Adaptation and decarbonisation: two halves of one valuation problem

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Infrastructure investors usually treat physical climate risk and decarbonisation as separate problems, but we show that both can be expressed as the same thing: an impact on net asset value.

We use the example of a Brazilian transmission line facing severe physical risk and a Norwegian waste-to-power plant facing substantial transition risk.

Both face material losses in value, yet each would have looked safe if it had been screened for only one of the two risks.

Hence investors need to screen on both axes, rank interventions before funding them, and treat the financing structure as part of the decision.

Infrastructure investors have learned to treat physical climate risk and decarbonisation as separate disciplines, run by separate teams on separate timetables. Two recent asset-level analyses, one on a Brazilian transmission line and one on a Norwegian waste-to-power plant, suggest that is a mistake. Both resolve into the same number.

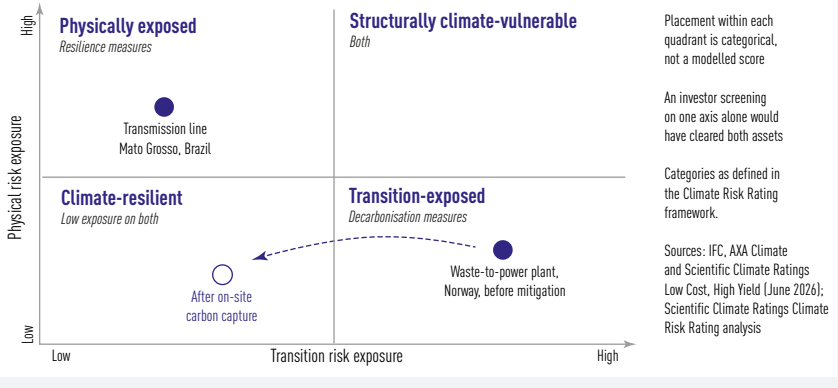
The problem is a valuation problem

Infrastructure is the asset class where climate risk bites earliest and hardest. Assets are immobile, long-lived, capital-intensive and often contractually bound to deliver a service for decades. They cannot be repositioned away from a hazard, and many of them sit in sectors where the cost of emitting is set by policy rather than by the market.

The aggregate numbers are now large enough to be a portfolio consideration rather than a disclosure exercise. A report published this year by the World Bank Group's International Finance Corporation puts average annual loss from extreme weather events affecting infrastructure and buildings at more than $700bn, and estimates that low- and middle-income countries alone absorb around $390bn a year in financial and economic losses, equivalent to 1–2% of GDP. On an unmitigated path, it projects that climate impacts could cost 43m jobs across 49 countries by 2050, and that targeted measures could cut those losses by more than half.

What those figures do not tell an investment committee is what to do on a Tuesday morning about a specific asset. That requires the risk to be expressed in the same units as everything else on the investment case: cash flow, net asset value, internal rate of return. Two recent pieces of asset-level work do exactly that, from opposite directions (figure 1).

Figure 1. The four climate vulnerability categories, and where each asset sits



Physical risk: what a transmission line in Mato Grosso reveals

That report, Low Cost, High Yield: The Adaptation and Resilience Investment Opportunity for Infrastructure, was published in June 2026 and co-produced with AXA Climate and Scientific Climate Ratings, which led the quantitative business case analysis. It examined three existing Brazilian assets across power transmission and distribution, water and sanitation, and roads.

The transmission case is the clearest illustration. The asset is a 500kV double-circuit overhead line of more than 1,000km running through three consecutive segments in Mato Grosso, operating under a concession that runs to 2042. As of 2024 it supplied electricity to roughly 8.8m people in a state that is one of Brazil's largest producers of soy, corn, cotton and cattle.

Modelled without any adaptation, the three material hazards erode around 30% of net asset value over the 2026 to 2042 concession period. Two findings matter more to investors than the headline.

The first is the composition of the loss. Wildfire, not flood or storm, is the dominant driver, and 95% of the projected loss is direct physical damage rather than revenue lost to service disruption. Storms were modelled as low risk, although the report notes that historical experience suggests greater impact from downbursts, which the hazard modelling does not capture.

The second is that the loss barely moves between scenarios. The figure is approximately 30% under an intermediate-emissions pathway and 30.3% under a high-emissions one. Over a horizon that ends in 2042, the two pathways have not yet diverged far enough to change the answer. Scenario choice is therefore a second-order question for this asset, which removes one of the more common reasons for deferring a decision.

From diagnosis to a ranked set of decisions

A risk number on its own does not generate an action. What turned this analysis into a capital allocation exercise was costing and ranking seven candidate measures on a common basis. The measures were selected by partner engineering companies, which assessed implementation costs, and their effectiveness was evaluated using the ClimaTech database of adaptation and resilience strategies, which also supplied cost estimates where local data was unavailable.

The ranking is more instructive than any single result (figure 2):

- Firebreaks cost around 3% of NAV and avoid 25.7%, a benefit–cost ratio of roughly 8:1. Financed by a 10-year loan, total losses fall from 30.3% of NAV to 7.6% once the cost of the measure is counted: 4.6 points of residual damage plus 3 points of cost.
- Vegetation management avoids 18.2% at a cost of 5.1%, a ratio of about 3.5:1. Worth doing, clearly second.
- Fireproof building materials avoid 9.1% but cost 55.5% of NAV. The benefit-cost ratio falls below 1. The measure addresses the right hazard and still fails the test.
- Flood and storm measures avoid less than 1% of NAV each and did not proceed to financial analysis at all.

That last point deserves emphasis in a market where adaptation is often discussed as an undifferentiated good. On this asset, most of the available measures were not worth financing. The value sat in one cheap intervention against one dominant hazard.

The financing analysis produced a further result that runs against instinct. Comparing an internal cashflow payment against a 10-year loan, loan tenor mattered considerably more than interest rate. Longer maturities spread repayment while avoided-loss benefits compound, and interest rate variation had minimal effect. For investors negotiating resilience capex with lenders or regulators, that reframes what to argue for.

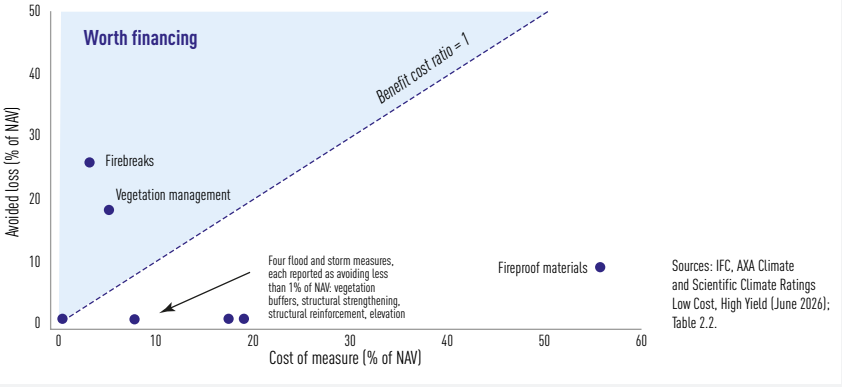
The operational co-benefits reinforce the financial case. Modelled service disruption falls from around 10.8 days a year to 1.6, a reduction of roughly 85%. Across all three Brazilian assets, investing less than 10% of NAV in targeted measures delivered multiples of that cost in protected value: $8.60 per dollar in transmission and distribution, $6.30 in water and sanitation, $2.20 in roads.

The report is explicit about its limits. The cases use simplified assumptions and publicly available data rather than operator inputs, exclude measures operators have already implemented, and rest on damage functions that are tailored to sector and geography but not to the specific asset. The internal rates of return reflect only avoided losses and measure costs, not full project economics. The authors describe the output as illustrative, indicating the order of magnitude and the business-case logic rather than an asset-specific risk assessment. Read as a screening output rather than a forecast, that is the appropriate standard of proof for a prioritisation decision.

Transition risk: a waste-to-power asset in Norway

The second case inverts the exposure. Scientific Climate Ratings assessed an operating waste-to-power and heat generation asset in Norway using the Climate Risk Rating framework. It begins with asset mapping and boundary extraction. Physical and transition risk are then modelled in parallel, on separate data and separate damage logic, before

Figure 2. Cost against avoided loss, transmission line, high-emissions scenario



Sources: IFC, AXA Climate and Scientific Climate Ratings Low Cost, High Yield (June 2026); Table 2.2.

the two are brought together and adjusted for resilience and decarbonisation measures, projected through a discounted cash flow model of net asset value, and aggregated across scenarios into an A–G rating (figure3).

The initial physical risk work found the plant to have low physical exposure. On the transmission line's terms, it would have screened as a low-priority asset.

The transition picture was entirely different. The asset's Scope 1 and 2 emissions, multiplied by a national carbon price on a steep upward path, produced a rising and material carbon cost. The sector had already absorbed a 200% increase in carbon tax in the two years before the project, with further increases projected. On a business-as-usual path, the asset was on a trajectory towards becoming stranded: forced to cease operating before the end of its natural life because transition costs had become prohibitive.

The owner is constructing an on-site carbon capture facility, supported by state funding aligned with the country's net zero ambitions. The facility is expected to cut operational emissions by close to 90% against business as usual over 10 years.

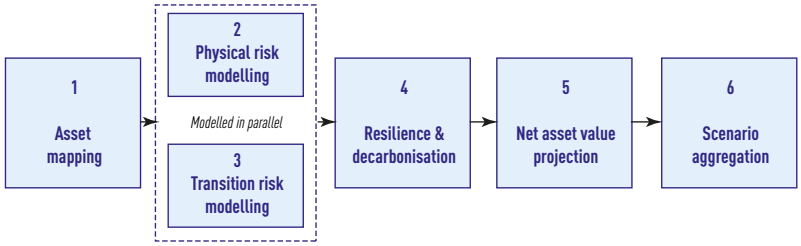
The valuation effect is measured against what the asset stands to lose. Without mitigation, projected climate-induced net value loss by 2050 runs to 13%. With the capture facility factored in, that narrows to 7%, recovering roughly six percentage points of value. The rating moves from D to C, and in the framework's terms the asset shifts from transition-exposed to climate-resilient (figure 4).

Two features of that result deserve attention. The mitigation narrows the loss rather than removing it: on these figures the asset still sits below an unimpaired valuation once the work is done, which is the realistic outcome for most assets and a more useful planning assumption than a return to par.

And the figures measure value preserved. They do not net off the capital cost of the facility itself, so the six points recovered are not a return, and the investment case would need that cost set against them.

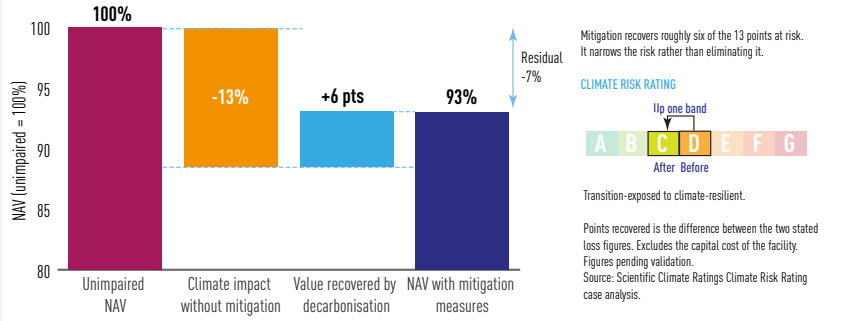
For an investor, the relevant output is not the letter. It is that a specific engineering decision has been priced, and that the pricing is expressed in a currency that survives an investment committee: value at risk, value recovered and what remains exposed after the work is done.

Figure 3. The six steps, with physical and transition risk modelled in parallel and combined at the adjustment stage



Source: Scientific Climate Ratings Climate Risk Rating methodology

Figure 4. Projected climate-induced net value loss by 2050, before and after the decarbonisation investment



Putting both into the investment process

The two cases are complementary rather than parallel. A Brazilian transmission line carries almost no transition risk and severe physical risk. A Norwegian waste-to-power plant carries almost no physical risk and severe transition risk. A screen on either axis alone would have flagged one asset and cleared the other.

The two analyses did not use the same method. The Brazilian business cases were a streamlined screening exercise, run across an intermediate and a high-emissions pathway and built for speed across many assets. The Norwegian asset went through the full rating framework, which weights outcomes across a set of scenarios by assigned probability. What they share is the endpoint. Physical damage, business interruption and carbon cost are all routed through a discounted cash flow model and expressed as an impact on net asset value, which is what makes two very different assets comparable at all. Where probability weighting is applied it adds something a stress test cannot, converting a question about what could happen into an estimate of what is likely, which is what a valuation requires.

Three practical implications follow.

- ***Screen on both axes, always.*** Exposure is unevenly distributed. A first-level exposure assessment across a portfolio costs far less than missing a concentration, and identifies which assets justify deeper financial analysis.
- ***Rank interventions before funding them.*** Neither case supports the proposition that adaptation or decarbonisation is uniformly value-accretive. Both show wide dispersion, and in the Brazilian case the majority of candidate measures failed a benefit–cost test. The ranking is the deliverable.
- ***Treat the financing structure as part of the measure.*** The tenor finding is not incidental. An intervention that fails on one financing structure can clear comfortably on another.

Implications for portfolios

Neither case requires an investor to take a view on climate policy. The transmission line loses roughly the same share of its value under both modelled scenarios, and the Norwegian asset faces a carbon cost that has already risen sharply under existing policy. Both are exercises in pricing conditions that are substantially already in motion.

Both also argue for spending, and for spending decisively. One measure on the Brazilian line returned roughly eight times its cost and cut projected losses from 30% of net asset value to under 8%. Across the three assets, less than a tenth of NAV committed returned multiples of that in protected value. But the returns were concentrated rather than spread. On the same asset, against the same dominant hazard, one intervention cleared at eight times cost while another fell below break-even. A portfolio-level mandate to adapt or to decarbonise averages across exactly the distinction that produced the return.

Asset-level quantification is what makes that distinction visible. Instead of asking whether a portfolio is exposed to climate risk, an investor can ask which assets, exposed to which hazard or which cost, at what magnitude, addressable by which measure, at what ratio, financed how. Those are ordinary investment questions. They happen to need climate science to be comprehensively answered, and such answers belong on the investment case rather than in a separate report.