

# Financing development in times of climate emergency

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# Content

- How can Keynesian approaches shed light on the climate action **economic** agenda
- **Today:** climate action as a macro-financial issue
  - (1) The investment function
  - (2) The supply of finance
  - (3) Funding and patient, and focused capital
  - (4) Climate risk and financial instability
- **Wednesday:** Financing development in times of climate crisis

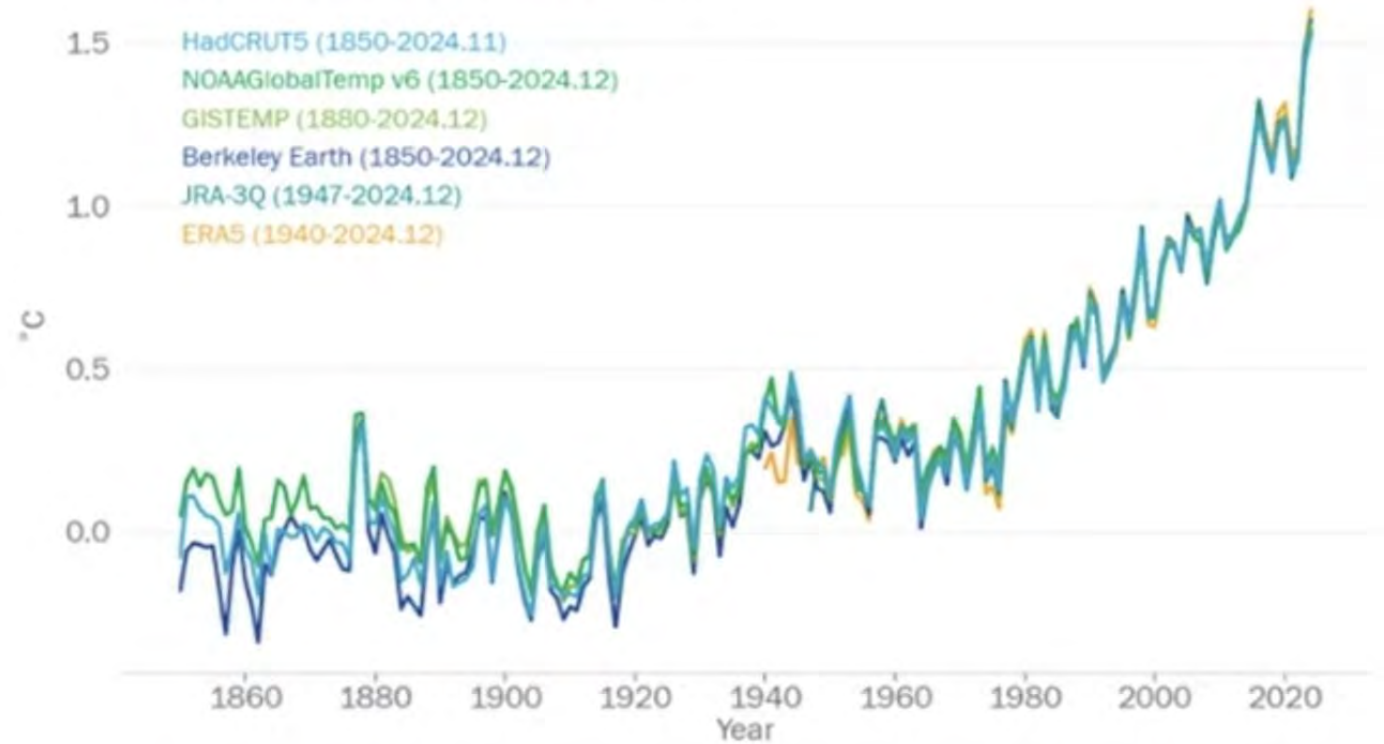


# Why action is needed: beyond the moral imperative



Climate  
science:  
where are  
we?

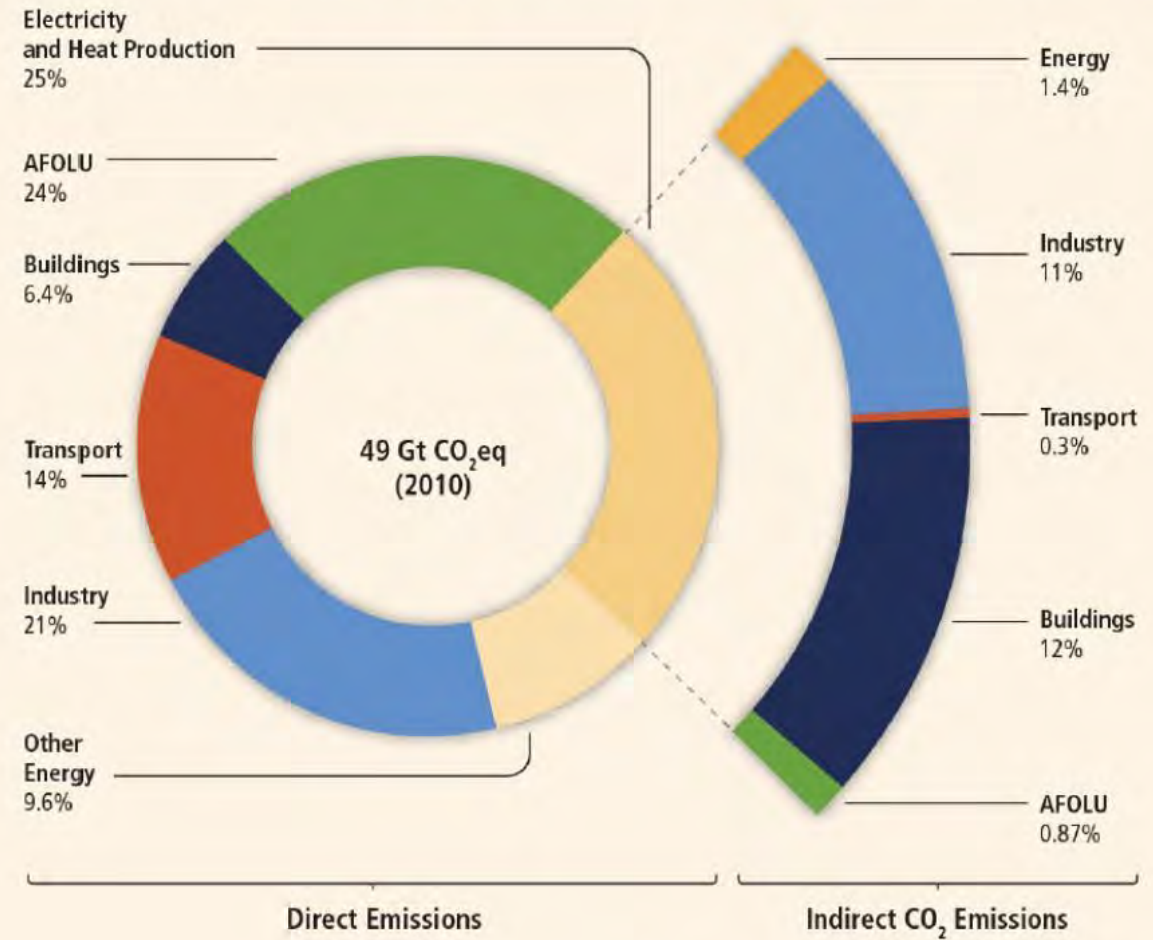
Global mean temperature 1850-2024  
Difference from 1850-1900 average



Global average temperature data from six organisations show 2024 was world's hottest year on record and the first to breach the 1.5°C mark. (WMO)

# Causes

Global greenhouse gas emissions by economic sectors, 2010

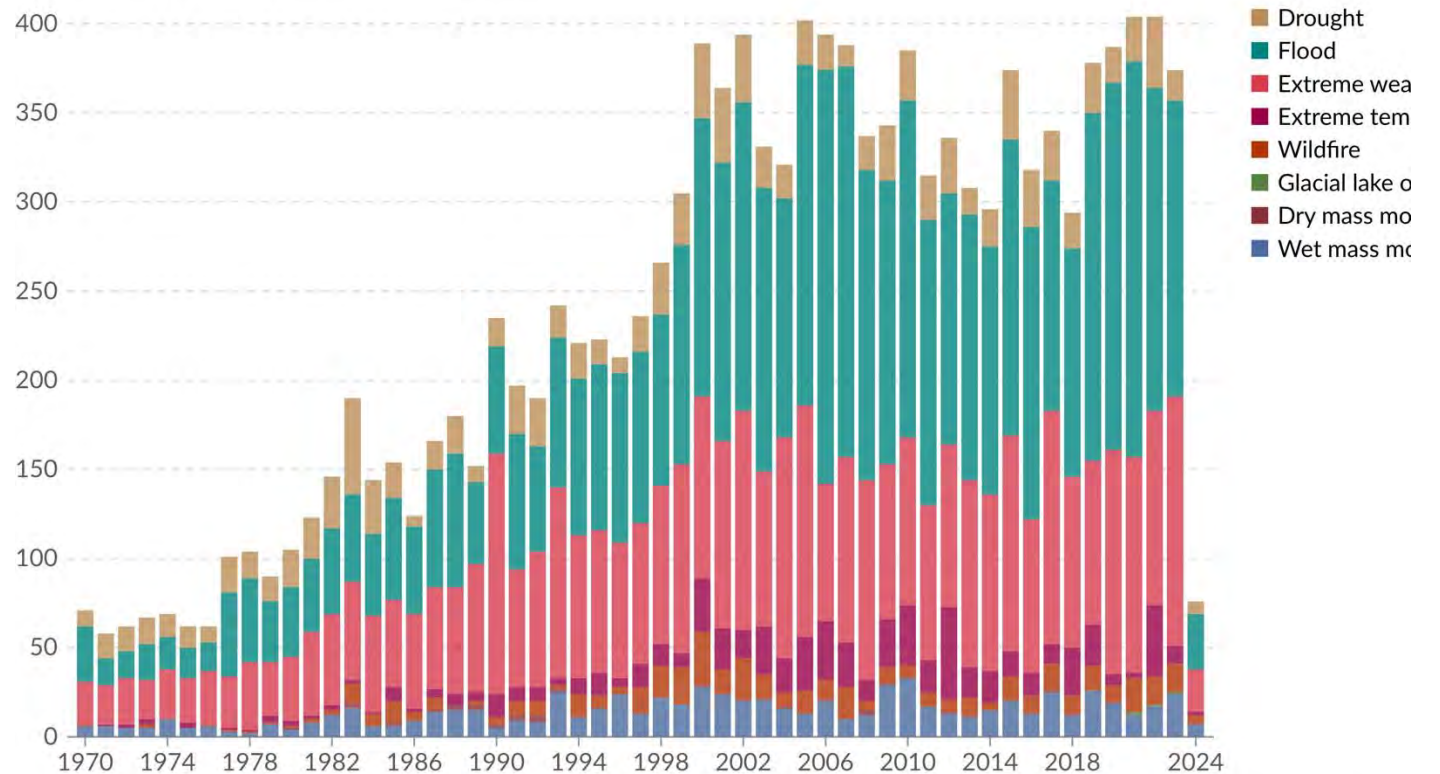




## Consequences: Extreme climate events

### Global reported natural disasters by type, 1970 to 2024

The annual reported number of natural disasters, categorised by type. The number of global reported natural disaster events in any given year. Note that this largely reflects increases in data reporting, and should not be used to assess the total number of events.



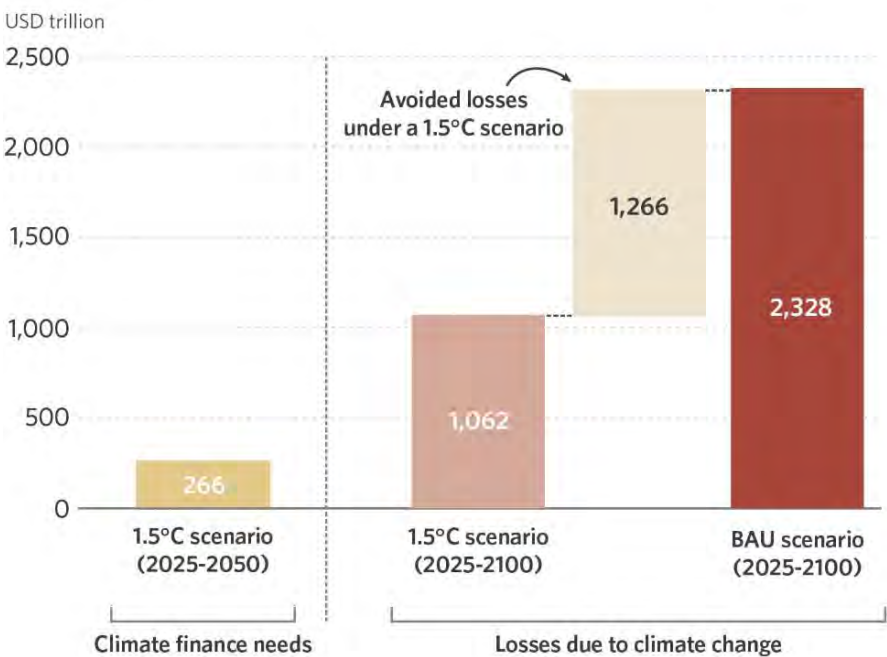
Data source: EM-DAT, CRED / UCLouvain (2024)

Note: Data includes disasters recorded up to April 2024.

[OurWorldinData.org/natural-disasters](https://OurWorldinData.org/natural-disasters)

# The cost of inaction: beyond solidarity

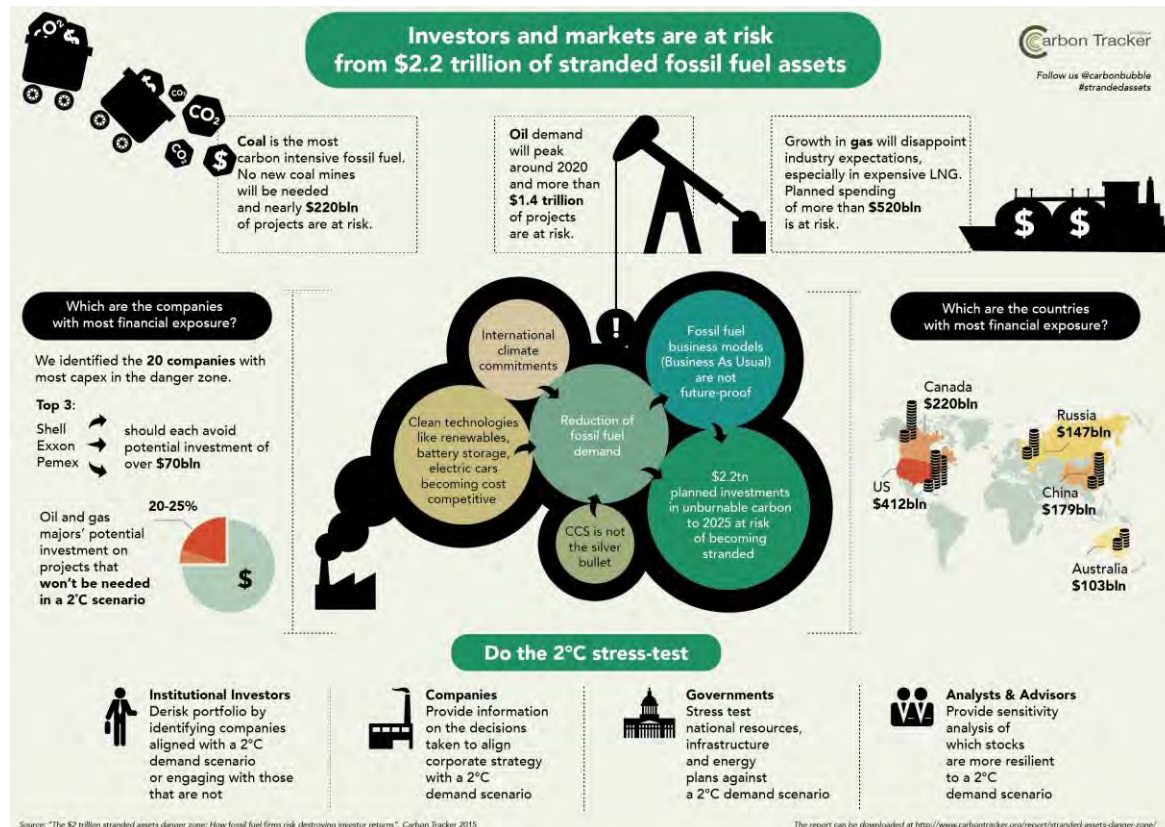
Figure ES4: Cumulative climate finance needs vs. losses under 1.5°C and BAU scenarios



Source: Climate Policy Initiative

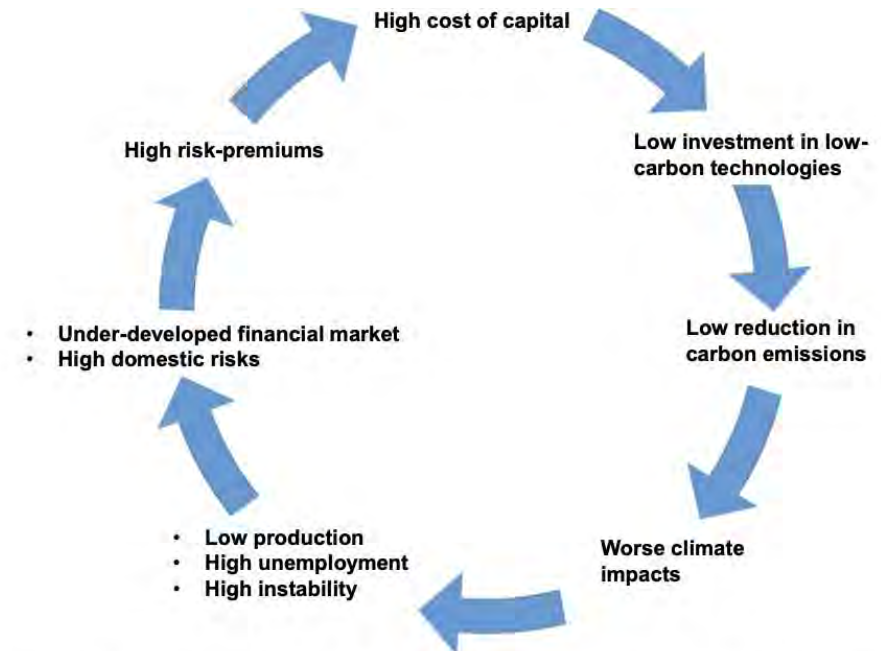
Report <a href="#">Click any below to see more info</a>	Economic costs			Social costs			
	Impacts on productivity	Damage to assets and capital	Global flow of currency	Health and well-being	Loss of nature & biodiversity	Conflict and migration	Global and local inequalities
OCED, 2015							
The Economist, 2015							
IRENA, 2017							
ILO, 2019							
OCED, 2019							
Kalkuhl & Wenz, 2020							
NRDC, 2021							
Swiss Re Institute, 2021							
World Bank, 2021							
Deloitte, 2022							
EEA, 2022							
NGFS, 2022							
Oxford Econ., 2022							
AON, 2023							
NOAA, 2023							

# Other consequences of inaction: stranded assets and macro-financial impacts



Source: "The \$2 trillion stranded assets danger zone: How fossil fuel firms risk destroying investor returns", Carbon Tracker 2015

The report can be downloaded at <http://www.carbontracker.org/report/stranded-assets-danger-zone/>



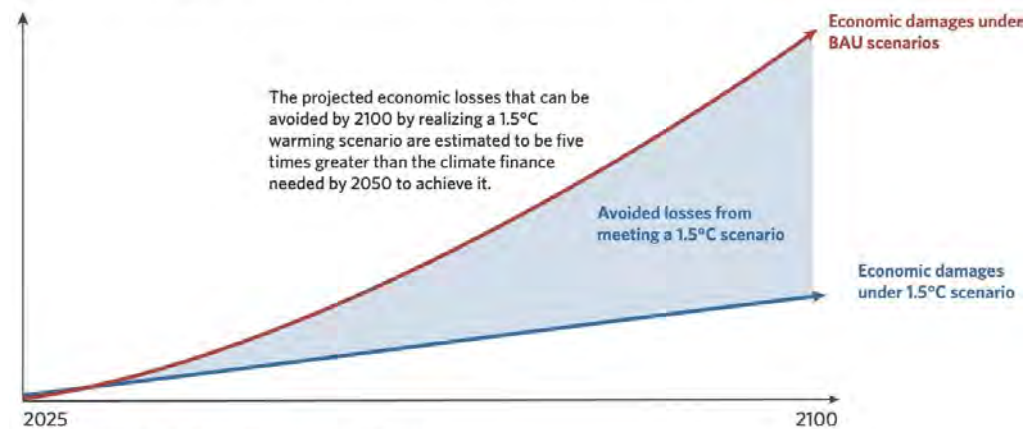
**Asset price trap at the macroeconomic level.** The figure shows the set of self-reinforcing mechanisms and related impacts characterised by the high cost of capital. The strength of these links is strongly linked to local conditions implying it could be exacerbated (or less relevant) in some economies.



# The paths ahead

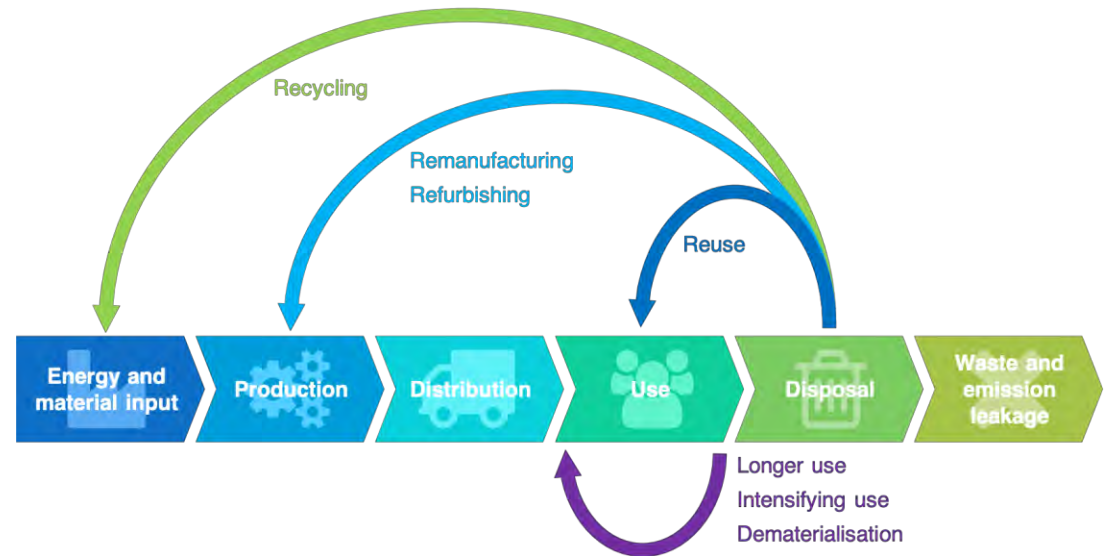
## Two basic scenarios

Figure 1.3: Meeting climate investment needs will avoid exponential future costs



Source: CPI analysis of NGFS. See CPI (2024a) for details

## Decarbonize, restore, preserve and make it circular





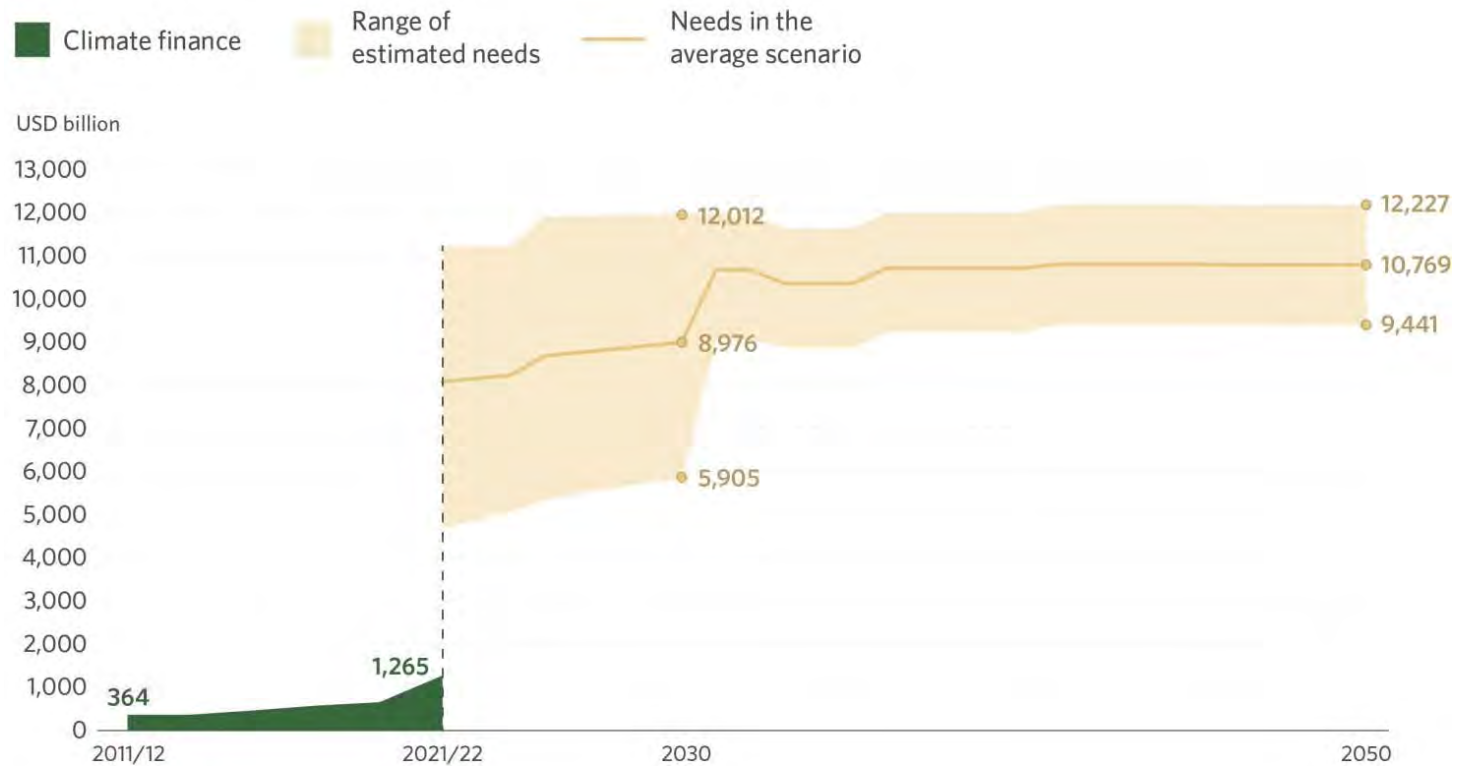
(1) The investment function:  
beyond “animal spirits”

Average global climate finance needs are estimated at USD 9.7 trillion between 2023 and 2050, moving from an average USD 8.6 trillion per year up to 2030 and rising to USD 10.7 trillion in the two decades after that.

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Investment needs: Mind the gap

**Figure ES3:** Global tracked climate finance and average estimated annual needs through 2050



Source: Climate Policy Initiative

The background is an abstract composition of overlapping, semi-transparent red and blue lines and shapes. A prominent circular element, resembling a lens or a joint, is visible in the upper left quadrant. The overall aesthetic is modern and technical.

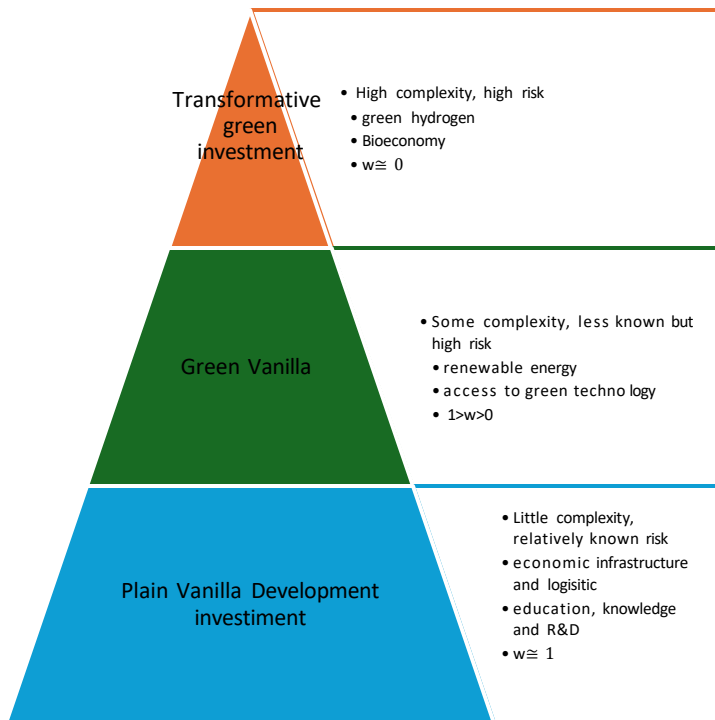
## (2) The supply of finance: beyond liquidity preference



# Two types of climate risks

- Transition risk
  - Abrupt changes in regulation imposing caps on emissions
  - Examples:
    - Non-tariff trade barriers
    - Mainstreaming climate risk in banks stress tests
    - Imposition of carbon emission on carbon intensive production
- Physical risk
  - Destruction of economic infrastructure (impacts on governments and corporations)
  - Rising insurance premia leading to rapid debt-deflation in real state business
  - Disruption of ecosystems reducing the profitability of agriculture and other economic sectors

# Some investment needs are very uncertain and complex



## 📌 Perceived Risk with Confidence Weighting

We define:

$$\text{Perceived Risk} = \sum_i w_i \cdot p_i \cdot L_i$$

or in continuous form:


$$\text{Perceived Risk} = \int_{\Omega} w(\omega) \cdot p(\omega) \cdot L(\omega) d\omega$$

where:

- $p_i$  or  $p(\omega)$  is the objective or estimated **probability** of event  $i$  or state  $\omega$ ,
- $L_i$  or  $L(\omega)$  is the associated **loss**,
- $w_i$  or  $w(\omega) \in [0, 1]$  is a **confidence weight**, representing the **degree of trust** in the reliability of the information or model regarding that event or state.

## 📌 Interpretation of $w$ :

- $w = 1$ : full confidence in the information (risk is taken at face value).
- $w = 0$ : no confidence; the information is ignored in the perceived risk.
- $0 < w < 1$ : partial trust; risk is discounted proportionally.



(3) Patient, and focused  
capital: beyond funding

# A tale of three stories

## LANDSCAPE OF CLIMATE FINANCE IN 2021/2022

Global climate finance flows along their life cycle in 2021 and 2022. Values are averages of two years' data to smooth out fluctuations, in USD billions



### SOURCES AND INTERMEDIARIES

Which type of organizations are sources or intermediaries of capital for climate finance?

Government \$108  
National DFI \$238  
Multilateral DFI \$98  
State-owned FI \$61  
Bilateral DFI \$30  
Multilateral Climate Funds \$3  
SOE \$98  
Other\* \$35

Commercial FI \$244  
Corporation \$206  
Household/Individual \$185

### INSTRUMENTS

What mix of financial instruments is used?

Grant \$73  
Low-cost project debt \$76  
Project-level market rate debt \$571  
Project-level equity \$57  
Unknown \$29  
Debt \$129  
Balance Sheet Financing  
Equity \$369

### USES

What types of activities are financed?

Adaptation \$68  
Multiple Objectives \$65  
Mitigation \$1,171

1.3 TRILLION USD ANNUAL AVERAGE

### DESTINATION

Where are the flows directed by region?

Other Oceania \$14  
Transregional \$19  
Middle East & North Africa \$21  
Central Asia & Eastern Europe \$35  
Sub-Saharan Africa \$37  
South Asia \$45  
Latin America & Caribbean \$56  
US & Canada \$156  
Western Europe \$340  
East Asia & Pacific \$584

PRIVATE PUBLIC

"Other" public sources include export credit agencies and unknown public funds  
"Other" private sources include institutional investors, funds, and unknown



## (4) Climate risk and financial instability: beyond Minsky

# A Minskian climate-related financial instability: a “perfect storm” - leading to a very high $CR_t$ – generating stranded assets and starting a debt deflation process and a financial crisis

## New Dimensions

- **Climate Risk** ( $CR_t$ ) reduces effective cash flow.
- **Cost of Inaction** ( $\theta_t$ ) increases future liabilities and debt needs.

## Climate-Adjusted Fragility

- Adjusted cash flow:

$$CF_t^{adj} = CF_t(1 - CR_t)$$

- New fragility condition:

$$CF_t(1 - CR_t) < CC_t$$

## Debt Acceleration via Inaction

- Debt growth becomes sensitive to climate inaction:

$$\frac{dD_t}{dt} = f(I_t, r_t, \theta_t), \quad \frac{\partial f}{\partial \theta_t} > 0$$

## Climate-Driven Financial Instability

$$\frac{dD_t}{dt} > \frac{d}{dt}[CF_t(1 - CR_t)] \Rightarrow \text{Amplified fragility via climate stress}$$

## Core Logic

- Financial systems evolve from stability to fragility due to rising debt and over-optimism.
- Three types of financial units:
  - **Hedge**:  $CF_t \geq CC_t$
  - **Speculative**:  $CF_t \geq \text{interest only}$
  - **Ponzi**:  $CF_t < \text{interest payments}$

## Mathematical Formulation

- Investment condition:

$$\Pi_t \geq r_t D_t$$

- Fragility condition:

$$CF_t < CC_t$$

- Systemic instability over time:

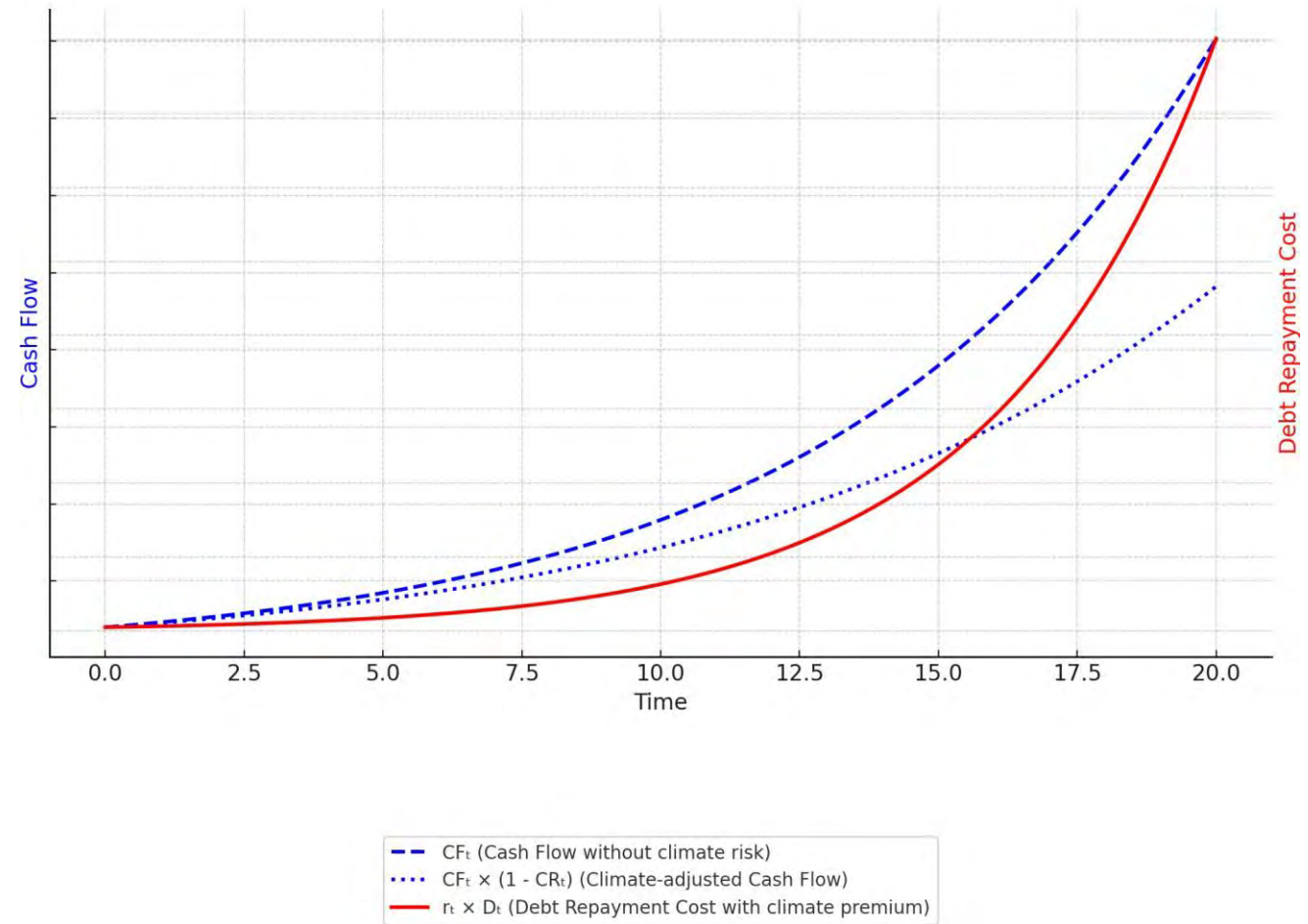
$$\frac{dD_t}{dt} > \frac{dCF_t}{dt} \Rightarrow \text{Growing fragility}$$

## Key Mechanism

Success  $\rightarrow$  Optimism  $\rightarrow$  Leverage  $\uparrow \rightarrow$  Fragility  $\uparrow \rightarrow$  Crisis

# Climate risk as a source of financial stability

Cash Flow vs. Debt Repayment Cost – Onset of Financial Fragility



# So: can (climate make) it happen again ?



Stranded assets -> assets that at some time prior to the end of their economic life, are no longer able to earn an economic return (i.e. meet the company's internal rate of return), as a result of changes associated with the transition to a low-carbon economy (lower than anticipated demand / prices).



Yes, climate risk can lead to stranded assets and a debt-deflation process



In addition, increasing extreme climate events lead to higher cost of inaction that have fiscal and corporate finance implication



It is already happening in developing countries that are financing climate-related debt crisis



# Conclusions:

## Macro-financial issues brought up by the climate crisis

- **Investment needs** are incredibly high, and some of them are “transformative” – with high levels of uncertainty and “complexity” (not **risk**)
- **Finance requirements** are accordingly high too, and some of them are perceived to be less attractive than “business as usual” (carbon-intensive sectors)
- **Patient capital** is critical, but **private funding mechanisms** (e.g. very limited scope of green securities and underdeveloped carbon credit markets)
- **Climate risk, stranded assets and financial instability**