TECHNICAL DOCUMENTATION

Climate Exposure Rating

COVERING TRANSITION AND PHYSICAL RISKS OF INFRASTRUCTURE ASSETS
FORWARD-LOOKING FOR FIVE TIME HORIZONS UNTIL 2050

Scientific Climate Ratings
An EDHEC Venture

CERinfraMod_26.00.02 – June 2026

About Scientific Climate Ratings

Scientific Climate Ratings is an independent climate risk ratings agency born from the EDHEC Climate Institute's applied research ecosystem. We deliver forward-looking ratings, data, and analytics that quantify the financial materiality of climate risks for infrastructure, real assets, corporate, and sovereign exposures worldwide. Combining high-resolution geospatial data, proprietary climate risk models, and one of the world's largest financial datasets, Scientific Climate Ratings evaluates both transition risks (linked to the shift toward a low-carbon economy) and physical risks (arising from climate hazards such as floods, storms, heatwaves, and wildfires).

Our ratings and climate metrics assess climate exposure and financial vulnerability across multiple climate scenarios and time horizons, enabling users to move beyond qualitative climate risk assessments toward fully quantified inputs for financial decision-making. Applications include capital allocation, risk pricing, resilience planning, portfolio construction, scenario analysis, and regulatory disclosures.

Climate ratings are currently available for more than **6,000 infrastructure assets** globally, over **180 sovereigns**, and can be extended to any real asset worldwide through the ClimateMetrics self-assessment platform. Scientific Climate Ratings will expand its coverage in 2026 to **4,000+ listed equities**, delivering consistent, comparable, and forward-looking climate ratings across asset classes.

Scientific Climate Ratings aims to set a new standard in climate risk management, steering capital towards a more resilient future.

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This document summarises the development of ***Climate Exposure Rating for infrastructure (CERinfra)***. It explains the general approach, provides the assumptions and calculations made, justifies the methodology, and presents the results. For more information on Scientific Climate Ratings and our products and methodologies, please visit our website, where we share a variety of technical documentations: https://scientificratings.com.

Scientific Climate Ratings developed a rating for infrastructure companies that reflects their sensitivity to present and future climate exposure[1]: the Climate Exposure Rating for infrastructure (CERinfra). As a potential measure of climate exposure and vulnerability, we provide CERinfra and numerous exposure metrics under eight climate scenarios and for five time horizons, considering two types of climate exposure:

- **Physical exposure** encompasses all damage and disruption that companies may experience from the increased severity and frequency of climate-related hazards (e.g., floods, storms, wildfires, and heat stress) driven by climate change.
- **Transition exposure** encompasses all financial costs that may arise from policies and technologies aimed at mitigating climate change (e.g., carbon taxes), changes in market preferences (e.g., lower demand for local flights in favour of rail commutes), and shifts in values and reputation (e.g., people avoiding companies that harm the environment).

Our modelling approach includes estimating companies' carbon emissions and the expected damages and disruptions from climate-related hazards. At this point, our estimates do not account for technologies that companies may deploy in the future to reduce emissions or increase resilience to climate-related hazards. Such measures are idiosyncratic to each company and, in most cases, not publicly known. However, the CERinfra allows asset-specific adjustments to the underlying transition and physical exposure metrics by integrating contributed data from the rated company, subject to our team's verification and validation.

1. General Approach

The methodology for calculating the CERinfra follows a forward-looking approach, considering exposure and vulnerability to climate change-related damages and costs for five future horizons: 2030, 2035, 2040, 2045, and 2050. Compared to the Climate Risk Rating for infrastructure (CRRinfra), it focuses on future physical damages, operational disruptions, carbon costs, and market shifts, without a direct relation to companies' cash flows and value. Accordingly, CERinfra represents an "exposure" rather than a "risk" rating.
The calculation of the CERinfra proceeds in three steps, as summarised in Figure 1.

1. First, we calculate three company-level **impact metrics** that quantify exposure to transition costs as well as physical damage and disruption from today through each of the five time horizons.

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[1] We understand "exposure" in a financial and strategic sense to demonstrate assets' vulnerability and position to risk, which goes beyond their geographical presence (similar to market exposure, duration exposure, carbon exposure, etc.). Under this logic, the CER measures an asset's exposure and vulnerability to climate forces before any financial modelling. This means, under our framework, a wooden and a concrete bridge in the same location would not be equally exposed to storms because we include vulnerability within the exposure concept.

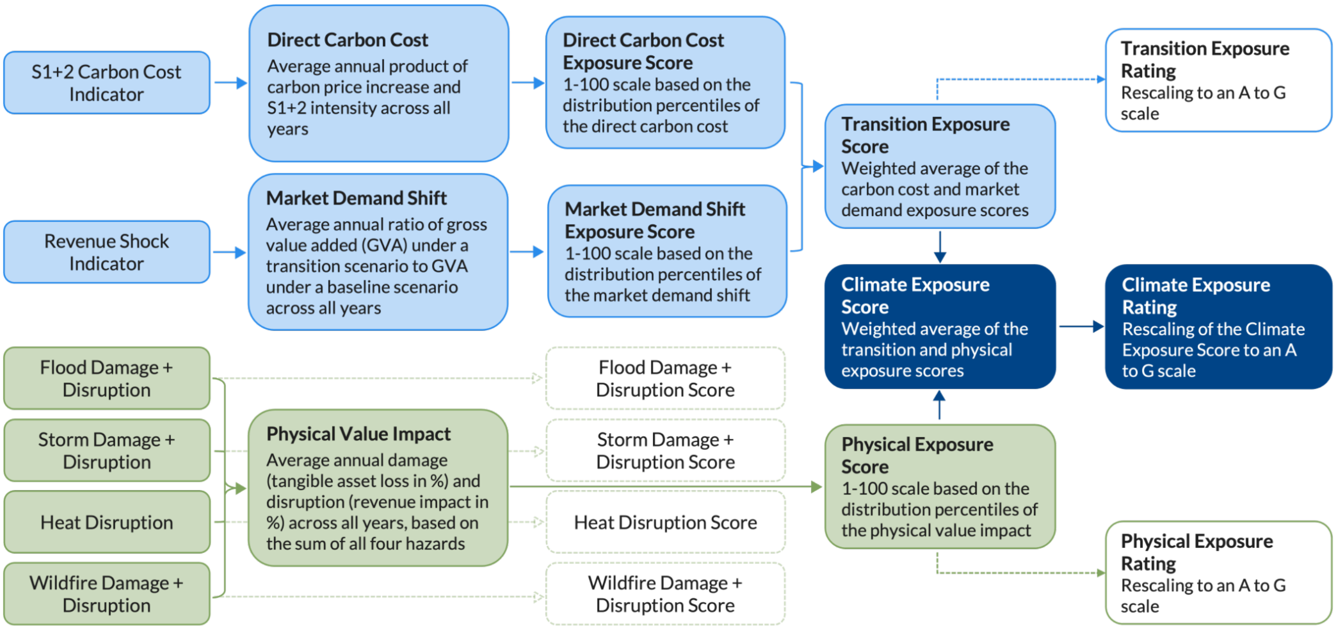

Figure 1: Illustration of the methodology for calculating the CERinfra.

Note: Light blue boxes represent transition exposure metrics, while light green ones represent physical exposure metrics. We combine both impacts to calculate the Climate Exposure Rating (dark blue). White boxes illustrate some of the additional score and rating metrics calculated as side products.

i. Transition Exposure: The first two metrics measure different types of impacts from transitioning to a low-carbon economy:
   - *Direct carbon cost* measures the impact of carbon taxes, which we use as a proxy for policy actions aimed at reducing carbon emissions. For this, we calculate a Scope 1 and 2 (S1+2) carbon cost indicator as the product of companies' S1+2 intensities per revenue and the country-specific carbon tax increase compared to 2025 (depending on a company's location).
   - *Market demand shift* reflects impacts of transition measures on the sector's economic value, a proxy for changes in market preferences and demand. For this, we calculate a revenue shock indicator that quantifies sector-level demand shifts as the ratio of gross value added (GVA) under a transition scenario to GVA under a scenario-consistent baseline.

ii. Physical Exposure: This metric measures the impact from four different climate change-related physical hazards (flood, storm, wildfire, and heat stress):
   - *Physical value impact* measures the sum of exposure to damage and disruption from physical hazards, expressed as a percentage of tangible asset loss[2].

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[2] For flood, storm, and wildfire exposure, our metrics distinguish between damage to physical assets (measured as a % loss of tangible assets) and disruptions to companies' activities (measured as a % loss of revenue) to measure the vulnerability and exposure to the respective hazard. For heat exposure, we calculate "damage" as the percentage of revenue loss attributable to the direct impact of heat on the workforce's productivity. In order to combine damage and disruption, we calculate an equivalent metric that translates disruption (and its indicator of revenue loss) into a tangible asset loss.

Additionally, we produce multiple impact metrics related to companies' transition exposure and carbon emissions as well as physical exposure, further distinguishing between damage and disruption and individual hazard types. These are listed in our data dictionary and available on request.

2. Second, we derive three company-level **exposure scores**, ranging from 1 to 100, with 1 representing the best possible score and 100 representing the worst :
   i. **Transition Exposure Score:** This score is calculated as the weighted average of the Direct Carbon Cost Exposure Score and the Market Demand Shift Exposure Score (the weighting process is described in more detail in Section 5). Both scores are derived from the percentiles of their respective impact metric distributions.[3]
   ii. **Physical Exposure Score:** This score is calculated based on the percentiles of the distribution of the physical value impact metric.
   iii. **Climate Exposure Score:** This score is calculated as the weighted average of the Transition Exposure Score and the Physical Exposure Score. The weighting process is described in more detail in Section 5.
3. Finally, the **CER** is calculated by rescaling the Climate Exposure Score to a 1 (A) to 7 (G) scale, where A represents the best possible rating and G the worst . Additionally, we rescale the remaining exposure scores in the same manner to obtain specific **Transition Exposure Ratings** and **Physical Exposure Ratings.**

   We produce multiple score and rating metrics to further distinguish impacts from direct carbon costs, market demand shifts, as well as damage and disruption from floods, storms, wildfires, and heat stress. These are listed in our data dictionary and available on request.

Our **climate exposure approach** translates the evolution of future climate impacts on revenue or tangible assets into a single value by averaging the respective metrics over multiple time periods: from 2025 to 2030, 2035, 2040, 2045, and 2050. To this end, the approach requires developing indicators that represent costs relative to revenue and damages relative to tangible asset value. These indicators provide comparable measures across assets but do not rely on complex financial models to assess a company's financial capacity. Before presenting the climate impact metrics in more detail (Section 4), we introduce the climate scenarios (Section 2) and clarify the data requirements (Section 3).

Rating a company implies the (pre-)existence of a **rating scale**. In the CER context, we calculate percentiles for each metric based on its distribution, which can then be used to translate exposure into a score and, hence, a rating. We describe this step in more detail in Section 5 and 6. In some cases, we can adjust the ratings based on company-specific decarbonisation measures and resilience actions. For this, we utilise the ClimaTech database developed by the EDHEC Climate Institute

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[3] The percentiles of all exposure metrics are updated annually and hence, stable even when assets are added to the rating universe.

(ECI), which provides decarbonisation and resilience strategies along with their effectiveness levels across various sectors. We explain the process in Section 7. Finally, Section 8 provides a specific example of the CER calculation.

2. Climate Scenarios

Climate scenarios are projections of future macroeconomic conditions influenced by climate change based on various assumptions about greenhouse gas emissions, socioeconomic developments, and technological advancements. We use the scenarios and underlying data from the Network for Greening the Financial System[4] (NGFS, 2024) as well as two additional scenarios developed by the ECI that further emphasise potential physical risks: Climate Destabilisation and Climate Breakdown (for more details, see our technical documentation on the extension of NGFS scenarios). Overall, NGFS distinguishes four main categories of scenarios: orderly, disorderly, too little too late, and hot house world. Figure 2 illustrates the position of each scenario along a transition and physical risk axes.

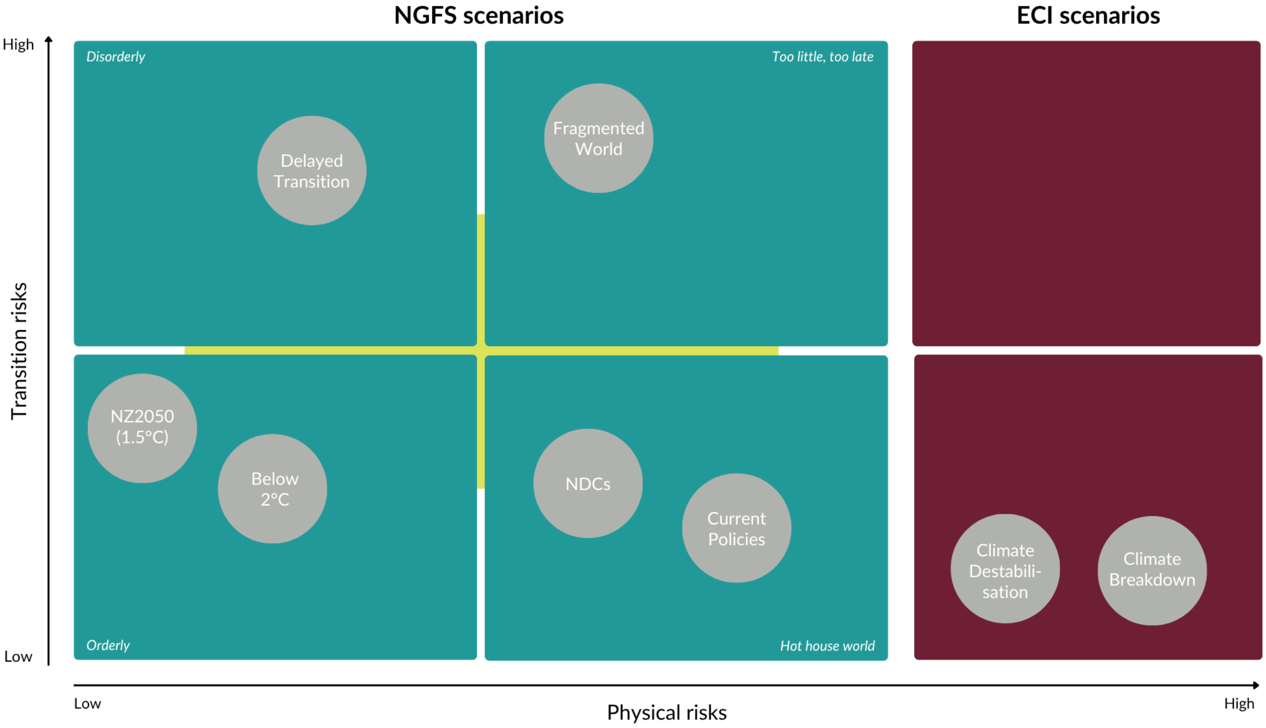

***Figure 2:** Position of NGFS and ECI climate scenarios along the physical risk and transition risk axes (own illustration, based on NGFS, 2024)*

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[4] NGFS is a global network of central banks and financial supervisors. It aims to strengthen the financial system's ability to manage climate-related and environmental risks and to support the transition toward a sustainable economy. NGFS publishes guidance, research, and climate scenario frameworks that are widely used by financial institutions, regulators, and researchers (NGFS, n.d.).

a. In **Orderly Transition scenarios**, immediate and ambitious climate policies are applied, enabling the containment of physical risks while avoiding significant transition risks.

  i. Net Zero 2050 aims to reach net-zero emissions by 2050 to limit global warming to 1.5°C.
  ii. Below 2° C aims to partially meet net-zero targets to limit global warming to 2°C.

b. In the **Disorderly Transition scenario**, climate policies are not applied immediately. To compensate for the delay while maintaining the goal of mitigating global warming, carbon taxes are introduced as a shock and increase sharply, entailing high transition risks.

  iii. Delayed Transition postpones the net-zero transition to 2030.

c. The **Too Little Too Late scenario** assumes that climate policies are not only delayed but also introduced in an uncoordinated and insufficient manner, failing to limit both transition and physical risks.

  iv. Fragmented World describes delayed and divergent climate policies across countries, resulting in missed transition goals and elevated physical risks.

d. In the **Hot House World scenarios**, climate policies remain mostly unchanged from their current state. Transition risks are low but come at the cost of significant physical risks.

  v. Nationally Determined Contributions (NDCs) include current pledges and targets to counter climate change, even if not yet implemented in climate policies.
  vi. Current Policies include only currently implemented policies to counter climate change.
  vii. Climate Destabilisation assumes higher emission trajectories than under the Current Policies pathway, resulting in high physical risks and global temperatures around 3.6°C by 2100.
  viii. Climate Breakdown is a worst-case scenario in which no transition efforts are made, the global temperature reaches about 4.4°C by 2100, and countries experience the most severe physical risks.

Furthermore, ECI developed a methodology to estimate the probability of each climate scenario occurring (for more details, see our technical documentation on climate scenario probabilities). We use these probabilities, presented in Table 1, to construct an "expected scenario" that yields probability-weighted impact and exposure metrics and adds an additional reference point alongside the scenario-specific results.

Table 1: Probabilities associated with each of the extended climate scenarios

Extended Scenarios	Probability (%)
Climate Breakdown	10.4
Climate Destabilisation	32.9
Current Policies	30.9
NDCs	9.2
Fragmented World	12.3
Delayed Transition	2.4
Below 2° C	1.5
Net Zero 2050	0.4

3. Data Requirements

The CERinfra relies on various inputs from each company included in the rating, as well as macroeconomic key variables related to the climate scenarios provided by NGFS (2024) and ECI. Specifically, our climate exposure metrics require the following information:

- **Company-specific information**, including asset size and tangible asset value, revenue, industrial activity, and physical address, among others
- **Carbon emissions**, *a minima* today (i.e., the year when the rating is calculated)
- **Physical damages**, specifically from floods, storms, wildfires, and heat stress
- **Key variables from the extended NGFS climate scenarios**, including GDP, GVA, carbon emissions, and carbon price[5]

We use the data to develop CERinfra's three base impact metrics: the direct carbon cost, market demand shift, and physical value impact.

4. Climate Impact Metrics

The CERinfra is forward-looking, and its calculation incorporates the evolution of transition and physical impact metrics across multiple future horizons, from 2025 to 2050, which allows us to calculate an asset's exposure and vulnerability to climate risks arising from carbon-related costs, shifts in market demand, and physical damage and disruption due to flood, storm, wildfire, and heat hazards.

4.1. Transition Impact Metrics

4.1.1. Direct carbon cost

For each company, the direct carbon cost is based on the S1+2 intensity per revenue.[6] Because a company's emissions alone are insufficient to fully characterise its exposure to transition risks, we developed a **carbon cost indicator**. This indicator is the product of S1+2 intensity per revenue and carbon price – a country-specific proxy for policy actions aimed at reducing carbon emissions. More specifically, we use the carbon price increase, rather than the price itself, to capture the additional cost burden relative to the initial carbon tax, which is already reflected in the carbon intensity.

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[5] NGFS (2024) uses various models that specify the impacts of different climate-policy assumptions on the energy sector, land use, and the emissions cycle (Integrated Assessment Models: REMIND-MAgPIE, MESSAGEix-GLOBIOM, and GCAM), and explain the consequences of transition and physical risks on macroeconomic key variables (NiGEM). Following common practice, all our results are derived from the average of the three Integrated Assessment Models.

[6] Details on how we estimate companies' S1+2 intensities per revenue can be found in the respective technical documentation.

For each country, we use NGFS' scenario-specific projections of carbon price. To project companies' S1+2 intensities, we follow the assumption that S1+2 intensity per revenue grows similarly to the ratio of country-specific emissions to GDP in each climate scenario. Accordingly, we obtain the projected S1+2 intensity by applying the country- and scenario-specific change in emissions-to-GDP ratio to today's S1+2 intensity per revenue. In other terms, if a country is projected to become less emissions-intensive relative to its GDP, we assume that a company's emissions intensity per unit of revenue decreases to the same extent as that of the country in which it operates.

We calculate the carbon cost indicator for each year as the product of S1+2 intensity per revenue and carbon price increase. Finally, we define a company's **direct carbon cost** as the average S1+2 carbon cost indicator across all years from 2025 to the desired time horizon

4.1.2. Market demand shift

For each company, the market demand shift is based on sector- and country-level GVA – a measure of a sector's economic output, which we use as a proxy for shifts in demand and, in turn, for shifts in a company's revenue. Because a company's emissions alone are insufficient to fully characterise its transition exposure – particularly shifts in market preferences – we developed a **revenue shock indicator**. This indicator captures how much a sector's output is expected to change because of the low-carbon transition, relative to a world without it.

For each sector and country, we use climate scenario-specific GVA projections to calculate the indicator for each year as the ratio of GVA under a transition scenario to GVA under a scenario-consistent baseline, recentred on 0. Recentring on 0 (rather than 1) aligns the indicator with our other impact metrics. The indicator equals 0 when transition GVA equals baseline GVA (no shift). A positive indicator (>0) means demand is expected to grow under the transition relative to baseline, implying lower exposure to market demand shifts; a negative indicator (<0) implies higher exposure. Each company is assigned the revenue shock indicator of its sector and country. Finally, we define a company's **market demand shift** as the average revenue shock indicator across all years from 2025 to the desired time horizon.

3.2. Physical Exposure Metric

The physical impact value combines the impact from floods, storms, wildfires, and heat stress and is quantified by two key parameters: (1) The **severity** indicates the extent of the impact a hazard has on an infrastructure asset and can be proxied by a damage factor (for floods and storms), damage probability (for wildfires), or the level of operational disruption (for heat stress). (2) The **frequency** represents the likelihood of a hazard occurring in a given year and can be derived through the inverse of the return period, probabilistic models, or climate scenario projections. Based on these key parameters, ECI developed various methodologies to calculate

a. expected damages from floods, storms, and wildfires, measured as the annual tangible asset loss (in percent), as well as
b. expected impact to companies' revenues from productivity losses due to heat stress, measured as the annual revenue loss (in percent).[7]

While ECI's calculations centre on expected damages, we further distinguish between damages to a company's tangible assets and disruptions to its activities. The evaluation of business-day **disruption** allows us to consider additional impacts on companies' revenues when their activities are disrupted by hazards that damage their physical assets. Following Mandel et al. (2025), our approach combines the physical damage associated with each hazard (flood, storm, and wildfire) with sector coefficients from the Federal Emergency Management Agency (FEMA, 2013) that indicate the number of interruption days following the complete destruction of a facility's capital stock. For partial damage, the interruption is assumed to scale in proportion to the share of capital lost, allowing the hazard magnitude to be translated directly into expected business-day interruptions for each asset.

As both the severity and frequency of climate hazards evolve over time, we project these changes to calculate future damages and disruptions. However, as the models in NGFS focus primarily on transition risks, we supplement them with physical risk projections drawn from the Shared Socioeconomic Pathways and Representative Concentration Pathways (SSP-RCP) framework – the standard scenario architecture adopted in recent climate science, including the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC AR6; IPCC, 2023).[8] We use two SSP-RCP scenarios representing a moderate (SSP2-4.5) and a worst-case (SSP5-RCP8.5) climate trajectory for physical risks.[9] We map the physical risk projections of these scenarios to ECI's extended scenario data, as presented in Table 2.

In order to calculate a single physical value impact metric that combines damage and disruption, we rescale revenue losses to tangible asset losses, yielding an equivalent measure of damage. The rescaling factor is the tangible asset-to-revenue ratio β. Accordingly, the fraction of revenue loss divided by β represents the fraction of tangible asset loss (since revenues are "β times" smaller than total assets). If the tangible asset value is unknown, we use the sector's median value.

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[7] Details on how we estimate assets' expected damages from floods, storms, wildfires, and heat can be found in the respective technical documentations.

[8] Climate scenario frameworks have evolved significantly over the past two decades. The RCPs were among the first standardised scenarios developed at the request of the IPCC to explore the effects of varying greenhouse gas concentration trajectories on future climate conditions (Van Vuuren et al., 2011). These were subsequently integrated into the broader SSP-RCP framework, which pairs each physical hazard pathway (the RCP component) with an SSP describing the underlying socioeconomic conditions — such as population growth, economic development, and policy ambition — that give rise to those emissions. This combined framework was formally adopted in the IPCC AR6 and is now the standard reference in climate risk literature. ECI's extended climate scenarios have been developed in alignment with this evolving framework.

[9] Ideally, we aim to apply more than the two presented SSP-RCP scenarios to distinguish between various physical risk levels (notably, SSP1-2.6, and SSP3-7.0). Due to limitations in the availability and robustness of hazard and impact datasets associated with some SSP-RCP trajectories, the current mapping therefore reflects practical data constraints in addition to conceptual climate scenario alignment.

We calculate the equivalent physical damage[10] for each year as the sum of flood, storm, and wildfire damage, and flood, storm, wildfire, and heat disruption (using the equivalent damage measure). Finally, we define a company's **physical value impact** as the average equivalent physical damage across all years from 2025 to the desired time horizon.

Table 2: Correspondence between the extended scenarios and the SSP-RCP scenario framework

Extended Scenarios	SSP-RCP Scenarios
Climate Breakdown	SSP5-8.5
Climate Destabilisation	SSP5-8.5
Current Policies	SSP2-4.5
NDCs	SSP2-4.5
Fragmented World	SSP2-4.5
Delayed Transition	SSP2-4.5
Below 2° C	SSP2-4.5
Net Zero 2050	SSP2-4.5

5. Rescaling into Scores

In order to translate each impact metric into an exposure score (and ultimately a rating), we first need to rescale them. To facilitate comparisons of asset exposure across our infrastructure universe[11], we calculate percentiles based on each metric's distribution and translate them into scores from 1 to 100. For example, if a company's direct carbon cost metric falls below the 1st percentile, we assign a score of 1; if a company's physical value impact falls between the 1st and the 2nd percentile, it receives a score of 2; and if the market demand shift metric falls above the 99th percentile, the company's score is 100.

To further enable comparisons across the various time horizons and climate scenarios, we need a **common scale** (i.e., a single set of percentiles). For this common scale, we use the 2035 time horizon under the probability-weighted expected scenario (introduced in Section 2), which provides the most relevant risk-management perspective.

We perform the analysis on approximately 6,000 companies[12] across eight TICCS superclasses[13] in

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[10] Many companies are not exposed to any of these four types of hazards. Their physical risk is therefore 0, which automatically gives them the best possible physical exposure.

[11] The Unlisted Infrastructure Universe is a database of tracked assets that represent the fair value- and risk-adjusted performance of the unlisted infrastructure asset class. It includes 9,100 unique infrastructure companies in the 27 most active national markets for infrastructure investors to define an investible universe of private infrastructure companies. These companies have a minimum of USD 1 million in total asset book value, are privately owned, and can be categorised using TICCS (SIPA, 2025a).

[12] We review and update the data on a regular basis to account for new assets added to the tracking list.

[13] The Infrastructure Company Classification Standard (TICCS) provides investors with a frame of reference for approaching the infrastructure asset class. It offers an alternative to investment categories inherited from the private equity and real estate universe, which are less informative when classifying infrastructure investments (SIPA, 2025b).

our infrastructure universe for which we have all the necessary information to calculate the impacts from direct carbon costs, market demand shifts, and damages and disruptions from physical hazards. The available data enable us to derive robust statistics and representative distributions.

6. Additional Scores and Rescaling into Ratings

Based on the distribution, we assign each company a score for its direct carbon cost, market demand shift, and physical value impact. Furthermore, we developed two additional exposure scores:

- Transition Exposure Score:
  This score is calculated as the weighted average of the Direct Carbon Cost Exposure Score and the Market Demand Shift Exposure Score. We derive the weights from the relative financial impact of direct carbon costs and shifts in market demand on companies' Net Asset Value (NAV) at the geo-sectoral level.[14] For this, we average the impact on NAV across TICCS sectors and climate zones[15], and calculate weights as their relative values. In line with the common scale we used to calculate percentiles, we calculate the weights under the expected scenario at the 2035 time horizon. These weights are then applied across all climate scenarios and time horizons.

- Climate Exposure Score:
  This score is calculated as the weighted average of the Transition Exposure Score and the Physical Exposure Score. As with the Transition Exposure Score, we derive the weights from the relative financial impact of physical and transition risk on companies' Net Asset Value (NAV) at the geo-sectoral level. For this, we average the impact on NAV across TICCS sectors and climate zones, and calculate weights as their relative values. Again, we calculate the weights under the expected scenario at the 2035 time horizon.

Finally, we transform all exposure scores (in particular, the transition, physical, and climate exposure scores), ranging from 1 to 100, into ratings on a scale from A to G. In line with standard practices in financial risk ratings, our final ratings are intended to be approximately uniformly distributed. For this, we split the scores into equal-sized buckets. As in the previous steps, we use the exposure

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[14] These calculations are based on the CRRinfra framework, which focuses on climate risks and their impacts on NAV (more details can be found in the respective technical documentation).

[15] The Köppen-Geiger climate classification categorises the world into five primary climate zones, based on temperature and precipitation. Following Beck et al. (2018), we differentiate between tropical, arid, temperate, cold, and polar. Additionally, we consider a sixth category – offshore – to include the specific climate conditions at sea.

1. Tropical: regions with temperatures above 18 degrees Celsius throughout the year and significant precipitation
2. Arid: regions with low precipitation that do not fit the polar criteria
3. Temperate: regions with a moderate climate with distinct seasons
4. Cold/continental: regions with at least one month averaging below 0 degrees Celsius and at least one month averaging above 10 degrees Celsius
5. Polar: regions with monthly average temperatures below 10 degrees Celsius throughout the year
6. Offshore: oceans or large water bodies characterised by marine conditions that differ from adjacent land climates

scores under the expected scenario at the 2035 time horizon to identify the thresholds (i.e., the numbers that separate the buckets). The thresholds are then applied as a common scale for ratings across all climate scenarios and time horizons. Figure 3 presents the final CERinfra distribution.

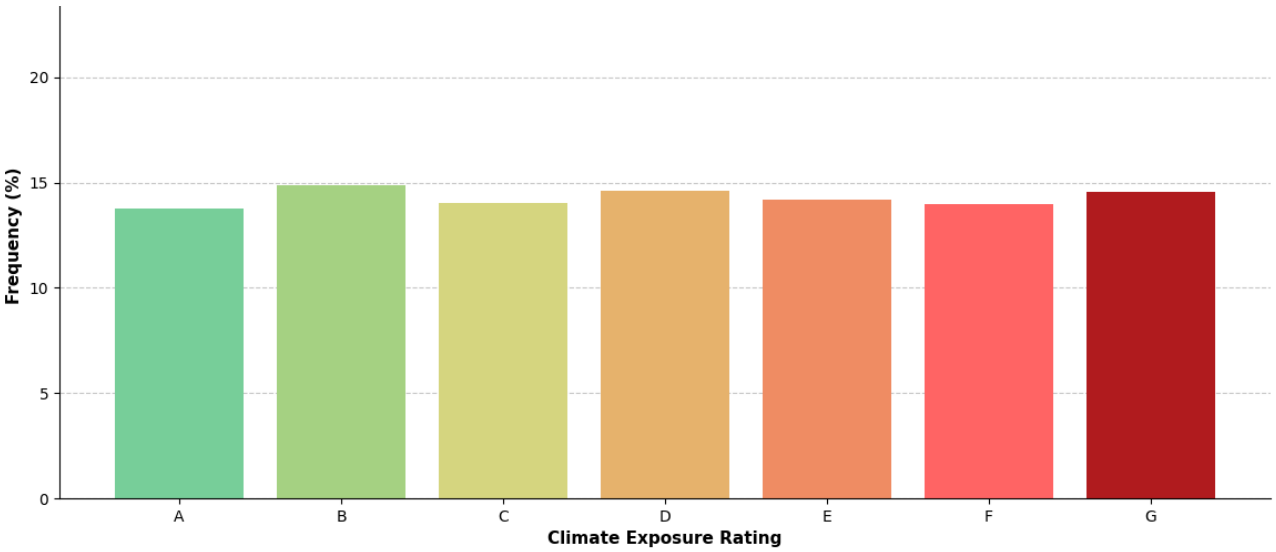

Figure 3: *Distribution of the CERinfra ratings for all assets in our infrastructure universe in 2035 under the expected scenario*

7. Potential Adjustment Procedures of the CERinfra

We demonstrated how to estimate companies' exposure to transition and physical risks, which is the basis for calculating the CERinfra. However, there may be company-specific characteristics that our approach, which focuses on systemic climate impact components, does not capture. For example, a company may implement technologies to reduce its emissions or mitigate impacts from specific hazards. In such cases, and at the request of the rated companies[16], we can adjust the relevant metrics based on implemented technologies and current measures, and their respective effectiveness.

7.1. ClimaTech – Database of Decarbonisation and Resilience Strategies

In order to specifically evaluate infrastructure companies' climate strategies and implemented measures, we utilise the ClimaTech database to adjust their CERs accordingly. **ClimaTech** is a comprehensive initiative designed to assess and evaluate decarbonisation and resilience strategies in response to the increasing risks posed by climate change. The ClimaTech project distinguishes between decarbonisation and resilience strategies, both of which are crucial to addressing climate risks to infrastructure assets (ECI, 2025).

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[16] Companies requesting the revision of their metrics need to provide information demonstrating the technologies implemented to reduce their emissions, increase their resilience to climate disasters, or both. This information allows us to capture the company's idiosyncratic risk components.

- **Decarbonisation strategies** focus on reducing greenhouse gas emissions associated with infrastructure. These strategies aim to lower carbon footprints by employing technologies and practices that minimise fossil fuel use and enhance energy efficiency. For example, integrating renewable energy sources, such as solar and wind power, and adopting low-carbon construction materials are key decarbonisation strategies.

- **Resilience strategies** aim to mitigate the physical risks posed by climate change, such as floods and storms. These strategies ensure that infrastructure can withstand climate-related disruptions and continue functioning effectively in the face of extreme weather events. Resilience measures include building flood defences, improving structural integrity, and using fire-resistant building materials.

The ClimaTech database provides evidence-based assessments of these **strategies** and offers a detailed evaluation of their **effectiveness** across various infrastructure sectors. It serves as the largest global repository of decarbonisation and resilience measures, with a structured methodology grounded in scientific research and expert analysis. This enables stakeholders to make informed, data-driven decisions to future-proof their infrastructure investments against both transition and physical risks.

The ClimaTech database is pivotal to our adjustment procedure: If companies share their decarbonisation and resilience measures, the database provides information on the extent to which our model-estimated emissions and expected damages can be reduced (effectiveness) for specific scopes, hazard types, and return periods.

7.2. Adjustments based on Decarbonisation Measures

To update the carbon intensities per revenue, companies must provide information on their latest revenues, emissions, and implemented decarbonisation measures (including supporting materials). Several cases may arise for companies interested in a reviewed CERinfra (see also Figure 4):

- *The company does not provide revenue information.*
  In this case, it is not possible to update the CERinfra, as this information is required to adjust the carbon intensities.

- *S1, S2, or S1+2 emissions are reported.*
  In this case, we replace our model-based S1+2 intensity estimation with the reported values and update the CERinfra accordingly. However, this does not apply to S3 emissions, as S3-related calculations are too uncertain to rely on the reported values (Shrimali, 2022).

- ***S1, S2, or S1+2 emissions are not reported, but decarbonisation measures are listed.***
  In this case, we use the ClimaTech database to evaluate the effectiveness of the implemented measures and adjust the CERinfra accordingly. Note that most decarbonisation technologies impact only parts of a company's total emissions. Accordingly, companies are required to specify the share of emissions that are impacted by the reported technology.

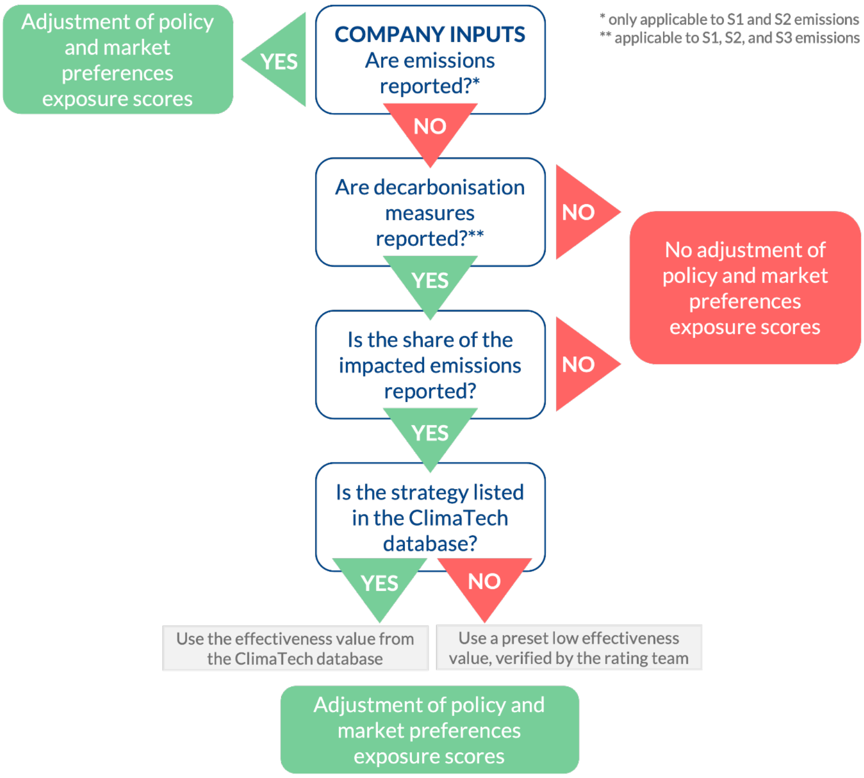

Figure 4: *Illustration of the process to adjust carbon intensities per revenue based on implemented decarbonisation measures*

7.3. Adjustments based on Resilience Measures

For the adjustment process based on resilience strategies, we consider the three most material types of hazard events in infrastructure: floods, storms, and wildfires (UNDRR, 2020). These hazard events can physically damage assets and are characterised by their return periods[17], which serve as a proxy for their severity (more details on these physical risks can be found in their respective technical documentation).

We update the expected damages from floods, storms, and wildfires for companies that have implemented technologies to reduce the impact of such hazards. Again, in order to adjust the CERinfra, companies are required to provide information (and supporting materials) on their

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[17] The return period estimates the average time interval between occurrences of a hazard event of a defined size or intensity. To obtain return periods, statistical estimates are first calculated for a range of all possible hazard events based on historical observations. If a particular hazard event value has a 1% frequency of occurrence, it has a one in a hundred probability of occurrence at any given year and is hence known as the 100-year return period.

current resilience measures. Similar to the adjustment of carbon intensities, we assess the effectiveness of resilience measures and technologies for each relevant return period using the ClimaTech database. After determining the effectiveness for all possible return periods, we can adjust the damage of each hazard. Overall, we adopt a conservative approach and assume that if a resilience strategy is designed to protect against an extreme (less frequent) event, it also provides protection against more frequent, less severe events.

8. Example of the CERinfra and the Adjustment Process

To illustrate the rating process, including potential adjustments to the CERinfra, we use Brisbane Airport in Australia as an example. We draw on resilience information from the company's latest sustainability report (BAC, 2023) to illustrate the adjustment process for physical impacts.

8.1. Initial Calculation of the CERinfra (Before Adjustments)

Table 3 shows Brisbane Airport's physical value impact from hazard events and the resulting Physical Exposure Rating under the expected scenario for a 2050 time horizon before adjustments.

Table 3: Brisbane Airport's flood, storm, wildfire, and heat value impact (expressed in %) as well as its Physical Exposure Rating (A-G)

Flood value impact	Storm value impact	Wildfire value impact	Heat value impact	Physical Exposure Rating
1.84	0.34	0.0008	0.08	G

8.2. Adjustments for Resilience Measures

In this case, we can adjust the physical value impact to flood and storm hazards[18] if the company has implemented technologies that increase its resilience to such hazards. We relate each technology mentioned in Brisbane Airport's sustainability report to the hazard and return period it is intended to protect against, as well as its corresponding level of effectiveness, based on the ClimaTech database (see Table 4).

Each resilience technology mentioned in the table offers protection against different hazards. The level of protection depends on the magnitude of the hazard, which is determined by its return period. For instance, flood barriers offer a "step function" protection that only works below a certain threshold. Accordingly, such barriers are able to offer 80 percent protection against floods with a return period of 1,000 years or less. However, they are almost unable to protect (2% protection) against more severe floods with a return period of more than 1,000 years.

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[18] As of June 2026, we do not adjust for resilience strategies that protect against heat stress.

Table 4: Implemented resilience technologies based on Brisbane Airport's sustainability report

Resilience technology	Hazard	Type	Return period (years)	Effectiveness
Elevation	Flood	Inland + coastal	100 or less	80%
Flood barriers	Flood	Coastal	1,000 or less	80%
Flood barriers	Flood	Coastal	More than 1,000	2%
Natural infrastructure – habitat creation / restoration	Storm		50 or less	98%
Natural infrastructure – habitat creation / restoration	Storm		Between 50 and 1,000	Linear gradient
Natural infrastructure – habitat creation / restoration	Storm		1,000 or more	2%
Undergrounding	Storm		10,000 or less	20%
Undergrounding	Storm		More than 10,000	2%

Note: Based on ClimaTech's classification of resilience measures, we can link these technologies to specific hazards and protection levels (i.e., return periods for floods and storms), and associate an effectiveness level to each of them.

Furthermore, a technology can supersede another in terms of protection at certain return periods. For instance, natural infrastructure in the form of habitat creation and restoration offers decreasing protection against storms, from 98 percent protection against mild storms with a return period of 50 years or less, to only 2 percent protection against severe storms with a return period of 1,000 years or more. Accordingly, there is a return period between 50 and 1,000 years where natural infrastructure can only offer a level of protection of less than 20 percent. In those cases, the protection level will remain constant at 20 percent because the additional undergrounding technology provides a 20 percent protection for storms with a return period of 10,000 years or less.

8.3. Recalculation of the CERinfra

Following Table 4, we can update the physical value impact metrics for each hazard separately, and hence the overall Physical Exposure Rating. In summary, we calculate the following impact metrics (expressed in %) after the adjustment process:

- The resilience measures reduced the **flood value impact** by 94 percent between 2026 and 2050 from 1.84 percent to 0.11 percent.
- The resilience measures reduced the **storm value impact** by 53 percent between 2026 and 2050 from 0.34 percent to 0.16 percent.

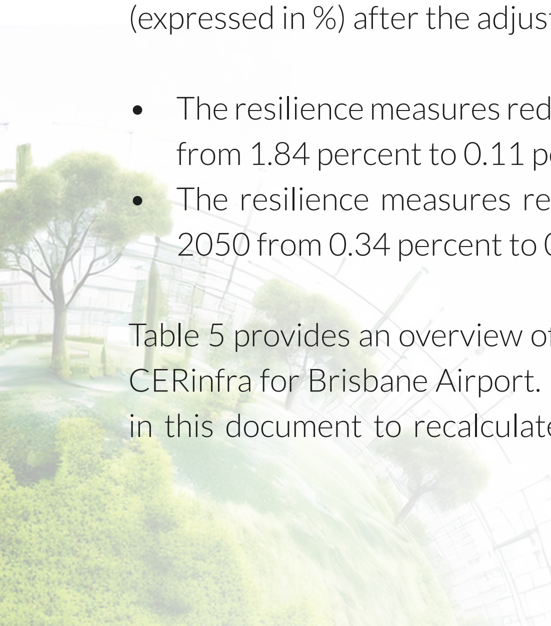

Table 5 provides an overview of the initially estimated and adjusted values needed to calculate the CERinfra for Brisbane Airport. Using the adjusted values, we can re-run the procedures presented in this document to recalculate Brisbane Airport's Physical Exposure Rating and the underlying hazard-specific ratings. We observe a significant improvement (from G to B) after adjusting for the implemented resilience technologies. This leads to an overall improvement of the Climate Exposure Rating from G to B.

Table 5: Brisbane Airport's estimated and adjusted values of flood and storm value impact (expressed in %), as well as the respective exposure ratings

	Flood value impact	Storm value impact	Flood exposure rating	Storm exposure rating	Physical Exposure Rating	Climate Exposure Rating
Estimated	1.84	0.34	G	E	G	G
Adjusted	0.11	0.16	E	D	B	B

The Climate Exposure Rating reflects the combined impact of physical and transition exposure on an asset's value. It is derived by comparing an asset's combined impacts with those of other assets within the rated infrastructure universe. Because each impact type affects assets differently, the overall rating does not move in a strictly linear way with changes in individual components. For example, an asset with severe physical impacts but low transition impacts may initially appear more exposed to climate risks overall than one with moderate impacts in both areas. Once resilience measures are introduced and physical impact declines, total impact can decrease significantly – enough to drastically shift the overall rating. This can make the improvement from the initial to the adjusted rating seem disproportionate. However, such outcomes are a natural result of integrating different types of risks that interact in complex, non-linear ways, reflecting the model's holistic view of how combined climate risks affect asset value.

References

BAC (2023). Annual report 2023. *Brisbane Airport Corporation*. Retrieved May 25, 2026, from https://www.bne.com.au/sites/default/files/no-index/2023-10/BAC-Annual-Report_2023.pdf

Beck, H.E., Zimmermann, N.E., McVicar, T.R., Vergopolam, N., Berg, A., & Wood, E.F. (2018). Present and future Köppen-Geiger climate classification maps at 1-km resolution. *Scientific Data*, *5*, 180214. https://doi.org/10.1038/sdata.2018.214

ECI (2025). The ClimaTech project: Assessing infrastructure decarbonisation and resilience strategies. *EDHEC Climate Institute*. Retrieved May 25, 2026, from https://climateinstitute.edhec.edu/climatech-project

FEMA (2013). Hazus-MH 2.1. Earthquake model. Multi-hazard loss estimation methodology. [Technical manual]. *Department of Homeland Security, Federal Emergency Management Agency*. Retrieved June 4, 2026, from https://www.fema.gov/sites/default/files/2020-09/fema_hazus_earthquake-model_technical-manual_2.1.pdf

IPCC (2023). *Climate change 2023. AR6 synthesis report. Contribution of working groups I, II and III to the sixth assessment report of the Intergovernmental Panel on Climate Change*. IPCC, Geneva, Switzerland. https://doi.org/10.59327/IPCC/AR6-9789291691647

Mandel, A., Battiston, S., & Monasterolo, I. (2025). Mapping global financial risks under climate change. *Nature Climate Change, 15(3)*, 329-334. https://doi.org/10.1038/s41558-025-02244-x

NGFS (n.d.). NGFS Scenario Portal. *Network for Greening the Financial System*. Retrieved May 11, 2026, from https://www.ngfs.net/ngfs-scenarios-portal

NGFS (2024). NGFS climate scenarios. Technical documentation. V5.0. *Network for Greening the Financial System*. Retrieved May 19, 2026, from https://www.ngfs.net/en/publications-and-statistics/publications/ngfs-climate-scenarios-central-banks-and-supervisors-phase-v

Shrimali, G. (2022). Scope 3 emissions: Measurement and management. *The Journal of Impact and ESG Investing, 3(1)*, 31-54. https://doi.org/10.3905/jesg.2022.1.051

SIPA (2025a). Global universe standard for infrastructure investment benchmarking. *Scientific Infra & Private Assets*. Retrieved May 25, 2026, from https://docs.sipametrics.com/docs/infrastructure-universe-standard

SIPA (2025b). The Infrastructure Company Classification Standard (TICCS). *Scientific Infra & Private Assets*. Retrieved May 25, 2026, from https://docs.sipametrics.com/docs/ticcs

UNDRR (2020). The human cost of disasters: An overview of the last 20 years (2000-2019). *United Nations Office for Disaster Risk Reduction*. Retrieved May 25, 2026, from https://www.undrr.org/publication/human-cost-disasters-overview-last-20-years-2000-2019

Van Vuuren, D.P., Edmonds, J., Kainuma, M., Riahi, K., Thomson, A., Hibbard, K., Hurtt, G.C., Kram, T., Krey, V., Lamarque, J.-F., Masui, T., Meinshausen, M., Nakicenovic, N., Smith, S.J., & Rose, S.K. (2011). The representative concentration pathways: An overview. *Climatic Change*, *109*, 5-31. https://doi.org/10.1007/s10584-011-0148-z

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