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Climate Resilience for Physical Assets: An Approach to Assess Climate Risks

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Climate Change as the Urgent Driver of Action

The global average temperature is steadily rising, leading to more frequent and severe weather events, and a continuous rise in sea levels. To protect a company's physical assets, such as buildings and infrastructure, from potential damage or disruptions, it has become more critical than ever to conduct comprehensive climate risk assessments. Typically, the responsibility of identifying and executing the appropriate climate adaptation measures falls on Sustainability, Asset and Facility Managers. Sustainability Managers are tasked with dealing with climate change impacts and ensuring their company's compliance with various (new) legislations. Meanwhile, Asset and Facility Managers are responsible for driving investment decisions for their companies and must also take into account the implications of climate risks.

Especially in asset-intensive organizations, there is a high exposure to climate-related risks due to their asset base. For example, research shows that for every 1°C of global warming, extreme daily precipitation events may intensify by about 7%. By 2030, the fire season could extend by three months in areas already susceptible to wildfires, and coastal flooding events could threaten assets equivalent to up to 20% of the global GDP by 2100.[1] Recent data from the World Meteorological Organization (WMO) reveals that the number of climate- and weather-related disasters has surged fivefold over the last 50 years, resulting in a sevenfold increase in economic losses from the 1970s to the 2010s. This rise translates to an average daily global cost soaring from $49 million to $383 million.[2]

The severe global trends and profound repercussions of climate change need immediate and comprehensive risk assessments for physical assets of companies in order to take the appropriate adaptation actions in response to the risk. In most firms, this topic is of interest to Sustainability as well as Asset and Facility Managers. The purpose of this article is to provide an overview on (new) regulatory requirements, the procedure for climate risk assessments and the importance of climate projections from climate models in this context. This article will highlight how climate risk assessments are intrinsically linked to good asset management practices and why they should be seen as an opportunity rather than an obligation.

The Legislative Framework Propelling Companies Forward

Companies often respond reactively to events, particularly when they are triggered by calamities, instead of adopting a proactive and forward-thinking approach. Recent regulations, such as the EU Taxonomy, now require companies* to perform physical climate risk assessments. An overview of recent legislations on climate risk assessments and their requirements is presented in Figure 1. In the upcoming section of this article, we will introduce a comprehensive step-by-step assessment process. Embracing this approach not only enhances the organization's understanding of climate risks but also ensures compliance with the latest regulations.

Figure 1. Overview of legislations which enforce companies to perform a climate risk assessment driven by compliance needs, strategy and/or infrastructure management[3]

	EU Taxonomy	CSRD	TCFD	Critical assets management
Driven by	Compliance	Compliance	Strategy to feed sustainable transformation business case	Risk management + EU critical infrastructure directive
Applicable for	Various groups of companies. There are 3 thresholds defining a 'large' company: companies with 250+ employees, exceeding EUR 20 million in total assets and exceeding EUR 40 million net turnover (2 out of 3 criteria to be met).	Various groups of companies. There are 3 thresholds defining a 'large' company: companies with 250+ employees, exceeding EUR 20 million in total assets and exceeding EUR 40 million net turnover (2 out of 3 criteria to be met).	Voluntary basis	Voluntary basis
Assets and activities scope	Assets to run eligible EUT activities	All business activities and related assets	All business activities and related assets	Specific assets considered as critical for business continuity
Amount of scenario	1 – 2	Min. 2	3 – 4 (recommended)	1 – 2
Risks and/or opportunities	Risks	Risks and opportunities	Risks and opportunities	Risks
Identification of relevant physical risks	✓	✓	✓	✓
Identification of transition risks	✗	✓	✓	✗
Exposure and vulnerability assessment	✓	✓	✓	✓
Climate risk adaptation solutions	✓	✓	Optional	✓
Value chain	Limited to EUT activities	Phase-in	✓	Optional
Climate risk financial impact: risks on business continuity and asset value	✗	✓	✓	Optional
Other financial impact: identification of tax credits and incentives, cost of capitals, needed resources, etc.	✗	Partial	✓	Optional

Legend:

✓ – Applicable

✗ – Not applicable

EUT = EU Taxonomy

CSRD = Corporate Sustainability Reporting Directive

TCFD = Taskforce on Climate-related Financial Disclosures

* See applicability in Figure 1

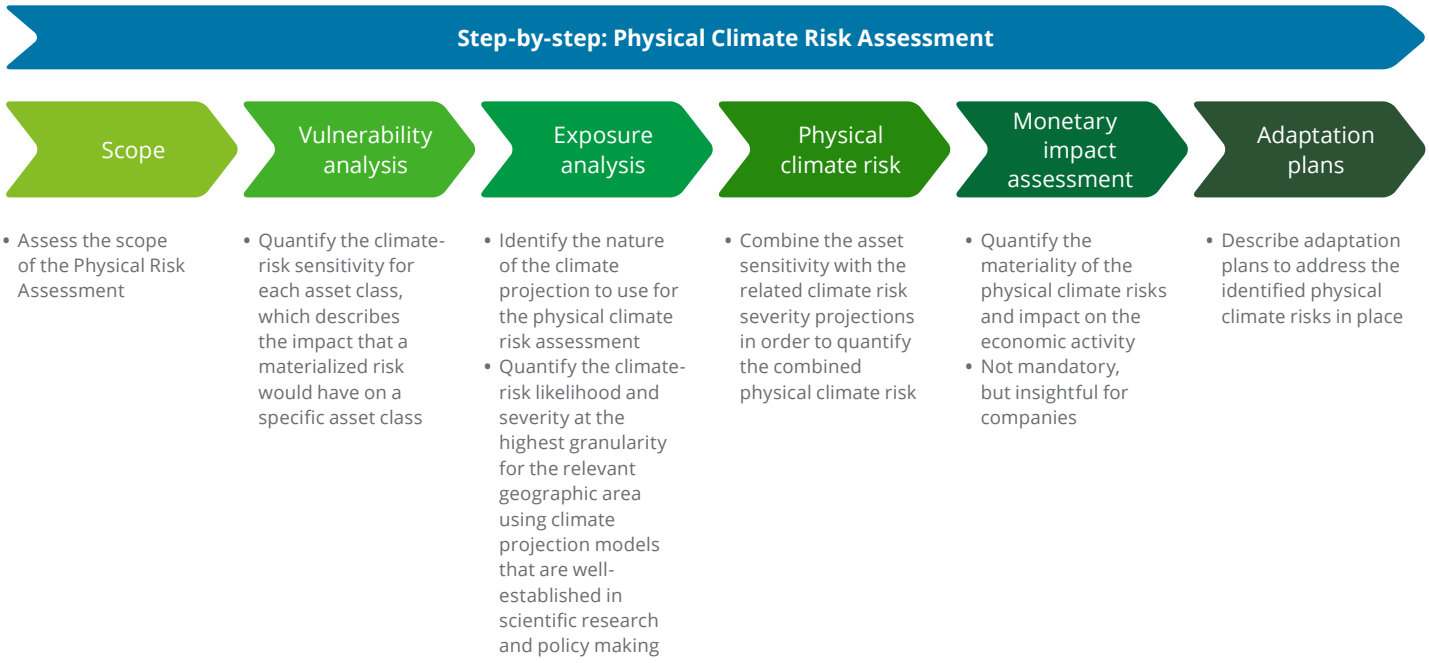
The Approach to Assessing Climate Risks

Figure 2 illustrates a comprehensive step-by-step process for conducting physical climate risk assessments. Typically, such an assessment revolves around a vulnerability and exposure analysis aimed at quantifying the physical climate risk. In the vulnerability analysis phase, the focus is on assessing the potential impact of specific risks like floods, fires, landslides, etc. on specific asset classes, such as buildings, pipes, cables, etc. Expert judgment plays a crucial role in evaluating vulnerability. The exposure analysis seeks to quantify the likelihood of these risks occurring in a specific geographical area. During this stage, projections from climate models are used, which we'll further elaborate on in the upcoming section of this article.

Often, the results from the assessments are translated into a monetary impact assessment. While not mandatory under the EU Taxonomy, conducting a monetary estimate can offer valuable insights to companies. It helps quantify the materiality of climate risks on their assets indicated by the loss of the financial value of the asset. Furthermore, it emphasizes indirect monetary repercussions, as disruptions in an asset's performance can have ripple effects as for example a blackout and resultant economic losses for companies without a stable energy supply.

The final, and critical step, involves the identification and establishment of adaptation plans to mitigate the identified climate risks. The ultimate goal of physical climate risk assessments is to understand the potential consequences of climate change on physical assets and to design adaptation measures. Adaptation measures are aimed at increasing resilience and reducing vulnerabilities of assets in order to mitigate the unavoidable negative effects of climate change.[4] The EU Adaptation Strategy[5] outlines how the European Union will adapt to the unavoidable consequences of climate change and aims to become climate resilient by 2050. The Strategy advocates accelerating adaptation planning and risk assessments as a vital step towards better, faster, and more systematic adaption throughout Europe. Furthermore, the European Parliament resolution of 15 September 2022[6] also encouraged the Commission to prepare an EU-wide climate risk assessment in order to guide and prioritize short-, medium- and long-term adaptation efforts.

Figure 2. Steps of a physical Climate Risk Assessment



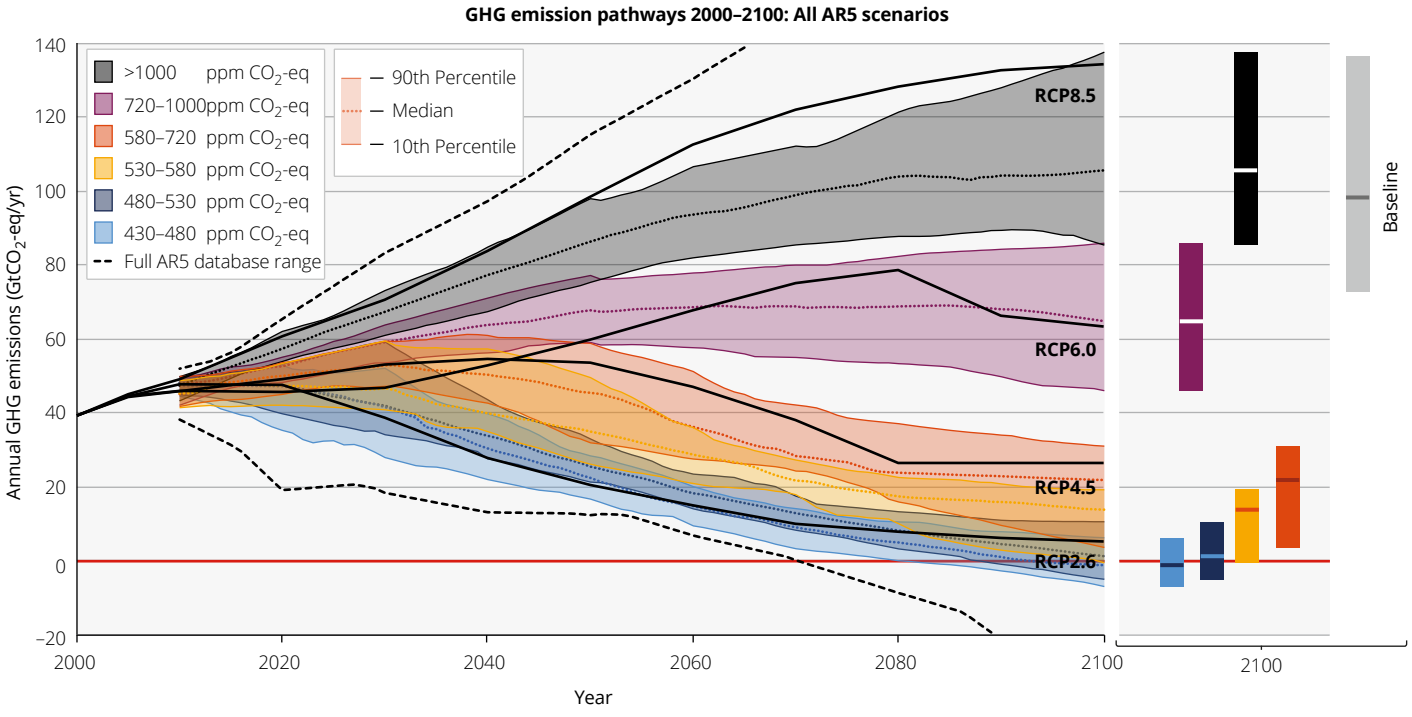
Climate Models as Important Assessment Enablers

The availability and accessibility of data on floods, storms, droughts, etc. under various climate scenario's is at the heart of climate risk assessments. Climate model projections enable governments, corporations, and communities to get a comprehensive picture of climate change vulnerabilities and hazards. Stakeholders can identify hotspots of climate impact, evaluate the risk for disruptions and build focused adaptation measures by combining asset data with meteorological records, climate models, socioeconomic data, and other relevant information.

The Intergovernmental Panel on Climate Change (IPCC) has developed four emission pathways (see Figure 3) that are commonly used for climate modeling and research. These pathways depict different climate futures, all of which are considered possible based on the volume of greenhouse gases emitted in the years to come. The Representative Concentration Pathway 8.5 (RCP 8.5) is considered the most appropriate climate projection to use when performing a physical climate risk assessment, as it represents the worst-case scenario, is a conservative approach, and is widely used in scientific research and policy-making.

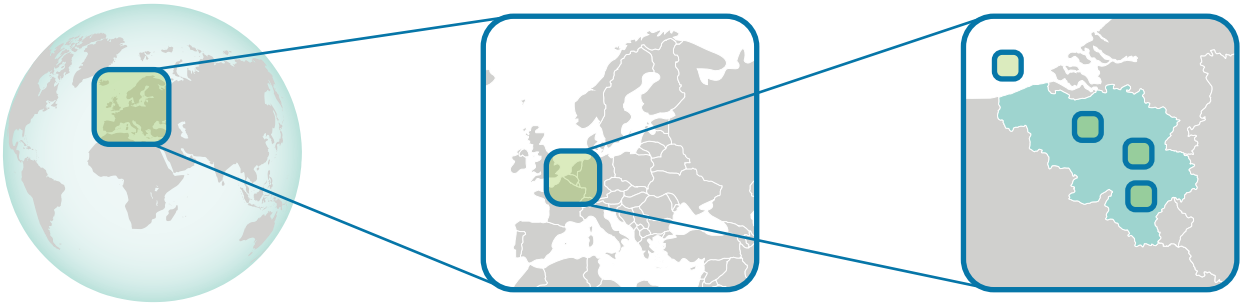
Climate model projections enable the integration of various climate scenarios into the risk assessment of physical assets. This lays the foundation for evidence-based decision-making and effective risk management.

Figure 3. GHG emission pathways by the IPCC, where RCP 8.5 is considered the wort-case scenario and most suitable for climate risk assessments



Source: IPCC Synthesis Report 2014

Figure 4. Downscaling climate model calculations from global models (100 km) to regional (12,5 km) and to spatially detailed models (4 km) to ensure a more realistic representation of the extreme climate events.



Global climate model 100 km

Regional climate model 12.5 km

Limited area model 4 km

Generally, global and regional climate model calculations are done through coordinated and international frameworks to ensure that model results for past, present and future climate conditions can be provided in a consistent and standardized way.

Global climate model calculations are conducted through the 'Coupled Model Intercomparison Project' (CMIP). International climate researchers convene every five to seven years for coordinated model simulations (currently in CMIP6[7]). These simulations contribute to reports by the IPCC. The latest CMIP6 scenarios used in the IPCC Sixth Assessment Report (2021) combine new societal development narratives (SSPs) with previous scenarios (RCPs).[8] This shows that climate modeling is an evolving field, with scientists always working to improve accuracy in future projections.

Aside from climate projections, it is critical to examine the quality and granularity of available climate data on a certain location, as these differ based on the country where the assessment is conducted. To allow for more spatially detailed climate model information and projections, regional climate models use the global climate model results to 'zoom' or downscale on specific regions of interest (see Figure 4).

The regional climate model calculations are done in the context of the international 'Coordinated Regional Climate Downscaling Experiment' or CORDEX.[9] The CORDEX project ensures the consistency of calculations with regional climate models, meaning that the regions, variables, and different greenhouse gas emission scenarios are predefined.

At the Belgian level, the CORDEX.be project brings together all Belgian research groups active in climate and impact modelling. Spatially detailed regional climate models with a high level of spatial detail (up to 4 km) are used to estimate the expected climate changes and impacts until the end of this century.[10] Although the CORDEX.be projects focus on modelling and the development of Belgian climate projections, the results provide also an essential source of information for climate policy (adaptation) and climate risk assessments in Belgium and the regions. It is essential that governments on federal and regional level coordinate their data provision, to ensure coherently provided climate data. Currently, this is still not always the case. The Climate Centre aims to facilitate coherence in the provision of climate projections and statistics.

"The Belgian climate projections with a high level of spatial detail are an essential data source for climate adaptation and climate risk assessments in Belgium."

Rozemien De Troch from the Belgian Climate Centre

Including Climate Risks in Asset Risk Management Processes

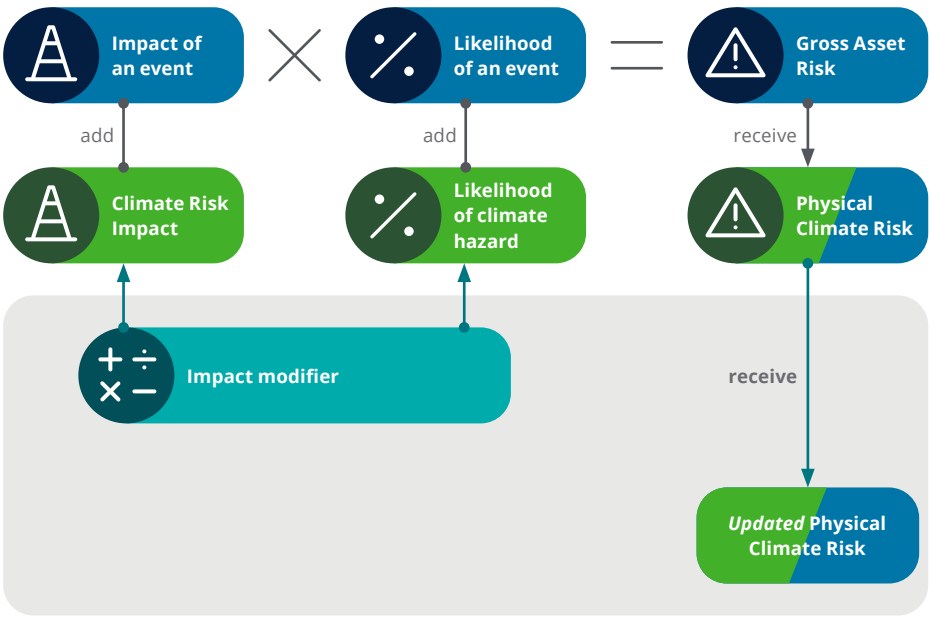
For companies with physical assets, a robust Climate Risk Assessment plays a pivotal role within the Asset Risk Management Process, as outlined by the Institute of Asset Management (IAM).[11] These organizations have a high exposure to climate-related risks due to their asset base. However, only a limited number of companies are integrating climate risk assessments and corresponding action plans beyond their risk management. Below, we outline a proposed strategy for seamlessly incorporating climate risks into existing asset risk management frameworks.

Traditionally, assessing the risk associated with an asset involves using a formula that multiplies the impact and likelihood of an event, such as a pipeline break or power outage, resulting in a gross asset risk score. However, this conventional approach fails to account for the potential risks posed by climatic factors. To obtain a truly accurate evaluation of an asset's overall risk, it is imperative to factor in its exposure to climate-related threats. Figure 5 illustrates the correct representation of this equation: it multiplies the impact (including climate risk impact) by the likelihood (including the likelihood of a climate hazard), yielding the physical climate risk. Conducting this comprehensive assessment offers a holistic understanding of asset risk.

Following the implementation of adaptation measures post-climate risk assessment, it becomes necessary to adjust the equation by introducing an "Impact modifier," represented by the grey box in Figure 5. This modification takes into account the reduced climate exposure resulting from the implemented adaptation actions. Similarly, it considers the impact of climate threats. The impact modifier, which ranges from 0 to 1, provides valuable insights into the extent to which the impact factor has been mitigated by the adaptation measures. By incorporating these adjustments, an updated asset risk assessment that includes climate risk is derived. This methodology offers a comprehensive perspective, enabling the calculation of adjusted asset risk and simplifying the evaluation of the effectiveness of adaptation measures.

Understanding climate-related risks is crucial for long-term sustainability and resilience for all organizations with physical assets. Climate risks should become an integral part of Asset Risk Management.

Figure 5. Calculation of Physical Climate Risk and the updated Physical Climate Risk (after implementation of adaptation measures)



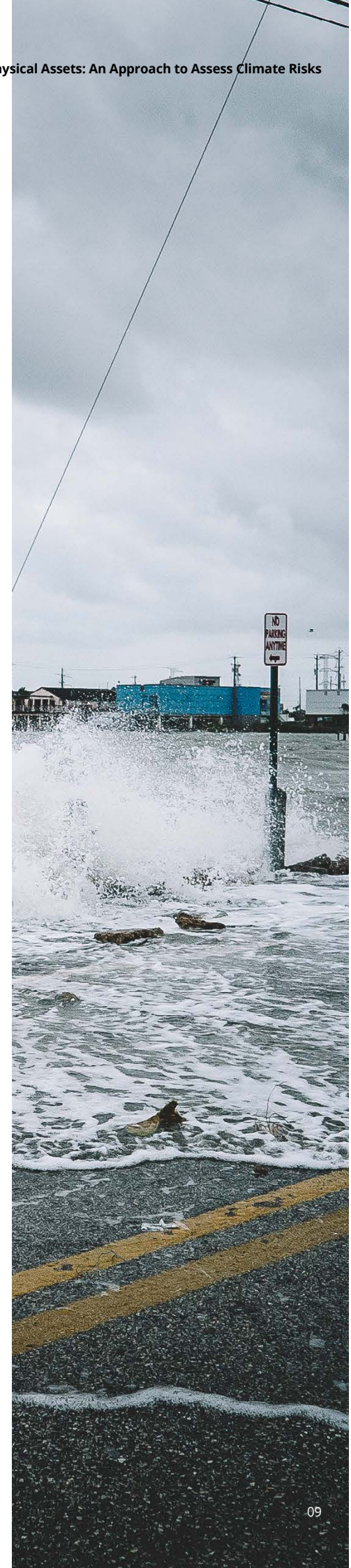
Conclusion

In light of the urgent challenges posed by climate change, protecting corporate physical assets stands as a paramount imperative. Climate-related risks can lead to operational disruptions, safety hazards, asset destruction, and more. The key to protecting these assets and preserving their future value lies in a comprehensive understanding of climate risks. This understanding can be attained through the process of physical climate risk assessments. For organizations, these assessments are essential, providing the necessary insight to comprehend how climate change may impact their physical assets in the years to come and to devise effective strategies for adaptation.

The efficacy of these assessments depends on the availability and precision of climate models, encompassing future climate scenarios. By dissecting climate risks such as floods, fires, and landslides on an asset-by-asset basis, quantifying their financial implications, and evaluating their repercussions on the organization's economic operations, companies can gain valuable insights. Furthermore, the integration of climate risks into asset risk calculations enables a more precise evaluation of the overall risk profile of assets.

As reporting obligations increasingly become mandatory for organizations, the advantages of embedding climate risk assessments into asset risk management processes extend well beyond mere compliance. These assessments offer companies with the opportunity not only to quantify the tangible impact of climate risks on their assets but also to gauge the effectiveness of implemented adaptation measures. This newfound knowledge empowers organizations to make informed decisions concerning the future of their assets, proactively enhancing resilience and ensuring their long-term value.

In summary, companies can take proactive measures to fortify the value of their physical assets in the face of climate change. However, the realization of these opportunities critically relies on collaborative efforts between the scientific community, the private sector and governments at both federal and regional levels. The scientific expertise and the coherence in climate projections serve as the cornerstone upon which these assessments are build.



Endnotes

1. https://www.undrr.org/climate-action-and-disaster-risk-reduction#:~:text=Climate%20change%20increases%20the%20frequency,Current%20mitigation%20efforts%20are%20insufficient. (Website visited 23/08/2023)
2. https://news.un.org/en/story/2021/09/1098662 (Website visited 25/05/2023)
3. Various European Legislations (as mentioned)
4. In general, there are two types of climate action:
    1. adaptation, aiming to reduce the climate change risks, and
    2. mitigation which focusses on the cause of the climate crisis by reducing emissions.

    The aim of climate risk assessments is to establish adaptation plans rather than mitigation measures depending on the risk that has been identified.
5. https://climate-adapt.eea.europa.eu/en/eu-adaptation-policy/strategy/index_html (Website visited 18/07/2023)
6. https://www.europarl.europa.eu/doceo/document/TA-9-2022-0330_EN.html (Website visited 18/07/2023)
7. https://www.wcrp-climate.org/wgcm-cmip (Website visited 18/07/2023)
8. https://www.sciencedirect.com/science/article/pii/S0959378016300681?via%3Dihub
9. https://cordex.org/ (Website visited 18/07/2023)
10. https://cordex.meteo.be/about/context (Website visited 18/07/2023)
11. https://theiam.org/news/climate-emergency-action-planning-guidance-for-asset-owning-organisations/ (Website visited 20/07/2023)

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