Global Landscape of Climate Finance 2023

Methodology

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CLIMATE
POLICY
INITIATIVE

Contents

1. DEFINITIONS, DATA COLLECTION PROCESS AND SCOPE

The Global Landscape of Climate Finance series (the *Landscape*) captures available data on primary financing supporting greenhouse gas (GHG) emissions reductions and climate resilience activities. The *Landscape* consolidates data from a wide range of primary and secondary sources. It follows financial flows along their lifecycles, from the original source of financing, through financial intermediaries, their deployment in the form of financial instruments, and the recipients of finance, to how finance is ultimately used on the ground (see Buchner et al., 2011, 2012, 2013, 2014, 2015, 2017, 2019, 2021; Oliver et al., 2018, Macquarie et al., 2020; Naran et al., 2022).

In order to combine data from various sources, Climate Policy Initiative (CPI) has adopted an operational definition of climate finance and a standardized accounting methodology to ensure that data are comparable and consistent, and that overlaps are avoided, to the fullest extent possible.

This document outlines the *Landscape* methodology as used in the 2023 report, in terms of definitions, principles, accounting scope, outstanding issues, assumptions, and data coverage.

1.1 CLIMATE FINANCE DEFINITION

The CPI working definition of climate finance is aligned with the recommended operational definition of the UNFCCC Standing Committee on Finance (see UNFCCC SCF, 2014, 2016, 2018, 2020), which states: "Climate finance aims at reducing emissions, and enhancing sinks of greenhouse gases and aims at reducing vulnerability of, and maintaining and increasing the resilience of, human and ecological systems to negative climate change impacts."

Our climate finance mapping exercise is limited to primary capital flows directed toward low-carbon and climate-resilient development interventions with direct or indirect GHG mitigation or adaptation benefits. These flows include support for capacity-building measures as well as for the development and implementation of policies. To determine what constitutes mitigation and adaptation finance provided by the public sector, we rely on the tracking methodologies and reporting followed by: i) the members of the OECD's Development Assistance Committee (DAC), data for which is publicly available through the Creditor Reporting System database;[1] ii) the group of Multilateral Development Banks (MDBs) and members of the International Development Finance Club reporting on climate finance;[2] and iii) the group of multilateral climate funds, as reported through the Climate Funds Update.[3]

[1] See OECD (2011, 2016 and 2021, 2023).
[2] See MDBs (2015a, 2015b, 2018, 2019, 2021).
[3] See ODI/HBF (2023)

In addition, we classify and track climate solutions to mitigation and adaptation activities as described in Section 3. We consider:

Mitigation finance as resources directed to activities:

- Contributing to reducing or avoiding GHG emissions, including gases regulated by the Montreal Protocol; or
- Maintaining or enhancing GHG sinks and reservoirs.

Adaptation finance as resources directed to activities aimed at reducing the vulnerability of human or natural systems to the impacts of climate change and climate-related risks, by maintaining or increasing adaptive capacity and resilience. Throughout the report we use the words 'climate resilience finance' and 'adaptation finance' interchangeably but acknowledge that differences exist between the two.

Dual benefits finance as resources directed to activities contributing to both "climate change mitigation" and "climate change adaptation" and meeting the respective criteria for each category. An afforestation project preventing slope erosion is an example of a "dual benefit" project because it brings significant adaptation benefits, while also making a positive contribution to mitigation (Klein et al., 2007).

CPI analysts endeavor to identify eligible and ineligible climate finance flows through a set of general principles discussed further below. While we make every effort to ensure the consistency of the data reported in the *Landscape*, we do not audit or verify data providers' application of climate finance definitions, and we rely on the reporting provided.

1.2 PROCESS OF DATA COLLECTION AND REPORTING

Following an extensive data scoping exercise, datasets are intensively cleaned and processed. Where financing flows are detailed at the project level, data are checked manually for the consistency of information about actors, geographies, instruments, and sectors. Desk research complements the cleaning process where the datasets are incomplete.

To ensure consistency and comparability in our data between the private and public sectors, we set and observe the following general principles when collecting and reporting the data.

Avoid double counting

CPI's *Landscape* tracks only those transactions that represent new money targeting climate-specific outcomes. For instance, both private research and development for new technologies and investment in manufacturing for low-GHG and climate-resilient development are excluded, because at the technology deployment stage such costs are capitalized and factored in the investment amounts of new projects that implement these technologies, increasing the risk of double counting if the initial

investment were to be tracked separately. Similarly, revenue support mechanisms such as feed-in tariffs reimburse the initital investment costs, so including them would constitute double counting. Thus, we do not track policy-induced revenue support mechanisms or other public subsidies[4] whose primary function is to pay back initial investment costs.[5]

There are significant overlaps between datasets meaning that the same flows are recorded several times. During the consolidation phase, CPI ranks sources of duplicate flows according to reliability and comprehensiveness, selecting only the highest quality entry for each overlapped transaction in order to avoid double counting.

Track primary investment

The *Landscape* captures total primary financial transactions and investment costs or, where tracked, components of activities that directly contribute to adaptation and/or mitigation, plus public framework and capacity development expenditures (e.g., development of national climate strategies). Secondary market transactions (e.g., re-selling of stakes or public trading on financial markets) are not tracked because they do not represent new investment targeting climate-specific outcomes, but rather money being exchanged for existing assets. See Section 2.2 for more details.

Exclude carbon emissions lock-in

Investments and expenditures captured in the *Landscape* do not capture investments that have a high risk of locking in significant future GHG emissions. Based on this principle, fossil-fuel-based, lower-carbon and energy-efficient generation transactions, such as financing for efficiency retrofits of coal-fired power plants, are excluded.

Maximize granularity

Wherever possible, CPI uses project-level data to check and select flows. Project-level information is more likely to provide verifiable details on project characteristics, instruments, destinations of financing and financing structures. Where project-level data are not available or insufficiently complete for inclusion in the *Landscape*, aggregated data are used.

Include tangible financial commitments

[4] Please note that public subsidies for EVs are included as an exception. For further details, please refer to "Electric Vehicles" under "Assumptions" section.
[5] See Falconer and Stadelmann (2014) for further details on CPI's understanding and definition of key climate finance terms.

The figures reported in the *Landscape* represent financial commitments made during the period being tracked. Depending on the context (e.g., a public commitment by a government, versus a private financing contract agreed between corporate actors), commitments may refer to firm obligations by means of Board decisions on investment programs, closure of financing contracts or similar actions. Such commitments are backed by the necessary funds to provide specified assistance/financing to a project, recipient country, or any other partner organization. Financial resources committed record the amount of expected transfer at the time the contract was closed, or the commitment otherwise established, irrespective of the time required for the completion of disbursement. It is important to note that we only track financial commitments from the institutions financed through their own funds and exclude any external funds managed and/or implemented by the institutions. For further details, please see "□ National and multilateral climate funds" below.

The focus on commitments rather than disbursement may affect the sequencing of flows over time – given that committed amounts are often disbursed over a number of years, disbursement information would provide a more accurate picture of the financial resources devoted to addressing climate change in a given year. However, consistent data on disbursements is often lacking across various actors. We note that some of the CPI's country-specific Landscapes (to date, covering Brazil, China, Côte d'Ivoire, Germany, India, Indonesia, Kenya, and South Africa) also capture disbursement data, as it is more readily available through national budget and expenditure systems.

Err toward conservativeness

When faced with insufficient details, CPI takes a conservative approach and prefers to under-report rather than over-report climate finance. A case in point is energy efficiency investment from the private sector. Due to methodological differences regarding how energy efficiency components, often part of a larger project, are estimated in external sources using top down approaches (IEA, 2021a), these investments re not included in the report. Together with the 2021 *Landscape,* CPI also published a methodological brief about tracking energy efficiency investments in buildings in the context of climate finance, which addresses some of the previously mentioned issues, and demonstrates the application of the proposed methodology based on a sample of asset-level data collection. These estimates are not included in this edition of the *Landscape*.

1.3 SCOPE OF ACCOUNTING OF CLIMATE FINANCE

1.3.1 FINANCIAL INSTRUMENTS

The 2023 *Landscape* captures the following financial instruments:

- **Grants**: Transfers made in the form of cash, goods, or services for which no repayment is required.
- **Project-level debt**: Debt relying on a project's cash flow for repayment.
    - *Low-cost debt* refers to loans extended at terms preferable to those prevailing on the market. We count the full amount of the loan, not the grant equivalent.
    - *Market-rate debt* refers to loans extended at regular market conditions. Examples include (not limited to) term loan, credit facility, bridge loan, mezzanine debt etc.
- **Project-level equity**: Equity investment relying on the project's cash flow for repayment.
- **Balance sheet financing**: Direct debt or equity investment by a company or financial institution.[6]

We acknowledge the importance of risk management instruments like guarantees and insurance in enabling increased private climate flows, in particular to areas and sectors with low risk appetites for private investment. However, following the principle of conservatism, we exclude these instruments from the total climate finance figure because actual disbursements from these instruments are contingent upon uncertain future events. Guarantees are only exercised in particular circumstances, and there is a chance of there never being any financial outflow from the guarantor.[7]

1.3.2 PRIVATE CLIMATE FINANCE FLOWS

The nature of financing is determined by the actors undertaking a given transaction. We categorize private investors as:

- **Corporations**, which can have activities in the energy sector, other sectors, or both (e.g., a large water utility company installing both hydropower generation and water treatment facilities).
- **Households**, i.e. family-level economic entities, including high-net-worth individuals and their intermediaries (e.g., family offices investing on their behalf);
- **Commercial financial institutions**, i.e. providers of private debt capital (and occasionally other instruments), including commercial and investment banks;

[6] The share of climate finance allocated to different categories of financial instruments may not fully reflect reality, as our categorization is based on the quality of the data sources we can access.
[7] We acknowledge that risk management instruments are accounted by other organizations producing, collecting, aggregating, and publishing data on climate finance flows, including the group of MDBs jointly reporting on climate finance, and the OECD.

- **Institutional investors**, including insurance companies, asset management firms, pension funds, foundations, and endowments;
- **Private equity, venture capital, and infrastructure funds**.

1.3.3 PUBLIC CLIMATE FINANCE FLOWS

The 2023 *Landscape* covers public climate finance commitments from:

- **Development Finance Institutions (DFIs).** We classify DFI flows in the following categories:
    - **Multilateral and regional**, where the institution has multiple shareholder countries and directs finance flows internationally
    - **Bilateral**, where a single country owns the institution and it directs finance flows internationally; and
    - **National**, where a single country owns the institution and finance is directed domestically.
- **Government and their agencies.** These include:
    - Bilateral climate-related development finance reported to the OECD-DAC Creditor Reporting System (OECD, 2023) to track Official Development Assistance and Other Official Flows in 2021.[8]
    - Domestic financing through public budgets carried out by central, state, or local governments and their agencies.
- **National and multilateral climate funds.** We include commitments from DFIs' own resources only and exclude the following: external resources that DFIs manage on behalf of third parties; governments' contributions to DFIs or Climate Funds; bilateral Climate Funds' commitments; DFIs' contributions to projects reported by Bloomberg New Energy Finance (BNEF, 2023a) to avoid double counting.
- **State-owned enterprises (SOEs) and financial institutions (SOFIs).** We classify institutions as state-owned if they are at least majority owned by a government or government agency.

Since the 2020 update of the *Landscape*, partially or fully SOEs and state-owned financial institutions (SOFIs) are classified as public entities. Note that national DFIs (including development banks) are not labeled as SOFIs, since they are reported as separate categories. 'Public Funds,' which are institutional investors managing funds under public ownership, are another additional category which has shifted from the private to public grouping.

[8] Our estimate captures the portion of bilateral climate-related development finance reported in the OECD's DAC Creditor Reporting System (CRS) qualifying as Official Development Assistance or Other Official Flows in 2021. The lower bound of our figures includes finance marked as having 'climate change mitigation' or 'adaptation' as its 'principal' objective. The upper bound includes activities with a 'significant' climate change objective. In the case of activities marked both as mitigation and adaptation, we attributed related financing to the use marked as 'principal'. Due to lack of data for 2022, we assumed that bilateral climate finance commitments were the same amount as in 2021.

2. DATA SOURCES AND ASSUMPTIONS

2.1 KEY DATA SOURCES

Table 1: List of data sources used for the analysis of climate finance flows

Category	Flow	Source of data	Data granularity
Private	**Private finance**	BNEF (2023a) BNEF (2023b)	Project-level (large-scale renewable energy projects) Aggregated (small-scale solar)
		Climate Bonds Initiative (proprietary data)	Aggregated by investor type of country of destination level
		International Energy Agency, World Energy Investment (2023)	Aggregated by region
		IEA SHC (2023)	Aggregated (solar water heater capacity additions)
		Proprietary data from IEA on EV Charging	Aggregated
		Proprietary data from IEA on EV Investment	Aggregated
		IJGlobal[9] (2023)	Project-level
		REN21 (2015)	Aggregated (solar water heater country and regional capital costs)
		BEAM (2023) BREEAM (2023) DGNB (2023) LEED (2023)	Project-level
Public	**Development Finance Institutions**	Surveys*	Project-level or aggregated (depending on reporting institution)
		BNEF** (2023a)	Project-level (large-scale renewable energy projects)
		OECD (2023)	Project-level
		Annual reports/websites	Project-level
	Climate Funds	Climate Funds Update via ODI/HBF (2023)	Project-level
		OECD (2023)	Project-level
	Governments and their agencies	OECD (2023) BNEF (2023a) Proprietary data from Climate Bonds Initiative	Project-level Aggregated by investor type of country of destination level
		IEA (2023a)	Aggregated

(*) This year's report includes primary survey data from 44 DFIs.

(**) Additional data not provided in the surveys or OECD reporting.

[9] IJ Global databases were used to gather information on primary financing for non energy projects like water, waste, municipal infrastructure, power T&D, and low-carbon transport from corporations and financial institutions.

2.2 ASSUMPTIONS

In certain instances in which complete investment information is unavailable, assumptions are made to fill gaps. These assumptions are in line with the principles outlined earlier in this document and are regularly updated to reflect changing market conditions at the most granular level possible.

Green bonds

The 2023 *Landscape* uses a dataset of use of proceeds estimates of green bond issuances from Climate Bond Initiative (CBI) as prepared for the Sustainable Debt State of the Market 2022 report. While the finance raised through green bond issuance itself is excluded as these are not yet allocated to specific projects, primary investment in climate projects is sometimes disclosed in post-issuance reporting. Eligibility of Use of Proceeds (UoP) categories is determined through publicly available information made by issuers through sustainability reporting, final terms, or prospectus (CBI, 2022). We assume that projects with completion dates after the date of issuance receive primary financing unless otherwise specified. Where this information is not available, flows are excluded to avoid capturing refinancing and other non-primary transactions. To ensure no double counting with other data sources, we included data on UoP for regions and sectors where CPI had data gaps.

Electric vehicles

Through collaboration with the IEA, the 2023 *Landscape* includes data on electric vehicle (EV) purchases from 2021 to 2022. This dataset was constructed through desk research to identify country-level retail prices of all commercially available models of battery EVs, combined with annual sales data by country. The base price paid by the consumer is then recalculated, adjusting for any governmental incentives or taxes. However, unlike general subsidies, public incentives for EV purchases are included in the *Landscape* because public finance does not flow to the vendor (as with most revenue support schemes) but instead contributes directly to consumption of low-carbon transport. Plug-in hybrid EVs are excluded in our analysis given their potential to pollute depending on the drivers' behaviour.

The methodology for allocating the breakdown of private purchases of EVs has been modified relative to the 2021 *Landscape*. In previous editions, EV purchases were split by private vs. public (accounting for both subsidy schemes and government direct expenditure). As before, governments are responsible for all the public spending, using grants as the sole financial instrument. The private investment is further broken down into purchases by households/individuals (equity balance sheet), purchases by corporates (equity balance sheet), and commercial financial institutions (FIs; project-level market-rate debt) that facilitate purchases of EVs through debt.

Large-scale renewable energy projects

This year, we individually analyzed direct primary financing data from large-scale renewable energy projects[10] based in 158 countries to identify their financing structure and the entities providing financing. For this, data are retrieved from the BNEF renewable energy and asset finance databases (BNEF, 2023a). In some instances where full project information was not available, we used a set of assumptions to address the data gap.

Gearing ratios

Gearing ratios describe the ratio of a project's long-term debt to the total capital invested. Where a project-specific gearing ratio is provided, it is used directly to calculate debt and/or equity values for the relevant project. Where no gearing ratio is provided, we apply gearing ratio assumptions to estimate debt and equity financing for renewable energy projects. Depending on data availability, the average gearing ratio observed for a given technology (e.g., Wind – Onshore, Solar – PV, etc.) in each country in the dataset is calculated and applied to matching country-technology combinations for which this value is unknown. When country-technology level information is not available, we compute and apply region-technology averages.

Tax equity

Since the 2021 *Landscape*, we use updated assumptions on tax equity financing for US renewable energy projects. These assumptions were formed based on representative gearing ratios for solar PV financing provided by the National Renewable Energy Laboratory, as well as informal discussions with multiple US renewable energy developers. Generally, for projects using all three of tax equity, sponsor equity, and debt, the gearing ratio applied was 40% tax equity, 40% debt, and 20% sponsor equity. Other cases applied slightly different assumptions, varying based on data availability and project structure; however, the overall practice was to assume slightly higher debt as a share of overall project value, in order to more accurately account for debt that continued to be associated with renewables projects even after undergoing tax equity refinancing and/or other ownership restructurings that commonly occur in US-market renewables projects.

Capacity Multipliers

The 2023 *Landscape* consolidates and updates technology- and geography-specific investment cost multipliers used in previous editions. Multipliers are used in cases where financing information is not available, to estimate total investment costs based on the size of the project in megawatts (MW). Country-level multipliers from the IRENA's Renewable Power Generation Costs report (IRENA, 2022a, IRENA, 2023a) are used where possible. When these are not available, country-technology averages are computed using the

[10] We consider investments in wind, solar, biofuels, biomass & waste, geothermal, marine, and small hydro projects that reached financial closure in 2019 and 2020.

observations from BNEF that contain both data on asset finance (total investment in USDm) as well as on the renewable project financed (capacity, in MWe). Where country-level multipliers are not available, IRENA regional multipliers are used and, if still not available, BNEF region-technology averages are computed.[11]

To avoid double counting of public financial flows, we remove all observations tracked in BNEF relating to investments made by development finance institutions surveyed by CPI.

Small-scale renewable energy investments

This refers to mainly residential and commercial solar PV projects with capacity of less than 1MW. It accounted for 434 GW of new capacity installed in 2021/2022, obtained from BNEF market size generation capacity and finance databases (BNEF, 2023b).

The dataset places all finance within three regional categories: the Americas, Europe/Middle East/Africa, and Asia/Pacific. It includes both capacity additions and finance of small-scale solar panels at the regional and country level. However, for some countries only the capacity data are available, but not the investment data.

We generate "Rest of Americas,""Rest of Europe/Middle East/Africa," and "Rest of Asia/Pacific" investments by summing up investments from countries of one region and subtracting from the respective total region investment. In cases where we do not know a country's investment, we proportionally allocate the respective "Rest of Region" investment value based on the country's capacity share within its region.

Solar water heating systems

Households, corporates, and governments' investments in solar water heating systems, estimated based on cost data from IEA SHC (2020), country-level inflation rates from World Bank (2023), and capacity additions data from IEA SHC (2022 and 2023).[12,]

When calculating country-level investment costs for solar water heaters, cost estimates for countries lacking specific costs are derived by averaging available values for other countries in the same region. Where regions have no country-level estimates available, the global average is used. Some exceptions have been made to this rule where appropriate. For example, the European average cost for large

[11] Country-technology and region-technology averages are only retained if there exist at least 10 observations relating to that combination in the original BNEF data, after manually excluding lower and upper outliers.

[12] We considered new installed capacity in 2019 and 2020 as reported in IEA SCH (2021), and systems capital costs reported in IEA SCH (2018). Since the latest capital costs available in this report were form 2016, we used country-level consumer-inflation rates from the World Bank (2021) from 2016 to 2019 and 2020 respectively to produce actualized capital costs. The IEA SCH (2021) report installed capacity estimates were broken down by segment (governments, households, corporates) and geographies.

domestic hot water applications does not include France, given that it is an outlier relative to other countries' cost ranges, and does not comprise a significant portion of the European solar water heating market.

Energy efficiency

Certificate data retrieved from the sources described in Section 2.1 is combined to data on building costs from the "International construction market survey 2023" (Turner & Townsend, 2023) to derive the total value of the building, based on location (Africa, Asia, Europe, Middle East, North America, South America, Australia and New Zealand) and use (commerical, hotel, industrial, retail, and residential).

The resulting value is then multiplied by 1 + *gp*, where *gp* is a certificate-specific multiplier representing the price premium per square meter to make the building energy-efficient. This value is then in turn multiplied by an energy efficiency share. This methodology follows the one adopted for CPI's "Tracking Incremental Energy Efficiency Investments in Certified Green Buildings"report (Naran et al., 2021).

Other private financing

Additional private financing is tracked in the online dataset collected by IJ Global (2023). Data is reported at project level and therefore needs to be pro rated across investors, countries of destination, and sectors targeted by the financing.

To avoid double counting of projects between BNEF and IJ Global, we compare the names and descriptions of projects that are classified according to the same sector and country of origin in the two data sources in the same year (e.g., the descriptions of a flow originating from the US in 2021 with the aim of financing a wind farm that appears in both BNEF and IJ Global are compared using a string metric of their distances; if it is judged high enough to indicate that the project is indeed the same, the line appearing in IJ Global is removed from the final dataset).

Similarly, we also remove all observations relating to investments made by DFIs who also appear in our data sets tracking public climate finance.

3. MITIGATION AND ADAPTATION SECTORS AND ACTIVITIES

This section describes the sectoral breakdown used to categorize mitigation and adaptation flows and provides examples of the kinds of projects that may be covered by the selected categories.

The 2023 *Landscape uses the* sector classification based on the 2021 Landscape. The 2021 Landscape offered a a multi-layer economic sector breakdown. This effort was carried out to reflect the increasing need to understand investments' real economy impacts, align with new methodologies, and fully exploit the potential of more granular data. This updated sector classification is, among others, inspired from the following economic activities classifications: MDB (2021) and MDB (2023), CBI taxonomy (CBI, 2021), IPCC WG3's AR6 (IPCC, 2022), the EU taxonomy (EU Technical Expert Group on Sustainable Finance, 2020), OECD's Creditor Reporting System purpose codes (OECD, 2021).

We applied this classification as consistently as possible when compiling this report. Finance qualifying as Official Development Assistance and tracked in the OECD's DAC Creditor Reporting System can be marked as having mitigation or adaptation as its 'principal' objective or having a 'significant' climate change objective (OECD, 2016). MDBs, meanwhile, identify components of projects that can count either fully or partially towards adaptation finance, but each bank's individual processes determine which proportions to count as mitigation or as adaptation so that the actual financing will not be double-counted (MDB 2023). Due to absence of granular data in 2022, the sub-sectoral classification for the MDBs was the same as 2021.

We allocated finance to 'dual benefits' if it was specifically labeled as such by the surveyed DFI or by the databases used for retrieving Climate Funds' commitments, or if either the DFIs or aforementioned databases labeled it as having adaptation and mitigation both as 'principal' or 'significant' benefits.

Differences between CPI coverage and other data sources

CPI's coverage of climate finance in the energy sector differs from energy transition related investment. Key differences are summarised in Table 2.

Table 2: Energy transition investments vs climate finance for the energy sector

Sector/ technology	Energy transition investments	Climate finance (CPI, 2023) (energy sector only)*
Renewable energy (power generation and direct uses)	Included	Included. Given the debate around risks and benefits of large hydropower plants, these projects are included only when financed by DFIs who have proper environmental safeguards
Energy efficiency	Included	Included but generally taking a more conservative approach, e.g., including energy efficiency measures for power plants only when applied to renewable assets (not fossil fuels) or retrofits only when they bring clean energy gains
Electrified transport	Includes all types of EVs	Only includes battery EVs. Excludes plug-in hybrid EVs as these also partially run on fossil fuels
Electrified heat	Included	Included only when using renewable energy
Hydrogen	Included	Included only when using exclusively green hydrogen
Carbon capture and storage and other carbon removal measures	Included	Excluded as technology is still in its early stage and there are cautions that it may further lock-in fossil fuel based development
Energy storage	Included	Included only when supporting renewable energy systems
Nuclear	Excluded	Excluded given the debate around risks and benefits of nuclear power plants
Fossil fuels (coal, oil, natural gas)	Excluded	Excluded

Table 3: Climate finance taxonomy used in the Landscape analysis

Sector	Sub-Sector	Mitigation or adapdation solution	Additional information and examples
Energy Systems	Power & Heat Generation	Biofuel/Biomass-fired	If a project's GHG emissions reductions are demonstrated compared with technically and economically viable alternatives
		Geothermal	
		Hydropower[13]	If a project's GHG emission reductions are demonstrated compared with technically and economically viable alternatives
		Hydrogen fuel cell	Using green hydrogen only
		Off grid (renewables only)	Renewables only
		Other Marine	Wave, Tidal, etc
		Solar – Concentrated Solar Power (CSP)	
		Solar – Photovoltaic (PV)	Utility scale and distributed
		Wind – Offshore	
		Wind – Onshore	
		Carbon Capture Use and Storage (CCUS) in Fossil Fuel power plants	Incremental costs of CCUS technology only
		Waste-to-Energy	Ex. incineration, gasification, pyrolysis and plasma with clear mitigation benefits
		Multiple	Unspecified RE projects or projects with combining multiple energy sources
		Renewable Retrofit	Energy Efficiency in existing renewable power assets
		Resilient Infrastructure and Infrastructure for Resilience	Ex. Reduction in river flows leading to loss of generation from a hydroelectric plant
	Power & Heat Transmission & Distribution	District Heating	Fueled by renewable energy only
		Smart Grid	
		Mini grids	
		Power Grid – Retrofit	Retrofits that lead to clear energy efficiency gains
		Power Grid – New	That enable the integration of renewable power capacity

[13] CPI does not include large hydro projects financed by 1) the public sector and that does not demonstrate mitigation potential, and 2) the private sector.

Sector	Sub-Sector	Mitigation or adapdation solution	Additional information and examples
		Resilient Infrastructure and Infrastructure for Resilience	Ex. Undergrounding of power lines
	Fuel Production	Biogas	Production of biogas connected to natural gas pipelines
		Biofuel	Biofuel production
		Hydrogen from Renewables	
	Fuel Transmission & Distribution	NA	Ex. Green hydrogen pipelines
	Policy & National Budget Support & Capacity Building	NA	
	Other/Unspecified	NA	Other energy projects including general energy access development with clear mitigation and/or adaptation benefits
Industry	Industrial, Extraction, and Manufacturing Processes	Non-Energy and Fugitive GHG reduction	Ex. Substitutions in industrial processes with associated GHG cuts
		Carbon Capture Use and Storage	Excluding Energy sector – Incremental cost only
		Energy-Use mprovements & Other GHG cuts	Energy consumption and GHG cuts in industrial processes
		Substitution with Hydrogen from Renewables	Industrial processes using hydrogen shifting from FF-based Hydrogen to RE-based hydrogen
	Industry Infrastructure & Warehouse	Energy Efficiency	Low-consumption warehouses and light industry buildings
		Resilient Infrastructure and Infrastructure for resilience	Ex. Improve resilience of existing industrial plant/flood protection etc.
	Policy & National Budget Support & Capacity Building	NA	
	Other/Unspecified	NA	
Waste	Solid Waste	Infrastructure & Management (incl. recycling)	
	Policy & National Budget Support & Capacity Building	NA	
	Other/Unspecified	NA	

Sector	Sub-Sector	Mitigation or adapdation solution	Additional information and examples
Water & Wastewater	Water Supply & Sanitation	Efficient Large Infrastructure	
		Basic Water Access	
	Waste Water Treatment	Infrastructure & Management	Greenfield or brownfield projects that reduce methane or nitrous oxide emissions through wastewater, fecal sludge, or septage management
		NA	
	Policy & National Budget Support & Capacity Building	NA	Ex. Improved catchment management planning and regulation of water abstraction
	Other/Unspecified	NA	
Buildings & Infrastructure	Building & Infrastructure Construction Work	Energy Efficiency - New Construction	
		Energy Efficiency - Retrofit	
		Resilient Infrastructure and Infrastructure for Resilience	
	HVAC & Water Heaters	Renewable Energy-based HVAC	
		Solar Thermal Water Heaters	
		Energy Efficient HVAC	Efficient cooling, etc.
	Appliances & Lighting	Efficient Lighting systems (incl. public lighting)	Ex. LEDs
	Policy & National Budget Support & Capacity Building	NA	Ex. More robust building regulations and improved enforcement
	Other/Unspecified	NA	
Transport	Private Road Transport	Battery EVs	
		EV Chargers	
	Rail & Public Transport	Modal Shift Policy Support	
		Energy Efficiency - Retrofit	Fleet Retrofit with clear energy efficiency gains
		New Bus, Light or Heavy Rail Fleet & Related Infrastructure	With associated modal shifts from a higher-carbon transport mode. FF-powered rail engines are excluded
	Waterway	Energy Efficiency - Retrofit	Fleet Retrofit
		New Low-carbon Fleet & Related Infrastructure	

Sector	Sub-Sector	Mitigation or adapdation solution	Additional information and examples
	Aviation	Energy Efficiency - Retrofit	
		Modal Shift Policy Support	
	Policy & National Budget Support & Capacity Building	NA	
	Transport-oriented Infrastructure and Urban Development	Infrastructure for non-motorized transports	
		Resilient Infrastructure and Infrastructure for Resilience	Ex. Use of revised codes for infrastructure design that consider increased frequency or severity of extreme events
	Other/Unspecified	Modal Shift with Associated GHG Emission Cuts	
Information and Communications Technology	Data Centers	NA	New highly energy efficient centers or energy efficient retrofits
	Telecommunication Networks	NA	New highly energy efficient networks or energy efficient retrofits
		Resilient Infrastructure and Infrastructure for Resilience	
	Policy & National Budget Support & Capacity Building	NA	
	Other/Unspecified	NA	
Agriculture, Forestry, Other land uses and Fisheries	Agriculture	Sustainable Crops, Agro-forestry, Livestock production	Ex. Investments in crops that are more resilient to climate extremes and change
		Supply chain management (commercialisation, primary processing & storage)	
		Financial services for sustainable production, commercialisation, storage and processing	
	Forestry	Afforestation, Reforestation, Forest Conservation, sustainable management of existing forest, including extraction of non-timber products	
		Supply chain management (commercialisation, primary processing & storage)	

Sector	Sub-Sector	Mitigation or adapdation solution	Additional information and examples
	Fisheries	Sustainable fish production	
		Supply chain management (commercialisation, primary processing & storage)	
	Food & diet	Food waste and low-carbon diets	
	Policy & National Budget Support & Capacity Building	NA	
	Unspecified / Multiple	NA	
Others & Cross-sectoral	Policy & National Budget Support & Capacity Building	NA	
	Biodiversity, Land & Marine Conservation	NA	
	Disaster-risk Management	NA	Ex. Integration of climate change scenarios and climate risk assessments into disaster-risk plans and preparedness
	Other/Unspecified	NA	

4. GEOGRAPHIES AND COUNTRIES

This section describes the regional breakdown adopted in the 2023 *Landscape* to represent the destinations of climate finance flows (see Table 4). Flows are classified as 'transregional' when resources are channeled to more than one region.

Country classification by region

Table 4: Regional grouping used for the analysis of climate finance flows

Region	Country or territory
Central Asia & Eastern Europe	**OECD:** Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, Turkey. **Non-OECD:** Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Georgia, Kazakhstan, Kosovo[14], Kyrgyz Republic, North Macedonia, Montenegro, Republic of Moldova, Romania, Russian Federation, Serbia, Tajikistan, Turkey, Turkmenistan, Ukraine, Uzbekistan
East Asia & Pacific	**Non-OECD:** American Samoa, Brunei, Cambodia, China, Cook Islands, Democratic People's Republic of Korea, Fiji, Indonesia, Kiribati, Lao PDR, Malaysia, Marshall Islands, Micronesia (Federated States of), Mongolia, Myanmar, Nauru, Niue, Palau, Papua New Guinea, Philippines, Republic of Korea, Samoa, Singapore, Solomon Islands, Thailand, Timor-Leste, Tonga, Tuvalu, Vanuatu, Viet Nam
Latin America & Caribbean	**OECD:** Chile, Colombia, Costa Rica, Mexico **Non-OECD:** Anguilla, Antigua and Barbuda, Argentina, Bahamas, Barbados, Belize, Bolivia (Plurinational State of), Bonaire, Brazil, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Guadeloupe, Guatemala, Guyana, Haiti, Honduras, Jamaica, Nicaragua, Panama, Paraguay, Peru, St. Barthélemy, Sint Eustatius and Saba, St. Kitts and Nevis, St. Lucia, St. Vincent and Grenadines, Suriname, Trinidad and Tobago, Uruguay, Venezuela (Bolivarian Republic of), West Indies
Middle East & North Africa	**Non-OECD:** Algeria, Bahrain, Egypt, Islamic Republic of Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, State of Palestine, Syrian Arab Republic, Tunisia, United Arab Emirates, Yemen
Other Oceania	**OECD:** Australia **Non-OECD:** New Zealand, Tokelau

[14] This designation is without prejudice to positions on status, and is in line with United Nations Security Council resolution 1244 and the International Court of Justice Opinion on the Kosovo Declaration of Independence.

Region	Country or territory
Sub-Saharan Africa	**Non-OECD:** Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cabo Verde, Central African Republic, Chad, Comoros, Republic of Congo, Democratic Republic of the Congo, Côte d'Ivoire, Djibouti, Equatorial Guinea, Eritrea, Eswatini, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mayotte, Mozambique, Namibia, Niger, Nigeria, Réunion, Rwanda, São Tomé and Principe, Saint Helena, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, South Sudan, Sudan, United Republic of Tanzania, Togo, Uganda, Zambia, Zimbabwe
South Asia	**Non-OECD:** Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Sri Lanka
US & Canada	**OECD:** Canada, United States of America
Western Europe	**OECD:** Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Slovenia, Spain, Sweden, Switzerland, United Kingdom. Annex I Parties: Andorra, Liechtenstein, Malta, Monaco **Non-OECD**: San Marino, Vatican City

Domestic and international flows

Financial flows are categorized into domestic and international. This categorization indicates how much climate finance is flowing beyond national territories and determines dependency of countries to domestic and international finance for climate investments. The analysis further investigate international climate finance coming from and flowing to OECD and non-OECD countries.[15]

Domestic flows pertain to climate finance that was raised and spent within the same country, while international flows pertain to climate finance flows that were raised in a specific country but spent in another. Climate finance from multilateral DFIs is automatically categorized as international flows.

Least developed countries, emerging markets and developing counties, developed countries

For the first time, the 2023 Landscape adopted a high-level classification of countries based on income and development status.

[15] The list of 38 members to the Organisation for Economic Co-operation and Development (OECD) can be found at https://www.oecd.org/about/.

Table 5:Country classification used for the analysis of climate finance flows

Classification	Country or Territory
Least Developed Countries	Afghanistan, Angola, Bangladesh, Benin, Bhutan, Burkina Faso, Burundi, Cambodia, Central African Republic, Chad, Comoros, Congo, Democratic Republic, Djibouti, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Haiti, Kiribati, Lao PDR, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Myanmar, Nepal, Niger, Rwanda, São Tomé and Principe, Senegal, Sierra Leone, Solomon Islands, Somalia, South Sudan, Sudan, Tanzania, Timor-Leste, Togo, Tuvalu, Uganda, Vanuatu, Yemen, Zambia
Emerging Markets and Developing Countries	Algeria, Antigua and Barbuda, Argentina, Armenia, Aruba, Azerbaijan, Bahamas, Bahrain, Barbados, Belize, Bolivia, Botswana, Brazil, Brunei, Cameroon, Cape Verde, Chile, China, Colombia, Congo Republic, Costa Rica, Côte d'Ivoire, Cuba, Ecuador, Egypt, El Salvador, Equatorial Guinea, Fiji, Gabon, Georgia, Ghana, Guatemala, Honduras, Hong Kong, India, Indonesia, Iran, Iraq, Jamaica, Jordan, Kazakhstan, Kenya,, Korea, Democratic People's Republic Korea, Kuwait, Kyrgyzstan, Lebanon, Libya, Malaysia, Maldives, Marshall Islands, Mauritius, Mexico, Micronesia, Mongolia,, Morocco, Namibia, Netherlands Antilles, Nicaragua, Nigeria, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Puerto Rico, Qatar, Saint Helena, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Saudi Arabia, Seychelles, Singapore, South Africa, Sri Lanka. State of Palestine, Suriname, Swaziland, Syria, Taiwan, Tajikistan, Thailand, Trinidad and Tobago, Tunisia, Turkmenistan, United Arab Emirates, Uruguay, Uzbekistan, Venezuela, Vietnam. Zimbabwe
Developed Countries	Albania, Andorra, Australia, Austria, Belarus, Belgium, Bermuda, Bosnia and Herzegovina, Bulgaria, Canada, Croatia, Cyprus, Czech Republic, Denmark, Estonia, European Union, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Jersey, Latvia, Lithuania, Luxembourg, North Macedonia, Malta, Mayotte, Moldova, Montenegro, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russia, San Marino, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom, United States of America

5. CLIMATE FINANCE NEEDS AND COST OF INACTION

The 2023 *Landscape* report analyses climate finance flows in the broader context of a global transition towards a 1.5°C pathway. This contextual analysis compares historical flows with estimated climate finance needs. For the first time this year, it also compares climate finance flows and needs with the economic and social losses associated with a business-as-usual trajectory (here referred to as "cost of inaction"). Section 5.1 and 5.2 provide details on the approach and data sources used to estimate climate finance needs and cost of inaction.

5.1 CLIMATE FINANCE NEEDS

The climate finance needs estimates included in the 2023 *Landscape* report are based on a collection of several existing scenarios and models which aim to estimate the investment requirements to reach climate goals in various sectors. Our efforts further focused on the standardization and processing of data coming from very different sources to ensure consistency and comparability.

Scenarios considered

The finance needs estimates presented in the *Landscape* are the product of prospective scenarios and models, which are not anticipation exercises but, rather, represent possible pathways to reach the internationally agreed goal of limiting the rise in the global average temperature to well below 2°C, and ideally 1.5°C, by the end of the present century, compared to pre-industrial levels. The scenarios considered are based on different methodologies and assumptions (some of which are incompatible with each other, e.g., 100% renewable vs high shares of fossil fuels with carbon removal technologies), leading to very different investment needs estimations. To reflect this variability, our climate needs estimates are presented as ranges of investments needed, rather than single values.

As such, **our climate finance needs estimates represent a comprehensive and impartial overview of available scenarios and models to date**. The range of values resulting from our calculations should be read as a reliable indicator of the level and order of magnitude of the investments required to reach the goal of the Paris Agreement, although the investment amounts remain sensitive to the methodologies and assumptions under each scenario.

Data sources

Table 6 includes a comprehensive list of data sources reviewed and used for our 2023 *Landscape* needs estimates. This list builds on and updates the set of data sources used in the 2022 *Landscape* (CPI, 2022). While we collected data from all the sources reviewed, we

only processed and used a subset of scenarios for our final calculations. Attention was especially paid to avoiding double counting by:

- Excluding multiple references of the same sector/technology when coming from the same scenario by the same institution;
- Prioritizing the primary data sources (e.g., if a report is referring to another document, the data from the original document is used, unless more granular or additional information can be gathered from the secondary source);

  Prioritizing more granular data when available (e.g., country vs region, sub-sector vs sector).

Because of the variability in scenarios and reports' publication dates, investment needs data collected was standardized and final results are expressed in 2022 USD billon.

Table 6: Data sources used for the climate finance needs estimates in 2022 and 2023

Sector	Sources used for the 2022 needs estimations	Sources reviewed in 2023	Sources used in the 2023 needs estimations
Buildings & Infrastructure	IEA (2021) IRENA (2022b)	***Additional sources*** Bhattacharya et al. (2022) McKinsey (2022) Vivid Economics (2021) IEA (2023b) Songwe at al. (2022) ***Updated sources*** IRENA (2023b)	**LSE** (2021) **IRENA** (2023b), **IEA** (2023b) **McKinsey** (2022)
AFOLU	UNEP (2022) Harmsen et al. (2019)	***Additional sources*** Bhattacharya et al. (2022) Songwe at al. (2022) McKinsey (2022) Vivid Economics (2021) LSE (2021) FOLU (2019) Paulson Institute (2020) Thornton et al. (2023)	**FOLU** (2019) **McKinsey** (2022) **UNEP** (2022) **LSE** (2021) **Paulson Institute** (2020) **Thornton et al.** (2023)
Transport	IEA (2021) IEA (2020a) IRENA (2022b) BNEF (2021) IEA (2019)	***Additional sources*** Songwe at al. (2022) World Bank (2019) McKinsey (2022) Vivid Economics (2021) LSE (2021) IEA (2023c) IEA (2023b)	**BNEF** (2022a) **IRENA** (2023b) b) **McKinsey** (2022) **IEA** WEI (2023)

Sector	Sources used for the 2022 needs estimations	Sources reviewed in 2023	Sources used in the 2023 needs estimations
		Updated sources IEA (2023d) IRENA (2023b) BNEF (2022a)	
Industry	IRENA (2022b) IEA (2021)	***Additional sources*** McKinsey (2022) Vivid Economics (2021) IEA (2023b) Songwe at al. (2022) IEA (2023c) NGFS (2023) ***Updated sources*** IRENA (2023b) BNEF (2022a)	**McKinsey** (2022) **BNEF** (2022A) **IEA** (2023b) **IRENA** (2023b) **IEA** (2021)
Energy	BNEF (2021) IRENA (2022b) IEA (2020b) IEA (2021)	***Additional sources*** Bhattacharya et al. (2022) BNEF (2023b) Songwe at al. (2022) McKinsey (2022) Vivid Economics (2021) IEA (2023b) BP (2023) IEA (2023c) LSE (2021) IPCC (2022) NGFS (2023) ***Updated sources*** IRENA (2023b)	**BNEF** (2022b) **BNEF** (2022a) **IEA** (2021) **IRENA** (2023b) **LSE** (2021) **IEA** (2023b) **IPCC** (2022) **McKinsey** (2022)
Adaptation	UNEP (2021) World Bank and GFDRR (2021)	***Additional sources*** Bhattacharya et al. (2022) Songwe at al. (2022) GCA (2022) LSE (2021) Markandaya and Eguino (2018) Baarsch et al. (2015) Chapagain et al. (2020) World Bank (2010) UNEP (forthcoming) ***Updated sources*** UNEP (2022)	**Chapagain et al.** (2020) **Songwe at al.** (2022) **Bhattacharya et al.** (2022) **LSE** (2021) **UNEP** (forthcoming)

Comparison with previous needs estimates

In an effort to improve our coverage of existing investment needs scenarios, our 2023 needs estimates update figures presented in the 2022 *Landscape* (CPI, 2022). Changes stem from the update of some scenarios already included in our 2022 needs database, the inclusion of new scenarios previously not covered, and improvements in our methodological approach to standardize and process the data collected (see Table 7).

Table 7: Changes in needs estimates by sector compared to the 2022 *Landscape*

Sector	Average annual investment needs by 2030 (2022 *Landscape*, USD bn)	Average annual investment needs by 2030 (2023 *Landscape*, USD bn)	Changes in needs estimations (USD bn)	Changes due to additional data sources	Changes due to updates in scenarios and methodology improvements
AFOLU	245	1,304	+1,059	98%	2%
Buildings	773	1,242	+469	71%	29%
Transport	1,713	1,904	+191	68%	32%
Industry	326	934	+608	84%	16%
Energy	2,425	2,966	+540	76%	24%
Adaptation	160	212	+52	87%	13%

5.2 COST OF INACTION

We deploy a framework that classifies the cost of inaction into two broad categories (further details in Table 8):

1. **Economic costs**, which consist of direct losses of GDP due to climate-related risk and impacts, and
2. **Social costs**, which include indirect economic costs due to negative climate-related impacts on people and/or their environments.

Table 8: Classification of economic and social costs

Economic costs	
Impacts on productivity	• Lost labour due to extreme heat and other climate-related illnesses • Halted or stalled productivity and investment due to extreme weather • Reduced agricultural yields due to drought, warmer temperatures, extreme weather and other climate-related impacts
Damage to assets and capital	• Physical assets damaged by extreme weather, heat, or sea-level rise • Loss of productive land, agricultural or urban, due to sea-level rise • Depreciation of capital and market instability due to uncertainty a warming climate and its consequences • Losses from investment in assets that will become stranded[16]
Disruptions to global flow of currency	• Lost travel and tourism due to negative impacts of climate change (extreme weather events, extreme heat, sea-level rise)
Social costs	
Impacts on health and well-being	• Increased mortality and climate-related illnesses dues to heat, poor air quality, and extreme weather • Increased healthcare spending due to increased climate-related diseases in the short and long term
Loss of nature and biodiversity	• Loss of nature and biodiversity due to rising temperatures, land degradation and deforestation • Costs from the loss of ecosystem services such as pollination, timber, and marine stocks
Conflict and migration	• Increased global movement of people due to conflict, loss of land or loss of resources due to climate-related impacts such as floods, drought, extreme weather, water and food scarcity, etc.
Exacerbation of global and local inequalities	• Costs are disproportionately felt in developing countries or in disadvantaged areas, worsening existing local and global inequalities

The costs listed in Table 8 are costs that are direct or indirect results of climate-related risks. In determining relevant climate-related risks, we use a classification adapted from NGFS (2022) which distiguishes between physical risks – or risks that result in physical damages and impacts – and transition risks, which are risks associated with changing to a net zero economy (see Table 9).

Table 9 Classification of climate-related risks

Physical risks	**Transition risks**
• Warming temperatures and extreme heat • Sea-level rise • Extreme weather events and increased rates of natural disaster such as hurricanes, floods, droughts, wildfires, etc. • Land degradation and deforestation • Pollution and worsening air quality	• Costs associated with adapting the economy to more stringent environmental policies • Opportunity costs of not taking part in a net zero transition, including stranded assets • Coping with unintended or unforeseen consequences, such as political or market instability in an uncertain climate

Adapted from NGFS (2022)

[16] Stranded assets are investments (typically in fossil fuel industries) that will lose value or become obsolete due to changes in the market, new technologies, or increased environmental regulations.

Using this framework, we did an extensive literature review to identify studies and models projecting economic and social costs from both physical and transition risks. We considered a wide range of literature with projections across different timeframes and with different projected warming scenarios.

Table 10 contains a summary of the literature on the costs of inaction considered within our framework. In general, available projections of the costs of inaction primarily estimate the impacts of economic costs. With the exception of costs to human health, social costs, particularly the impact of climate-driven migration and worsening inequalities, are more difficult to quantify and are often excluded from estimates.

Due to varying timescales and warming assumptions, it is difficult to compare, aggregate, or average estimates of the cost of inaction across the literature. For this reason, for the analysis in the 2023 *Landscape*, we decided to focus only on estimates developed by the Network for Greening the Financial System (NGFS, 2022).

Table 10: Summary of cost of inaction literature

Source	Costs	Risks	Time period	Cost	Climate scenario
NGFS (2022)	**Economic:** Productivity, assets/ capital, flow of currency **Social:** Health and well-being	Temperature, extreme weather, sea-level, transition risks	2022-2100	Up to 20% GDP losses by 2100	Current policies (3°C)
Deloitte (2022)	**Economic:** Productivity, assets/ capital, flow of currency **Social:** Health and well-being	Temperature, extreme weather, sea-level	2021-2070	USD 178 trillion	3°C
EEA 2022: (focus on EEA member countries)	**Economic:** Productivity, assets/ capital **Social:** Health and well-being	Temperature, extreme weather	1980-2020	EUR 450 – 520 billion (EEA member countries only)	Actual (business as usual)
OCED (2015)	**Economic:** Productivity, assets/ capital, flow of currency **Social:** Health and well-being	Temperature, extreme weather, sea-level rise	2015-2100	1-3% GDP loss (by 2060) 2-10% GDP loss (by 2100)	1.6-2.6°C (by 2060) (2.2-4.5°C by 2100)
AON (2023)	**Economic:** Assets/ capital	Extreme weather	2022-2022	USD 299 billion	Actual (business as usual)

Source	Costs	Risks	Time period	Cost	Climate scenario
Oxford Economics (2022)	**Economic:** Productivity, assets/ capital	Temperature	2022-2050	Up to 20% GDP reduction	2.2°C
Kalkuhl and Wenz (2020)	**Economic:** Productivity, assets/ capital	Temperature	2020-2100	7-14% GRP reduction	RPC 8.5 (3°C)
ILO (2019)	**Economic:** Productivity	Temperature	2019-2030	USD 2.7 trillion	RCP 2.6 (1.5°C)
IRENA (2017)	**Economic:** Assets/ capital	Transition risks	2015-2050	USD 12 trillion	Delayed policy action
The Economist and Vivid Economics (2015)	**Economic:** Assets/ capital	Temperature, extreme weather, transition risk	2015-2100	USD 4-14 trillion	3°C+
World Bank (2021)	**Social:** Biodiversity/ nature	Land degradation	2021-2030	USD 90-225 billion	RCP 4.5
NOAA (2023) (focus on USA)	**Social:** Assets/ capital	Extreme weather	1980-2022	USD 2.6 trillion (USA only)	Actual (business as usual)
NRDC (2021) (focus on USA)	**Social:** Health and well-being	Air pollution	2022-2022	USD 800 billion per year (USA only)	Actual (business as usual)

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