



Award Winner

Incorporating Climate Risk Modeling into ORSA Reporting

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INTRODUCTION

Imagine you are the CRO of XYZ Life Insurance company. XYZ is not domiciled or doing business in a state where the NAIC Climate Survey Disclosure is available. While sitting in your office one afternoon, you receive an email from the CEO. Her email mentions that the Board of Directors has just reviewed your most recent ORSA report. The Board is somewhat surprised that there are no references in the ORSA to climate risk. The CEO is questioning what your intentions are with regard to incorporating climate change risks in the next ORSA report. You panic on reading the email as your mind races to formulate a response. Climate change risk is something you have been aware of on the horizon of your work. However, because of your many job duties and more pressing needs, you have unfortunately not given it the attention it deserves.

Now all that is about to change as you have no choice in this regard. You respond to the CEO's email by letting her know that you and your team will be looking into the matter and will get back to her shortly. She emails with thanks. She also mentions that one of the board members had mentioned a situation where a competitor of XYZ had recently been sued by an activist shareholder for not doing enough to address climate risks. Your stress level just increased significantly. But have no fear. The pathway below will shine a light on one possible approach to modeling climate change in the ORSA report.

STANDARDS

Your first step is to ask a junior team member to pull together all the reporting standards they can find on climate change disclosures. Using their favorite AI tool, the junior member prepares a high-level summary of many standards around the globe:

- Task Force on Climate Change Disclosure (TCFD)
- IFRS S-1 – sustainability
- IFRS S-2 – climate disclosure
- NAIC Climate Disclosure Survey
- UK SS 5/25
- OSFI B-15 in Canada
- California (SB 253/261)
- EU Directive on ORSA scenario testing
- Australian requirements
- Recent pronouncements in Japan, South Korea, Singapore, and Colombia
- IAA ISAP-8

- IAA IAN 200

There's enough reading there to keep you up all night. Your next move is to assign one standard to each of your team members to summarize. You on the other hand decide to read the SOA Research Institute's well written publication on Implication for Actuaries from the ISSB and Global Climate-related Financial Disclosure Standards¹ in order to get an overview of the subject.

You then schedule a meeting with your team to discuss all of the standards. At the meeting, you discover that many of these global standards all seem to have similar corresponding frameworks. Typically, they are divided into sections like Governance, Strategy, Risk Management, and Metrics and Targets. Many also refer to Physical and Transition Risk. Physical risk can be defined as the risk from climate events such as floods, wildfires, storms, heatwaves, cold snaps, etc. Transition risks refer to the risk, and in some cases opportunities, as we transition to a lower greenhouse gas world. Opportunities in climate change may seem like a strange term in risk management. But for pension and annuity actuaries, mortality deterioration from climate change may reduce their liabilities minimally to the advantage of their clients. Not so in the life and health insurance space.

SCENARIOS

But how do you incorporate any of the standards into ORSA/Financial Condition Reporting? The brilliant genie that lives rent-free in your head suggests that you first start identifying scenarios to model.

You recall a webinar where someone mentioned the NGFS scenarios. NGFS stands for Network For Greening the Financial System.² It is a series of seven scenarios used by central banks and supervisors to "provide a window into plausible futures." The seven scenarios are long term in nature. They are:

- Net Zero 2050
- Below 2⁰ Celsius
- Delayed Transition
- Nationally Determined Contributions
- Fragmented World
- Current Policies
- Low Demand

Recently, NGFS has also developed four short term scenarios. They are:

- Highway to Paris
- Sudden Wake-up Call
- Disasters and Policy Stagnation
- Diverging Realities

Since these scenarios focus on a five-year horizon, they may be more appropriate for ORSA/FCR due to their short-term nature. These scenarios place significant emphasis on physical and transition risks.

¹ Society of Actuaries. (2024, August). *Implications for actuaries from the ISSB and global climate-related financial disclosure standards*. <https://www.soa.org/resources/research-reports/2024/issb-fin-disclosure-standards/>

² Network for Greening the Financial System. (n.d.). *NGFS Scenarios Portal*. <https://www.ngfs.net/ngfs-scenarios-portal/>

Underlying the NGFS scenarios are a plethora or maybe a mountain of statistical data. The IPCC (Intergovernmental Panel on Climate Change) has approximately 20,000 datasets. A few of these actually have life and health data. But with your busy work schedule, you don't have enough time in the day to go through 20,000 datasets. The United Nations Environmental Program (UNEP) has approximately 100 tools on climate change. But none are suitable for your purposes.

You decide instead to use the seven NGFS scenarios as stress tests in your ORSA reporting. But how do you incorporate them into this process?

You start to look for research articles on relationships between climate change, mortality, and morbidity. The data is mostly sparse. There is some data from NOAA on weather related mortality. [Weather Related Fatality and Injury Statistics](#). The latest study covers the 2024 calendar year.

A study by RGA Re in South Africa shows a less than 40 basis point change in deaths from physical risks.³

You begin to contemplate how to model the transition risk. One possible approach is to project out energy usage and the transition of CO² emissions under the seven NGFS scenarios. Then you could look at causal relationships between the CO² pathways and mortality and morbidity outcomes. One UK study suggests that 10% of all future lung cancers will be climate change related. A Chinese study suggests that there is an almost one-for-one relationship between the increases in CO² emissions and healthcare costs in Beijing.

Other research focusses on the health effects of climate change on mental health disorders, diabetes, and a host of other diseases. For instance, one study found that there is a 50% spike in mental health illness in the six months following a flood for those impacted. The challenge for you is that many of these research articles are not in jurisdictions where XYZ operates.

LLMS

You begin to wonder if maybe you could use Large Language Models ("LLMs") to do some of the stress testing and ORSA work. You reach out to a consultant who tells you that developing such models will cost between \$1 million to \$100 million to develop. Your company doesn't have the time or the budget to stand up a Large Language Model. You are hopeful that at some point the industry will develop an LLM model to be used by all practitioners. But that day is not today.

You have also heard recently about Graduated Linear Models ("GLMs"). GLMs are like the spaghetti models shown on weather forecasts. They combine a series of weak models to produce a more robust model. However, neither of the language model approaches seem feasible for your assignment at this point. You abandon those approaches.

STRESS TESTING

With the thin and disjointed level of data on climate mortality and morbidity out there, you decide to take a different approach. You decide to incorporate a climate mortality table into your scenario testing for your

³ Falkous, C. (2024). *The impact of climate change on future mortality in South Africa* (White paper). Reinsurance Group of America. https://www.rgare.com/docs/default-source/knowledge-center-articles/south-africa-climate-change-white-paper-final.pdf?sfvrsn=debd283a_1

life business to get a better handle on the effects of climate change on your capital and balance sheet. You will also use the same table for your annuity and pension de-risking business. For your employee benefits/worksites marketing health business, you will use a climate morbidity table for stress testing the NGFS scenarios. Now it's time to put some hard metrics together for your ORSA report.

Let's assume that XYZ insurance company has 10,000 policyholders on its' life insurance business. All are age 65 and female. Each has a life insurance policy with a death benefit of \$100,000. An excerpt from the climate mortality tables for the Net Zero 2050 scenario looks as follows:

Table 1
CLIMATE MORTALITY TABLE FOR NET ZERO 2050 SCENARIO

Age	Female Climate Mortality
65	0.003%
70	0.0035%
75	0.005%
80	0.01%
85	0.03%

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The annual claims payout at age 65 are $10,000 * 100,000 * 0.00003$

$$= \$30,000$$

For simplicity at this point, discount rates, premiums, lapse rates, and expenses will not be discussed. The model used shows an uptick in GAAP reserve of \$350,000 under the Net Zero 2050 scenario. Under the full seven NGFS scenarios, the range of results is \$225,000 to \$1,200,000. This becomes a liability stress that has to be funded by free capital on the ORSA. Resiliency can be demonstrated by showing there is enough free capital to cover this uptick in mortality from climate change.

ORSA

Now that the liability side of the balance sheet has been addressed, it's time to think about the asset side. One possible approach is to apply an algorithm to depress the market value of energy assets on the balance sheet. Correspondingly, the sustainable assets can have their market values increased with the algorithm. Let's delve into this concept a little further. XYZ owns an energy asset that's currently trading at 250 basis points over the 10-year treasury. However, the climate asset algorithm suggests that the asset should really be trading at 400 basis points above the 10-year treasury spread given the current climate (no pun intended) around energy assets with many investors. The climate asset algorithm would be based on established parameters. It reduces the market value of the asset based on what it perceives to be the "correct" spread in the market for an energy asset. On the flip side, renewable assets may have their market values increased.

Let's look at just a few of the assets XYZ owns in its portfolio, see Table 2.

Table 2
CURRENT SAMPLE ASSETS

Asset	Issuer	CUSIP	Book Val	Mrkt Val	Mk Yield
ABC	L Motors	111111	1000000	900000	5.0%
DEF	B Energy	222222	5000000	4500000	4.5%
GHI	R Renew	333333	3000000	2800000	7.0%
JKL	C Constr	444444	6000000	5700000	4.0%
MNO	T Food	555555	9000000	8600000	5.5%
Total			24000000	22500000	5.1%

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After running the assets through the climate risk algorithm, market values for the Net Zero 2050 scenario come back as follows:

Table 3
MARKET VALUES FOR NET ZERO 2050 SCENARIO

Asset	Issuer	CUSIP	Book Val	Mrkt Val	Mk Yield
ABC	L Motors	111111	1000000	900000	5.0%
DEF	B Energy	222222	5000000	3000000	8.5%
GHI	R Renew	333333	3000000	3500000	7.0%
JKL	C Constr	444444	6000000	5700000	4.0%
MNO	T Food	555555	9000000	8600000	5.5%
Total			24000000	21700000	5.7%

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The energy and renewable assets have had their market values adjusted under the Net Zero 2050 scenario by the climate risk algorithm. Under the Net Zero 2050 scenario, the market value of these five assets has been depressed by:

$$22,500,000 - 21,700,000 = 800,000$$

So, the total capital reduction under this scenario from both the liability and asset side of the balance sheet becomes:

$$\text{Capital reduction is } 350,000 + 800,000$$

$$= 1,150,000$$

The algorithm also provides for asset defaults and rating downgrades. But those two concepts will be ignored or brevity of this example.

You remember the comment from the board member about lawsuits for not addressing climate change appropriately. You decide to add an additional credit spread for lawsuits in the climate asset algorithm of 40 basis points. Your market value of assets moves a further \$920,000.

XYZ holds \$30 million of free capital. The Net Zero 2050 climate change scenario would represent a

Capital Reduction of $(\$1,150,000 + \$920,000) / \$30,000,000$

= 6.9% of free capital

This does not represent a significant impairment to XYZ's capital ratios. However, the above is all under the Net Zero 2050 scenario. Other scenarios may be more or less punitive.

You decide to stress test other operational climate risks that could impact your risk management profile. For instance, you look at a scenario where a large forest fire in the Western U.S. shuts down an important brokerage operation for six months. The brokerage provides significant sales and support to XYZ and its policyholders. You quantify the potential loss of premium revenue based on the last three years of sales as \$1,500,000 for a six-month operational shutdown of the brokerage. You assign that loss as an operational risk from climate change.

CONCLUSIONS


This essay has taken a look at how climate change stress testing may be incorporated into ORSA and/or Financial Condition Reporting for life and health companies. While it's certainly not the only approach available, it provides one roadmap for practitioners struggling with how to incorporate climate risk modeling into their overall risk management framework.

It is believed at the time of this writing that approximately 15% of the Russel 1000 companies report on climate change impacts to their organizations. Given that the U.S. SEC has paused climate change reporting and the California legislation is also pending, this reveals how important climate change disclosure is for companies even when the requirements are voluntary in nature. Beyond the ORSA/FCR reporting, we need to also think about including climate change analysis in our pricing. At its core, we have to ask ourselves the question if we as an industry are charging the right price for the products we sell.

As more knowledge and best practices emerge under climate change risk modeling, it's expected that the approaches and standards of practice will become more streamlined.

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