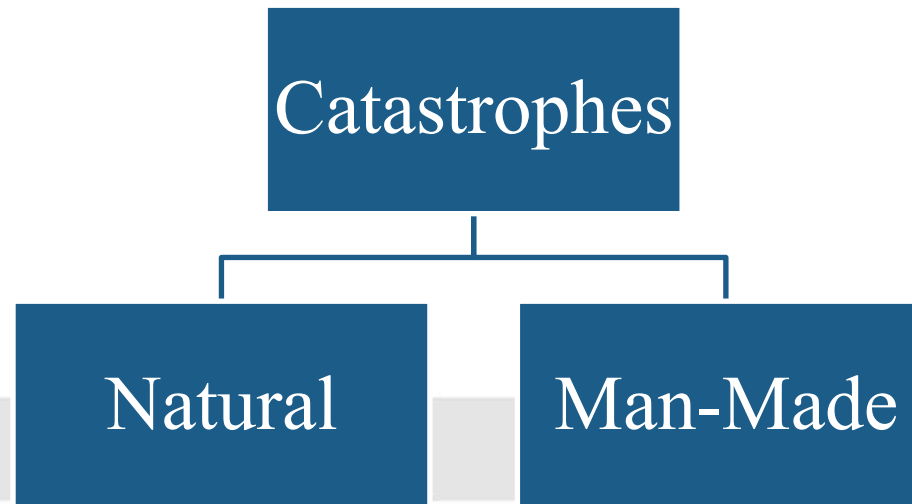
Man-Made catastrophe modelling – Liability modelling including Climate Liability

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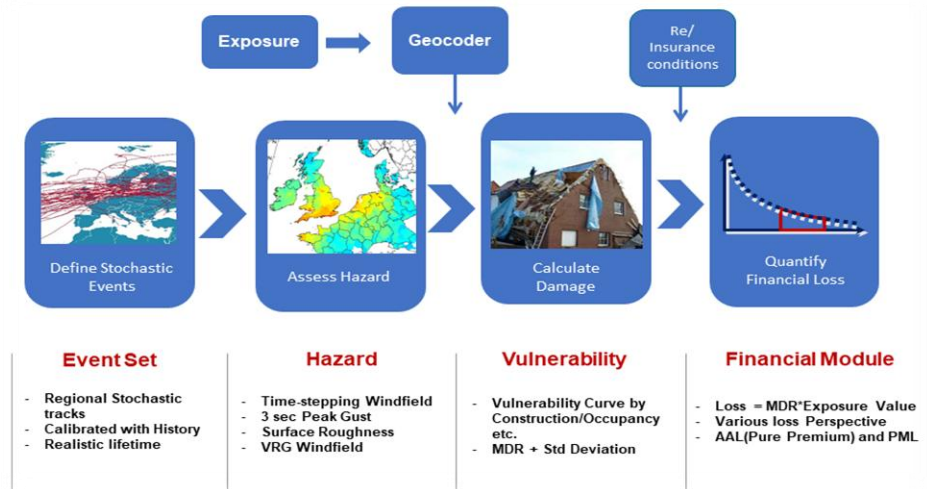
What is Catastrophe Modeling?

- **Catastrophe** - a sudden event that causes very great trouble or destruction.
- **Modeling** - *The activity of using mathematical models (= simple descriptions of a system or process) to do calculations or predict what might happen.*



What is Catastrophe Modeling?

- Cat models are giant simulation engines that ask:
 - What if a big disaster hits your portfolio tomorrow? Next year? Once in 200 years? And they estimate your losses
 - Insurer solvency pressure → need for deeper risk intelligence
- A catastrophe model combines scientific hazard simulations, engineering vulnerability curves, financial terms, and stochastic event catalogues to estimate probabilistic and scenario losses for natural and man-made catastrophes.



Natural Catastrophes



- **Geological:** Earthquakes, volcanic eruptions, landslides, and avalanches
- **Hydrological:** Floods, flash floods, and tsunamis
- **Meteorological/Climatological:** Cyclones, hurricanes, typhoons, tornadoes, hailstorms, and severe heat waves.
- **Biological:** Famine and wildfires.

Man-Made Catastrophes



- Cyber: Data Breach, Ransomware, etc.
- Chemical & product: PFAS, Phthalates, Pharma Drugs w side effects etc.
- Financial: Subprime Mortgage, Madoff Scandal, Financial Reporting – D&O, Professional etc.
- War & Terrorism
- Accidents: Explosions, Oil spills etc.

Why model catastrophes?

- Pricing (adequacy of premium)
- Solvency, RBC, reinsurance optimization
- Capital allocation (1-in-200, tail risk, TVaR)
- Emerging risk assessment
- Climate transition vs physical impacts
- Strategic underwriting (geo-mix, peril-mix, accumulation)
- Reserving
- Post event analysis – Event Response

Liability Modeling



- Lines impacted the most -
 - Product Liability
 - D&O
 - Professional Liability
 - Environmental & Pollution
- Clash events –
 - Events that can impact Product liability and also cause D&O lawsuits. Ex. Opioids
 - Events that can impact multiple companies but in the same lines. Ex. Sub-prime Mortgage Crisis, Bid-Rigging.
- Climate Change
 - Greenwashing
 - Pollution incidents – cleanup costs, indemnity amounts, fines etc.

Nat Cat Modeling vs Liability Modeling



- Policy type -
 - Losses Occurring policies for Liability modeling
 - Long tail losses. Taking decades to evolve in some cases.
- Stacked Limits –
 - Due to losses occurring policy type, limits stack across years causing larger losses
- Social Inflation –
 - Higher number of lawsuits in the recent past.
 - Litigation financing and funding.
- Underlying Peril
 - Lawsuits – Class-actions & MDLs.
 - Settlement amounts.
 - Legal fees.
 - Complex and can happen in any sector/industry as opposed to NAT-CAT where peril wise geographical monitoring exists.

Nat Cat Modeling vs Liability Modeling



- Natural catastrophes are driven by physics/geography etc.
 - Fault lines and subduction zones – EQ
 - Oceans, depressions, temperature – Hurricanes
 - Weather, rainfall etc. – Draughts/Floods
- Liability catastrophes are driven by law, science, and human behavior.
 - Govt in office.
 - Policy decisions.
 - Landmark judgements
 - Public outcry
 - Social inflation

Understanding the peril



- Lawsuits
 - The law of torts is a branch of civil law focusing on civil wrongs that cause injury, harm, or damage to another person's legal rights, reputation, or property, primarily managed through common law and judicial decisions rather than statutes. It provides monetary compensation (damages) to injured parties, acting as a deterrent against wrongful acts.
 - Product liability tort is the legal responsibility of manufacturers, distributors, and sellers to compensate consumers for injuries or damages caused by defective products. It generally covers manufacturing defects, design defects, and failure-to-warn (marketing) defects, focusing on strict liability, negligence, or breach of warranty to ensure consumer safety.
- Class-Action
 - a legal action (a case that is decided in a law court) that is organized by a group of people who all have the same legal problem.
- Multi District Litigation
 - MDLs combine individual lawsuits for pre-trial proceedings but allow cases to remain separate for potential trials, often used in complex mass torts.

Mass Litigation Process

- Scientific Discovery
- Litigation Emergence
- Class Actions or MDLs
- Settlements – sometimes tranches
- Insurance claims if any.



History of liability lawsuits



- 1980s - Asbestos
- 1990s - Tobacco litigation
- 2000s to Present
 - Pharma linked drug side effects
 - Financial crisis – Subprime, Bid Rigging, Madoff, Enron etc.
 - Oil spills, explosions, accidents etc.
 - Medical equipment – Hip Implants, Knee Implants, etc.
- Above MDLs and Class actions ushered in a new wave of systemic losses impacting multiple companies, lines creating large clash events impacting reserves.
- Forced the evolution of new modelling approaches –
 - Need to study emerging risks
 - Need to study causations and potential mass litigation events.
 - Need to understanding changing litigation landscape – access to funding, changing laws, public sentiment.
 - Rise in non-traditional approaches of handling liability risk – Rise of vendors, RDS Scenarios etc.

Portfolio accumulation risk



- Possibility of -
 - Back-to-back events
 - Events happening at the same time.
 - Events spreading multiple companies at once or back-to-back.
- In one industry, companies usually mimic each other in terms of –
 - Process design
 - Organizational processes and policies
- Exposing them to similar lawsuits or part of a class action or individual class actions
 - Product design for – Proton pump inhibitors
 - Product design for – Hip implants and Knee Implants
 - Process - Subprime Mortgage. Bid rigging etc.
- This leaves a possibility of multiple insureds being in the same portfolio year(s) leading to large accumulations.

How liability cat models work?

- Hazard Identification
- Corporate exposure mapping
- Lawsuit and cost estimation
- Loss simulation
- Stress testing
- Stakeholder reporting and discussion
- Comparison with market – emerging trends, lawsuit updates etc.
- Finalize reporting.



Climate Liability



- Why are climate liability lawsuits filed?
 - Greenwashing.
 - Pollution incidents.
 - Influence policy/decision making.
 - Deterrent against practices.
- Which lines are impacted?
 - Greenwashing – D&O for Companies, Professional for consulting/report makers etc.
 - Pollution incidents – General liability with pollution covers, EIL policies, WC policies for injuries etc.

Landmark Lawsuits



- Insurance related
 - Green NGOs v. Major Insurance
 - The lawsuit alleges that the insurance company improperly excluded a shareholder proposal that asked the insurer to evaluate how it might hold climate polluters accountable for losses, impacting its climate strategy.
 - This litigation follows a trend of increasing shareholder proposals surrounding climate change, specifically regarding how insurers handle "ordinary business" exclusions related to environmental, social, and governance (ESG)
 - The company has faced pressure to stop insuring new fossil fuel projects, though it has restricted some coal and tar sands underwriting.
- Greenwashing
 - Fashion Industry: H&M, Zara, Uniqlo, Shein, ASOS, and Boohoo have faced scrutiny for exaggerating sustainability efforts.
 - Airline Claims: Lufthansa and KLM have faced legal action regarding "carbon offset" claims, with courts finding they misinformed consumers about the climate impact of flying.

Emissions

- Carbon emissions are the release of carbon dioxide (CO₂) into the atmosphere, primarily from burning fossil fuels (coal, oil, natural gas) and industrial processes like cement production. As a major greenhouse gas, traps heat, driving climate change and causing severe weather, drought, and rising sea levels.
- Methane is a potent, short-lived greenhouse gas responsible for about 30% of global warming since the Industrial Revolution. While it stays in the atmosphere for only ~12 years, it is over 80 times more powerful than at warming the planet over a 20-year period. Major sources include agriculture, fossil fuels, and waste.
- Nitrous oxide (N₂O) is a potent, long-lived greenhouse gas, roughly 270–300 times more effective than (CO₂) at trapping heat over a century. It is now the dominant ozone-depleting substance emitted. Agricultural practices—specifically synthetic fertilizers and manure—account for this majorly.



Attribution Science



- Attribution science is a field that quantifies the influence of human-caused climate change on specific extreme weather events, such as heatwaves, floods, and droughts. By comparing observed climate data with models of a hypothetical world without human-induced emissions, scientists can determine if climate change made an event more likely or intense.
- **Tricky part that is evolving rapidly** - Attribution science quantifies how specific greenhouse gas emissions—particularly from "carbon majors" (fossil fuel/cement producers)—increase the intensity, likelihood, or probability of extreme weather events and global temperature rise.
- Why does this matter?
 - It is at the heart of - **scenario-based modelling.**

Scenario based modeling

- Climate scenarios - example - Emission based scenario where a particular industry or group of industries could be held liable due to policy change.
- Emission Attribution – Largest emitters with large revenues likely to be parties in future litigation (already part of current litigation).
- Damage modeling – Revenue based, Settlement based etc.
- Insurance penetration – Policy wording, stakeholder interactions etc.
- Outputs – Tail loss distributions, insurer exposure, reserve impacts, stress testing.

Why? Regulatory and Solvency considerations



- Solvency II Orsa considerations
- Demand from shareholders/stakeholders
- Demand from regulators
- Forward looking risk management
- ESG reporting for Insurance companies

Indian insurance market context



- Increasing industrialization
- International financing and fund raising
- Environmental regulations
- Growth of liability insurance
- ESG pressures on corporates

- Potential emerging risks around –
 - Pollution incidents
 - Chemical exposures
 - Climate litigation
 - Infra failures
 - Transition risks

Scenario Modelling Using Public Data



- [Lloyds RDS Scenarios guidance](#)
- Focus on page 58 onwards – Liability Risks –
- Professional lines –
 - Mis-selling of a financial product
 - Failure/Collapse of a Major Corporation
 - Failure of a Merger
 - Failure of a Construction Project
 - Recession-Related Losses
- Non-Professional lines –
 - Industrial/Transport Incident
 - Multiple Public/Product Losses
- Tweak above scenarios w.r.t. climate change – emissions-based litigation related losses, stress test with NGFS explorer – Hot House world, Orderly, Disorderly, Too little too late

NGFS Explorer scenarios



- Orderly scenarios assume climate policies are introduced early and become gradually more stringent. Both physical and transition risks are relatively subdued.
- Disorderly scenarios explore higher transition risk due to policies being delayed or divergent across countries and sectors. For example, (shadow) carbon prices are typically higher for a given temperature outcome.
- Hot house world scenarios assume that some climate policies are implemented in some jurisdictions, but global efforts are insufficient to halt significant global warming. The scenarios result in severe physical risk including irreversible impacts.
- Too little, too late scenarios assume that a late and uncoordinated transition fails to limit physical risks.

NGFS Explorer scenarios

Net Zero 2050

Net Zero 2050 limits global warming to 1.5°C through stringent climate policies and innovation, reaching global net zero CO₂ emissions around 2050.

Low Demand

The Low Demand scenario assumes that significant behavioural changes - reducing energy demand - in addition to (shadow) carbon price and technology induced efforts, would mitigate pressure on the economy to reach global net zero CO₂ emissions around 2050.

Below 2°C

Below 2°C gradually increases the stringency of climate policies, giving a 67% chance of limiting global warming to below 2°C.

Delayed Transition

Delayed Transition assumes global annual emissions do not decrease until 2030. Strong policies are then needed to limit warming to below 2°C. Negative emissions are limited.

Nationally Determined Contributions

Nationally Determined Contributions (NDCs) includes all pledged policies even if not yet backed up by implemented effective policies.

Current Policies

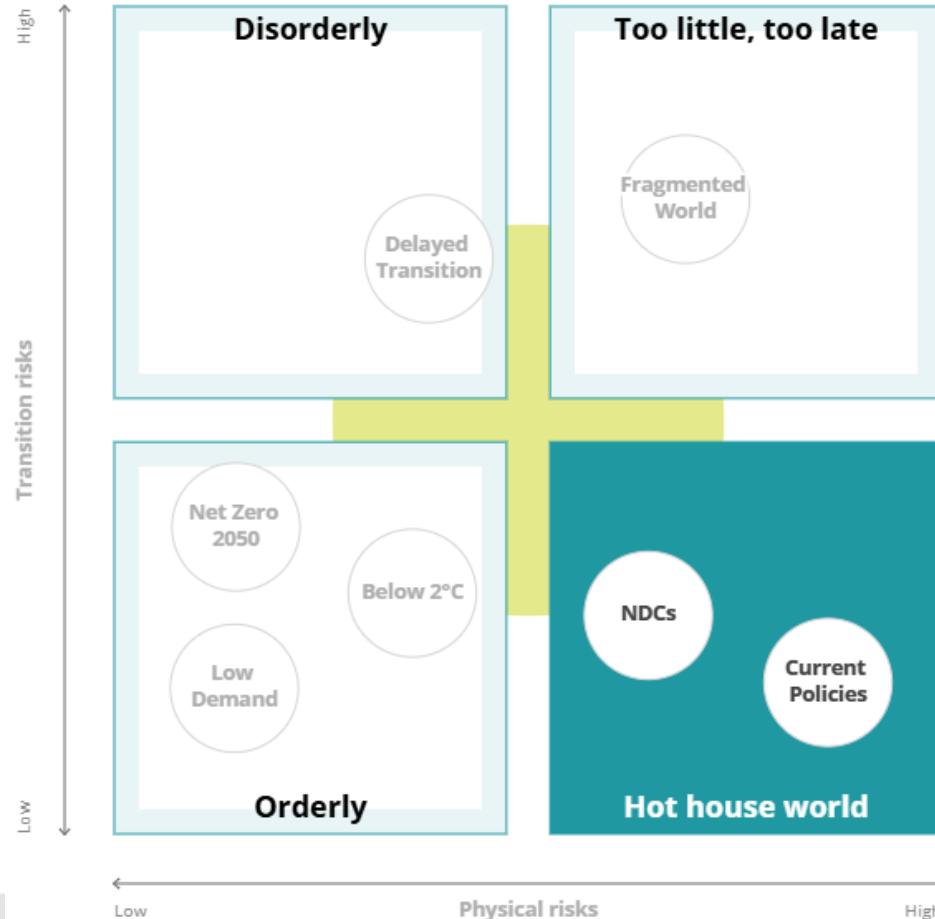
Current Policies assumes that only currently implemented policies are preserved, leading to high physical risks.

Fragmented World

The Fragmented World scenario assumes delayed and divergent climate policy ambition globally, leading to high physical and transition risks.



NGFS Explorer scenarios



- The intersection of these both is liability risks –
 - Companies failing to transit/reduce emissions.
 - Companies with largest share of emissions etc.
 - Companies failing to meet Net-Zero standards.

NGFS Explorer scenarios

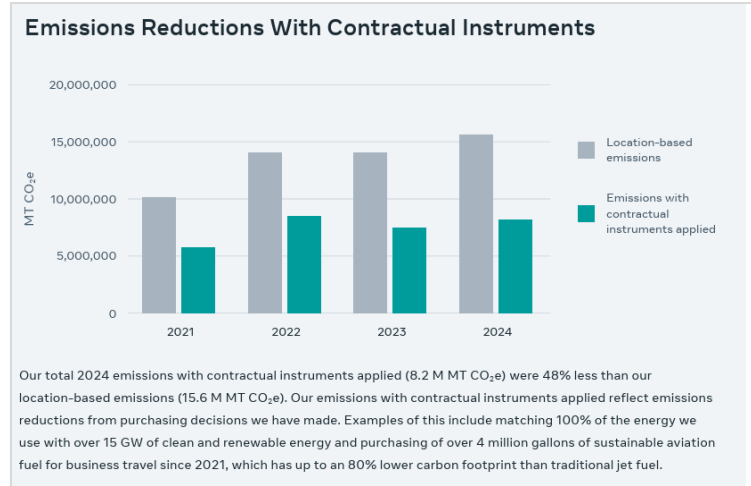
- [Sample workspace](#)



Sustainability Report



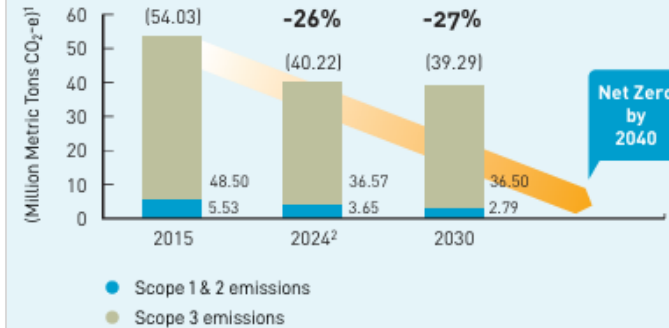
- Meta –



- PG&E –

On the path to net-zero in 2040, PG&E exceeded our annual greenhouse gas emission reduction goal in 2024, achieving an overall 26% reduction in Scope 1, 2, and 3 emissions, relative to a 2015 baseline.

PG&E's Scope 1, 2, and 3 emission reductions



1. Scope 1 emissions are direct emissions from PG&E's operations, Scope 2 emissions are indirect emissions from facility electricity use and electric line losses, and Scope 3 emissions are emissions resulting from value chain activities not owned or controlled by PG&E but can be indirectly impacted by PG&E actions.
2. PG&E's 2024 voluntary greenhouse gas emissions inventory is undergoing third-party verification before being finalized with The Climate Registry.

Sample Implementation



- Step 1 – Pick a base scenario, example - Industrial/Transport Incident
- Step 2 – Tweak it – Industrial contamination(pollution) incident
- Step 3 – Map lines impacted – General Liability (with pollution inclusion), D&O, Environmental policies etc.
- Step 4 – Identify exposure or Identify potential impacted companies/industries and build exposure – Large industrial companies into manufacturing, utilities, energy etc.
- Step 5 – Loss estimation, either based on revenue or past settlement amounts (build historical event set if needed*) but test for multiple magnitudes – High loss, Medium loss, low loss etc.

Building historical event set



- Step 1 – Research news articles, university publications etc. to build a set of large events where liability was triggered or companies had to pay a settlement.
- Step 2 – Research on official court documents to identify final settlement amounts.
- Step 3 – Research on company's financial reports (pertaining to year(s) of settlement) to identify and confirm amount and note any insurance payment received/expected.
- Step 4 – Repeat for all events.

Conclusion



- Liability related policies' revenue are a major source of revenue and tend to be a huge chunk of earnings.
- They behave very differently from Property related insurance policies.
- They often result in long tail risks, which take multiple years to decades to mature.
- They are complex and turn into large clash events.
- Back-to-back events and large simultaneous events can erode reserves.
- Lack of predictive behavior compared to Nat Cat perils – EQ/Hurricane
- Climate liability is a growing and emerging risk that is being monitored globally.
- Scenario building, stress testing help in early identification of emerging patterns.
- Research is key to building robust assumptions and scenarios(models)

Q&A