



**3<sup>rd</sup> CAREC Climate Policy Dialogue (April 25)**

# **Investmment Gap and Climate Inaction in Water, Agri, and Energy Sectors**

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## Project Background

### **Objectives:**

- Categorize and indicate potential impacts of climate inaction based on the two scenarios developed in previous research (optimistic and pessimistic).
- To demonstrate potential benefits nexus approach and improved regional collaboration, and identify investment gaps across water, agriculture and energy sector

### **Reports:**

- 1-Investment Gap Analysis of Central Asia's Water, Agriculture, and Energy Sectors
- 2- Implications of Climate Inaction across the Water-Agriculture-Energy Nexus and Potential Benefits of Improved Intersectoral and Regional Cooperation



## Motivation

Central Asia is among the most vulnerable to climate change and face two types of climate-related risks:

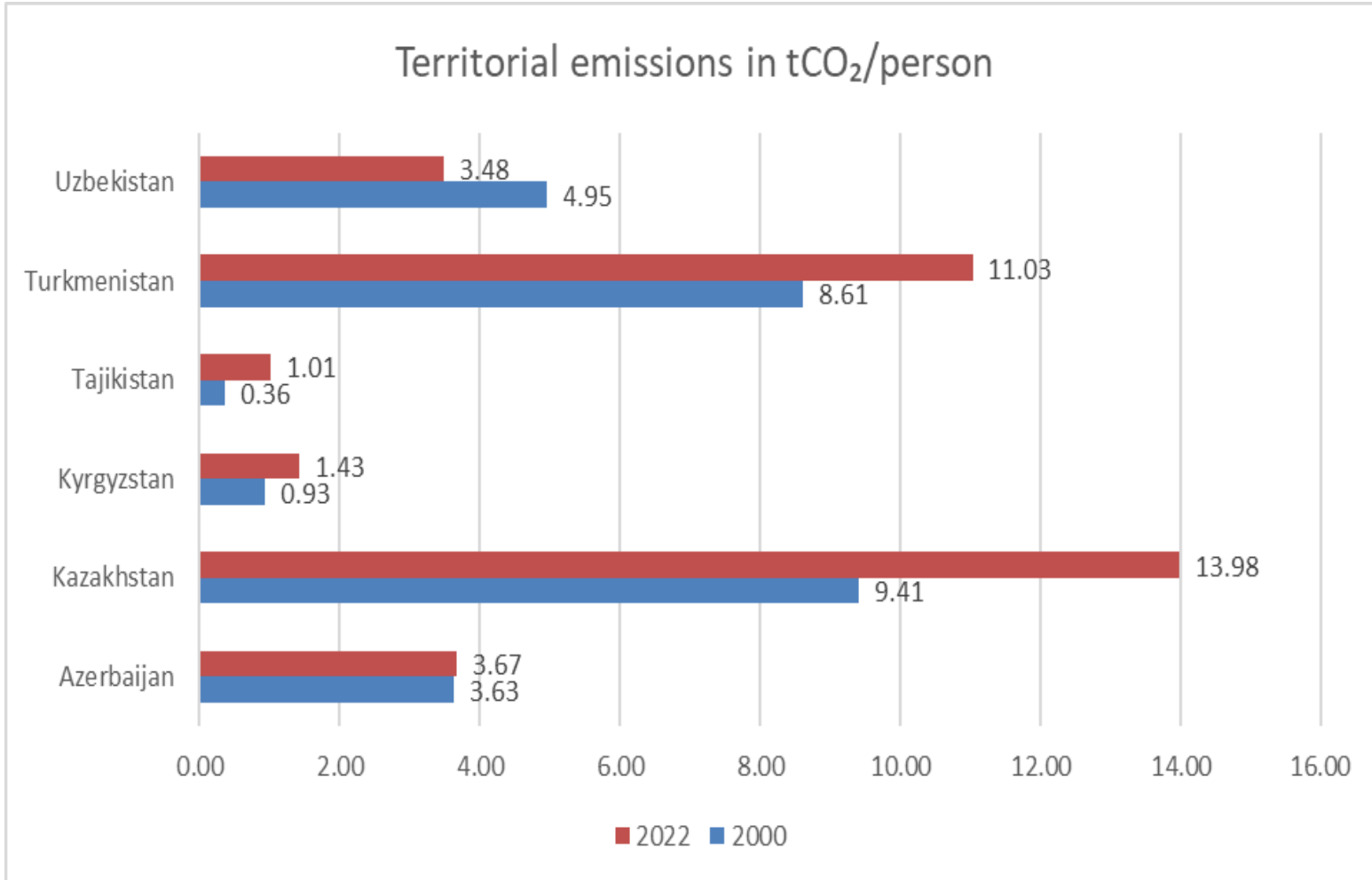
**1-Physical risks:** There are adverse climate change consequences in the region such as the drying of the Aral Sea, a shortage of water resources, food security risks, and increased frequency of extreme weather events and agriculture sector.

**2-Transition risks** (related to regulatory changes in global markets) are also significant for the region. i.e After the imposition of the EU's Carbon Border Adjustment Mechanism (CBAM) in 2026, Kazakhstan exporters may lose up to \$250 million in revenues per year.

○ Levels of carbon emissions differ significantly among Central Asian countries.



# Per Capita Emissions Metric Tons of Carbon Dioxide



○ Four key “pain points” in the region’s sectoral structure that produce the highest volume of GHG emissions and should be in focus: fugitive emissions, **electricity and heat production, agriculture, and buildings.**

○ These sectors produce about 80 percent of GHG emissions in Central Asia

## Greenhouse gas emissions by sector in CO2 equivalent, 2019

	Central Asia	Kazakhstan	Kyrgyz Republic	Tajikistan	Uzbekistan	Turkmenistan
Fugitive emissions	27.6%	10.1%	1.7%	0.8%	13.7%	46.8%
Electricity and heat	23.1%	42.5%	16.2%	10.6%	30.1%	16.3%
Agriculture	14.6%	10.3%	40.4%	37.3%	19.7%	6.2%
Buildings	12.4%	16.3%	37.5%	6.5%	14.3%	10.9%
Transport	8.0%	6.2%	8.8%	7.9%	8.4%	7.5%
Manufacturing and Construction	4.8%	10.1%	6.7%	11.3%	7.0%	1.5%
Other fuel combustion	4.1%	0.8%	0.2%	7.5%	0.9%	7.5%
Industry	3.1%	2.0%	6.5%	13.0%	3.7%	1.4%
Waste	2.6%	2.1%	5.7%	5.1%	3.9%	0.9%
Aviation and shipping	0.6%	0.7%	0.2%	0.7%	0.2%	0.9%
Land-use change and forestry	-1.0%	-1.1%	-23.9%	-0.7%	-1.8%	0.0%



## Emissions Transfers metric tons of carbon dioxide 2021

Transfer emissions in tCO <sub>2</sub> /person					
Year	Azerbaijan	China	Kazakhstan	Kyrgyzstan	Tajikistan
1990	3.115	0.143	-0.684	-0.181	1.253
2000	0.727	0.306	2.647	-0.326	-0.511
2010	-0.292	0.952	6.610	-0.913	-0.691
2021	-0.053	0.710	4.747	-1.315	-0.349



# CAREC Countries NDCs

Country	First NDC Targets of Reduction in GHG Emissions	Updated NDC Targets of Reduction in GHG Emissions
Azerbaijan	35% by 2030 from 1990 level	No new target submitted
Georgia	15% by 2030	35% by 2030 from 1990 level 50-57% by 2030 from 1990 level subject to international assistance
<b>Kazakhstan</b>	<b>15% by 2030, 25% by 2030 from 1990 level subject to international assistance</b>	<b>No new target submitted</b>
<b>Kyrgyzstan</b>	<b>11.49%-13.75% by 2030 from 2010 level 29-31% by 2030 from 2010 level subject to international assistance</b>	<b>15.97% by 2030 43.62% by 2030 from 2010 level subject to international assistance</b>
Mongolia	14% by 2030 under BAU scenario	22.7% by 2030 under BAU scenario 27.2% by 2030 subject to mitigation measures
Pakistan	20% by 2030	50% by 2030 15% from domestic resources 35% subject to international assistance
PRC	60-65% by 2030 from 2005 level	65% to achieve carbon peaking by 2030 and carbon neutrality by 2060
<b>Tajikistan</b>	<b>23%-35% by 2030 from 1990 level</b>	<b>50%-60% by 2030 from 1990 level</b>
<b>Turkmenistan</b>	<b>unconditional 20% reduction in emissions by 2030, compared to 2010 levels</b>	<b>No new target submitted</b>
<b>Uzbekistan</b>	<b>10% by 2030 from 2010 level</b>	<b>35% by 2030 from 2010 level</b>





# Investment Gaps

<b>Kazakhstan</b>	Transition to “Green Economy” by 2050 is around \$112 billion, \$3–4 billion annually. \$37 billion for implementing energy efficiency measures, \$55 billion for expanding renewable energy sources and gas infrastructure, \$4 billion dedicated to the agricultural sector. 50% of its energy from renewable sources, with anticipated capital expenditures for water resources reaching up to \$10 billion by 2030
<b>Kyrgyzstan</b>	Climate-related loss of \$1 billion in no-action warming scenarios. NDC outline climate financing needs, including \$7.1 billion for energy mitigation, \$2 billion for water resources adaptation, and various amounts for other sectors, such as agriculture, health, and forestry.
<b>Tajikistan</b>	Climate-related development financing surpassed \$1 billion over the past decade. The projected funding needed to execute the Green Economy Development Strategy for 2023–2037, focusing on climate-related developmental issues, is estimated at \$2.1 billion.
<b>Turkmenistan</b>	Sectors in urgent need of investment (e.g., agriculture and education) have received scarce attention. Challenges associated with insufficient productive capital, limited technology and technical expertise, and sector-specific experience.
<b>Uzbekistan</b>	The country’s financial needs for mitigating negative climate impacts on several sectors and decarbonization projects amount to over \$220 billion in the next four decades, 5.5 billion a year
<b>Central Asia</b>	Business-as-usual scenario aiming at strengthening energy resilience to prevent blackouts and ensure reliable supply, the region would need to invest some \$1.407 trillion between 2020 and 2050.
<b>Emerging Europe and Central Asia (WB)</b>	Achieving the ambitious Net Zero Energy 2060 target requires an investment of USD\$4.7 trillion (3.9 percent of the regional GDP), most of which will come from the private sector.



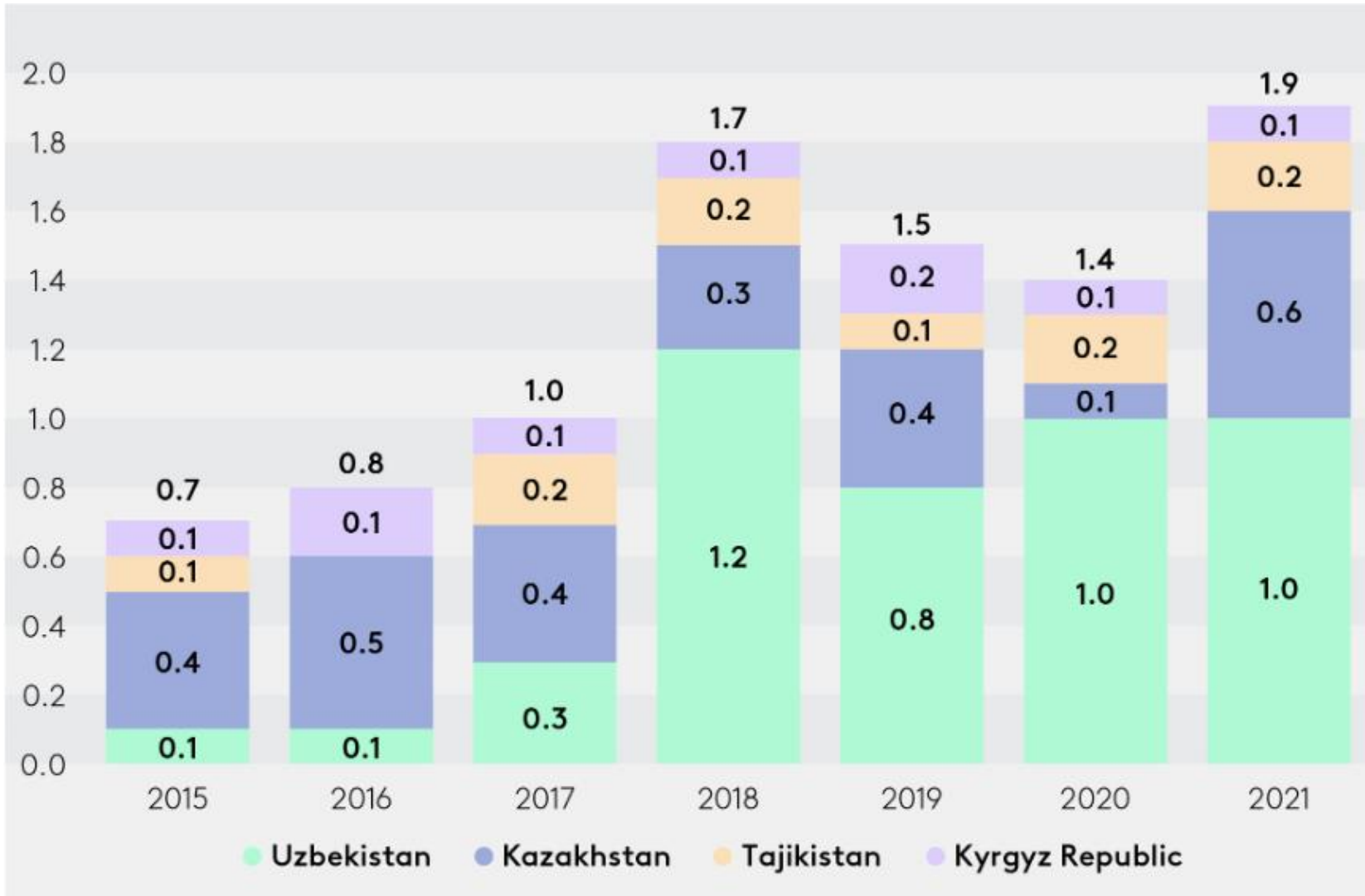


## Investment Need

- The region needs more investment in the development of new generation capacity, including hydro power plants, solar and wind power plants, the construction and upgrade of water treatment facilities, and so on.
- Climate finance instruments provided by multilateral development banks (MDBs) for adaptation and mitigation could further boost the low-carbon transformation of the region.
- In 2021, major MDBs provided more than **\$81.7 billion in climate finance worldwide**, of which **\$50.7 billion was channeled to low- and middle-income countries**.
- In 2021, Central Asian countries received **\$1.9 billion in climate finance**, or 2.2 percent of the total amount, in comparison with Central Asia's 0.4 percent share of global GDP.
- From 2010 to 2020, **Central Asia obtained \$ 5 billion green finance** in general
- From 2015 to 2021, **Central Asia obtained \$8.9 billion** from MDBs as green finance
- Above # varies subject to source, definitions and methods used by different studies



## MDBs' total climate finance of Central Asian countries, \$ billion





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# **Climate Inaction in Water, Agri, and Energy Sectors: Potential for Intersectoral and Regional Cooperation**

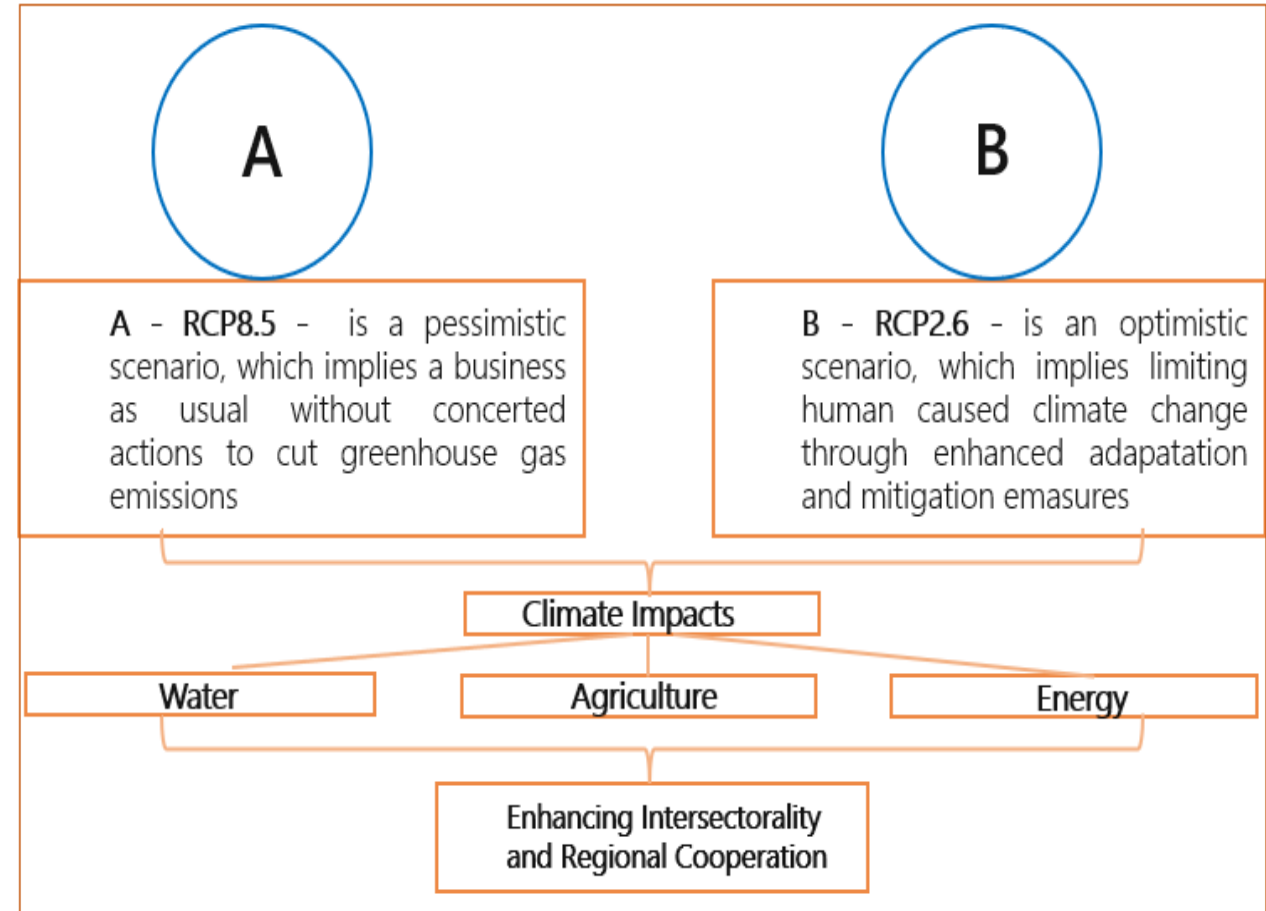
Abdurasul Kayumov

# Approach and methodology

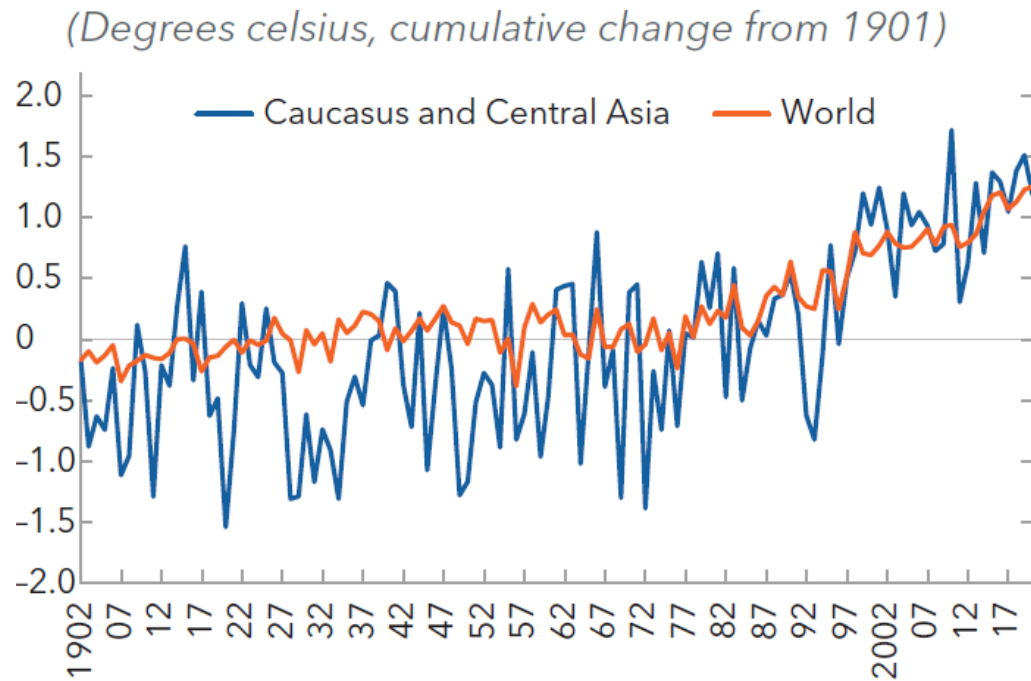
**A two-scenario approach** based on two projections: Shared Socioeconomic Pathways (SSPs) and Representative Concentration Pathways (RCPs)

The most optimistic scenario based on **SSP1-2.6/RCP -2.6** versus the most pessimistic scenario based on **SSP5- 8.5/ RCP-8.5**

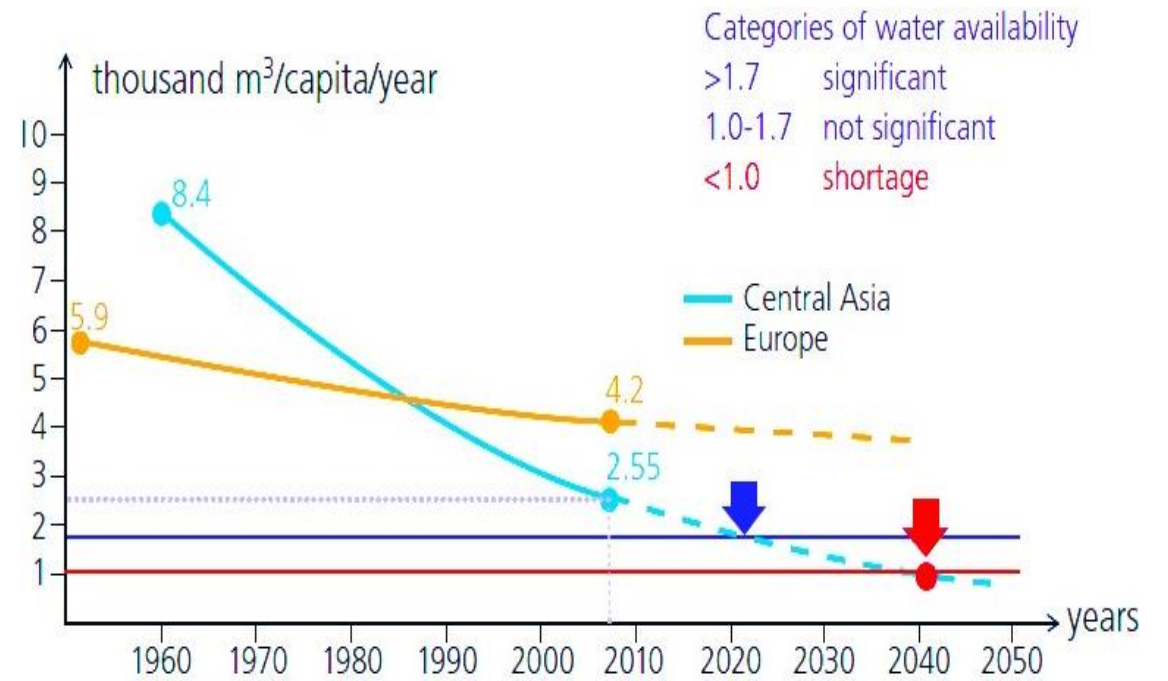
**A four-step methodology:** secondary data research, aggregation of data, primary data collection through semi-structured interviews, and data analysis



# Regional Context: Effects of climate change in Central Asia



Source: IMF (2023a)

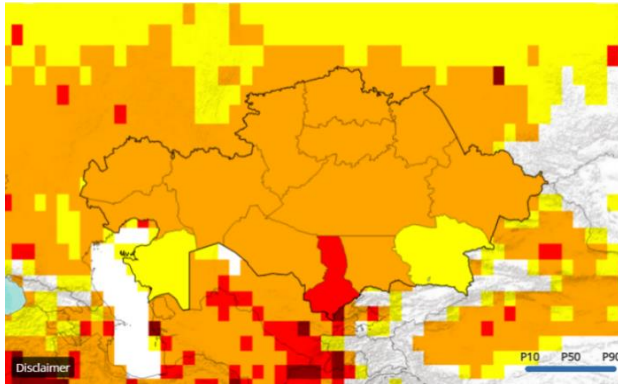


Source: World Bank (2019)

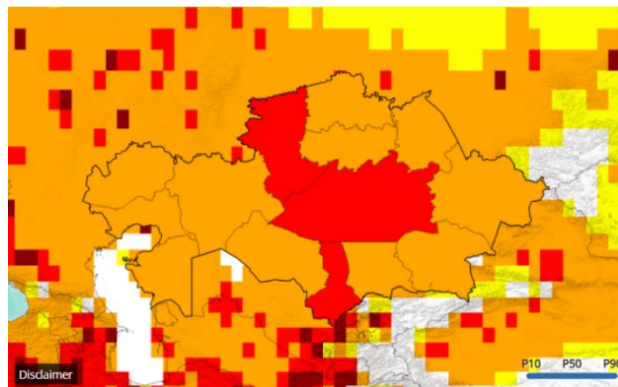


# Kazakhstan: Climate Change impacts on the Water, Agriculture and Energy Nexus

SSP1-2.6 Temperature-Based Heat + Population for 2080-2099



SSP5-8.5 Temperature-Based Heat + Population for 2080-2099



## Water

- The expansion of irrigated lands from **1.8 to 3 million ha by 2030** will lead to an increase in water usage
- Under SSP5- 8.5/ RCP-8.5 available water resources will only meet **50% of requirements by 2040**
- Water deficiency in water-dependent sectors will lead to a **6% decrease of country's GDP by 2050**



## Agriculture

- Under SSP5- 8.5/ RCP-8.5 wheat yields are expected to **decline by 30%–50% by 2050**
- Annual economic losses in the agriculture sector will reach **up to \$ 1.3 billion by 2050**
- Decrease of **pasture lands by 9.8% by 2030**, potential economic losses of over **\$330 million by 2050**



## Energy

- Kazakhstan generates **0,70% of global GHG** and the energy sector produces 78% of these emissions
- Under SSP5- 8.5/ RCP-8.5 climate change will reduce the **efficiency of energy infrastructure by 3%**
- Financial losses in energy sector will reach up to **\$1.5 billion annually**



## Climate-related disasters

- The country's average annual flood-related losses are estimated at **\$419 million**



**The total climate-related investment requirements are projected to exceed \$112 billion until 2050, averaging \$3-4 billion annually.**

# Kyrgyzstan: Climate Change impacts on the Water, Agriculture and Energy Nexus



## Water

- Under the SSP5-8.5 scenario, it is projected that the Tien Shan mountains will lose **50% of their glacier volume by 2050**
- Water resources in the country will **decrease by 40% by 2050**
- Due to inefficient irrigation systems, approximately **40% of the country's total water intake** will be lost



## Agriculture

- The sector employs **60% of the rural population** and contributes to 12% of national GDP
- Desertification will expand **from 15% in 2000 up to almost 50% in 2100**
- Serious decline in crop production, especially wheat, sugar and fruit crops.



## Energy

- About 90% of Kyrgyzstan's electricity is generated by hydropower
- **20% decrease** in hydroelectric power generation
- Under the SSP5-8.5 scenario, the hydropower potential **is expected to decrease to 36 billion kWh**



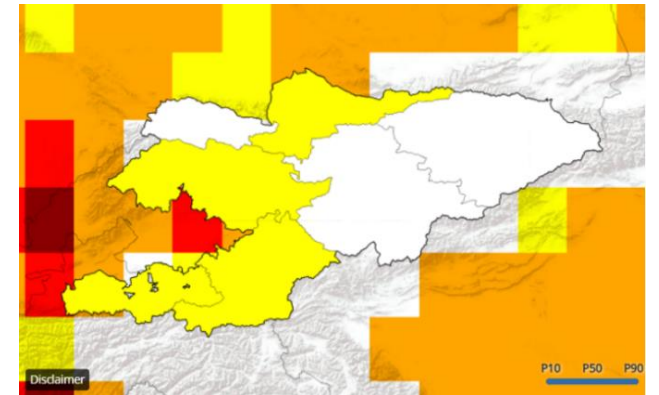
## Climate-related disasters

- **Climate-related disasters** cause financial losses up to \$73 million annually

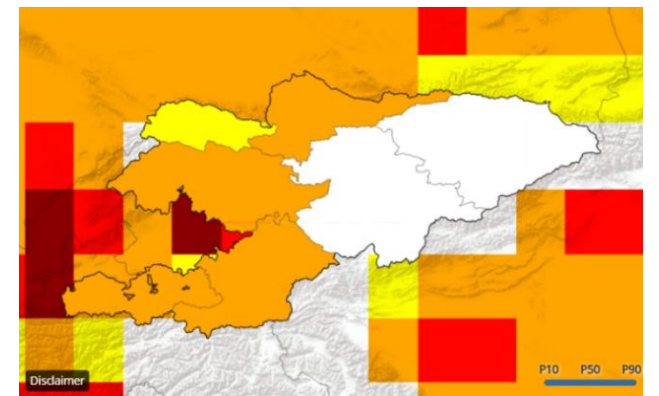


Climate investment needs, including mitigation and adaptation measures, are estimated to be around \$ 10 billion.

SSP1-2.6 Temperature-Based Heat + Population for 2080-2099



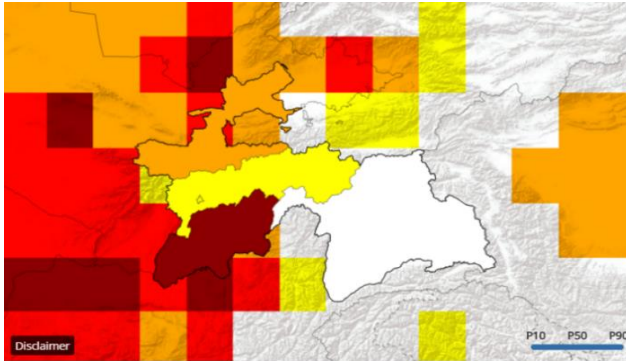
SSP5-8.5 Temperature-Based Heat + Population for 2080-2099



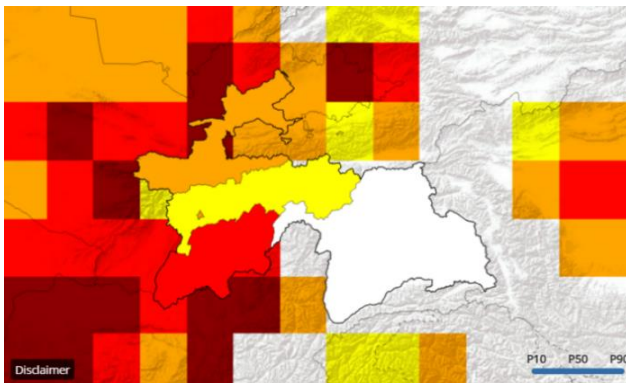


# Tajikistan: Climate Change impacts on the Water, Agriculture and Energy Nexus

SSP1-2.6 Temperature-Based Heat + Population for 2080-2099



SSP5-8.5 Temperature-Based Heat + Population for 2080-2099



## Water

- Tajikistan contributes to formation of 60% of Central Asian water resources
- Under the SSP5-8.5 scenario, glacial volumes **will decrease by up to 30% by 2050**
- Water resources may increase as projected by **up to 15%** due to melting glaciers
- Tajikistan relies on **water for 95%** of its electricity generation



## Agriculture

- The agriculture sector contributes nearly 25% of GDP and employs **over 60% of the total workforce**
- Yield declines for key crops, such as wheat, barley, maize, vegetables, and fruits, will range between **5% to 10% by 2050**



## Energy

- A climate-induced decline in hydropower can exacerbate energy scarcity
- Climate change will contribute to significant **electricity shortage of 2.2–2.5 billion kWh** in winter
- The shortage of electricity in the winter months is 15.5% of the annual energy production



## Climate-related disasters

- Under an RCP8.5, the country is projected to face **7%–23% more heatwaves by the 2090s**, droughts will increase by **3% to over 25%**, and their impact on **GDP by \$30 million by 2050s**



**The estimated funding required to finance climate change mitigation and adaptation measures amounts to around \$2.1 billion by 2037.**

# Turkmenistan: Climate Change impacts on the Water, Agriculture and Energy Nexus



## Water

- **95% of Turkmenistan's water originates outside the country**
- Due to its arid climate, more than **80% of Turkmenistan's territory** lacks a constant source of surface water
- The flow of major rivers (Amudarya) is **expected to decrease by 10%–15% by 2050**



## Agriculture

- **92% of all water consumed in Turkmenistan is used for agriculture**
- Agriculture's share of **GDP was almost 12%**; in addition, the sector provides employment **for over 40% of the population**
- The loss of crop production could cost the country **\$20 billion until 2030**



## Energy

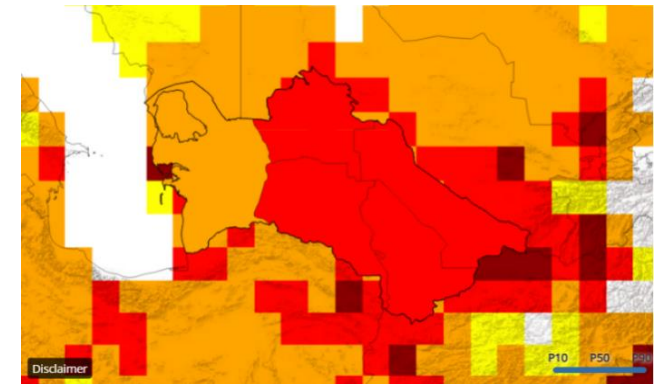
- Under the RCP8.5 scenario, the median projection could see the **number of cooling degree days increase by 84%**
- A one degree increase in ambient temperature can increase electricity demand by up to **8.5% under the RCP.8.5.**



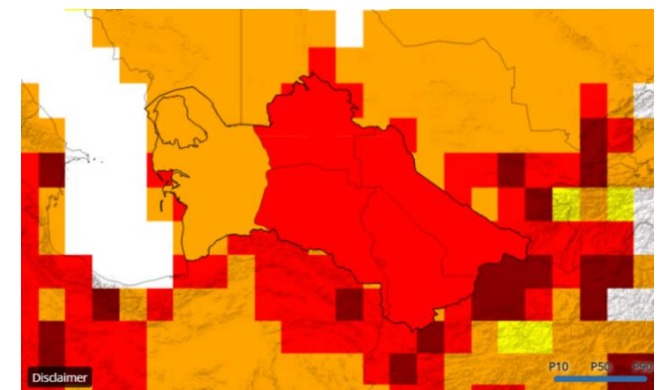
## Climate-related disasters

- Climate change will lead to a **10% annual increase in floods** and mudflows and a **5% annual increase in heavy rainfall**
- Under the RCP8.5 scenario, the country's annual losses are estimated at **\$140 million from floods**

SSP1-2.6 Temperature-Based Heat + Population for 2080-2099

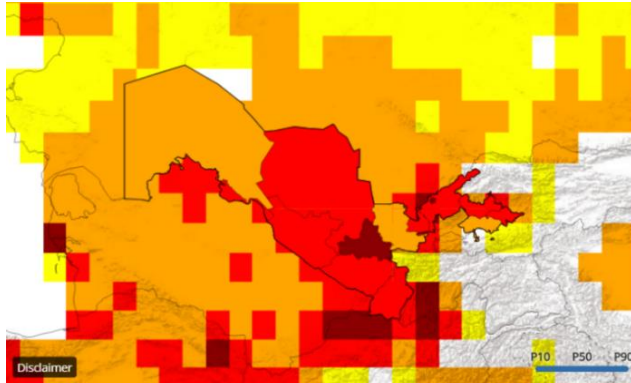


SSP5-8.5 Temperature-Based Heat + Population for 2080-2099

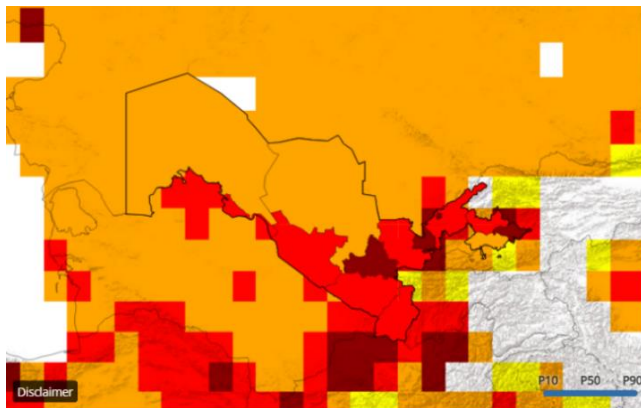


# Uzbekistan: Climate Change impacts on the Water, Agriculture and Energy Nexus

SSP1-2.6 Temperature-Based Heat + Population for 2080-2099



SSP5-8.5 Temperature-Based Heat + Population for 2080-2099



## Water

- Water **provides 13.6%** the country's total electricity production
- Irrigation consumes **90%** of the country's total water withdrawals
- The demand for irrigation water will increase by **5% by 2030 and 10% by 2050**
- The inefficiencies in the use of water will **cost about 8% of the country's GDP**



## Agriculture

- As the main consumer of water resources, the agriculture sector contributes to **27% of total GDP** and employing around **24% of the population**
- Climate change is likely to reduce yields **by up to 50% by 2050** for nearly all crops in the country



## Energy

- Climate change will impact hydropower production which accounts for **11% of Uzbekistan's electricity generation**
- Under the RCP8.5 scenario, Rising temperatures could shorten the average heating season **by 9%**, while the cooling season's duration might extend **by 16%**



## Climate-related disasters

- Floods will impact **1.4 million people annually causing nearly \$3 billion** in losses
- Extreme floods could incur approx. **\$2.8 billion** in costs at the 100-year return period



**Uzbekistan needs to allocate \$46,7 billion for adaptation measures and over \$140 billion for decarbonization until 2060.**

# Costs of Climate Inaction in Central Asia

Risk	Water		Agriculture		Energy		Natural hazards		Total	
	\$	% of current GDP	\$	% of GDP	\$	% of GDP	\$	% of GDP	\$	% of GDP
Kazakhstan	13.2 bn	6%	3 bn	1.5%	1,5 bn	0.7	480 mil	0.2%	18.2 bn	8
Kyrgyzstan							146 mil	2%		
Tajikistan							1.5 bn	20%		
Turkmenistan			20 bn	45%			140 mil	0.3%		
Uzbekistan	6.4 bn	8%					7.2 bn	9%		
	Unutilized benefits of concerted regional actions									
	4.5 bn				18 bn					
Total	24.1 bn		23 bn		19.5 bn		9.4 bn			
Grand Total					\$76 billion					



# Regional Cooperation and Nexus approach

## Central Asian Water and Energy Complex Infrastructure modernisation and joint development



### Current challenges

By 2035, demand for electricity will grow **by 46%**

Irrigation water shortages in the summer period **up to 26%**

Irrigation water losses amounting **to 50%**



### Effects of joint development

Additional GDP growth **by 1.5% per year**

Additional **\$22bn** in investment resources

Increase in water availability **by 40%**

Source: Vinokurov et al. (2021)

# Recommendations for Future Actions

## Water sector

1. Modernize Infrastructure, Improve Maintenance and Monitoring of Water Facilities
2. Enhance Climate Risk-Related Decision-Making and Preparedness
3. Enhance Research and Digitalization of the Water Sector
4. Improve planning
5. Implement flood control measures

## Agriculture sector

1. Introduce new approaches in wheat cultivation
2. Enhance Climate Risk-Related Decision-Making and Preparedness
2. Diversify crops for cultivation
3. Promote climate-smart agricultural practices
4. Improve pasture management
5. Introduce agroforestry and soil conservation

## Energy sector

1. Harness solar and wind opportunities
2. Promote energy conservation and awareness
3. Build climate resilient energy infrastructure

## Regional Scale

1. Establish regional climate change framework
2. Expand joint investment in transboundary infrastructure and upscale climate investments
3. Promote regional data sharing practices