


AAE  
DISCUSSION  
PAPER



**HOW TO CLOSE THE PROTECTION  
GAP AND INCREASE RESILIENCE  
AGAINST CLIMATE CHANGE**

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This discussion paper examines Europe's widening natural catastrophe protection gap – estimated at 50–75% of economic losses remaining uninsured – and sets out how it can be addressed through a coordinated, Europe-wide approach that combines expanded insurance coverage with meaningful investment in physical resilience. Drawing on analysis of the drivers and challenges facing policyholders, insurers, and governments, the paper explores the dynamics between these three key stakeholders that shape the current landscape: policyholders face unattractive financial payback periods for prevention measures and limited access to location-specific risk information; insurers encounter data and modelling constraints alongside difficulties in accurately quantifying the benefits of adaptation; and governments must navigate complex multi-level responsibilities while balancing short-term fiscal pressures with long-term resilience investment. Particular attention is given to the financial viability of micro-adaptation measures, the interaction between the current Solvency II framework and resilience incentives, and the role of public-private risk-sharing mechanisms in making coverage sustainable in high-risk areas.

The paper argues that addressing the protection gap calls for each party to contribute in accordance with its role: policyholders supported by clear risk information and meaningful financial incentives; insurers pricing resilience accurately and working towards standardised adaptation standards; and governments providing co-funding, enabling regulatory frameworks, and European-level risk pooling to address systemic tail risks where private markets alone face limitations. Throughout, the paper highlights the distinctive contribution actuaries can make, through catastrophe modelling, risk-based pricing, and the structural design of public-private frameworks, in translating complex climate risk dynamics into economically sustainable and socially proportionate policy solutions.

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## EXECUTIVE SUMMARY

Europe's natural catastrophe protection gap, estimated at 50–75% of economic losses being uninsured, is widening as climate change accelerates, assets accumulate in high-risk zones, and vulnerability persists. This is not just an insurance problem: without investment in physical resilience, expanding coverage alone will not protect societies from escalating losses, and the insurance market itself risks becoming unsustainable. The root cause is a coordination failure. Many policyholders underinvest in prevention, expecting government aid or affordable premiums. Insurers hesitate to deploy capital into hard-to-insure risks without regulatory support or public backstops. And governments often await clearer signals before committing to structural intervention.

Breaking this persistent coordination challenge requires a coordinated approach where each party contributes according to its role. Policyholders need access to clear, location-specific information on risk and the effectiveness of adaptation measures, backed by meaningful financial incentives that make prevention viable within realistic horizons. Insurers must price resilience benefits accurately and actively support standardised adaptation standards, while governments must provide co-funding, regulatory frameworks, and public-private backstops where private markets cannot deliver alone. At European level, risk pooling across perils and geographies can lower costs through diversification, and prudential frameworks must be adapted to recognise the systemic value of adaptation. As the illustrative calculations in Section 2.3 demonstrate, the financial payback period for a typical micro-adaptation investment is, under current conditions, very long and unattractive for most policyholders, underscoring why insurance pricing incentives alone cannot drive adoption at scale and must be complemented by meaningful co-funding and public support.

The path forward demands that insurance expansion and risk mitigation advance in tandem and consistently across Europe. This requires harmonised data standards, risk-based pricing that accurately reflects the benefits of adaptation investment, regulatory frameworks that recognise the macroprudential value of resilience, and European-level pooling mechanisms to address systemic tail risks. Actuaries have a central role to play throughout – through catastrophe modelling, risk-based pricing, and the structural design of public-private frameworks – in translating complex climate risk dynamics into economically sustainable and socially proportionate solutions. The tools exist; what is missing is their coordinated deployment across policyholders, insurers, and governments.

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## 1 INTRODUCTION

It is widely recognized throughout Europe that individuals and businesses, particularly those in high-risk areas, are often inadequately protected against natural disasters. Recent analysis by the European Insurance and Occupational Pensions Authority (EIOPA) and the European Stability Mechanism (ESM) quantifies the scale of this challenge, estimating the European natural catastrophe protection gap to range between 50% and 75% depending on the methodology used. Crucially, that paper further demonstrates that a coordinated European approach to risk pooling across Member States could reduce aggregated natural catastrophe capital requirements by up to 67%, underscoring the substantial dividend available from diversification at the European scale. This protection gap (defined as uninsured economic losses from natural catastrophes) is worsening over time. The main drivers of this deterioration are the continuously increasing effects of climate change (with Europe warming faster than the global average), as well as an increasing accumulation of assets in high-risk areas and persistent vulnerability.

The insurance of economic losses from natural disasters varies significantly across European countries, as is the level of protection. Some countries provide public insurance or reinsurance schemes for some or most perils, typically obligatory covers organised by public authorities and backed by government guarantees (such as in France, Spain, and most Swiss cantons). Other countries rely purely on individuals or businesses buying insurance from private companies, and some countries combine both solutions.

In countries where individuals or businesses must voluntarily purchase natural catastrophe insurance themselves for certain perils, we observe a significant insurance protection gap. This gap has persisted or even increased over the last decade. Awareness of the risk remains too insufficient, as well as the availability and affordability of attractive policies and climate adaptation measures, is too low. This typically affects the socially and economically vulnerable groups in society even more, as well as small to medium-sized enterprises (SMEs). SMEs may have adequate coverage for buildings and their contents, but often not for business interruption.

Conversely, despite the growing protection gap, the insurance industry has experienced significantly higher losses from natural catastrophes and extreme weather events over the last few decades. Merely increasing insurance coverage to reduce the protection gap is not enough to protect Europe against escalating climate change. Societies and businesses must also adapt and become less vulnerable to more frequent and more severe natural catastrophes. Therefore, a balanced, Europe-wide approach is required to tackle the climate insurance protection gap while also increasing societies' resilience to climate change through investments in risk mitigation and adaptation measures.

The Actuarial Association of Europe addresses this topic in the present paper because actuaries are uniquely positioned to bridge the gap between technical risk assessment and practical

policy design. In this context, the actuarial profession can contribute through advanced catastrophe modelling, risk-based pricing, and the structural design of public-private risk-sharing frameworks. These analytical capabilities are essential for translating the complex and fast-evolving climate risk landscape into economically sustainable solutions that balance solvency requirements with societal resilience and affordability.

This discussion paper builds on the AAE's earlier contributions to this field. The AAE's 2022 position statement on sustainability and climate change identified the protection gap as a priority for the sector, and subsequent work on sustainable insurance products (2023) and social sustainability in insurance (2024) explored how product design and solidarity mechanisms can address it. The AAE's contribution to the European Commission's Climate Resilience Dialogue (2024) further developed these themes in dialogue with policymakers. The present paper extends this body of work by examining the protection gap from the intersecting perspectives of policyholders, insurers, and governments, and by proposing actionable elements for a coordinated European response.

## 2 MAIN DRIVERS AND OBSTACLES

Discussions on this topic have often been focused primarily on individual dimensions. Typically, either solutions for covering economic losses more effectively were discussed without considering how to improve the resilience of societies, or the focus was on the availability and affordability of solutions without considering how to finance them in the long term.

We would like to discuss the drivers and obstacles to implementing such solutions from the perspectives of the three groups involved: policyholders, insurers and governments. Our aim is to propose options that could provide a long-term win-win-win solution for all three groups.

### 2.1 PERSPECTIVE OF THE POLICYHOLDERS

Policyholders face significant challenges in assessing and planning for long-term effects of climate change. It is even more difficult for individuals and SMEs than for governments and insurers to fully understand potential future risks and trends, as these depend on many parameters in a non-linear way, and historical data may no longer serve as a reliable indicator. In general, future risks due to climate change are typically underestimated by policyholders.

However, purchasing protection and investing in the resilience of owned assets (such as hardening one's property against extreme weather events) can be costly. As insurance premiums must reflect risk, they could be unaffordable in high-risk areas. In some of these areas, cover may not be available at all, or may come only in degraded form with high deductibles and numerous exclusions. Inflation has also made investments in micro-adaptation measures for owned property more expensive in recent years. Consequently, the cost of financial protection or physical resilience measures often outweighs the perceived risk, and individuals or businesses may decide against it. The combination of investing in adaptation measures and profiting from lower insurance premiums is often unattractive as it requires a high upfront investment, and the expected future premiums and perceived reduction in risk offer an unattractive return on investment, with the perceived break-even point being too far in the future.

Moreover, systems based on national solidarity and cross-subsidies between high- and low-risk policies may erode as premiums rise gradually due to rising physical climate risks. For example, France's natural catastrophe regime recently increased its flat premium surcharges from 12% to 20%. While solidarity can be well tolerated in the case of low premiums, policyholders in lower risk areas may become reluctant to contribute to the insurance of higher-risk areas if this cross-subsidy is made explicit.<sup>1</sup> From a policyholder's perspective, the social and political acceptability of risk pooling is not guaranteed, as can be seen from current debates in Germany.

1 See Donahue, K., & Barocas, S. (2021, March). Better together? how externalities of size complicate notions of solidarity and actuarial fairness. In *Proceedings of the 2021 ACM Conference on Fairness, Accountability, and Transparency* (pp. 185-195), Lehtonen, T. K., & Liukko, J. (2011). The forms and limits of insurance solidarity. *Journal of business ethics*, 103(Suppl 1), 33-44.

To bridge the gap between technical risk adequacy and social affordability, the German Insurance Association (GDV) *proposed* the ‘Elementar Re’ mechanism. This mechanism would provide coverage in high-risk areas by capping premiums and cross-subsidising this through a solidarity-based surcharge across the entire insured pool, while still allowing for risk-based pricing to incentivise the implementation of micro-adaptation measures. By integrating government-funded stop-loss coverage for systemic tail risks, the Elementar Re proposal would provide a market-driven alternative to mandatory insurance while maintaining essential risk transparency.

Given that governments often provide ad hoc support and disaster relief following extreme weather events, the need for personal investment is perceived as even lower. However, even in these situations, where micro-adaptation measures could be incorporated into the rebuilding of a house after a natural catastrophe, or where the decision could be made not to rebuild a house in a high-risk area, these opportunities are frequently missed due to cost constraints, underestimation of future risks, and the short-term nature of most property insurance contracts.

In addition, the efficiency or adequacy of prevention measures is not always obvious from the perspective of a policyholder. While many solutions may be available to protect against a risk, their cost and efficiency can vary depending on the area.<sup>2</sup> Policyholders often lack access to relevant, location-specific information on this topic.

## 2.2 PERSPECTIVE OF THE INSURERS

The short-term trends in the future risks associated with climate change are usually well understood by insurers. Based on historical data, expert judgement and modelling, premiums for property insurance can be estimated adequately. The long-term perspective is more difficult, however, as, e.g., irreversible climate tipping points could cause trends to behave non-linearly and lead to exponential damage growth. This difficulty is also related to insurers’ need to have confidence in the data and models used to generate risk projections.<sup>3</sup> The data of a single insurer may not be sufficient to calibrate these risk projection models properly. Furthermore, standard climate models (such as the scenarios produced by the Intergovernmental Panel on Climate Change (IPCC) and the Network for Greening the Financial System (NGFS)) are not specifically designed for insurance purposes, particularly for the precise evaluation of the return period and severity of catastrophes. Even though some modelling frameworks, such as the various European PESETA<sup>4</sup> studies, integrate high-resolution climate change projections and physical models into an economic modelling framework to help quantify the impacts of climate change, this is not always directly applicable to insurance modelling. Explicitly including insurance within the scope of these studies would be beneficial.

2 See Anderson, C. C. et al. (2021). Public Acceptance of Nature-Based Solutions for Natural Hazard Risk Reduction, *Frontiers in Environmental Science*, 9.

3 Ingels, M. W., Botzen, W. W., Aerts, J. C., Brusselaers, J., & Tesselaar, M. (2024). The state of the art and future of climate risk insurance modelling. *Annals of the New York Academy of Sciences*, 1541(1), 100-114.

4 JRC PESETA V – Joint Research Centre, European Commission

Consequently, insurers may need to raise premiums for future coverage more than currently anticipated, which could also make them more reluctant to provide multi-year coverage. This could result in higher prices for policyholders and further widen the protection gap.

Without robust data quantifying the impact of micro-adaptation measures on expected losses, insurers struggle to accurately assess these benefits, meaning the potential premium discounts, or sometimes reduction in policy deductibles, may still be estimated too conservatively. Consequently, policyholders may not realise the full benefits of implementing these measures, and incentives from insurers and governments for increasing resilience may be insufficient to prompt them to act.

In practice, insurers are unlikely to offer highly personalised premium discounts for each individual household or SME, as the underwriting, modelling and verification effort would be disproportionate. Instead, insurers will typically rely on standardised, certified adaptation measures (such as recognised construction standards or accredited retrofitting schemes) to apply consistent and scalable discounts. This underscores the importance of harmonised resilience standards and clear certification processes. However, the cost of certain certifications might sometimes be prohibitive and limit the economic interest of implementing such a process.

In order to ensure that reconstruction after natural catastrophes leads to long-term resilience, ‘build back better’ requirements should be embedded into claims processes or public support schemes. Such mechanisms strengthen the incentives for all parties to invest in durable risk reduction. However, insurers are often reluctant to co-finance the necessary long-term investments in resilience measures<sup>5</sup>, as they fear that their policyholders may switch to another insurer and that their investments would end up subsidising that insurer’s portfolio. This represents a classic case where micro-economic decisions lead to sub-optimal macro-level outcomes. However, we note that the introduction of clawback clauses requiring partial reimbursement if the policyholder switches insurer shortly after receiving support could help mitigate these concerns.

Large insurance groups with a global portfolio can better diversify climate risks and generally provide efficient cover to the European market. Solvency II capital requirements are generally not the primary constraint; rather, the issue is a lack of appetite to deploy capital for covering the growing number of hard-to-insure risks that climate change creates. However, risk management measures such as certain reinsurance solutions may not be fully reflected under Solvency II, which could reduce the efficiency of the cover and increase costs and finally the premiums for the policyholders.

Currently, a regulatory obstacle to the widespread promotion of prevention measures lies in the calculation of the Solvency Capital Requirement (SCR) under Solvency II. EIOPA is evaluating how climate adaptation measures can be reflected appropriately in the Natural Catastrophe

5 France Inter, *On n’arrête pas l’éco*, 29 November 2025

(NatCat) module of the Standard Formula.<sup>6</sup> For now, the NatCat SCR calculation is primarily based on the sum insured of the covered risks. This creates a counter-intuitive situation: when a policyholder invests in physical adaptation measures to enhance a building's resilience against perils such as floods or windstorms, the replacement value – and, in most cases, the sum insured – typically increases. Rather than rewarding the reduced physical risk, this increased sum insured can paradoxically result in a higher capital charge for the insurer under the current framework.

However, where internal or partial internal models are implemented, such discrepancies could be managed more effectively than under the standard formula. Internal and partial internal models offer the flexibility to incorporate granular, location-specific underwriting variables – such as building construction standards, floor elevation, proximity to flood defences, and certified retrofitting measures – and can therefore more accurately reflect the loss-reducing effect of individual micro-adaptation investments than the standard formula currently permits. Therefore, adjusting capital requirements has only limited potential to improve the economic viability of resilience measures for policyholders, as the cost of capital is typically a secondary effect compared to direct adjustments to the price of insurance. Consequently, an effective underwriting process that accurately prices adaptation measures is far more critical.

A further limitation of the Solvency II Standard Formula arises in the context of non-proportional risk transfer solutions, which are prevalent in the retrocession market. Unlike proportional covers, where the NatCat SCR is driven primarily by the sum insured, non-proportional products are subject to premium-based capital calculation methods. This can result in disproportionate capital charges for insurers writing products specifically designed to cover concentrated, high-risk exposures, while also restricting the recognition of diversification across product types. Addressing these structural limitations in a future Standard Formula review would enable more risk-sensitive capital allocation and, in turn, might help to narrow the overall protection gap.

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6 EIOPA (2026). Consultation paper: Assessment of the prudential treatment under Solvency II of adaptation measures in NatCat insurance (EIOPA-BoS-26/005). Available at: [EIOPA-BoS-26-005 \(PDF\)](#)

## 2.3 COST OF MICRO-ADAPTATION MEASURES VS. INSURANCE PREMIUMS

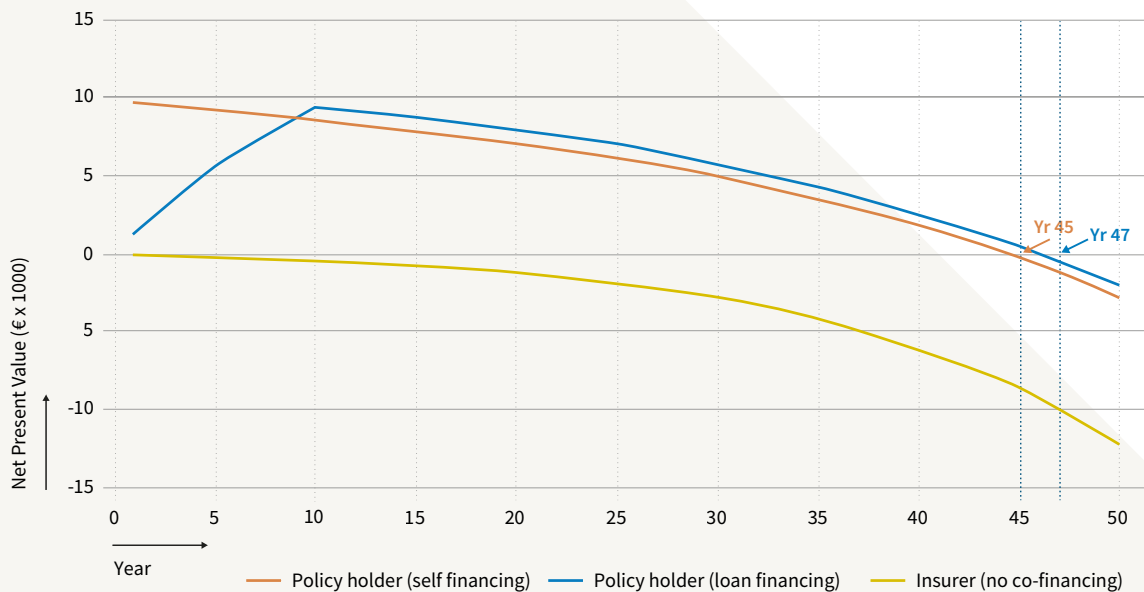
Insurers have been advocating for prevention and climate resilience, offering reductions in premiums in exchange for policyholders implementing and financing climate adaptation measures (e.g., home hardening against fires, floodproofing etc.).

We analysed the financial viability for policyholders using a simplified model with generic but plausible assumptions for a typical European home to estimate how many years it would take for the premium reductions and avoided damages to offset the initial investments.

### *Methodology:*

The model projects annual costs for a representative policyholder over a 50-year horizon under two scenarios: investing in micro-adaptation measures and not investing. In each year, the policyholder's total cost comprises the insurance premium, modelled as risk-based and therefore escalating in line with the 5% annual real increase in NatCat losses, and the expected deductible payment, calculated as the annual occurrence probability multiplied by the deductible amount. Where adaptation measures are implemented, the initial cost of renovation (€10,000) is borne in year one, and the insurance premium is reduced by 25%, representing the full pass-through of the risk reduction to the policyholder with no additional margin for the insurer. Expected claims costs are modelled as annual occurrence frequency multiplied by average damage severity net of the deductible, and grow at the same real NatCat trend rate. All cash flows are discounted at a flat nominal rate of 3%, consistent with the assumed 2% inflation rate. The break-even year is defined as the first year in which the cumulative net present value of incremental costs and savings turns positive. For the loan-financing scenario, renovation costs are funded over a 10-year term at a lending rate of 4%, reflecting a spread above the discount rate to account for the bank's margin. The co-financing scenario applies the same framework to a higher-risk property with materially larger premiums and deductibles, representing properties in areas with significantly elevated NatCat exposure. All parameter values are illustrative; while different assumptions may lead to moderately different break-even years, the qualitative conclusion – that payback periods under current incentive structures are very long relative to typical ownership horizons – is robust across a wide range of plausible inputs.

FIGURE 1: NET PRESENT VALUE OF COSTS FOR ADAPTATION MEASURES



Source: Authors' calculations. Parameters per model assumptions table.

### Results:

- Micro-adaptation measures improve the risk-adjusted position of insurers from year one: by reducing expected claims, adaptation lowers the insurer's required capital and claims exposure, maintaining the same return on risk even where a proportional premium discount is offered. Whilst the insurer's absolute premium income also falls, this is offset by a corresponding reduction in expected loss – the insurer's loss ratio is preserved. This benefit accrues regardless of whether the insurer co-finances the renovation.
- In case of self-financing by the policyholder, the financial break-even point is reached only after 45 years (long payback since renovation cost is upfront and premium savings are very small in comparison). Over a more typical household planning horizon of 20 years, the cumulative discounted net cost to the policyholder remains approximately €7,200 – underscoring that the economic case for adaptation is weak from an individual perspective without external incentives. Such a long time is seen as very unattractive for most policyholders' cost-benefit analysis.
- In case the policyholder must borrow to finance the costs, the financial break-even period extends to 47 years (an additional 2 years, as bank financing eases liquidity constraints but increases effective costs by adding the bank's margin).

**Additional Considerations:**

- Policyholders may have liquidity constraints and limited access to lending, as many individuals and SMEs may be unable to self-finance or to borrow money at affordable rates.
- Policyholders generally prefer to avoid damage, even when fully reimbursed. Their utility function extends beyond pure cash flows to include behavioural preferences, emotional, and disruption costs – such as the stress of temporary relocation, loss of business continuity, and the upheaval of rebuilding. These represent real economic costs even where losses are fully reimbursed by insurers. When these broader costs are incorporated into the policyholder’s cost-benefit assessment, the effective payback period for adaptation investment is significantly shorter than a pure premium-savings calculation would suggest.
- For properties with very high exposure to natural catastrophes, e.g., with annual insurance premiums amounting to 1% to 2% of the property value and high deductibles, the financial break-even point for the policyholder improves by approximately 10 years, bringing the effective break-even to approximately 35 years – still a significant horizon, but closer to typical homeownership durations and markedly more favourable once emotional and disruption costs are factored in.
- Without climate adaptation measures, policyholders in high-risk regions may eventually face a choice not between a full or a discounted insurance premium, but between an affordable premium or being excluded by the insurer.

Similar conclusions were drawn in a recent report from the Geneva Association on ‘Addressing Growing Protection Gaps through Better Public-Private Insurance Programmes’.<sup>7</sup> The report mentions the example of a policyholder who might spend USD 60,000 to elevate a house, receive a sizeable USD 30,000 government subsidy (i.e., half the value of the adaptation measure), but only saves USD 1,000 annually in premiums. This implies a 30-year payback period, exceeding typical ownership durations. In such cases, few households invest.

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<sup>7</sup> Geneva Association (2026). [Addressing Growing Protection Gaps through Better Public-Private Insurance Programmes](#). Geneva Association, February 2026.

The table below sets out the assumptions used for our calculations. These assumptions are illustrative for this example. Results are sensitive to the cost of renovation works and the assumed rate of increase in NatCat losses: a renovation cost of €20,000 extends the self-financing break-even to approximately 60 years, while a lower NatCat trend growth rate of 2% per annum pushes it beyond 75 years. Different assumptions may be equally reasonable and lead to different conclusions.

TABLE 1: ILLUSTRATIVE ASSUMPTIONS USED

PARAMETER	VALUE	COMMENT
Value of the house	€ 300,000	Assuming typical middle-class home in Western Europe
Annual cost inflation	2.0%	ECB official inflation target
Annual property insurance premium	€ 350	Must remain consistent with frequency and severity parameters below (i.e., higher than the pure risk premium to allow for the insurer's margin and loadings)
Property insurance deductible	€ 350	In practice, this parameter has little influence on results
Frequency of natural catastrophe	0.30%	May be lower in safe regions; may also be much higher in high-risk regions
Severity of damage as % of house value	25%	May be much higher for extensive floods or fires
Annual increase in total NatCat costs (above inflation)	5.0%	Source: lower estimate for long-term trend from Swiss Re
Cost of home-hardening renovations	€ 10,000	May be lower if quick wins are possible; may also be significantly higher
Corresponding insurance premium discount	25%	Assuming this represents the full risk reduction (the insurer does not generate extra margins)
Flat discount rate	3.0%	Must remain consistent with inflation rate above
<b>In case of policyholder borrowing to finance the renovations</b>		
Lending rate	4.0%	Must remain consistent with the discount rate above (i.e., higher to allow for the bank's margin and loadings)
Loan duration	10 years	Typical duration for home renovation loans

## 2.4 PERSPECTIVE OF THE GOVERNMENTS

As also noted by the Geneva Association, private-market mechanisms often do not, on their own, generate sufficient risk reduction or insurance coverage. Individuals may underinvest in protection and insurance due to limited budgets, behavioural biases, and expectations of government aid. Insurers may be unable or unwilling to cover large, uncertain, and correlated risks at prices customers can afford. This creates a clear rationale for government intervention to narrow the disaster protection gap to an economically efficient and socially acceptable level.<sup>8</sup>

As is the case for insurers, short-term trends are well understood by governments and usually the main focus of public action. Risk profiles in Europe are quite diverse (and the physical manifestations of climate change themselves can vary significantly across the continent), as are the public-private solutions for covering natural catastrophes in different countries. However, due to limited resources and funds, local solutions may be oriented towards the short term, and long-term measures may not obtain enough political support. At a European level in particular, consistent, economically sustainable and long-term solutions are required.

A key challenge is the fragmentation of responsibilities between different levels of government, which can hinder the effective prevention of risk and macro-adaptation to them. For example, the division of powers between the federal and state governments in Austria complicates the introduction of uniform, binding rules for building in natural hazard zones. While the federal government provides hazard mapping, the state governments control building and zoning regulations. As a result, enforcement and standards vary widely, and in some regions, new construction is still permitted in some high-risk areas. This regulatory patchwork increases vulnerability to climate-related losses and widens the protection gap.<sup>9</sup>

Governments could design, co-finance and implement macro-adaptation measures on a larger scale, e.g. for cities or regions particularly at risk. These measures must also reflect future climate change trends and protect against events with a sufficiently high return period. While such measures would be very effective over the mid- and long-term and could be reflected in insurance premiums, they would also be costly over the short-term.

Governments must also consider social aspects when designing public cover solutions. Awareness, accessibility, availability and affordability are key. However, this could lead to property insurance prices being too low in high-risk areas and price incentives for investing in individual adaptation measures could be lost. Furthermore, this could lead to risks being underestimated when building new properties or rebuilding after a natural catastrophe in high-risk areas, as these prices may not adequately reflect the risks. For governments, there is a narrow trade-off to find between supporting insurance markets and making sure they are not suppressing risk incentives and subsidising vulnerabilities.

8 Geneva Association (2026). Addressing Growing Protection Gaps through Better Public-Private Insurance Programmes. Available at: [Geneva Association – Addressing Growing Protection Gaps through Better Public-Private Insurance Programmes](#)

9 Austrian Court of Audit (2025). Extremwetterschäden [Extreme weather damage], Bundesrechnungshof. Available at: [Rechnungshof Austria – Extremwetterschäden \(PDF\)](#)

It is also important to note that government intervention can only be fully effective if it is implemented in a forward-looking manner and as a ‘last resort’. Anticipation helps reduce the amount of capital needed to address the protection gap and ensures its efficient allocation among beneficiaries when the time comes. This approach—especially when government intervention supports an insurance / reinsurance ecosystem that already absorbs a significant portion of the risk—helps to limit the impact on taxpayers and public finances without stifling market performance. Furthermore, diversifying risks can encourage the development of such coverage, whether public, private, or a combination of both. A ‘single-peril’ support system is more easily destabilised by a peak event. The European perspective should be seen as an asset in this area, given the variety of risks faced by Member States.

A further related consideration is the role of formal public–private partnership (PPP) arrangements in maintaining the insurability of climate-related risks. Existing PPPs (such as CCR in France or the Consorcio in Spain) demonstrate that state-backed mechanisms can stabilise markets and support broad availability of cover. However, their long-term effectiveness and financial viability are constrained by fiscal limits, political context, and the risk of distorting incentives. When governments absorb a large share of losses or provide predictable post-disaster aid, households and local authorities may underinvest in insurance and mitigation, reinforcing the public-sector moral hazard. Similarly, if PPPs suppress risk-based pricing or crowd out private reinsurance capacity, they may unintentionally lock in exposure growth and increase future losses.

For these reasons, PPPs cannot be viewed as a stand-alone solution to the protection gap. Their effectiveness depends on being embedded within broader national and European resilience strategies that strengthen risk reduction, enforce land use and building standards, and preserve market discipline. In this context, the December 2024 ECB/EIOPA proposal to explore an EU-level PPP merits careful consideration. A European risk pooling framework and backstop for extreme losses could benefit from diversification across perils and geographies and from a lower cost of capital. According to the follow-up EIOPA/ESM discussion paper from April 2026, such a European-level risk pooling could reduce aggregated capital requirements by up to 67%. Yet even such a scheme would need to operate within clear fiscal and market guardrails and reinforce, rather than replace or undermine, the incentives for prevention, adaptation and climate-resilient development. It will also require robust governance prerequisites, including harmonised data standards, unified definitions of covered perils, and common coverage triggers to ensure the mechanism adds value beyond existing national arrangements.

The analysis of drivers and obstacles set out above reveals a recurring theme: no single stakeholder group can resolve the climate insurance protection gap alone. Policyholders, insurers, and governments each face incentive structures and information constraints that, in isolation, produce a persistent coordination failure. Overcoming this requires a shift from fragmented, reactive action to a deliberately designed framework in which each party’s contribution is contingent on, and reinforces, the contributions of the others. The following section identifies the key elements of such a framework.

### 3 KEY ELEMENTS FOR AN EFFECTIVE SOLUTION

Ultimately, reducing the protection gap requires a shift from a mindset of waiting for others to act to one of shared risk ownership. Currently, policyholders often expect government bailouts or affordable premiums without investing in resilience; insurers hesitate to offer coverage or fund adaptation without regulatory clarity or government backstops; and governments delay intervention by hoping the private market will self-correct. This persistent coordination challenge among the three groups perpetuates the status quo. A sustainable solution demands that each party recognises that our collective fates are inextricably linked. Only then can we move from a coordination failure to a genuine ‘win-win-win’ outcome.

Based on the above-mentioned drivers and obstacles, an effective, economically sustainable solution to narrow the climate-related protection gap while increasing resilience should follow these principles:

#### ***Data & Transparency:***

- Facilitate the access for all stakeholders to relevant data and models:**  
This provides a more objective way of measuring the impact of micro and macro-adaptation measures. Better and earlier recognition of the impact of micro and macro-adaptation measures on insurance pricing and risk management approaches would benefit policyholders. In addition, recognising new and upcoming macro-adaptation measures in insurance and banking sector capital stress tests could also lead to investments being given greater financial recognition.
- Make benefits of micro adaptation measures transparent and link them to risk:**  
Based on the available data, the benefits of adaptation measures (e.g. eligibility criteria, deductibles and premium credits) should be tied quantitatively to location-specific hazards and verified mitigation measures. This would provide clear guidance to households and SMEs on how to reduce expected losses. Transparent communication of these effects would help prioritise different prevention strategies and enable the cost-benefit of prevention policies to be assessed more accurately.

#### ***Incentives & Affordability:***

- Provide meaningful incentives for micro adaptation:**  
Offer material, multiyear incentives—premium credits or co-funding—for certified, standardised micro adaptation measures. Insurance incentives alone cannot deliver adaptation at the scale required, as many effective measures have high upfront costs and payback periods far longer than typical insurance contracts or ownership cycles; they must therefore be complemented by public subsidies, regulatory standards and broader resilience frameworks.

- **Enable co-investment and public support for macro-adaptation:**

Governments and insurers should co-finance large-scale risk reduction measures and provide well targeted subsidies and financing tools for vulnerable groups. Insurers have a structural interest in co-financing macro-level resilience projects in regions where their portfolios are concentrated, but such investments require formal public-private frameworks rather than relying on isolated voluntary initiatives from insurers.

***Risk Sharing & Prudential Regulation:***

- **Ensure broad availability of NatCat cover through a tiered risk and cost-sharing framework:**

Private insurance markets can cover standard risks at risk-reflective prices, while hard-to-insure exposures should be able to access protection through public-private insurance schemes. Such schemes must be tied to verified adaptation and mitigation measures, and their financing must be equitably shared between governments, insurers, and policyholders.

- **Leverage diversification and scale to lower costs:**

Risk pooling across perils and geographies, and efficient (re)insurance arrangements, should be used to stabilise loss volatility and reduce costs. Coordinating or pooling risks at the EU level would allow the insurance market to benefit from imperfect correlations across flood, wind, wildfire, drought, and earthquake, thereby enhancing capacity and market stability.

- **Recognise the systemic benefits of adaptation:**

From a financial stability perspective, widespread adaptation and broad insurance coverage reduce systemic climate-related risk. Prudential frameworks such as Solvency II should explicitly recognise this macroprudential value when designing incentives for resilience and not focus solely on the microprudential benefits at company level.

## 4 EXAMPLES FOR HOW TO OVERCOME THESE OBSTACLES

### 4.1 CASE STUDY: AUSTRIA – BUILDING IN HAZARD ZONES

Austria is confronted with major challenges in terms of residential construction in areas at risk of natural hazards such as floods, avalanches, and landslides. Approximately 177,000 buildings are located in officially designated hazard zones, with a particularly high concentration in Tyrol and Carinthia. Many of these structures were built before hazard mapping existed.

A key issue is that hazard zone plans only become legally binding when incorporated into state building regulations. The enforcement and documentation of risk mitigation requirements are often weak and the responsibilities of the federal government and state governments are fragmented. However, the Austrian Court of Audit (Rechnungshof) has issued several recommendations on best practice to address these shortcomings:<sup>10</sup>

- **Stricter Construction Restrictions in Hazard Zones:**

The Court of Audit recommends introducing stricter building restrictions in yellow (moderate-risk) hazard zones, following the example of Upper Austria’s Building Technology Act 2013 (Öö. Bautechnikgesetz 2013) and the Styrian Development Programme for managing water-related natural hazards and avalanches. These models provide effective templates for other regions to harmonize and strengthen their regulations.

- **Mandatory Documentation of Risk Mitigation:**

The Court further suggests that building regulations should require, for any construction within hazard zones, the implementation of risk mitigation measures to be verifiably documented—such as through photographs or official reports. This ensures that safety requirements are not just prescribed, but actually fulfilled and traceable.

- **Nationwide Ban on New Buildings in Red Hazard Zones:**

In cooperation with federal states, the Court recommends explicit regulations to prohibit new residential construction in red (high-risk) hazard zones, as defined by the Austrian Forest Act 1975 (Forstgesetz 1975). This would harmonize standards nationwide and close the regulatory loopholes that currently allow risky development.

Many countries with a federal system of government face similar challenges when it comes to managing construction in hazard zones. The division of responsibilities between national, regional, and local authorities can often lead to inconsistencies in regulations, enforcement, and risk documentation. As a result, gaps in legal frameworks and varying levels of coordination can hinder the effective mitigation of natural hazard risks. Addressing these issues requires not only harmonized standards and clear responsibilities, but also close cooperation between different levels of government—a challenge also observed in countries such as Germany and Switzerland.

10 Austrian Court of Audit (2025). Extremwetterschäden [Extreme weather damage], Bundesrechnungshof. Available at: [Rechnungshof Austria – Extremwetterschäden \(PDF\)](#)

## 4.2 CASE STUDY: BELGIUM - RELOCATION AFTER 2021 BERND FLOOD EVENT

In July 2021, the Bernd event caused devastating flooding in large parts of Belgium and Germany, particularly in the region of Wallonia. Other countries were also affected, albeit to a lesser extent. In Belgium, the total cost of damage to insured assets exceeded €2 billion.

According to experts, climate change has increased the intensity of maximum one-day rainfall events in this region during the summer by 3–19%, compared to a global climate that was 1.2 °C cooler. A similar increase was observed for the two-day rainfall event. Compared to a 1.2 °C cooler climate, the likelihood of such a one-day event occurring today has increased by a factor of between 1.2 and 9 across the larger region. A similar increase was observed for the two-day event.

The main affected areas, located alongside secondary rivers, experienced record water flows. Many properties near these rivers were heavily or completely damaged. The intensity of the flows, combined with the presence of debris, exacerbated the impact of the floods.

Following this event, the Walloon Government reviewed the flood zones in the affected areas. As a result, some houses were demolished as they were located in newly designated high-risk zones. Hundreds of houses were affected. As these decisions are made at the commune level, it is difficult to estimate the total number of houses destroyed. In Verviers, for example, 63 houses were demolished. In some cases, renovation work had already begun or been completed following the Bernd floods.

In addition to protecting these properties against future events, the decision also took into account the need to restore the natural areas alongside these rivers, in order to reduce the impact of future floods, both within and beyond the areas affected in 2021. The Master Plan developed by the Walloon region following the floods totalled EUR 737 million. This was allocated to reconstruction, building resilience, and future prevention measures.

## 4.3 CASE STUDY: POLAND - THE IMPACT OF INFRASTRUCTURE DURING THE 2024 BORIS EVENT

During the summer of 2024, the Boris event impacted several countries in Central and Eastern Europe. Observed rainfall amounts broke historical records by significant margins, surpassing local and national records over a four-day period. Approximately two million people were directly affected. This event was by far the heaviest ever recorded in the region and it is estimated that the likelihood of heavy four-day rainfall events has doubled and their intensity has increased by 10% since the pre-industrial era.

In light of the estimated impact of climate change on the frequency and severity of major flooding, adaptation measures at both the individual building and public infrastructure levels will be crucial in managing the consequences of future events.

Regarding infrastructure, observations from the Boris event in Poland provide two notable examples:

- The Lower Racibórz Reservoir, located on the Oder River, was constructed following the ‘Flood of the Century’ in 1997. This recently built reservoir protected two cities, Opole and Wrocław, from flooding during Storm Boris. Both cities suffered severe damage in 1997, but were fully protected in 2024 thanks to this new infrastructure. Construction of the reservoir took over two decades, costing approximately 2 billion zlotys (€469 million), and required the resettlement of two villages. Funding was partially provided by the European Union and the World Bank. This example illustrates the positive impact of new infrastructure in protecting citizens and physical assets.
- In another part of Poland, however, a dam collapsed in the aftermath of Storm Boris. The resulting torrents of muddy water inundated the city of Stronie Śląskie. This incident highlights the urgent need to maintain and upgrade infrastructure in order to cope with the increasing severity of pluvial and fluvial events driven by climate change.

#### 4.4 CASE STUDY: FRANCE - CLINICAL STUDY OF CLAY-RELATED SUBSIDENCE

The ‘Initiative Sécheresse’ (Drought Initiative) is a study launched by France Assureurs (the French Federation of Insurance) and CCR to improve understanding of the effectiveness of various prevention techniques in addressing the challenges posed by clay-related subsidence. This is an example of insurers working together to achieve a better collective understanding of a risk, in order to determine the most relevant micro-adaptation strategies.

Although clay-related subsidence does not currently affect the whole of Europe, this approach could be extended to other hazards. This process is part of a wider initiative called ‘Mission Risques Naturels’ (Natural Hazards Mission), in which the main insurance companies operating in France share information about natural risks. The aim is to establish solutions and prevention guidelines that improve understanding of the risks and methods of adaptation.

The development of the ‘Initiative Sécheresse’ can be summarised as follows:

- Growing awareness of the risk: clay-related subsidence has been included in the French public-private protection regime against natural catastrophes since 1982 (implicitly at first, then explicitly from 1989 onwards). Average yearly losses increased from 400 million euros for the period 1989–2015 to 1 billion euros for the period 2016–2020. Mission Risques Naturels, BRGM and the French Ministry for the Ecological Transition produced the first exposure map in 2019. This map is also used to inform the public (it is mandatory to disclose the exposure to clay-related subsidence when selling a house).

- Inventory of prevention and repair techniques: insurers have struggled with two complementary problems: how to repair affected properties and how to prevent them from collapsing once exposed. Due to the small number of experts with the appropriate skills to implement these solutions, the cost of the measures increased without any guarantee that they were optimal (underpinning the foundations with micro-piles was often chosen despite being costly and offering no clear benefit).
- Clinical study: Initiative Sécheresse can be understood as a clinical study of clay-related subsidence. One hundred insured houses that had already been affected were selected, with geographical representativeness ensured by cartography (step 1 above). A further 200 houses in high-risk areas that are not yet affected were selected. The repair and prevention measures (inventoried in step 2) were tested on the 100 and 200 houses respectively. The consequences are monitored and observed in the medium to long term.
- Duration: The initiative is initially set at 5 years and could be extended in subsequent years if the partners agree. Although the first conclusions are expected to provide guidelines before the end of the project, the current duration is short (covering the selection of houses and deployment of solutions) to enable a good understanding of long-term developments to be reached. Therefore, the challenge of maintaining these epidemiological efforts in relation to natural hazards is a key parameter.

#### 4.5 CASE STUDY: US STATE OF ALABAMA – ROOF HARDENING PROGRAM

Alabama's roof hardening initiative is based on the FORTIFIED Roof standard. This standard employs stronger construction methods, such as enhanced roof fasteners and sealed roof decks, to minimise storm damage. Over 50,000 homes in Alabama have already been upgraded under the initiative, enabling policyholders to receive discounts of between 20% and 35% on the wind portion of their insurance premiums. Even greater savings are possible when additional parts of the home are strengthened. Homeowners play a central role in this by choosing to retrofit their roofs and invest in resilience measures that significantly reduce the likelihood of costly storm damage.

Insurers support the programme by offering substantial premium discounts in recognition of the reduced risk presented by hardened homes. This helps to stabilise an increasingly stressed insurance market. The Alabama Department of Insurance has played a key role in establishing and promoting the programme on behalf of the state government, ensuring standards, oversight, and public awareness. These three stakeholders work together to create a coordinated resilience strategy: policyholders take preventive action, insurers reward risk reduction, and the government provides the framework and incentives that enable widespread adoption.<sup>11</sup>

11 NPR (2025). Climate home insurance discount programme, Alabama. Available at: [NPR – Climate home insurance discount, Alabama](#)

## 5 CONCLUSIONS

In the face of rising costs associated with climate-related events, maintaining the status quo is no longer a viable solution for the insurance sector, either in terms of its mission to protect the public or its economic sustainability. The necessary adaptation effort must therefore involve three key stakeholder groups: policyholders, insurers, and governments acting as insurers of last resort. In this paper, we therefore explore the perspectives of these different parties.

A number of challenges emerge. For example, policyholders often lack the awareness and knowledge to address risk adequately, and there are insufficient incentives to invest in preventive measures personally. While insurers can play an educational role and help disseminate such recommendations, insurance premiums alone are unlikely to be an effective lever for changing behaviour. Alongside this challenge in their relationship with policyholders, insurers must also contend with conflicting regulatory signals, as the long-term benefits of adaptation efforts are sometimes overlooked in short-term accounting frameworks. From a governmental perspective, intervention in public-private schemes must not undermine individual responsibility. The absorption of risks not covered by the private sector must be anticipated and coordinated more effectively across different levels of responsibility (local, regional, national and European).

Rather than pitting the perspectives of these three types of stakeholders against one another, it is important to emphasise their complementarity. As they are on the front line of risk exposure, policyholders have a key role to play in the practical implementation of micro adaptation strategies. Insurers, with their collective view of risk, are well placed to provide recommendations that consider more than just individual risk; they also possess valuable information and expertise from networks of experts and technicians. Governments can provide protection as a last resort, supporting the efficient development of the market rather than acting as substitutes for insurers, and can most effectively plan where to invest for macro adaptation measures. In this context, public-private partnerships appear to be a relevant lever, provided that the need for an effective private reinsurance system is not overlooked, and that prevention measures on all levels are fully integrated into resilience strategies.

Faced with this challenge of adaptation, the European insurance sector has the necessary resources. We have sought to identify the key factors of an appropriate response, showing that a number of existing approaches can inspire broader implementation. The key elements lie in

- an improved access to and sharing of information,
- enabling better anticipation of the consequences of risk and providing meaningful incentives for micro-adaptation,
- and with that a more effective risk sharing and dissemination of prevention methods suited to the challenges.

Insurers play a central role in this process through their relationships with policyholders and their connections with networks of craftsmen and technicians responsible for repairs and implementing preventive measures.

It is also important to highlight the need for risk diversification and a sufficiently large pool of insured individuals to absorb risk. The European scale therefore represents an opportunity in this respect. European-wide systemic factors also need to be better considered.

- For the cooperation between insurers and governments it is key to co-finance large-scale risk reduction measures and provide well targeted subsidies and financing tools for vulnerable groups.
- Prudential frameworks such as Solvency II should explicitly recognise this macroprudential value when designing incentives for resilience and not focus solely on the microprudential benefits at company level

The case studies provided in this paper as examples can offer valuable insights into best practices and opportunities for learning from suboptimal implementations.

Actuaries have an essential role to play throughout this process. Their expertise in quantifying and pricing risk, modelling long-term climate scenarios, and designing resilient financial structures positions them as key advisors to insurers, governments, and regulators alike. A more prominent role for the actuarial profession in shaping the data frameworks, prudential standards, and public-private partnership models discussed in this paper would materially strengthen the quality and durability of the European response to the climate insurance protection gap.

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## THE ACTUARIAL ASSOCIATION OF EUROPE

The Actuarial Association of Europe (AAE), founded in 1978 under the name of Groupe Consultatif Actuariel Européen, is the Brussels-based umbrella organisation, which brings together the 38 professional associations of actuaries in 37 countries of the EU, together with the countries of the European Economic Area and Switzerland and some EU candidate countries.

The AAE has established and keeps up-to-date a core syllabus of education requirements, a code of conduct and discipline scheme requirements, for all its full member associations. It is also developing model actuarial standards of practice for its members to use and it oversees a mutual recognition agreement, which facilitates actuaries being able to exercise their profession in any of the countries concerned.

The AAE also serves the public interest by providing advice and opinions, independent of industry interests, to the various institutions of the European Union – the Commission, The Council of Ministers, the European Parliament, ECB, EIOPA and their various committees – on actuarial issues in European legislation and regulation.



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