

# PFM4CA

## The Economics of Climate Change

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December 3, 2024

## Structure

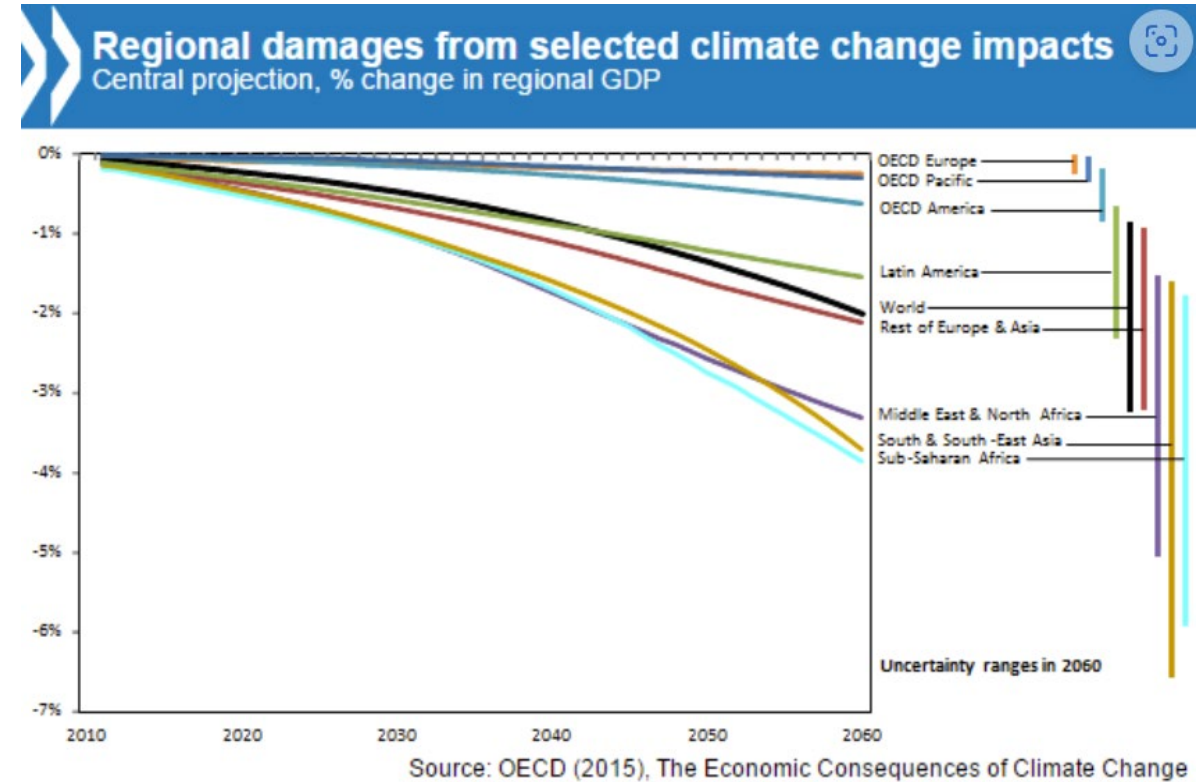
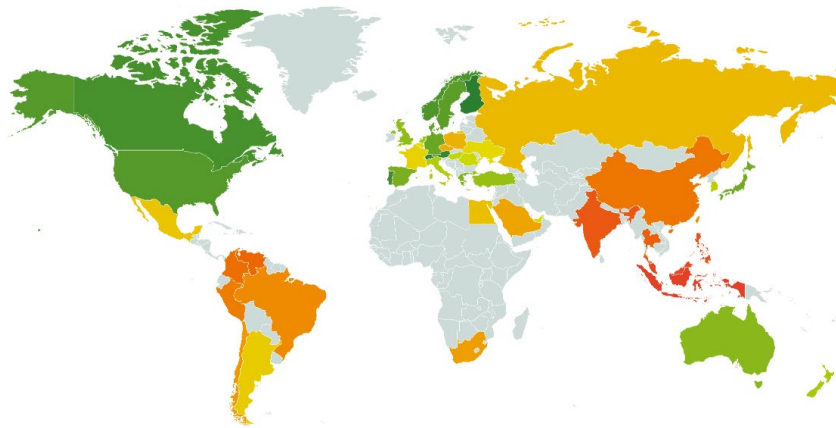
- I. Economic impact - global
- II. Economic impact - national
- III. Costs of climate response



# I. Economic impact - global

## Estimate

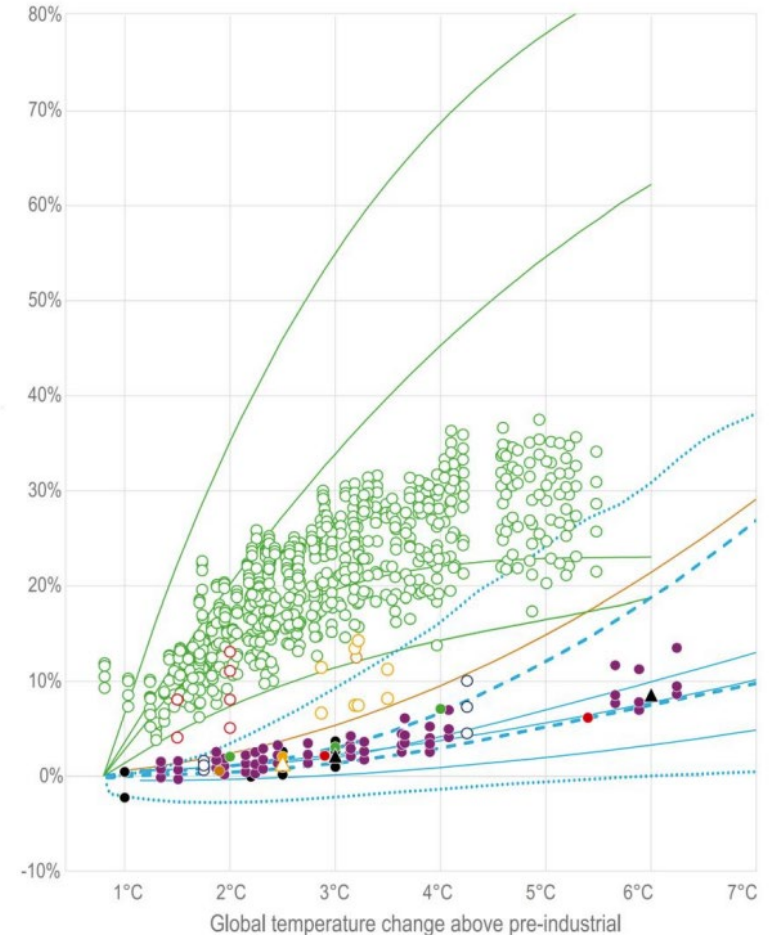
- **11 – 14% global economic output (or \$23 trillion) by 2050 – some Asian nations have 2/3rds wealth remaining (Swiss Re institute).**



# I. Economic impact - global

## Uncertainty

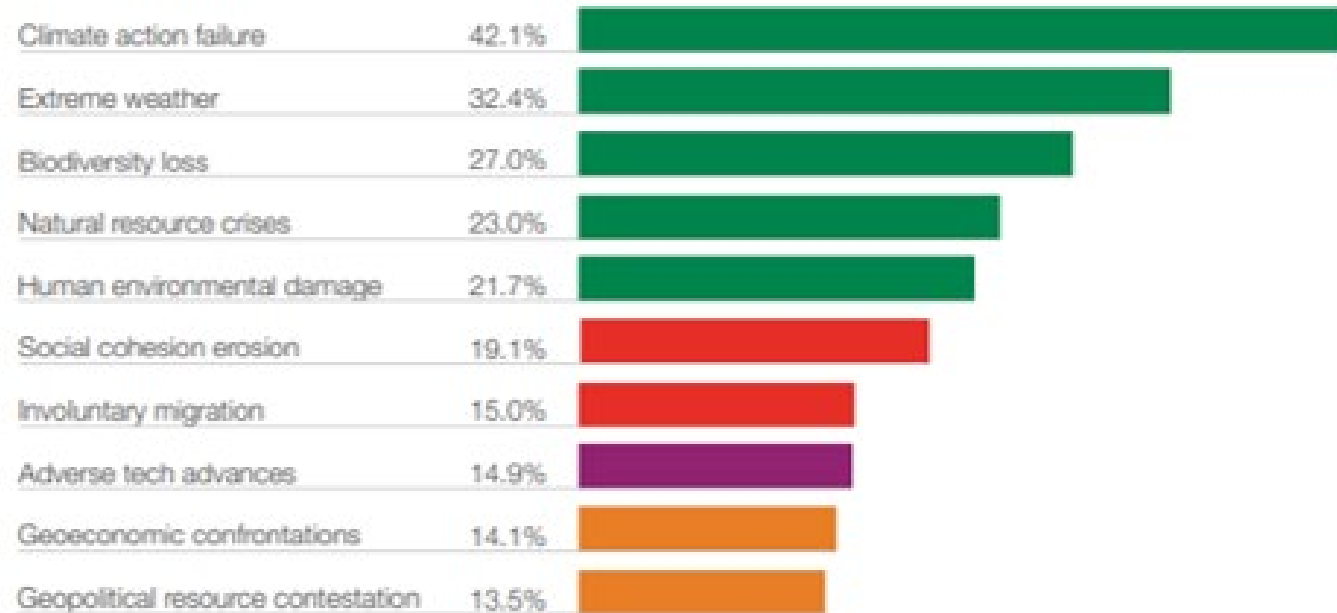
- IPCC provide a variety of loss of global GDP with temperature from 1°C at present
- AR6 showed that will be unequally distributed across systems, regions and sectors



# I. Economic impact - global

But climate will be at top of threats to the world (WEF, 2022)

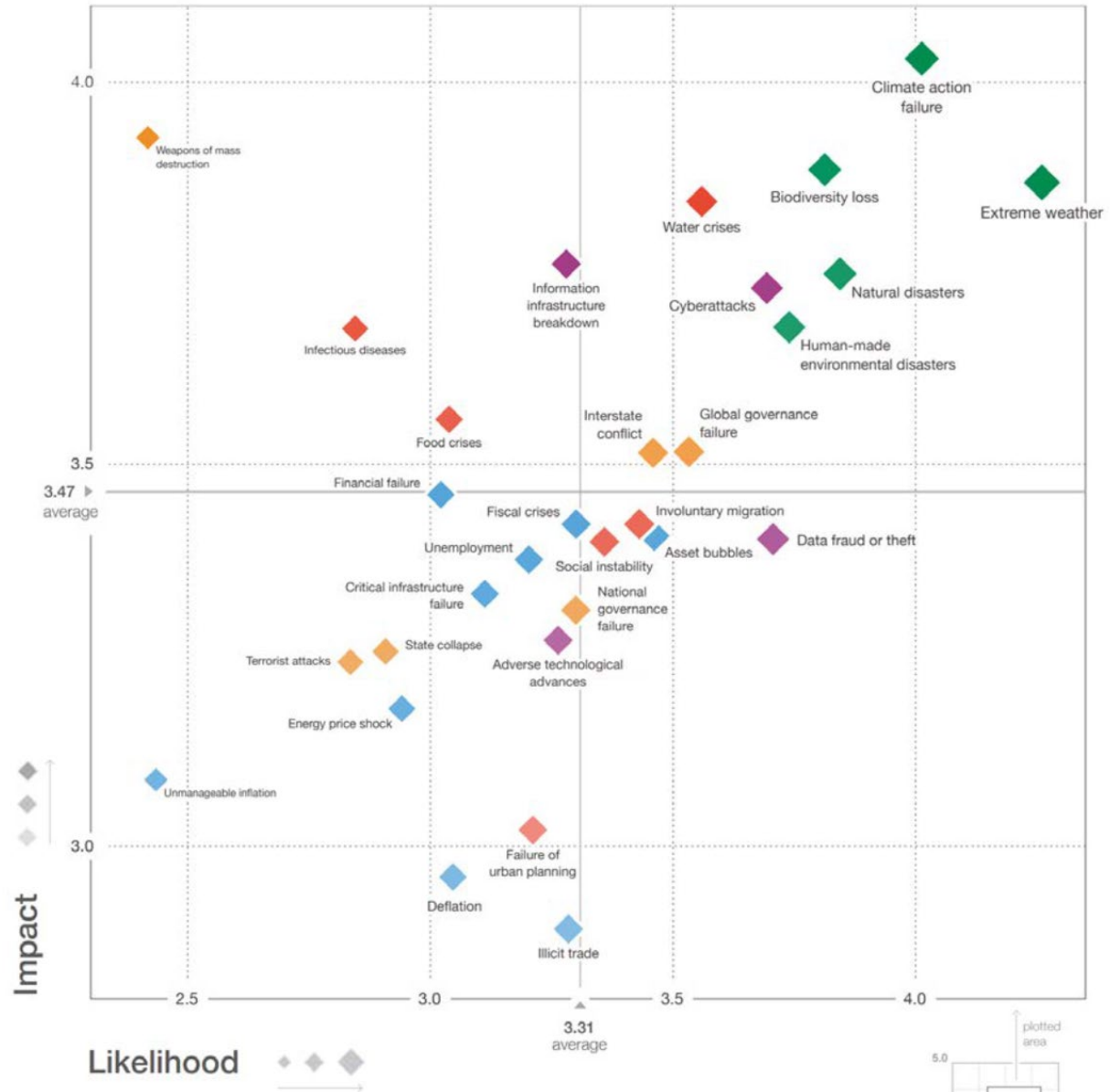
5-10 years



■ Economic ■ Environmental ■ Geopolitical ■ Societal ■ Technological

# I. Economic impact - global

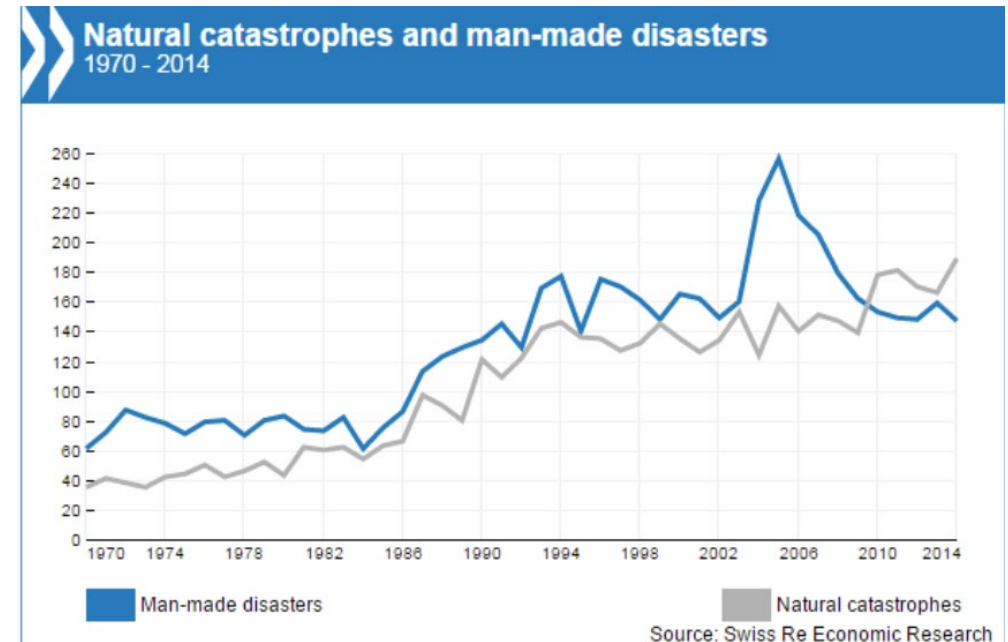
..and most likely and impactful



# I. Economic impact - global

## Climate affects frequency of extreme events

- **Mozambique – 2 cyclones in 2019 (103% of GDP debt), 2 more in 2021 (125% of GDP debt).**
- **Pakistan flooding in 2022, killed 1,700 and affected 33 million with losses of \$30 billion.**
- **2021 – 10 climate-related weather events cost \$170 billion in damages**

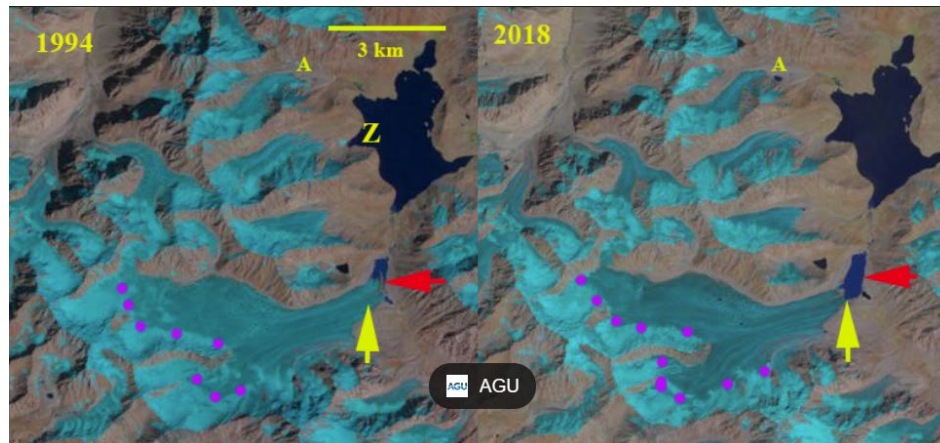


# I. Economic impact - global

## And climate affects slow-onset events

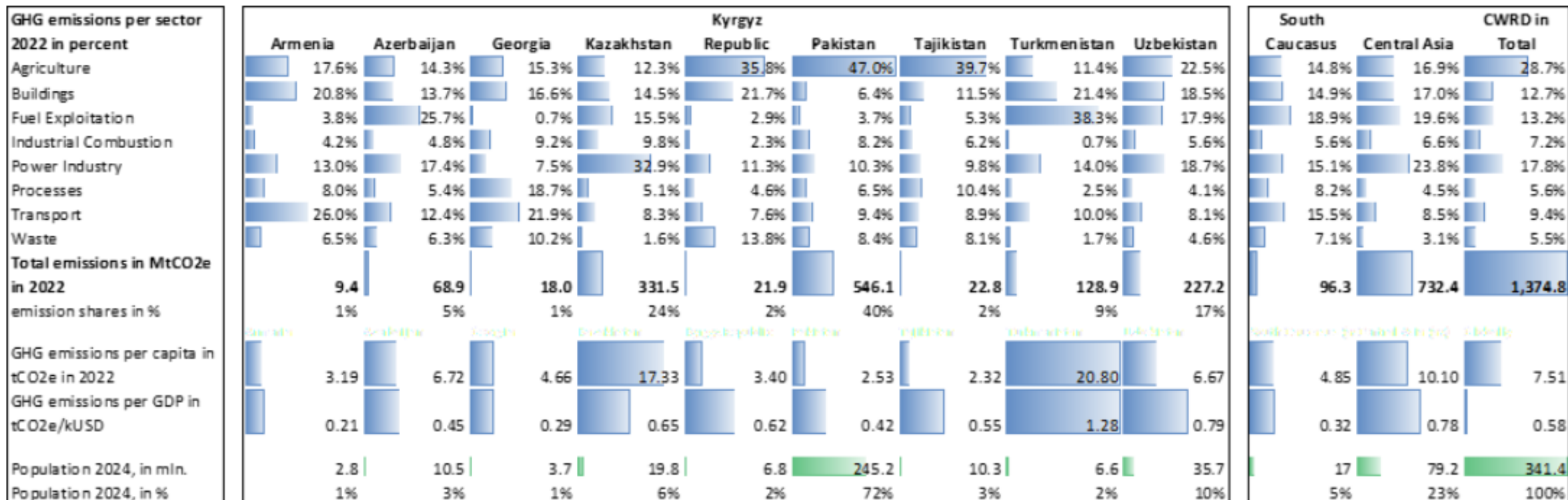
- **Slow onset – such as increasing temperature, desertification, sea level rise, salinization, loss of biodiversity, glacial retreat, mental health.**
- **More fatalities from slow onset events – especially desertification.**
- **Estimates difficult – but need to include effect of slow-onset processes in future economic growth.**
- **Societal economic damage \$3,000 per tonne of CO2**

<https://iopscience.iop.org/article/10.1088/1748-9326/ac1d0b>



## II. Economic impact - national

### Different emission profiles across region



## II. Economic impact - national

### Different vulnerabilities across region

	2022 population in million (% urban population) <sup>32</sup>	Population 2050 in million (low– high projection) <sup>33</sup>	2022 GDP per capita (current \$) <sup>34</sup>	Human Development Index (global rank in parentheses) <sup>35</sup>	GDP affected by 1:100 year flood (%) <sup>36</sup>	Population employed in agriculture sector (%) <sup>37</sup>	2022 GDP % agricult ure <sup>38</sup>
Armenia	2.8 (64)	2.4–2.8	7,018	0.786 (76/193)	6	52	10
Azerbaijan	10.1 (57)	10.0–11.8	7,762	0.760 (89/193)	2	36	5
Georgia	3.7 (60)	3.1–3.7	6,675	0.814 (60/193)	10	40	6
Kazakhstan	19.6 (58)	23.5–27.5	11,492	0.802 (67/193)	11	13	5
Kyrgyz Republic	7.0 (37)	8.5–10.2	1,655	0.701 (117/193)	7	25	11
Tajikistan	10.0 (28)	13.8–16.5	1,054	0.679 (126/193)	8	44	22
Turkmenistan	6.4 (53)	7.5–8.9	8,793	0.744 (94/193)	7	23	12
Uzbekistan	35.6 (50)	41.6–49.3	2,255	0.727 (106/193)	5	26	24
Pakistan	235.8 (38)	335.3–397.6	1,589	0.540 (164/193)	5	36	22

GDP = gross domestic product.

## II. Economic impact - national

### Different vulnerabilities across region – flooding 1:100 year

Country	Affected by 1:100 Years Flood at Present in \$ Billion (% of 2015 GDP)	Affected by 1:100 Years Flood in 2080 in \$ billion (% of 2015 GDP)
Armenia	0.7 (6%)	2–3 (19%–28%)
Azerbaijan	1 (2%)	2–3 (4%–5%)
Georgia	1 (10%)	6–8 (44%–58%)
Kazakhstan	10 (11%)	60–100 (50%–83%)
Kyrgyz Republic	0.4 (7%)	4–7 (73%–127%)
Tajikistan	0.5 (8%)	6–9 (87%–130%)
Turkmenistan	3 (7%)	10–30 (20%–60%)
Uzbekistan	4 (5%)	20–30 (30%–45%)

## II. Economic impact - national

### Tajikistan has several vulnerable economic sectors

- **Energy - 98% hydroelectric – risk to adequacy of rainfall.**
- **Water resources – risk across health, agriculture, energy and infrastructure, vulnerable to extreme events and slow onset.**
- **Industry and construction – especially mining risk from landslides, mudslides and floods.**
- **Healthcare – especially sensitive pre-existing patients and young and old, prolonged high air temperatures increase health risk.**
- **Agriculture – risk to productivity and natural disasters (temperature, pests, drought, glacial flooding).**

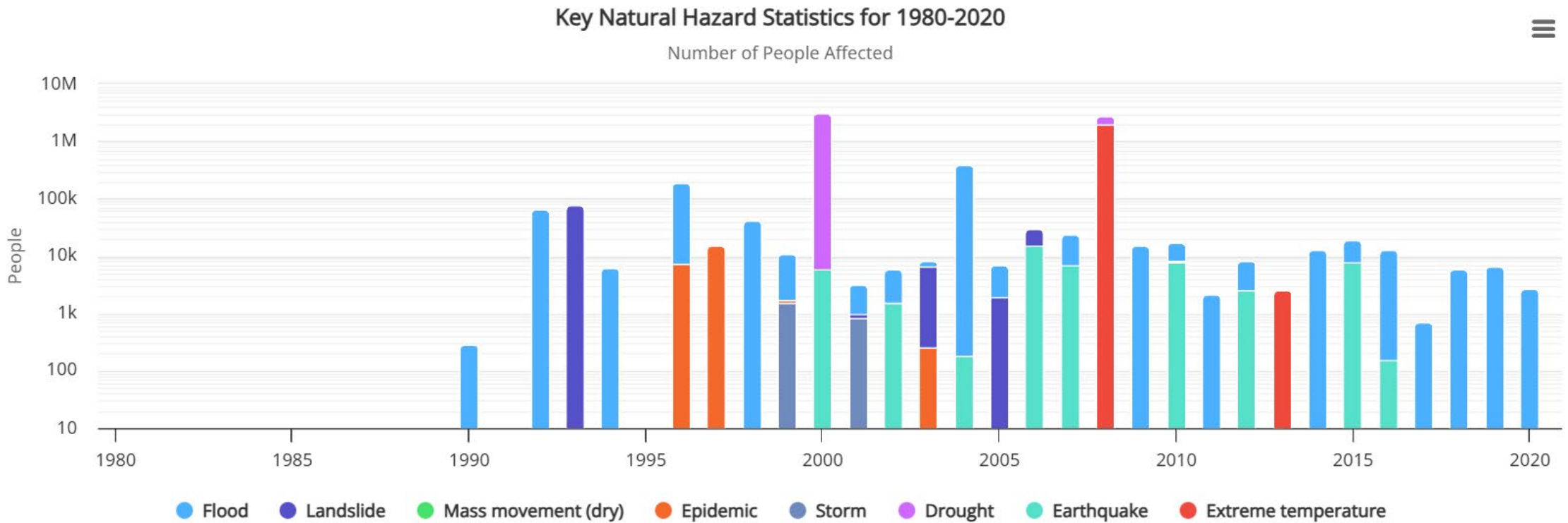
## II. Economic impact - national

But each sector is complicated – such as agriculture (GIZ, 2021)

Trends and phenomena related to climate change	Impact on agriculture
Temperature rise above the norm	<ul style="list-style-type: none"> <li>▪ Reduced productivity of agriculture and pastures;</li> <li>▪ Invasive and harmful organisms;</li> <li>▪ Crop losses due to insects, diseases, weeds;</li> <li>▪ Heat stroke and related livestock mortality;</li> <li>▪ An increase in the duration of the growing season (at the same time there is a danger of more frequent and intense heat waves);</li> <li>▪ Reducing the number of days with frost will reduce the risk of damage to crops from frost (however, any resulting benefit may be negated by the risk caused by pests and diseases).</li> </ul>
More frequent extreme temperatures	<ul style="list-style-type: none"> <li>▪ More frequent and intense heat waves that dramatically damage crops and cause soil erosion;</li> <li>▪ Loss of livelihood and income for the rural population;</li> <li>▪ Food price increases at local and national levels.</li> </ul>
Changes in precipitation, including extreme precipitation	<ul style="list-style-type: none"> <li>▪ Reduction of crop yields and production, cultivation of perennial fruit trees and cattle breeding;</li> <li>▪ Rapid damage to crops, soil erosion;</li> <li>▪ Loss of livelihood and income in rural areas;</li> <li>▪ Possible relocation from the lands;</li> <li>▪ Increase in local and national food prices.</li> </ul>
Droughts	<ul style="list-style-type: none"> <li>▪ Rapid rates of crop damage, soil erosion;</li> <li>▪ Growing demand for irrigation;</li> <li>▪ Reduced yields of non-irrigated or irrigated crops;</li> <li>▪ Loss of livelihood and income in rural areas;</li> <li>▪ Possible relocation from the lands;</li> </ul>

## II. Economic impact - national

More people are becoming affected by natural hazards:



## II. Economic impact - national

**Albania:**

**TABLE 4.1: Economic impacts of climate change under the trend growth**

Impact on real GDP as a percentage deviation from baseline*	RCP 2.6			RCP 4.5			RCP 8.5		
	2030	2040	2050	2030	2040	2050	2030	2040	2050
Without adaptation investments									
<b>Heat</b>	-0.23	-0.44	-0.67	-0.40	-0.77	-1.16	-0.57	-1.08	-1.65
<b>Drought (wheat and maize)</b>	-0.19	-0.27	-0.26	-0.24	-0.33	-0.43	-0.17	-0.24	-0.25
<b>Floods</b>	-2.45	-4.82	-6.67	-2.07	-4.07	-5.65	-1.94	-3.83	-5.31
<b>All combined</b>	-2.87	-5.49	-7.54	-2.70	-5.12	-7.16	-2.67	-5.10	-7.11
With adaptation investments									
<b>Heat</b>	-0.13	-0.26	-0.42	-0.22	-0.47	-0.78	-0.32	-0.70	-1.18
<b>Drought (wheat and maize)</b>	0.00	-0.01	0.00	-0.01	-0.01	-0.01	0.00	-0.01	-0.01
<b>Floods</b>	-1.55	-3.07	-4.27	-1.12	-2.22	-3.10	-0.99	-1.96	-2.73
<b>All combined</b>	-1.68	-3.33	-4.68	-1.35	-2.69	-3.87	-1.31	-2.65	-3.89

Note: \*The changes in the level of GDP or output are equivalent to changes in GDP per capita as the population figure is the same with and without the climate damage.

Source: World Bank staff estimates with inputs from JBA, IIASA and CIMA.

## II. Economic impact - national

### Bosnia and Herzegovina:

TABLE 2.2. Summary of damages and losses (2014 floods)

Sector	Damages	Losses	Total
<b>Agriculture</b>	204,090,000	162,070,000	366,160,000
<b>Education</b>	15,720,000	1,300,000	17,020,000
<b>Energy</b>	97,140,000	102,280,000	199,420,000
<b>Floods protection</b>	96,300,000	-	96,300,000
<b>Health</b>	11,330,000	92,180,000	103,510,000
<b>Housing and household items</b>	830,800,000	55,600,000	886,400,000
<b>Livelihoods and employment</b>	677,800,000	873,260,000	1,551,060,000
<b>Public services and facilities</b>	35,920,000	17,700,000	53,620,000
<b>Transport and communications</b>	511,960,000	168,080,000	680,040,000
<b>Water and sanitation</b>	10,640,000	4,050,000	14,690,000
<b>Gender</b>	-	16,550,000	16,550,000
<b>Total</b>	<b>2,491,700,000 BAM</b>	<b>1,493,070,000 BAM</b>	<b>3,984,770,000 BAM / US\$2,140,000,000</b>

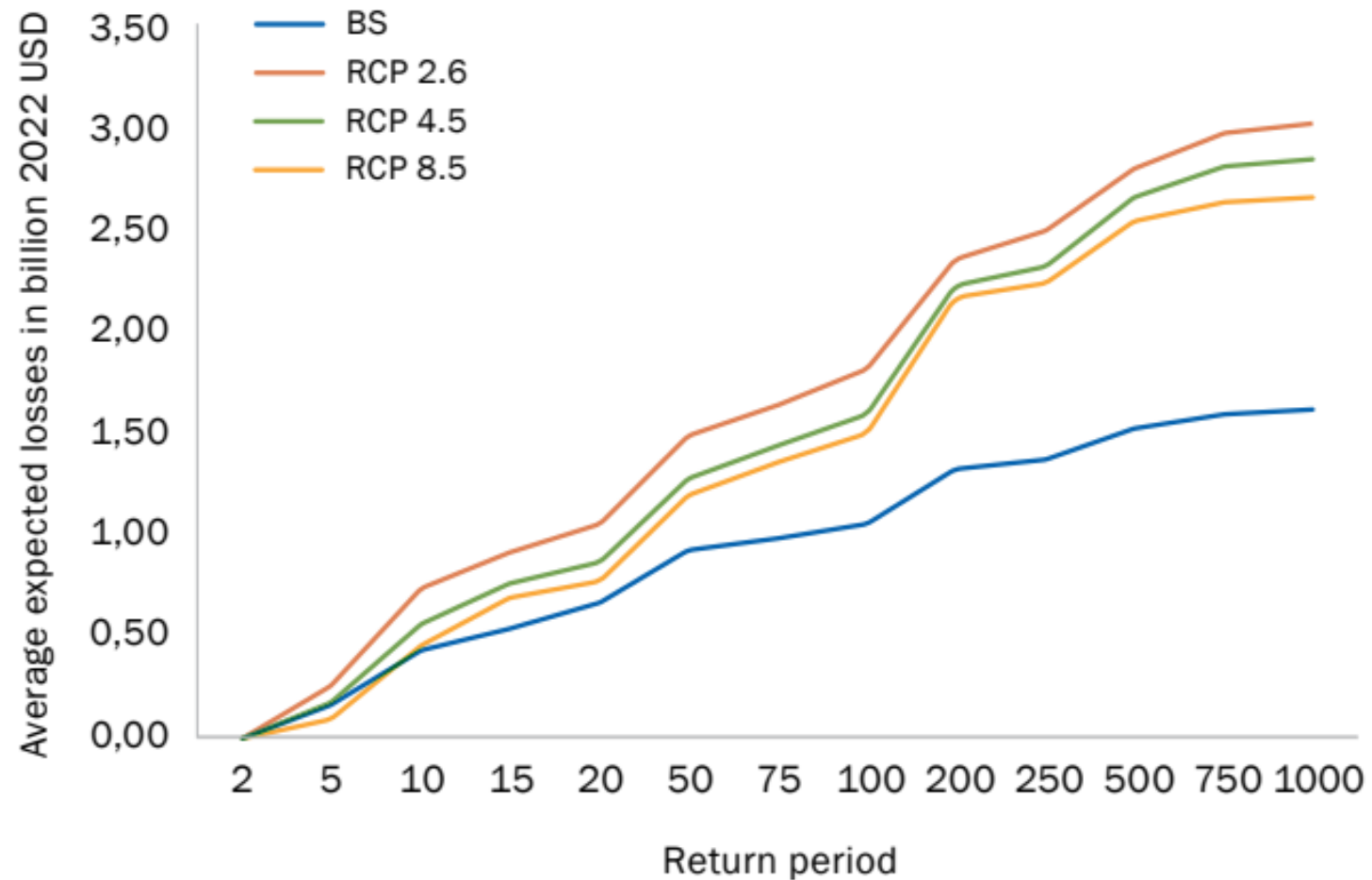
Source: Recovery Needs Assessment in BiH.

Note: BAM = Bosnia and Herzegovina convertible marka.

## II. Economic impact - national

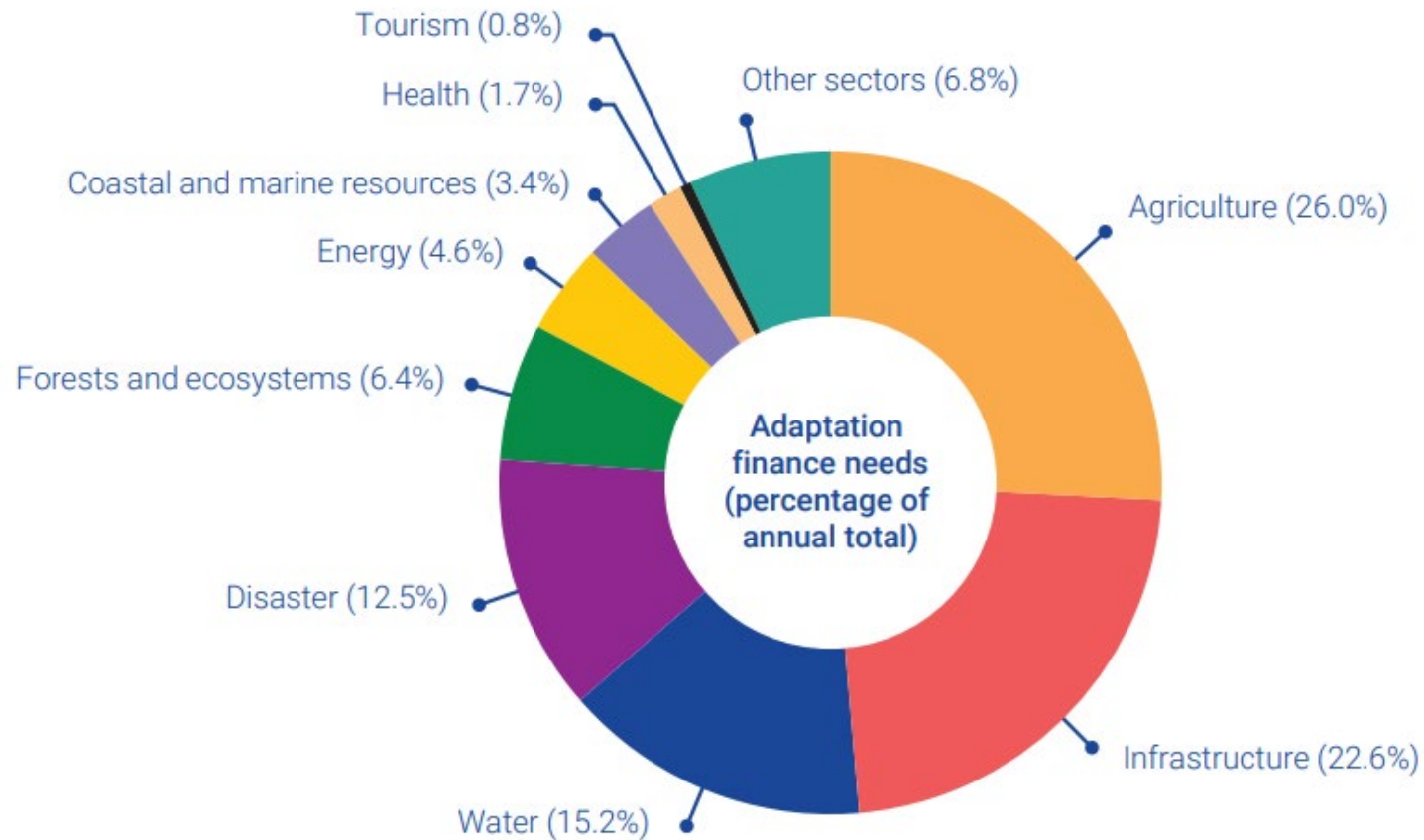
### North Macedonia:

**FIGURE 4.1. Average expected losses from floods**



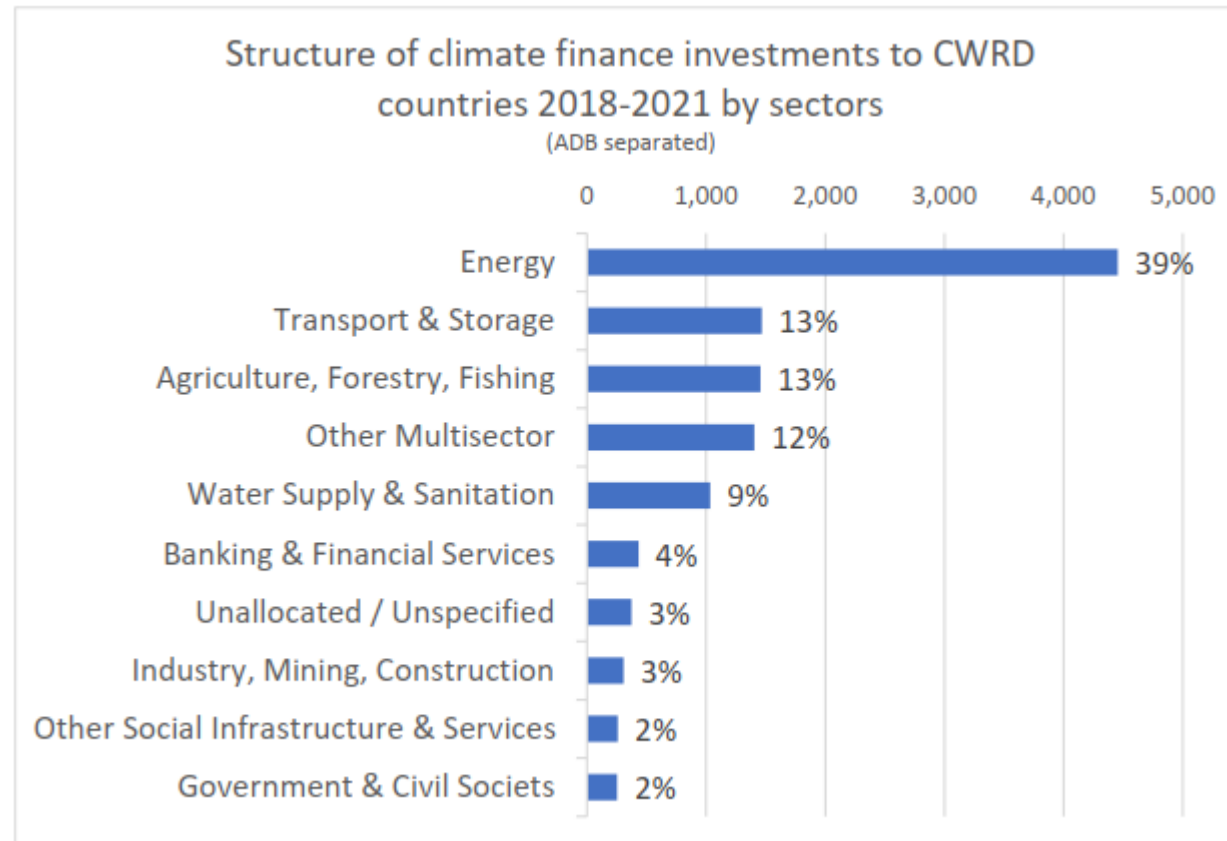
### III. Cost of response

**Adaptation needs \$140-300b per year by 2030 and \$280-500b per year by 2050 for developing countries only (UNEP, 2021):**



### III. Cost of response

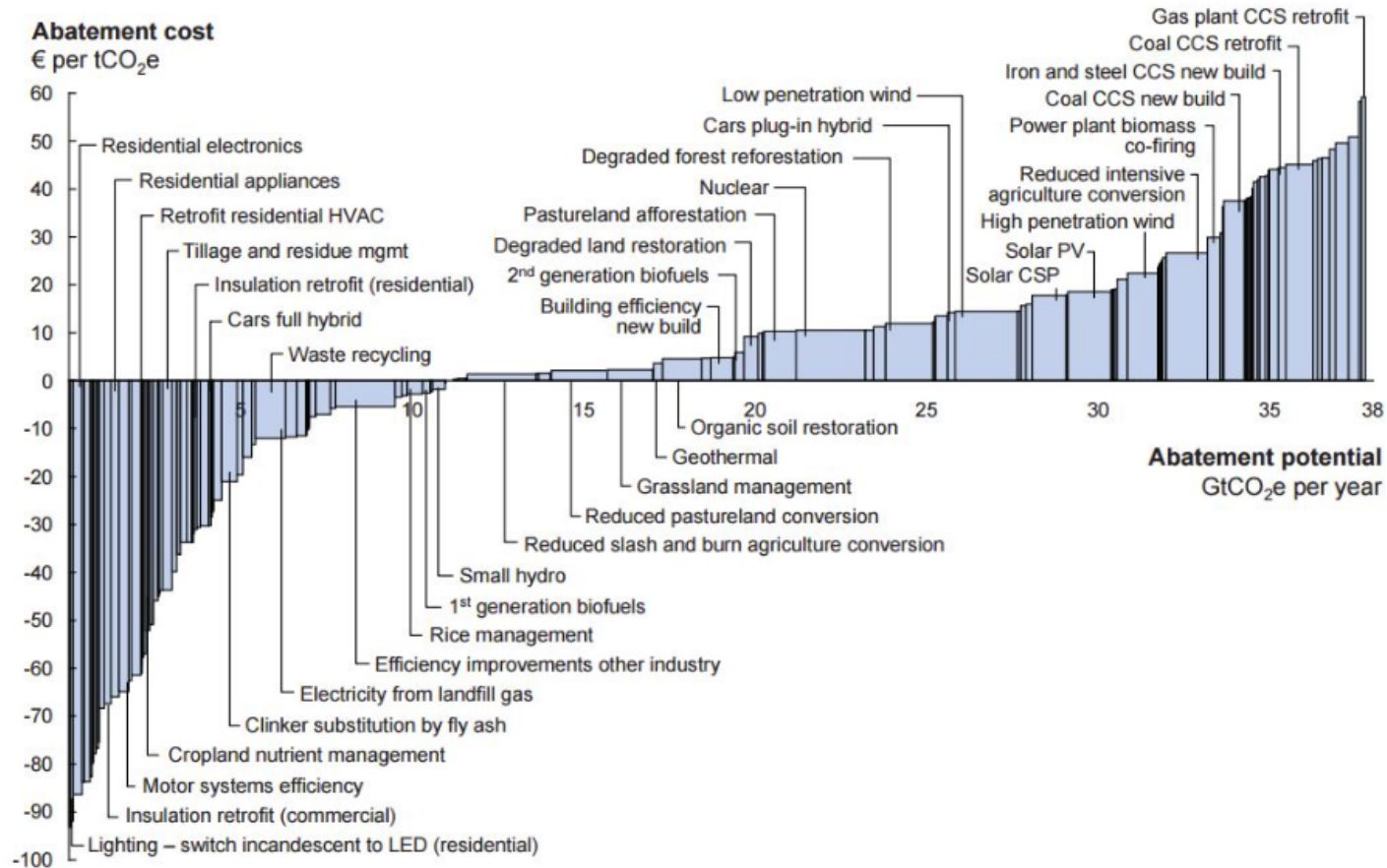
## Climate finance to Central and West Asia by sector (\$12.4 billion 2018-2019)



### III. Cost of response

Mitigation global cost of transitioning energy and other sectors to net-zero emissions by 2050 at US\$9.2 trillion a year.

Global GHG abatement cost curve beyond business-as-usual – 2030



### III. Cost of climate response

#### Climate-induced extreme events cost much money to recover from

Event	Damage and loss		Recovery and reconstruction needs (% public, where available)	Needs as a share of GDP	Estimated share of damages and losses insured
	Public	Private			
Storms (El Salvador, 2020)	60 (17%)	301 (83%)	1 212	4.9%	
Hurricane Dorian (Bahamas, 2019)	337 (11%)	2 845 (89%)	2 945	22.4%	71%
Cyclone Idai (Mozambique, 2019)	929 (33%)	1 867 (67%)	2 900	18.8%	4%
Kerala floods (India, 2018)	1 871 (49%)	1 948 (51%)	4 392	0.2%	10%
Hurricane Maria (Dominica, 2017)	467 (36%)	845 (64%)	1 368	253.3%	
Cyclone Winston (Fiji, 2016)	206 (16%)	1 121 (84%)	1 958	39.7%	9%
Floods (Sri Lanka, 2016)	71 (10%)	653 (90%)	959	8.0%	9%
Cyclone Pam (Vanuatu, 2015)	139 (31%)	310 (69%)	316 (52% public)	42.4%	1%
Tbilisi Floods (Georgia, 2015)	21 (73%)	8 (27%)	118	0.8%	
Bosnia floods (Bosnia & Herzegovina, 2014)	687 (25%)	2 064 (75%)	2 386	9.5%	
Floods (Thailand, 2011)	4 711 (10%)	42 759 (90%)	49 632 (26% public)	13.4%	33%
Elbe floods (Germany, 2002)	5 591 (56%)	4 383 (44%)			21%

# III. Cost of climate response

## Tajikistan updated NDC

- **7% GDP for financing climate change 2020-2030**
- **>\$ 1b per year by 2030**
  
- **20% to energy, transport, agriculture**
- **15% to water irrigation and biodiversity and natural disasters**
- **10% to water supply and sewage**
  
- **Combination of domestic and international funds**
- **Affected by COVID-19**



# III. Cost of climate response

## Kazakhstan updated NDC

- **Conditional - reduction of GHG emissions by 25% by the end of 2030**
- **2022 plan: “Just Kazakhstan – for all and everyone, Now and forever”**
- **>\$150 billion FDI by 2029**
  
- **60% gasification of the country area**
- **1.5x RE generation**
- **20% reduction pollution**
- **14.5m ha forestry**
- **Water conservation**



# III. Cost of climate response

## Triple-A Dividend of Resilience Framework

1<sup>st</sup> Dividend:

**Avoided**

Losses & Lives Saved

**Damages and losses avoided from disasters and climate impacts:**

- Reduced fatalities, injuries, and people affected
- Reduced damages to infrastructures and other assets
- Reduced losses to financial flows and government liabilities
- Reduced days of school closures
- Reduced skills mismatch on the labor market inherent to the green transition

2<sup>nd</sup> Dividend:

**Accelerated**

Economic Potential

**Economic activities stimulated from adaptation and reduced climate risk:**

- Business and capital investments
- Job creation and enhanced labor productivity
- Land value increased
- Sustainable and circular economic growth

3<sup>rd</sup> Dividend:

**Amplified**

Social & Environment

Co-benefits

**Social and environmental co-benefits of adaptation investments:**

- Positive human health effect and better learning outcomes
- Enhanced biodiversity and ecosystem services
- Recreational value and tourism gains
- Agriculture productivity gains

# III. Cost of climate response

## Doing nothing is too expensive

- **White House Office of Management and Budget (OMB)**
- **The economy could shrink – 10% decline in GDP, 7.1% revenue loss (\$2 trillion)**
- **Cost of programmes will rise – storms, flood, wildfires etc. cause \$120b damage; disaster related programmes will rise from 24b to 126billion; hurricanes \$94b annually by 2100.**
- **Vague and unquantifiable impacts – security, infrastructure and ecosystems unquantified; beyond federal programmes health & business significant.**



### III. Cost of climate response

- **Executive Order on Climate Financial Risks (2021):**
  - I. **Develop a Whole-of-Government Approach to Mitigating Climate-Related Financial Risk.**
  - II. **Encourage Financial Regulators to Assess Climate-Related Financial Risk.**
  - III. **Bolster the Resilience of Life Savings and Pensions.**
  - IV. **Modernize Federal Lending, Underwriting, and Procurement.**



***“The fiscal risk of climate change is immense”***

# III. Cost of climate response



# Summary

1. Climate change is projected to be highly significant.
2. The economic impact is estimated to be 11 – 14% global GDP.
3. Climate impacts range from extreme events to slow onset impacts
4. Economic effects of climate change will vary by country due to the constituent economic sectors
5. There is a significant climate finance gap.
6. Doing nothing will become increasingly expensive.



Thank you!

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