



# Water sector financing improvement action plan for efficient water sector financing

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## EXECUTIVE SUMMARY

In 2022, the CAREC Institute conducted research on water infrastructure in Central Asia, emphasizing the need for coordinated planning and investment. Cooperation among sectors is essential for leveraging synergies, decreasing costs, and ensuring sustainability. The state's role as a social regulator is crucial in the fair allocation of water resources. Private involvement in the water sector is uncommon owing to regulatory hurdles and unclear ownership structures. Despite efforts to improve fee collection and infrastructure, financing remains a challenge, prompting the need for targeted actions to prioritize funding for infrastructure projects. The objective of this report is to identify areas of insufficient governance in water financing, specific to each country under consideration and devise essential measures for prioritization. This will facilitate the allocation of suitable funds for vital infrastructure initiatives.

### Kazakhstan

The key financing schemes to finance water infrastructure projects include public funding, water tariffs, development bank loans, and public–private partnerships (PPPs). The water projects in Kazakhstan are mainly publicly financed. The international development banks issue loans on the basis of the state guarantees. The Islamic Development Bank (IsDB), for example, recently financed the water infrastructure projects in the agricultural sector. The European Bank for Reconstruction and Development (EBRD) has been particularly successful in working with the municipalities and providing long-term loans to the water utilities. At the beginning of 2024, the water tariff financing scheme was restructured to a progressive pricing scheme. Other strategies include green bonds for climate-related water projects, blended finance to attract private investment, microfinance for community-level projects, corporate social responsibility (CSR) funds for water stewardship, grants for socially impactful initiatives, performance-based financing for outcome-driven projects, and crowdfunding to pool resources for water solutions. These mechanisms aim to balance financial sustainability, social equity, and environmental stewardship in water sector development.

Kazakhstan faces significant challenges in water sector financing, including insufficient fiscal allocation, weak cost recovery, and financial management issues. Addressing these difficulties requires a comprehensive strategy involving policy cooperation, fiscal mechanisms, technological innovation, infrastructure development, and international cooperation. Kazakhstan needs collaborative efforts among government bodies, non-governmental organizations, and international organizations to implement effective water management policies. The new water code aims to balance economic development with environmental protection. Strengthening financial management practices, implementing revenue generation policies, ensuring government consistency, and investing in capacity building are all essential steps in promoting fiscal mechanisms in the water sector. Embracing technological advancements such as remote sensing and advanced wastewater treatment, as well as developing resilient infrastructure against climate change impacts, are crucial for sustainable water management. Kazakhstan must also engage in regional cooperation and adhere to international agreements to manage transboundary water resources effectively, despite geopolitical challenges and competing interests among neighboring countries. By addressing these areas comprehensively, Kazakhstan can overcome its water sector financing obstacles and achieve sustainable water management and security.

Central Asia's water resources are vital for agriculture, industry, and domestic use, but their distribution is uneven, with upstream countries controlling major rivers. Kazakhstan's water sector faces significant challenges owing to its aging infrastructure, inefficient water use, pollution, and the impacts of climate change. The country requires substantial investments to address these issues, including the rehabilitation of irrigation canals, upgrading wastewater treatment plants, and the implementation of efficient irrigation methods. The lack of market-driven water pricing mechanisms

contributes to wasteful water use, particularly in agriculture, which consumes over 65 percent of the country's water resources. The country's major industrial players lack industrial wastewater treatment systems, leading to surface and groundwater pollution. To address this, investment in wastewater treatment facilities is crucial, alongside reducing reliance on surface and groundwater sources. CSR funds can support sustainable technologies, environmental restoration, water efficiency, and community projects. Financing major water infrastructure projects is essential and involves domestic and international funding, PPPs, and innovative mechanisms such as green bonds. Encouraging private investment would require risk mitigation, capacity building, and the transformation of the water utilities for financial stability.

Climate change poses a significant threat to Kazakhstan's economic development goals, with potential negative impacts on GDP and water scarcity. Flooding and other climate-related effects are expected to increase water scarcity by 50 percent in the next few decades, affecting agriculture among other sectors. Climate change exacerbates competition for water resources, requiring investments in infrastructure, forecasting, and early warning systems. Measures such as switching to alternative crops, reducing water-intensive practices, and investing in research for drought-resistant crops are all recommended. Transboundary cooperation with neighboring states is crucial to mitigate climate change-related risks and ensure regional development.

### **Kyrgyz Republic**

The Kyrgyz Republic is a unique country as almost all water resources are formed within the republic. As a 'water tower' in the Central Asian (CA) region, it delivers potable water to a number of settlements, especially in rural areas. The Kyrgyz Republic has good hydroenergy potential but cannot meet all the country's energy demands. And agricultural land still requires irrigation.

And there is evidence everywhere that funds to rehabilitate, modernize, and construct infrastructure facilities are in deficit. The problem is not only in the need for investment, but also in institutional structuring, as well as the unclear division of job functions and responsibilities. Sector management requires more effective use of international loans and transparency.

The current government is responsible for the development of the country and aims to achieve sustainable sector management through further institutional development (norms and legislature, the introduction of water databases, improved state statistical accountability, and so on); basin management; the promotion of a digital information system for all water; and the establishment of economic management mechanisms stipulating rational water use.

These activities require the best international practices and competitive expertise for sector improvement in terms of physical condition and effective governance. Consequently, funds for the implementation of different infrastructure projects and human resources are highly sought after. The government might therefore set up effective public spending programs and identify cost-effective projects with a higher chance of receiving international support. Also, the government needs to foster certain practical skills to prepare economically sound public investment programs that can compete for support and funding from the state budget as well as donor and private sources. These programs should be integrated into national development strategies and medium-term budget processes, such as a medium-term expenditure framework (MTEF). In addition, government administrations must be prepared to employ best practices in public expenditure management, such as accountability, transparency, and efficiency.

## **Tajikistan**

For the Republic of Tajikistan, an overview of current water sector financing schemes is provided, with a primary focus on the main water user subsectors such as drinking water supply and sanitation, hydropower, land reclamation, and irrigation. The main financing problems in the water sector were identified. Analyses were carried out on the water infrastructure financing plan, and financing schemes were determined. The future impact of climate change on the country's water resources is also looked at. Based on the analyses, the financing needs for each major subsector were identified either with or without taking climate change into account.

The main conclusions are that the water infrastructure, which was built in the 1960s, has physically lost its designed capacity and cannot function properly owing to the influence of climate change. In this regard, it is necessary to modernize the infrastructure for climate resilience. To do this, it is necessary to attract financing from global international climate change funds as well as investment from the private sector.

## **Turkmenistan**

Turkmenistan's water sector is state managed and financed primarily through state funds. Its capital investments are generally enshrined in the government's multi-year development programs. Financing for operation and maintenance (O&M) is also covered annually from the state budget and, to a lesser extent, from tariff fees for water supply services. Until 2017, water supply in the country was significantly subsidized and consumers were largely exempt from paying for water services. The imposed fees were argued to still be low, as in the case of most developing countries, and insufficient to cover the required funds of O&M services. The sector is also financed externally through international and bilateral aid and loans, although their presence in the region is relatively small; the sector has compelling potential to attract more external financing. The share of private engagement in the water financing mix of the country is insignificant.

One of the challenges in the country's water sector relates to changing climate patterns and the need for more sustainable and financial schemes to adapt the sector and related industries to the impacts of climate change—especially rising temperatures resulting in water shortages. The multilayered analyses at state level leading to the long-term sustainable governance of the sector, along with targeted financial incentives for sustainable technologies and innovative policies fostering water saving solutions are identified as the main factors required to address the emerging climatic impacts. Another persistent issue with the financing of the state's water sector remains its relatively low share compared with other industries and limited diversification of sources. The main burden on state funds—increasingly challenged by projected economic, population, and climate growth—along with the fees scheme for water supply services are argued to impede the management of the sector. Private funds in the country's water sector are significantly limited given the extended role of state financing, and its prevalent management over the water resources and systems. For effective national water governance and diversified engagement of funds and technologies, PPPs are seen as the most acceptable regional schemes.

The state's water governance is reportedly undertaking projects aimed at ensuring national water availability and soil improvement in collaboration with international development partners. Most of the financing for these schemes is provided within state programs for the socioeconomic development of various sectors or regions, where investments mainly encompass the building of the nationwide drainage collector network; expansion of reservoir capacities; construction of river flow management and flood prevention units; capacity increasing of irrigation canals and drainage networks; and land reclamation. At the same time, to meet the growing demand for expansion while

maintaining the upkeep of supply systems, the participation of diversified funds—including private investment—is essential and the best way forward for rational water conservation.

With its comparatively low level of financing and the huge task of maintaining the aging infrastructure, the water industry's need for adequate funding is becoming a matter of increasing concern. Added to this urgency is the importance and vulnerability of the water sector for agricultural and domestic uses against the backdrop of a warming climate. Recent low river levels associated with rising temperatures and estimated future losses of several billion manats owing to climate impacts are reinforcing the need for additional financing. In this context, the Government of Turkmenistan, reaffirming its commitment to climate issues, noted future development plans of its agricultural and water sectors in accordance with the national climate change strategy. Currently, the capital investment needed to upgrade water related projects using the latest socioeconomic development program (2022-2028) has doubled and comes to more than USD 3.9 billion, and over USD 750 million according to the national rural program. Additionally, Turkmenistan takes part in a variety of projects financed from international funds dealing with climate change issues. However, of the five CA countries, Turkmenistan is involved in the smallest number of international climate finance sources, all of which have large and diverse portfolios. Overall, with funding requirements reaching 60 percent by 2021, and the share of investments in the water development program doubling, it can be presumed that these contributions will probably cover most of the sector's needs. However, the growing impact of climate change, aging infrastructure, and projected future economic and demographic pressures requires the elaboration of a multilateral mechanism, based on sustainable development, innovative policies, and a larger share of diversified funding sources.

## **Uzbekistan**

Uzbekistan's water sector faces a complex web of challenges that threaten its very foundation. Overlapping ministerial responsibilities lead to bureaucratic inefficiencies, project delays, and a lack of coordinated resource allocation. These institutional weaknesses undermine investor confidence and obstruct the efficient utilization of scarce financial resources. The problem is compounded by a distorted water pricing system that fails to reflect the true cost of delivering water services, maintaining infrastructure, and safeguarding the environment. This artificially low pricing structure fuels inefficient water use, disincentivizes conservation, and cripples the sector's ability to generate sufficient revenue. The result is a persistent cycle of underfunding that perpetuates infrastructure deterioration, pervasive water losses, and unsustainable water consumption patterns. The consequences of failing to address these deficiencies are far-reaching. Without substantial investments in modernization, Uzbekistan's aging water infrastructure will continue to degrade, leading to even greater water losses. This directly undermines the agricultural sector, a backbone of the Uzbekistani economy, jeopardizing food security and the livelihoods of countless farmers. The inability to implement water-saving technologies across industries will perpetuate wasteful practices, further straining limited water resources in an already water-scarce region. Moreover, while water pricing reforms are urgently needed, abrupt or excessive tariff increases could disproportionately harm vulnerable populations, including low-income households and small-scale farmers. Achieving a just balance between financial sustainability and equitable access to water is imperative to avoid exacerbating social inequities.

However, within these challenges lies an opportunity for transformation. By adopting a strategic and comprehensive approach, Uzbekistan can reshape its water sector into a model of resilience. A gradual, well-calibrated adjustment of water tariffs, alongside targeted subsidies to protect the most vulnerable, can lay the groundwork for a sustainable financing model. Prioritizing investments in infrastructure upgrades, leak repairs, and the adoption of water-saving technologies will reduce wastage and optimize the use of precious water resources. Intensive public awareness campaigns on water conservation must be implemented to foster a culture of responsible water stewardship

among citizens and businesses alike. Crucially, strengthening institutional coordination and prioritizing transparent data management will bolster investor confidence and attract much-needed funding. Uzbekistan must actively explore innovative financing mechanisms, including international partnerships, green financing instruments, and carefully structured PPPs to unlock new sources of capital for critical water infrastructure projects. By recognizing the interconnected nature of these challenges and deploying decisive action, the nation can overcome these financing hurdles, ensuring a sustainable and equitable water future for its citizens. Failure to act will only deepen the crisis, with dire repercussions for Uzbekistan's economic development, social well-being, and environmental health.

## OBJECTIVE AND PURPOSE OF THE ASSIGNMENT

### GENERAL

In 2022, the CAREC Institute conducted a research project on the theme ‘Water Infrastructure in Central Asia: Promoting Sustainable Financing and Private Capital Participation.’ The research helped to highlight ill coordinated planning and investment in the water sector in Central Asian (CA) countries and that economic frameworks that promote cooperation and integrated planning among sectors could be a solution. The approach should help to leverage possible synergies for decreasing costs, assessing trade-offs, demand side interventions, and decentralized services to ensure sustainability of infrastructure. In this context, the state could play the role of social regulator, ensuring that each water user receives a fair share of the available water resources.

Privatization, concessions, or any other private engagement in the water sector is not common in CA countries. Both ownership and investment in the water sector by private players have rarely been observed in the region. This is impeded mainly owing to extensive regulatory requirements, ambiguous ownership structures related to water infrastructure, and an unclear and weak water governance system. Although water agencies operate and maintain the water infrastructure, ownership rights are not clearly defined. In some cases, ownership is with municipalities; in other cases, infrastructure belongs to different line ministries or agencies (such as energy or water supply). This also complicates the tracing of financing sources.

Service fees charged by state water organizations are not fully collected and water users are reluctant to pay for unreliable water supply. However, household water supply fee collection has been improved lately owing to better metering and infrastructure improvements in this area. In irrigation water supply, the rights to collect service fees are still significantly below the level necessary to cover even a sensible portion of operation and maintenance (O&M) costs. Countries are trying to increase service collection rates by introducing water metering (Uzbekistan); giving more responsibility to water user organizations (Kyrgyzstan); giving water management organizations a right to keep part of the fees (Tajikistan); and by setting up an improved commercial model for water supply (Kazakhstan). None of these schemes alone can help to solve financing problems in the water sector.

Therefore, by pinpointing governance gaps in water financing within each targeted country, the project will establish key actions to prioritize. This will enable the provision of appropriate funding for the necessary infrastructure projects.



## SCOPE OF WORK

The scope of work included the following important output and related activities:

- I. Water financing gaps report:
  - a. Conducting a review of critical financial needs of the water sector, concentrating mostly on major infrastructure
  - b. Understanding major water infrastructure priorities of member states (with regional significance)
  - c. Developing water financing gap report for regional and national water infrastructure in Central Asia
- II. Water sector financing improvement action plan:
  - a. Systematizing the current water sector financing schemes from the region and international best practices for developing financing options
  - b. Finding major water financing problems and obstacles in the region
  - c. Preparation of a water infrastructure financing plan for selected regional and national infrastructure
- III. Policy paper and dialog series:
  - a. Developing and conducting a series of policy papers and dialogs for the initiation of partnerships and potential agreements
  - b. Initiation of the regional working group on water sector financing under the CAREC Program

This report covers activity II related to the water sector financing improvement action plan.

## REGIONAL CONTEXT

The management of water resources in Central Asia is of paramount importance for the countries there, particularly as water demands are increasing with population growth, while at the same time water availability becomes more variable with climate change. The challenging coordination between planning and actual practice within the water sector underscores the need for rigorous examination and analysis. This report provides a comprehensive exploration of the financial governance gap within Central Asia's water sector, bridging the divide between theoretical frameworks and real-world implementation.

With a complex network of rivers, lakes, and reservoirs shared among five countries—Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan—cooperation and effective water governance are essential for ensuring good utilization of resources, equitable access, efficient use, and environmental sustainability, as well as to utilize synergies where possible. However, there is a significant gap between needs and implementability, particularly with the existing water governance being unable to facilitate water financing efficiently.

The financial gap in Central Asia's water sector can be attributed to various factors. Despite the sector's crucial importance, governments often can allocate only insufficient funds to water management and infrastructure development. This lack of funds hinders the implementation of necessary projects and maintenance activities. Many water utilities in the region struggle with low revenue collection rates, resulting in financial deficits. Weak tariff structures, inefficient billing systems, and widespread non-payment of fees exacerbate this issue. On the other hand, alternative financing options are difficult to implement, and potential investors or financing institutions may be reluctant to invest owing to risks resulting from weak water governance framework or lack of suitable mechanisms for collaboration. This situation impedes investment in water infrastructure and technology upgrades.

It has far-reaching consequences that affect various stakeholders and exacerbate existing water-related challenges. Insufficient investments and inadequate financial management impede the construction, rehabilitation, and maintenance of water infrastructure, leading to deteriorating systems and service disruptions. Based on the overall socioeconomic situation in Central Asia, limited investment in water projects disproportionately affects marginalized communities, exacerbating disparities in access to clean water and sanitation services. Inadequate funding for environmental protection and conservation initiatives contributes to the degradation of water resources, including pollution, depletion of aquifers, and loss of biodiversity. On a broad scale, inefficient water management practices and underinvestment in infrastructure result in economic losses owing to decreased agricultural productivity, increased healthcare costs associated with waterborne diseases, and reduced tourism revenue. Water scarcity and inequitable distribution can fuel social tensions and conflicts, both within and between countries, posing significant risks to regional stability and security.

Addressing the financial governance gap in Central Asia's water sector requires a multifaceted approach involving government action, institutional reforms, and international cooperation. Adjustment and/or reforms are necessary to develop and implement robust policies and regulations that ensure reliable, transparent, and accountable financial governance in the water sector. This includes reforming ownership, establishing clear tariff-setting mechanisms, improving financial reporting standards, and implementing anticorruption measures. Water utilities must adopt cost-effective management practices, improve revenue collection mechanisms, and explore innovative financing options such as public–private partnerships (PPPs) and concessional loans to enhance financial sustainability. Given the transboundary nature of water resources in Central Asia, regional cooperation is essential. Countries should engage in dialog, share data, and collaborate on joint projects to optimize resource allocation and mitigate conflicts. Investing in the capacity building of water sector institutions and personnel is crucial to improve financial governance.

**SYSTEMATIZING THE CURRENT WATER SECTOR FINANCING SCHEMES FROM THE REGION AND INTERNATIONAL BEST PRACTICES FOR DEVELOPING FINANCING OPTIONS**

**KAZAKHSTAN**

Systematizing specific water sector financing schemes aims to ensure sustainable, equitable, and efficient funding for water infrastructure and services. The list of water sector financing schemes that include both state and international funding sources is presented in Table 1.

Public funding includes state and local funds that are allocated directly to water sector projects, covering capital and operational costs. The concept for the development of the water resources management system of the Republic of Kazakhstan for 2024 to 2030, developed by the Ministry of Water Resources and Irrigation and approved by the decree of the Government of the Republic of Kazakhstan on 5 February 2024, lists the water projects that are planned to be financed from the state budget in 2024 to 2030 (Government of the Republic of Kazakhstan, 2024).

**Table 1. Target indicators of the concept for the development of the water resources management system, 2024-2030**

#	Indicator	Unit	2024	2025	2026	2027	2028	2029	2030
1	Level of water losses in agriculture during transportation through main and inter-farm canals (from 50% to 25%)	%	50	47	43	39	35	30	25
2	Volume of additionally accumulated water (increase by 2.4 km <sup>3</sup> )	km <sup>3</sup>	-	-	0.5	1.0	1.5	2.0	2.4
3	Saving irrigation water through the introduction of water-saving technologies in irrigated farming	million m <sup>3</sup> /year	135	230	300	400	500	600	690
4	Level of irrecoverable water consumption and losses during transportation in industry (decrease from 26% to 20%)	%	26	25	24	23	22	21	20
5	Coverage of water infrastructure with digital technologies (growth to 40% by 2030)	%	0	5	10	16	24	32	40
6	Volume of inflow into Lake Balkhash (at least 12 km <sup>3</sup> /year)	km <sup>3</sup> /year	12	12	12	12	12	12	12
7	Volume of the Northern Aral Sea (increase from 20 km <sup>3</sup> to 27 km <sup>3</sup> )	km <sup>3</sup>	20	20.6	21.2	22	23	25	27
8	Level of pressure on water resources:								
8.1	In the Aral-Syr Darya water basin (decrease from 57.2% to 53.2%)	%	57.2	57.2	56.7	56.2	55.2	54.2	53.2
8.2	In the Shu-Talas water basin (decrease from 56.8% to 52.8%)	%	56.8	56.8	56.3	55.8	54.8	53.8	52.8

Source: Government of the Republic of Kazakhstan, 2024

**Water Tariffs:** The revenue generated from water users paying for their consumption and services is aimed to cover operation, maintenance, and capital costs. The international best practices for water tariffs aim to balance financial sustainability, social equity, and environmental sustainability. These practices help ensure that water utilities have the funds to maintain and modernize water infrastructure, while promoting water conservation and ensuring that everyone has access to affordable water services. Several countries are recognized for implementing best practices in their water tariff systems—including Germany, Singapore, and Denmark. In Germany, a strong regulatory framework supports the full cost recovery principle, ensuring that water utilities have the necessary funds to maintain and upgrade the infrastructure. The country also applies the polluter pays principle, charging more for wastewater treatment to encourage pollution reduction. Water utilities in Germany review their costs and adjust tariffs as necessary to ensure that they cover the full cost of providing water and wastewater services (ATT *et al*, 2021). In Singapore, a comprehensive water pricing strategy covers the full cost of water supply and promotes water conservation among its citizens (UNESCAP, 2012). The tariff structure includes a water conservation tax and uses a tiered pricing system to discourage excessive water use. The water tariffs also fund advanced water treatment technologies and infrastructure to ensure a sustainable water supply (Gordon, 2014). To keep up with the rising costs of water treatment and supply, the national water agency of Singapore

is to raise the water tariffs by 18.2 percent by 2025 (Pei Ting, 2023). In Denmark, water pricing includes environmental taxes that are aimed at reducing groundwater pollution and encouraging the efficient use of water resources. The water tariffs in Denmark are set by the individual water utilities to cover all costs associated with water supply and wastewater treatment, including environmental protection measures. The water utilities review their costs and tariffs periodically to ensure that they accurately reflect the cost of the service (DANVA, 2019).

In Kazakhstan, water tariffs are approved and regulated by the Committee on the Regulation of Natural Monopolies of the Ministry of National Economy of the Republic of Kazakhstan. As the water tariffs have been too low to cover the operation costs of the water utilities, in February 2024 Kazakhstan introduced a mechanism for differentiation by establishing a four-level water tariff for households, depending on the volume of consumption. The tariff for drinking water will be differentiated by group as follows (Zakon.kz, 2024):

- Group I: the current tariff will remain for households that consume up to 3 m<sup>3</sup> per month (49 percent of the population)
- Group II: the tariff will be 20 percent higher than the current tariff for households that consume from 3 m<sup>3</sup> to 5 m<sup>3</sup> per month (20 percent of the population)
- Group III: the tariff will be 50 percent higher than the current tariff for households that consume from 5 m<sup>3</sup> to 10 m<sup>3</sup> per month (20 percent of the population)
- Group IV: the tariff will be 100 percent higher than the current tariff for households that consume over 10 m<sup>3</sup> per month (11 percent of the population)

Public–private partnerships (PPPs) stand for collaborations between government entities and private companies to finance, build, and operate water projects. PPPs can include various models such as build–operate–transfer (BOT), design–build–operate (DBO), and performance-based contracts (PBCs). An increase of the private sector participation assumes increasing responsibility for the design, building, operation, maintenance, and finance (PPIAF, 2009). The BOT and DBO models have become solid business models to finance desalination and wastewater treatment plants in the Middle East, China, Mexico, and Brazil. Risk mitigation tools such as state guarantees often help in supporting the growing competition among international as well as regional players in the developing countries (Rigby Delmon, 2023).

In PBCs, the client specifies performance indicators that the contractor is required to meet when delivering the services. Thus, the contractor would be paid only for the output of their work, and failure to comply with the performance indicators would be reflected in the payment for the provided services (PPIAF, 2009). The PBC model is used mostly to fund water projects aimed at reducing non-revenue water, managing leakages, expanding connectivity, increasing efficiency, building capacity, and expanding knowledge of the utility workers. In Ho Chi Minh City in Vietnam, a successfully delivered PBC resulted in reducing the number of leakages by half, thus saving enough water to serve 500,000 people (Rigby Delmon, 2023).

In Kazakhstan, the PPP scheme is yet to be utilized to finance water infrastructure projects.

Development bank loans are provided by multilateral development banks—such as the World Bank (WB), Asian Development Bank (ADB), and European Bank for Reconstruction and Development (EBRD)—or bilateral donors for large-scale water projects, typically at favorable interest rates and over long repayment periods.

International organizations provide financial assistance and technical expertise to support water sector development in Kazakhstan. This financing scheme focuses on capacity building, policy reforms, and



investment in infrastructure projects. Table 2 lists the projects financed by the international financial institutions (IFIs) in Kazakhstan.

**Table 2. Major water projects in Kazakhstan with IFI participation**

Project Name	Project Type	Duration	Total Amount
<b>ASIAN DEVELOPMENT BANK</b>			
<u>Regional:</u> Improving access and strengthening innovations for water, sanitation, and hygiene in selected CAREC countries and the Caucasus	Technical assistance (TA)	2022-2025	USD 900,000 (regional)
<u>Regional:</u> Developing the CAREC water pillar	TA	2020-2025	USD 1,500,000 (regional)
Astana integrated water master plan: technical assistance	TA	2018-2022	USD 1,200,000
Kazakhstan urban infrastructure modernization program and finance facility	TA	2017-2021	USD 1,500,000
Irrigation rehabilitation project	TA	2017-2020	USD 1,500,000
Establishment of the Kazakhstan knowledge center on integrated water resources management	TA	2017-2019	USD 225,000
Rural area water supply and sanitation sector project (in East Kazakhstan, Pavlodar, and Almaty oblasts)	Loan	2005-2010	USD 52.64M
Resources management and land improvement project	Loan	1998-2006	USD 30M
<b>EUROPEAN BANK FOR RECONSTRUCTION AND DEVELOPMENT</b>			
<b>Aktobe WWTP modernization</b>	Loan	Approval date: 28/11/2023	EUR 95.3M
GrCF2 W2—Shymkent WWTP capacity extension project	Loan	Approval date: 20/09/2022. Status: disbursing.	EUR 6.9M
Shymkent water II	Loan	Approved in 2020. Project complete.	EUR 2.5M
South Kazakhstan water supply project <sup>1</sup>	Loan	Approved in 2016. Status: repaying.	USD 180.00M (EUR 163.6M equivalent)
Ust-Kamenogorsk water	Loan	Approved in 2016. Status: repaying.	KZT 2,247M (EUR 5.9M equivalent)

<sup>1</sup> Loan issued to the KazVodkhoz for the rehabilitation of the irrigation water conveyance infrastructure in South Kazakhstan, Zhambyl and Aktobe regions of Kazakhstan.

Kostanay water	Loan	Approved in 2016. Status: repaying.	KZT 2.4B
Semey water	Loan	Approved in 2015. Status: repaying.	KZT 1,156M (EUR 3.5M equivalent)
Petropavlovsk water	Loan	Approved in 2015. Status: repaying.	USD 9M
Shymkent water subproject	Loan	Approved in 2015. Status: repaying.	EUR 10M
Taraz water	Loan	Approved in 2015. Status: repaying.	KZT 1.05B (EUR 3.5M equivalent)
Water and wastewater modernization framework (2 projects signed under this contract: Shymkent water II in 2018 and Shymkent water II in 2019)	Loan	Approved in 2015. Status: approved.	Total proposed: EUR 150M
Kyzylorda water	Loan	Approved in 2014. Status: repaying.	USD 10M
Aktobe water	Loan	Approved in 2015. Status: repaying.	KZT 2B
Shymkent WWT essential modernization	Loan	Approved in 2010. Status: repaying.	EUR 13.6M
Aktau water	Loan	Approved in 2010. Status: complete.	KZT 1,230M
Shymkent Vodokanal	Loan	Approved in 2009. Status: complete.	USD 8.4M
<b>WORLD BANK</b>			
Second irrigation and drainage improvement project	Loan	2013-2025	USD 102.9M
Nura River clean-up project	Loan	2003-2013	USD 40.39M
Syr Darya control and Northern Aral Sea phase I project	Loan	2001-2013	USD 64.5M
Atyrau pilot water supply and sanitation project	Loan	1999-2013	USD 12M
Irrigation and drainage project	Loan	1996-2013	USD 80M
Pilot water supply project	Loan	1996-2013	USD 7M
<b>ISLAMIC DEVELOPMENT BANK</b>			
Rehabilitation of vertical drainage wells in Shardara district (Lot 3—Turysbekov, Kosseit, Koksus)	Loan (acc. to Islamic Law)	Approved in 2023. Project is active.	KZT 8.67B
Rehabilitation of Vertical Drainage Wells in Makhtaaral district (Lot 2—Kyzylkum, Abay, Makhtaly)	Loan (acc. to Islamic Law)	Approved in 2023. Project is active.	KZT 9.14B
Rehabilitation of Vertical Drainage Wells in Makhtaaral district (Lot 1—Yeraliev, Intymak, Dildabekova)	Loan (acc. to Islamic Law)	Approved in 2023. Project is active.	KZT 8.39B

Rehabilitation of Irrigation and Drainage works in Shardara (Lot 3—Turysbekov, Kosseit, Koksu)	Loan (acc. to Islamic Law)	Approved in 2022. Project is closed.	N/A
Rehabilitation of Irrigation and Drainage	Loan (acc. to Islamic Law)	Approved in 2022. Project is closed.	N/A
Rehabilitation of Vertical Drainage Wells in Shardara district (Lot 2—Uzyn-Ata, Alatau-Batyr, Kyzylkhyim)	Loan (acc. to Islamic Law)	Approved in 2023. Project is closed.	KZT 7.99B
Rehabilitation of Irrigation and Drainage—Procurement of Work—Lot 3	Loan (acc. to Islamic Law)	Approved in 2022. Project is closed.	N/A
Rehabilitation of the Irrigation System in Aksu District of Almaty Region	Loan (acc. to Islamic Law)	Approved in 2019. Project is closed.	N/A
Rehabilitation of the Irrigation System in Koksu district in Almaty Region	Loan (acc. to Islamic Law)	Approved in 2019. Project is closed.	N/A

Sources: ADB (2024), EBRD (2024), IsDB (2024), WB (2024)

Municipal bonds are bonds issued by local governments or municipalities to raise capital for water infrastructure projects, to be repaid over time with interest (Sustainable Fitch, 2024). Municipal bonds have been used successfully to finance water projects in various regions, predominantly in the United States. In Atlanta, Georgia, for example, the Department of Watershed Management has utilized municipal bonds to finance the overhaul of its water and sewer infrastructure. The delivered projects have significantly reduced water pollution, improved water quality, and increased the system's capacity (Quantified Ventures, 2024).

Green bonds are financing schemes aimed specifically at supporting climate change mitigation and adaptation projects, including sustainable water management and infrastructure projects that contribute to environmental sustainability (Climate Bonds Initiative, 2018; Leigh-Bell, 2015). In 2017, Fiji became the first emerging country to issue green bonds, raising USD 50 million to fund critical climate resilience projects (World Bank, 2017).

Blended finance is a mix of public and private funds, along with philanthropic contributions, to leverage additional investment by reducing risks and improving financial returns for private investors. Blended finance instruments and mechanisms include guarantees (credit risk, political risk guarantees) and technical assistance. Among other projects, a blended finance scheme funded the Kigali Bulk Water Supply Project in Rwanda; a wastewater and fecal sludge treatment and reuse project in Udaipur; and microfinance sanitation loans to expand access to sanitation in India (OECD, 2019a).

Microfinance and community-based financing are small loans provided to individuals or community groups for water and sanitation projects, particularly in rural or underserved areas (Fonseca, 2006). The WaterCredit Initiative by Water.org, for instance, leverages microfinance to provide small loans to individuals and communities for water and sanitation projects in developing countries, including India, Bangladesh, Kenya, and the Philippines (Water.org, 2024).

Corporate social responsibility (CSR) funds are investments or donations from private companies as part of their CSR initiatives, directed towards community water and sanitation projects (Figuerola *et al*, 2022). For instance, Nestlé's water access projects focus on creating shared value through water stewardship initiatives that aim to provide access to clean water and sanitation in communities where the company operates. This includes infrastructure development, conservation projects, and

educational programs on water conservation (Nestlé, 2024). PepsiCo's Safe Water Access Initiative partners with NGOs to implement programs focused on distribution systems, sanitation facilities, and water conservation techniques (PepsiCo, 2024). Coca-Cola's Water Stewardship project aims to replenish the water it uses in its beverages and production processes by investing in watershed protection, improving access to clean water for communities around its facilities (Coca-Cola, 2024). In 2014, Coca-Cola collaborated with the United Nations Development Programme in a project that aimed to increase rural access to safe drinking water in Kazakhstan (Ospanova, 2014).

Grants are non-repayable funds provided by governments, international organizations, or non-governmental organizations to support water sector projects, often used in low-income countries or for projects with high social impact by low financial returns (Hermann-Friede, 2021). The Global Environmental Facility (GEF), the Water Project, the United States Agency for International Development (USAID)'s Global Water Strategy, and UNICEF's Water, Sanitation, and Hygiene (WASH) program are all funded projects that aim to increase access to clean water and sanitation in communities worldwide.

Performance-based financing (PBF) is a payment approach where funds are contingent upon the achievement of specific outcomes or performance targets; PBF is often used to encourage efficiency and effectiveness in project implementation (Wuzel, 2020). McNicholl *et al* (2019) report that the PBF scheme has improved the functionality of the rural water infrastructure in Burkina Faso, the Central African Republic, Kenya, and Uganda. In 2016, the World Bank Group—the International Development Association (IDA); the International Water Association (IWA); and the Public–Private Infrastructure Advisory Facility (PPIAF) established a global partnership to support countries in improving the management of non-revenue water through performance-based contracts. This project has helped to increase the water supply to customers and reduce non-revenue water in New Providence, the Bahamas; Kuala Lumpur, Malaysia; Bangkok, Thailand; Ho Chi Minh City, Vietnam; and Kamataka, India (Fuhren, n.d.).

Crowdfunding stands for raising small amounts of money from people, typically via the Internet, to fund water projects or innovations (Smith, 2023). The Water Project is one of the most well-known non-profit organizations that utilizes crowdfunding to provide access to clean, safe, and reliable water across sub-Saharan Africa (The Water Project, n.d.). MyJal is a social enterprise in India that used crowdfunding to finance the installation of water ATMs in rural and urban areas lacking access to clean water (MyJal, n.d.).

## KYRGYZ REPUBLIC

The Kyrgyz Republic has specific financing plans and strategies to address water infrastructure needs that involve a combination of domestic and international funding sources. These sources include:

**Project-specific financing:** Identifying priority projects and securing funding from various sources, such as IFIs and bilateral partners, to implement those projects.

**Policy reforms:** Implementing policy reforms to attract private sector investment and promote PPPs in the water sector. This may include creating an enabling legal and regulatory framework and offering incentives to private investors.

**Capacity building:** Strengthening institutional capacity and expertise in water sector management to ensure efficient use of funds and successful project implementation.



Public awareness and participation: Encouraging public awareness and participation in water infrastructure planning and management, including the establishment of transparent mechanisms for public input and feedback.

### **Modalities of lending**

Mostly international financial institutions (IFIs)—such as the WB and ADB—provide financing as a loan + grant in the ratio 50 percent + 50 percent for the Kyrgyz Republic as a country. Countries at moderate risk of debt distress receive a mix of 50 percent loans and 50 percent grants.

Countries at high risk of distress receive only grant financing from the International Development Association (IDA). ‘Gap’ and ‘blend’ countries, or those countries currently above the IDA operational threshold of GNI per capita (currently set at USD 1,175), are deemed financially stable enough to be eligible only for loan financing, regardless of their risk of debt distress.<sup>2</sup> Gap countries are countries that: 1) are deemed by the IDA to be eligible for financing, 2) have a GNI per capita that has exceeded the cut-off for more than two consecutive years, and 3) are not creditworthy for IBRD loans. Blend countries are countries that are both 1) eligible for IDA financing and 2) creditworthy to borrow from the IBRD.<sup>3</sup> In 2021, the Kyrgyz Republic had a GNI as high as USD 1,180 per capita.<sup>4</sup>

The same principle is applied by ADB; EBRD’s approach is almost the same as WB and ADB.

Another type of lending known as results-based lending (RBL) was applied a few years ago in the sector. This kind of lending is the only one in CA so far and was used to fund the Naryn Rural Water Supply and Sanitation Project. The project has currently progressed by 30 percent and its realization is stable and reliable according to the ADB mid-term review.

Government budget: The Kyrgyz government allocates funds from its national budget to finance water infrastructure projects. This may involve direct investment or subsidies to support the construction, operation, and maintenance of water-related infrastructure.

IFIs: Organizations such as the WB, ADB, EBRD, and Islamic Development Bank (IsDB) provide loans and grants to support water infrastructure development in the country. These institutions often work in partnership with the Kyrgyz Government to implement projects.

It is important to note that specific details on current financing plans and the state of water infrastructure in the Kyrgyz Republic may change over time. For the most accurate and up-to-date information, it is recommended to refer to official government documents, reports, and relevant international organizations working in the region.

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<sup>2</sup> <https://www.cgdev.org/blog/more-world-bank-borrowers-will-need-grants-not-loans-result-more-world-bank-donors-will-need>

<sup>3</sup> [https://findevlab.org/wp-content/uploads/2023/05/FDL\\_Note\\_IDA-in-the-poorer-countries-debt-crisis\\_May23.pdf](https://findevlab.org/wp-content/uploads/2023/05/FDL_Note_IDA-in-the-poorer-countries-debt-crisis_May23.pdf)

<sup>4</sup> <https://data.worldbank.org/indicator/NY.GNP.PCAP.CD>

## Drinking water supply and sanitation subsector

Drinking water supply and sanitation is a key subsector for socioeconomic development. According to Article 15 of the Law of the Republic of Tajikistan ‘On drinking water supply and sewage,’ the sources of financing for this subsector include:

- Funds from republican and local budgets
- Funds from consumers of drinking water and users of wastewater systems based on approved tariffs
- Voluntary contributions from the population and economic entities
- Other sources not prohibited by the legislation of the Republic of Tajikistan

Among the other sources that are not prohibited by the legislation of the Republic of Tajikistan, grant and credit funds from IFIs and international organizations are envisaged.

The financing scheme for the activities of this subsector is carried out mainly through the following means:

- Revenue from the water supply and sanitation (WSS) service. Tariffs for WSS services are developed based on the procedure for developing tariffs for drinking water supply and sewage services<sup>5</sup> and approved by the antimonopoly service under the Government of the Republic of Tajikistan. The funds collected for water supply services are used for infrastructure O&M, depreciation, chemical reagents, electricity costs, salaries, taxes, and other expenses. The funds collected for WSS services by the state unitary enterprise KhMK are the main budget for its activities.
- Funds from the republican budget. These funds are allocated mainly for the payment of mandatory credit obligations to IFIs and for offsetting debtor and creditor tax obligations between the state unitary enterprise KMK and budgetary organizations of water users for drinking water supply and sanitation services and tax payments.
- Local budget funds are allocated primarily for taking urgent measures to eliminate accidents or restore drinking water supply and sanitation infrastructure affected by accidents or emergencies.
- Funds from IFIs (in the form of grants and loans) and international organizations (mostly grants) are directed mainly towards the modernization of existing infrastructure or the construction of new small-scale WSS systems.

Overall, financing for the construction of new infrastructure and the modernization of existing infrastructure is carried out mainly through grants and loans from IFIs and international organizations. Financing for the O&M of infrastructure is provided through WSS services provided by the enterprise itself. Financing for urgent measures to restore infrastructure or eliminate the consequences of natural disasters and accidents is supported by local budgets. Financing from the state budget includes attracting grants and loans from IFIs and international organizations, as well as

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<sup>5</sup> The procedure for developing tariffs for drinking water supply and sanitation services, adopted by the decree of the Government of the Republic of Tajikistan dated 23 June 2020, No. 364.

making payments for mandatory loans and providing financial assistance to settle debtor and creditor obligations.

## **Hydropower**

Hydropower is a key subsector that contributes to achieving the strategic direction for ensuring the country's energy security. The financing scheme for the hydropower sector is carried out through the state budget, revenue from the production and sale of electricity, and grants and loans from IFIs and organizations.

Funds from the state budget for the hydropower sector are allocated primarily for the construction of the Rogun hydroelectric power plant (HPP). Approximately 20 percent of the total state budget expenditure is directed towards this purpose.<sup>6</sup> Additionally, funds from IFIs are allocated for the construction of the Rogun HPP.<sup>7,8,9</sup>

The production and sale of electricity form the main revenue for the open joint stock holding company (OJSHC) Barki Tojik. These funds are used primarily for the O&M of infrastructure, depreciation, costs related to electricity production and sales, salaries, taxes, among other expenses. Funds from grants and loans provided by IFIs are also used for the modernization and reconstruction of existing infrastructure.

## **Land reclamation and irrigation**

Land reclamation and irrigation is one of the main subsectors of the economy that contributes to the achievement of the country's strategic goals of ensuring food security and employment in rural regions of Tajikistan.

The funding scheme for this subsector is mainly provided mainly from the following sources:

- Funds from republican and local budgets
- Funds from water supply services for water users at approved tariffs
- Voluntary funds from the population and business entities
- Funds of IFIs and international organizations

Funding from the state budget is allocated for capital construction, payment for electricity, salaries, and taxes, as well as the government's share in implementing investment projects through tax exemptions on imported goods and tax payments.

Funding from local budgets is used for activities aimed at improving land reclamation, procurement of equipment, and the elimination of accidents or consequences of natural disasters related to water.

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<sup>6</sup> Republic of Tajikistan, Public Expenditure and Financial Accountability Performance Assessment Report (PEFA), April 2022, p.16. [https://www.pefa.org/sites/pefa/files/2022-10/TJ-Apr22-PFMPR-Public%20with%20PEFA%20Check\\_RUS.pdf](https://www.pefa.org/sites/pefa/files/2022-10/TJ-Apr22-PFMPR-Public%20with%20PEFA%20Check_RUS.pdf)

<sup>7</sup> Internet source 2023, <https://www.vsemirnyjbank.org/ru/news/press-release/2023/01/12/tajikistan-to-improve-the-rogun-hydropower-project-implementation-with-world-bank-technical-assistance>

<sup>8</sup> Internet source 2023, <https://tj.sputniknews.ru/20230214/stroyka-veka-1054916135.html>

<sup>9</sup> Internet source 2023, <https://www.asiaplustj.info/ru/news/tajikistan/economic/20230518/na-stroitelstvo-rogunskoi-ges-videlyat-500-millionov>

Funds collected from water supply services and provided to water users based on approved tariffs are directed towards the construction and restoration of infrastructure, infrastructure O&M, procurement of equipment, salaries, taxes, and other mandatory payments.

Voluntary funds from the population and economic entities are also directed towards activities aimed at improving land reclamation, procurement of equipment, and the elimination of accidents or consequences of natural disasters related to water.

Financing from IFIs and organizations is used for the implementation of grant and loan projects aimed at modernizing and restoring the infrastructure of this subsector.

## **TURKMENISTAN**

In Turkmenistan, the water sector is entirely state managed and financed mostly by centralized state funds, budgets of local administrations, a smaller portion of tariff fees for the O&M of water services, and moderate funds from international development organizations or financial institutions.

### **Government funds**

Medium- and long-term capital investments are provided from state funds, most of which are enshrined in national programs for the socioeconomic development of various industries and regions. The cost of the O&M of water supply services is covered annually from the state budget<sup>10</sup> (from state funds and, to a lesser extent, from fees for O&M services) allocated to designated local entities.<sup>11</sup> However, it is noteworthy that—to address emerging challenges such as changing climate, population growth, and the recovering economy—more sustainable mechanisms for water financing will have to be implemented, as financing from water user fees and tariffs, along with state funds, might be insufficient in the future.

To consolidate the balance of public funding, the most important financing mechanism is the tariff system, which determines cost recovery and influences the quality of services provided.<sup>12</sup> In Turkmenistan, the fee was imposed for water service users in 2017<sup>13</sup> followed by the countrywide installation of metering systems in all residential buildings. The fee set for municipal water supply services is fixed, whereas for irrigation purposes the rates are established annually by the state resolution of the Cabinet of Ministers for each agricultural crop. It should be noted that rural producers have been granted minimum payment benefits for the use of land and water for agricultural purposes and are also exempt from taxes. Today, farmers who grow state ordered crops pay only 30 percent of water supply services, where the rest of the costs are borne by state water management organizations represented by district and regional water production associations of the State Committee for Water Management of Turkmenistan.<sup>14</sup>

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<sup>10</sup> Jumakuliev D, 2023. Water Sector Financing in Turkmenistan. In: *Water Infrastructure in Central Asia: Promoting Sustainable Financing and Private Capital Participation*. CAREC Institute. p.14

<sup>11</sup> Ministry of Environmental Protection of Turkmenistan, 2002. Strategy and action plan for the conservation of biodiversity in Turkmenistan

<sup>12</sup> Krutov A, 2019. Cost recovery and water pricing for irrigation and drainage projects.

<https://cyberleninka.ru/article/n/opredelenie-stoimosti-uslug-po-postavke-vody-dlya-tseley-irrigatsii>

<sup>13</sup> Online information agency 'Turkmenportal.' <https://turkmenportal.com/blog/12162/v-turkmenistane-s-1-noyabrya-2017-goda-ustanovleny-novye-tarify-na-zhilishchnokommunalnye-uslugi>

<sup>14</sup> Jumakuliev D, 2023. Water Sector Financing in Turkmenistan. In: *Water Infrastructure in Central Asia: Promoting Sustainable Financing and Private Capital Participation*. CAREC Institute pp15, 22



In most cases, in developing countries, both for irrigation and drinking water supply, the user contribution through tariffs and taxes is insufficient to cover all the costs associated with water supply where the remainder is financed from state funds or other sources. To achieve cost recovery objectives—including operation, management, and maintenance (OM&M)—both water tariffs and taxes can be applied; this is the case, for example, in Spain, France, Italy, and Jordan, where collected taxes are used to cover maintenance and management costs.<sup>15</sup> This type of consolidated payment may improve the quality of water supply and rational consumption.

### External funding

The sector is also financed by international financial institutes, development organizations, and funds of bilateral aid. The main international sources of climate, land, and water finance for the country are the Global Environment Facility (GEF), Adaptation Fund (AF), Green Climate Fund (GCF), United Nations Development Program (UNDP), Food and Agriculture Organization (FAO), United States Agency for International Development (USAID), Asian Development Bank (ADB), and Regional Environmental Centre for Central Asia (CAREC). International climate finance, which generally involves funds for soil and water initiatives, comes to Turkmenistan in smaller volumes than to other countries in the region, and is provided in the form of grants and technical assistance.<sup>16,17</sup>

Based on bilateral cooperation programs, the climate and water related projects are also supported by Norway (funding national policy dialogs on IWRM),<sup>18</sup> the United States (various projects, mainly through the USAID agency in the country), Germany (numerous projects through GIZ agency in the country), and the European Union (Nexus regional project, and so on).

### Private sector

According to international best practice, the effectiveness of water supply management is increased through the provision of permanent and long-term financing, with a certain portion covered by private funding. For the drinking water supply sector, the state law on ‘potable water’ (Ch. 3) stipulates the ‘attraction of investments in any form, including from international organizations and private entrepreneurs for financing of development of programs of drinking water supply’ in rural areas.<sup>19</sup> Articles added to the water code allow the transfer of on-farm facilities and water systems (objects of artificial origin) into private possession. In 2018, supporting the growth of domestic agricultural products, the Government of Turkmenistan introduced soft loans for the purchase of agricultural machinery, and water-saving and irrigation equipment,<sup>20</sup> and allotted lands for the long-term use of farmers, which facilitated a certain level of private funds. However, to date, only small private investments have been made in the country’s water sector through the purchase of water-saving irrigation technologies and the rental of reservoirs by local entrepreneurs.<sup>21</sup> At the same time, with the recent adoption of law on private–public partnerships in 2021, and with plans on increasing

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<sup>15</sup> Krutov A, 2019. Cost recovery and water pricing for irrigation and drainage projects

<sup>16</sup> OECD, 2016. Financing Climate Action in Turkmenistan.

[https://www.oecd.org/environment/outreach/Turkmenistan\\_Financing\\_Climate\\_Action.Nov2016.pdf](https://www.oecd.org/environment/outreach/Turkmenistan_Financing_Climate_Action.Nov2016.pdf)

<sup>17</sup> WBG, CAREC, 2020. Review of international and domestic funding sources. Climate finance in Central Asia. <https://zoinet.org/wp-content/uploads/2020/10/CA-climate-finance-en.pdf0>

<sup>18</sup> UNECE, 2012. Turkmenistan. Environmental performance reviews. First Review

<sup>19</sup> Turkmenistan Law ‘On drinking water’ (2010), chapter 3. article 11

<sup>20</sup> Turkmenportal, 2020. State Bank for foreign economic activity of Turkmenistan of Turkmenistan offers preferential lending. <https://turkmenportal.com/en/blog/28235/state-bank-for-foreign-economic-activity-of-turkmenistan-of-turkmenistan-offers-preferential-lending>

<sup>21</sup> Jumakuliev D, 2023. ‘Water Sector Financing in Turkmenistan.’ In: *Water Infrastructure in Central Asia: Promoting Sustainable Financing and Private Capital Participation*. CAREC Institute

the non-government share of investments as per SEDP 2022-2028, the scope of the role of private–public partnerships is noted to increase.<sup>22</sup>

### International practice

There is no universal financing model in water management even for countries with similar climates or other institutional or economic governance models. Nevertheless, there are good practices in water sector management of certain states—for instance, for lands with an arid climate, as in Turkmenistan. The change in the Israeli water sector has been driven largely by the crisis connected with the arid climate, several major droughts, and severe soil salinization. In addressing these challenges, the country has gradually implemented a policy that combines institutional and regulatory reforms with massive infrastructure investment. Today it is the largest user of recycled wastewater, with more than 87 percent consumed for irrigation to replace scarce fresh water for domestic and industrial uses.<sup>23,24</sup> As a response to water scarcity, it also launched several large-scale campaigns to promote water conservation.<sup>25</sup>

In addition to using wastewater for crops, Israel relies heavily on drip irrigation, which largely contributes to the elimination of water loss.<sup>26</sup> With the global drip irrigation market estimated to grow from USD 4.6 billion in 2020 to USD 10.8 billion in 2028, many countries today are switching to more efficient water management systems.<sup>27,28</sup> In this regard, many crop producers recognize drip irrigation to be the most effective technology, not only because its use avoids unnecessary financial costs, but also because it enables the accurate and uniform application of water and nutrients, as well as helping farmers adapt to climate change by ensuring efficient water use.<sup>29</sup>

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<sup>22</sup> NewsCentralAsia, 2022. <https://www.newscentralasia.net/2022/08/05/do-2028-goda-turkmenistan-vlozhit-znachitel%CA%B9nyye-investitsii-v-razvitiye-promyshlennogo-potentsiala-i-sozdast-svyshe-30-000-rabochikh-mest/>

<sup>23</sup> Philippe M, Tal S, Yeres J, & Ringskog K, 2017. Water Management in Israel: Key Innovations and Lessons Learned for Water-Scarce Countries. World Bank. <https://openknowledge.worldbank.org/server/api/core/bitstreams/2577d429-0114-5d64-884e-8ba80ecd82f6/content>

<sup>24</sup> OECD, website. Policies in practice. Israel's sustainable water management plans. <https://www.oecd.org/climate-action/ipac/practices/israel-s-sustainable-water-management-plans-d81db5f5/>

<sup>25</sup> Facts about Israel. [https://www.gov.il/BlobFolder/generalpage/facts-about-israel-2018/en/English\\_ABOUT\\_ISRAEL\\_PDF\\_Water.pdf](https://www.gov.il/BlobFolder/generalpage/facts-about-israel-2018/en/English_ABOUT_ISRAEL_PDF_Water.pdf)

<sup>26</sup> Desert News, 2023. <https://www.deseret.com/utah/2023/4/30/23703096/israel-agriculture-uses-drip-irrigation-vertical-gardens#:~:text=In%20addition%20to%20using%20wastewater,flower%20beds%20to%20agricultural%20crops>

<sup>27</sup> Research and Markets. Global Drip Irrigation Market Report 2021-2027. <https://www.globenewswire.com/en/news-release/2021/07/28/2270143/28124/en/Global-Drip-Irrigation-Market-Report-2021-2027-Focus-on-United-States-China-Egypt-India-Turkey-Saudi-Arabia-Pakistan-Iran-Tunisia.html>

<sup>28</sup> Research and Markets. Drip Irrigation Market, Size, Global Forecast 2023-2028, Industry Trends, Growth, Share, Outlook, Impact of Inflation, Opportunity Company Analysis.

<sup>29</sup> Research and Markets. Drip Irrigation Market, Size, Global Forecast 2023-2028, Industry Trends, Growth, Share, Outlook, Impact of Inflation, Opportunity Company Analysis (2023), Renub Research. <https://www.renub.com/drip-irrigation-market-p.php>

Uzbekistan, a landlocked country in Central Asia, has substantial difficulties in effectively managing its limited water resources owing to its location in dry and semi-arid areas. The challenges of climate change, population increase, and reliance on agriculture require the implementation of effective and environmentally friendly water management strategies. To tackle these difficulties, it is crucial to establish a strong and organized framework for funding the water industry. Under the present circumstances, Uzbekistan's water sector financing landscape is characterized by a varied and fragmented approach. Sources of funding include the following:

### **Government funding**

The Uzbek government dedicates a substantial percentage of its budget to water sector initiatives, specifically for the creation and upkeep of infrastructure and to provide financial support, notably in the agricultural sector. During the last two years, a total of UZS 22 trillion (USD 1.8 billion) has been allocated from the budget of Uzbekistan for water management, which includes around UZS 1 trillion (USD 81 million) in subsidies, specifically for water-saving technologies. Specifically, there are plans to execute water infrastructure initiatives valued at UZS 1.7 trillion (USD 139.2 million) in 2024 and to receive USD 300 million from IFIs. Although this approach guarantees the provision of crucial services and the advancement of infrastructure, it may face restrictions owing to financial constraints and sometimes lack the effectiveness and ingenuity shown in investments made by the private sector. Despite a gradual upward trend, water tariffs remain inadequate to reflect the true cost of water provision, which restricts their financial contribution.

### **International aid and loans**

For large-scale water initiatives, IFIs such as the ADB, IsDB, WB, and numerous other international aid organizations provide substantial funding. For example, the 'national policy framework for water management,' funded by the European Union, has shown the capacity of contemporary market processes and technology to improve water efficiency and mitigate tensions between farmers and water consumer groups. Implementing a system of charging for water use is considered a crucial measure to promote the efficient utilization of water resources and to address many political, social, economic, and environmental issues. The European Investment Bank (EIB) has assisted the Uzbekistan Water Framework Loan, a project that seeks to enhance water supply and management of wastewater in Uzbekistan. These funds frequently require the use of technical know-how and international standards but, in some cases, difficulties may present in conforming to local circumstances and requirements.

### **Public–private partnerships**

PPPs are emerging as a feasible funding strategy for several water sector projects, particularly in urban water supply systems and hydropower. PPPs have the potential to bring together the knowledge, technology, and funds of the private sector to supplement the efforts of the public sector in water management. One example is the contract for the wastewater treatment plant that was granted to Metito Utilities in Uzbekistan. The project, valued at USD 90 million, is being implemented as a PPP initiative and is being run based on a 25-year build–operate–transfer (BOT) framework. The project's objective is to provide wastewater treatment services to Namangan and its environs, enhancing quality of life and fostering sustainable development. Although PPPs can potentially entice investment and improve operational efficiency, they require a robust regulatory framework to safeguard public interests and guarantee long-term preservation.

While diverse financing sources provide several avenues for financial support, the result may be disparities in priorities, standards, and practices across different projects and locations. The absence of a unified national plan harmonizing the many financing sources and initiatives demonstrates fragmentation. This may lead to redundant endeavors, suboptimal allocation of resources, and deficiencies in crucial domains. Various parties—such as governmental authorities, foreign funders, and commercial organizations—often pursue different objectives and criteria for measuring success, which might impede collaborative endeavor.

## FINDING MAJOR WATER FINANCING PROBLEMS AND OBSTACLES IN THE REGION

### KAZAKHSTAN

Kazakhstan faces several significant financing problems and obstacles in the water sector, including insufficient allocation of fiscal resources, inadequate cost recovery mechanisms, and weak financial management practices. Addressing these challenges requires a comprehensive approach encompassing policy and institutional cooperation, fiscal and market mechanisms, technological innovation, infrastructural development, and international collaboration.

#### Policy and institutional cooperation

Policy and institutional cooperation in the water sector refers to the collaborative efforts between various government entities, regulatory bodies, non-governmental organizations, international organizations, and other stakeholders to develop, implement, and enforce policies and regulations that ensure sustainable water management and governance. This cooperation is crucial for addressing complex water-related challenges that cross administrative and geographical boundaries, such as water scarcity, pollution, climate change impacts, and the equitable distribution of water resources. Coherent national policies encouraging sustainable solutions ensure the efficient allocation and use of water resources. To address this, the Ministry of Water Resources and Irrigation has developed a draft of a new water code, which is a comprehensive legal framework that governs the management, protection, use, and restoration of water resources in Kazakhstan. Unlike the current document, where water is a means of achieving economic benefit, the goal of the new water code is to achieve and maintain a safe level of water use, allowing for sustainable economic development, improving the living conditions of citizens, and protecting the environment (Parliament of the Republic of Kazakhstan, 2024).

Below are the key aspects of policy and institutional cooperation in the water sector:

- **Integrated water resources management (IWRM)** advocates for the coordinated development and management of water, land, and related resources to maximize economic and social welfare without compromising the sustainability of vital ecosystems. IWRM requires collaboration among different water-using sectors (agriculture, industry, households), and across different levels of government (local, regional, national) to implement IWRM principles effectively (UNEP, n.d.). Kazakhstan has been addressing the IWRM principles, but still did not implement them effectively in practice.
- **Transboundary water management:** The uneven distribution of water resources in Central Asia has resulted in interdependence between upstream (Kyrgyz Republic and Tajikistan) and downstream (Kazakhstan, Turkmenistan, and Uzbekistan) countries (Janusz-Pawletta & Gubaidullina, 2015). Establishing international agreements and joint management bodies to oversee the shared management of transboundary water resources, such as rivers and lakes, is one of the main priorities for the water management sector of Kazakhstan.
- **Institutional capacity building:** Strengthening the capabilities of water sector institutions to manage water resources effectively, including planning, regulation, and enforcement, is

crucial for effective water management. To enhance institutional knowledge, technical skills, and management practices, training, technical assistance, and financial resources need to be provided on a regular basis (Hamdy *et al*, 1998).

- **Data sharing and information exchange:** Effective water management requires accurate and timely data on water availability, demand, and use. Developing data-sharing agreements and information exchange platforms between institutions to improve water resource assessment, forecasting, and decision-making is crucial for the successful management of the water sector of Kazakhstan and the neighboring countries of Central Asia, China, and Russia (Pohl *et al*, 2017).

## Fiscal and market mechanisms

While improving the regulatory framework of water management in the country, the institutional capacity of water sector agencies needs to be strengthened through training programs in financial management, project management, and service delivery. Addressing weak fiscal and financial management practices in the sector is crucial for ensuring the sustainability and efficiency of water services. Implementing strong financial management practices can help water utilities and governing bodies to improve service delivery, extend access to safe water, and achieve financial sustainability. Several strategies to strengthen fiscal and financial management in the water sector are as follows:

- **Financial management and accounting practices:** Effective financial management is essential for the transparent and accountable use of funds. This includes proper budgeting, financial reporting, and audit mechanisms to ensure that funds are used efficiently and for their intended purposes. Establishing clear objectives and priorities for water sector investments, considering infrastructure needs, population growth, climate change, water quality goals, and regulatory investments are top priorities for the water regulator (OECD, 2021).
- **Policies for revenue generation** in the water sector include policies on water tariffs, taxes, and fees for service connections, and fines for illegal water use. Pricing strategies are designed to cover the costs of WSS services, including operation, maintenance, and infrastructure investment (GWP, 2017).
- **Government consistency** is crucial for achieving long-term sustainability in the water sector of Kazakhstan by addressing water challenges and keeping to plan once the state programs are approved (Spackman, 2002).
- **Capacity building and training:** Investment in training programs for the staff of water utilities and regulatory bodies is strongly advised to enhance skills in financial planning, budgeting, accounting, and financial reporting. The promotion of leadership and management skills in the water sector would also drive organizational change and improve financial discipline. Training can be organized in the premises of the Kazakh Research Institute of Water Management and the Almaty Water Hub of the Kazakh Agrarian Research University as they have experience in the field of capacity building in the water sector.
- **For improved financial planning and budgeting,** long-term investment plans, operational cost assessments, and revenue projections need to be implemented in the sector. In addition, the development and adherence to rigorous budgeting processes are based on realistic assumptions about costs, revenues, and demand for services (Spackman, 2002).
- **Water banking** is a market mechanism that involves storing water during times of surplus for use during times of scarcity and moving water use from low value to high value. Water banks can be managed privately or by government entities and can help smooth out fluctuations in water supply (Fazeli *et al*, 2021).
- **Water markets** enable the buying and selling of water rights or allocations between users, allowing water to flow to its most valued use. In Australia, for instance, a water markets website gives access to minute-by-minute water market updates.



## Technological innovations and infrastructural development

Technological innovations in the water sector play a crucial role in addressing challenges related to the impacts of climate change, water scarcity, water quality, wastewater treatment, and overall water management. Such innovations as remote sensing technologies and in-pipe robotic mapping tools make possible water accounting and non-revenue water monitoring (Oliver Viola *et al*, 2020). Advanced wastewater treatment technologies enable the reuse of treated wastewater for non-potable applications such as irrigation, industrial processes, and groundwater recharge (Bauer & Wagner, 2022).

Adapting water infrastructure to cope with the anticipated impacts of climate change—such as increased variability in water availability and extreme weather events—is becoming increasingly important. Developing infrastructure to mitigate the impacts of extreme weather events, such as droughts and floods, through early warning systems, flood barriers, and water storage facilities, is essential for resilience (OECD, 2018). Overall, addressing the challenges related to water scarcity and successfully developing water sector infrastructure necessitates a multidisciplinary approach, involving engineering, environmental science, finance, policymaking, and community engagement as well as technical expertise and capital (George-Williams *et al*, 2024).

## International collaboration

Kazakhstan has been actively engaged in international collaboration to manage transboundary water resources effectively with neighboring CA countries in the south, Russia in the north, and China in the east. Through regional cooperation, partnerships with international organizations, and adherence to international agreements, Kazakhstan can enhance its water security, promote sustainable development, and contribute to regional stability (GWP, 2014). Navigating the geopolitical dynamics and aligning the diverse interests of neighboring countries remains a challenge. The regional collaboration in Central Asia, for instance, is undermined by the competing interests of the winter electricity needs of the upstream countries (Kyrgyz Republic and Tajikistan) and the summer irrigation needs of the downstream countries (Kazakhstan, Uzbekistan, Turkmenistan), which costs them USD 4.5 billion annually (Pohl *et al*, 2017; Abdullaev & Akhmedov, 2023).

### KYRGYZ REPUBLIC

It is important to note that specific details on current financing plans and the state of the water infrastructure in the Kyrgyz Republic may change over time. For the most accurate and up-to-date information, the advice is to refer to official government documents, reports, and other relevant sources.

Current situation and existing problems: The reasons for the water sector financing problems were addressed in Report D1 where all subsectors were included. The information given earlier is summarized here:

Institutional issue: As already mentioned, all subsectors belong to different agencies and government ministries. Irrigation is under the Ministry of Agriculture, Forestry and Water Resources;<sup>30</sup> drinking water is a department under Gosstroj; underground water is under the Ministry of Natural Resources

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<sup>30</sup> Recently renamed, now water resources are acknowledged as a priority and placed at the beginning of the agency name.

within the Department of Geology; and the Naryn River and its reservoirs are under the Ministry of Energy.

O&M issue: O&M is still problematic in all subsectors. Low quality of service because of low level of remuneration adversely affects the physical state of the infrastructure.

Absence of unified country water policy owing to the institutional structure: One agency should streamline the policy and put it into practice.

High level of government debt<sup>31</sup> owed to international funding institutions: This factor is also an obstacle to obtaining new loans from the IFIs for the water sector.

Underestimation of the role of water resources: Other sectors of human activity (mining, trade, customs, and so on) are currently seen as more important than water resources as they bring in more revenue in the short term. However, the consequences of this kind of misjudgment are already apparent.

Obsolete water standards and norms: The majority of water norms (for example, per capita) in all subsectors dates from the Soviet era, which has resulted in the overdesigning of infrastructure facilities and therefore in overspending.

No CA finance institution is available in the region: The establishment of a CA regional bank that will invest only in the water sector should be considered.

In rural areas, about 40 percent of the population does not have access to clean drinking water. The centralized wastewater disposal facilities are also problematic.

According to statistics, only 21 percent of the country's population is provided with a central sewerage system. For the city of Bishkek, this figure is 78 percent; in the regions, it does not exceed 10 percent. Some cities have outdated sewerage systems, but owing to lack of investment, they require rehabilitation or reconstruction.

In remote cities and district centers, access to wastewater systems is reduced by 1.5 percent to 2 percent annually owing to the degradation of the existing infrastructure. In rural areas, only 3 percent of residential and public buildings are connected to sewerage systems—these are schools and medical centers.

The energy sector is characterized by aged infrastructure and significant financial losses. System wear and tear is gauged at over 50 percent: the significant deterioration of energy assets and poor sector development are the result of heavy subsidies, particularly for electricity consumption, which drains resources for system maintenance and investment.

The Kyrgyz Republic has considerable untapped renewable energy potential. Currently over 90 percent of its electricity supply comes from hydropower generation; the Kyrgyz government emphasizes that only just over 10 percent of its hydropower potential has been developed. Opportunities to develop decentralized renewable energy technologies are especially promising, primarily small hydropower plants on rivers in the mountains.<sup>32</sup>

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<sup>31</sup> Up to 70 percent of the country's GDP

<sup>32</sup> <https://iea.blob.core.windows.net/assets/9d0cb3be-48fd-424f-8968-e543a43e8614/Kyrgyzstan2022.pdf>

Near-term objectives for new capacity include the construction of the remaining two 120 MW units at Kambar-Ata-2. Longstanding plans to develop the 1,860 MW Kambar Ata-1 HPP and the Verkhne-Naryn HPP cascade (over 200 MW), offering an additional 5 TWh of generation. Other proposed developments include the Kazarman and Suusamyр–Kokomerен hydropower plant cascades, which together would add over 2,465 MW.

Major investment opportunities:

- New infrastructure for the production of hydro energy
- New infrastructure for the transmission of electricity, natural gas pipelines, natural gas distribution systems
- Renewable energy projects (mini hydro, small hydro)
- Energy efficient enterprises
- Main grid interconnectivity, modernization, and development of cross-border electrical connections<sup>33</sup>

## **TAJIKISTAN**

Tajikistan is a leader in global water initiatives. The main focus of these initiatives is the rational use and conservation of water resources, taking into account the impact of climate change, and attracting financial resources for climate change adaptation. Therefore, Tajikistan is making every effort to improve the investment climate and attract funds to the water sector. The country has adopted relevant legislative acts to attract investment in the water sector.

However, the need to modernize the outdated water infrastructure and build new infrastructure exceeds the planned annual financial resources of the state budget and increases the burden on the budget. Therefore, the country is attracting concessional loans and grants from development partners to implement investment projects in the water sector.

Concessional loans and grants are attracted based on the state investment program, which is approved for a period of five years.

The state investment program for 2021-2025, adopted by the Government of the Republic of Tajikistan on 2 September 2021, No. 358,<sup>34</sup> provides financing for various sectors of the country's economy, including the water sector. This program envisages attracting funds for the implementation of 898 investment projects through the attraction of loans and grants totaling USD 19.1 billion.

For the development of the subsectors of drinking water supply and sanitation, hydropower, land reclamation and irrigation, the program allocates a total of USD 4.82 billion or 25 percent of the total program amount. This includes 92 projects for land reclamation and irrigation totaling USD 798.95 million, 23 projects for drinking water supply and sanitation totaling USD 410.31 million, and 15 projects for hydropower totaling USD 3,620.42 million.

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<sup>33</sup> <https://invest.gov.kg/about-kyrgyz-republic/key-industries/>

<sup>34</sup> Public Investment Program for 2021-2025, Decree of the Government of the Republic of Tajikistan dated 2 September 2021, No. 358, [http://www.adlia.tj/show\\_doc.fwx?rgn=140188](http://www.adlia.tj/show_doc.fwx?rgn=140188)

The program states that ministries, agencies, and local executive bodies of state power should give priority to projects of the state investment program for 2021-2025 and take necessary measures to implement the program when attracting domestic and foreign investments.

However, many sources of project financing are not specified in the program, which hinders the implementation of the planned projects.

Thus, in the planning for financing of the water sector, there are no major obstacles. The main challenges are insufficient attraction of funds to implement the program or a large number of planned projects without identified sources of financing, as well as insufficient funding capacity of water sector projects from the state budget.

## **TURKMENISTAN**

### **Sustainable and long-term financing**

Climate change: Climate impact on the water sector is a critical aspect of water resource management in the CA region. Potential losses of crops without climate adaptation measures could reach up to USD 20.5 billion during 2016-2030.<sup>35</sup> Given the vulnerable state of the water sector because of the growing impacts of climate change, the role of a sustainable and long-term financing model is imperative for the country. Therefore, the estimation of costs for long-term investments considering climate change patterns is one of the vital aspects that needs to be taken into consideration for this type of financing model. At the same time, the estimation of costs is a complex procedure that requires studies and the usage of climate, physical, and economic models,<sup>36</sup> to differentiate climate and natural phenomena. Institutional, financial, and technological support for the advancement of weather and climate information services is another crucial part of strengthening the capacity of the water infrastructure to be resilient and meet growing demands.<sup>37</sup>

Credits for sustainable cultivation and technologies: Availability and access to adequate, timely, and low-cost credit from institutional sources is of great importance, especially for small farmers. Along with other factors, credit is necessary to create sustainable and profitable farming systems. Easy access to affordable financial services has been shown to have a positive impact on productivity, asset formation, income, and food security of the rural population.<sup>38</sup> At the same time, it is noticeable that soft loans stimulate the sector, resulting in increased agricultural products and water utilization. Global water consumption will peak by 2050, following the population growth and hence the increased demand for food production by 70 percent.<sup>39</sup> Turkmenistan in this context is no exception. It is thus important to consider policies that facilitate the use of crops that consume less water or the widespread integration of water-saving technologies—in particular, on the cultivation of water-intensive plants. Today, private farmers are cultivating, mainly, two types of agricultural product: state strategic crops (cotton and wheat, which occupy 80 percent of the cultivated area) and increasing greenhouse vegetables and fruit (mostly tomatoes). Over the past four years, greenhouses have increased by more than 30 percent (from 530 hectares to 800 hectares during 2020-2023), and

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<sup>35</sup> OECD. 2016. Financing Climate Action in Turkmenistan

<sup>36</sup> CAREC Institute, 2020. Climate Vulnerability, Infrastructure, Finance and Governance in CAREC Region

<sup>37</sup> Nationally Determined Contribution of Turkmenistan under the Paris Agreement, 2022

<sup>38</sup> Durdymadov A, Ballyev Y, Khydyrova L, & Ovezov A, 2022. Features of financing the agricultural sector. Scientific journal: *In situ*. <https://cyberleninka.ru/article/n/osobennosti-finansirovaniya-selskohozyaystvennogo-sektora>

<sup>39</sup> Duan W, Chen Y, Zou Sh, & Nover D, 2019. Managing the water–climate–food nexus for sustainable development in Turkmenistan. <https://doi.org/10.1016/j.jclepro.2019.02.040>

the export indicators of greenhouse production have greatly increased. Greenhouses and their products are expected to grow substantially.<sup>40</sup>

None of the states in the region has yet been able to develop acceptable and long-term solutions for financing the adaptation of the water domain.<sup>41</sup> Considering the projected population growth by almost 36 percent (which is higher than the global average),<sup>42</sup> the rise in ambient temperature indicators, the expansion of agricultural production and water shortages in the region, there is a serious need for solutions and mitigation measures to be implemented.

Limited engagement of innovative technologies: Given the higher level of water stress largely caused by rising ambient temperatures, and the large scale of irrigation, it is expected that the state's water management will increasingly call for innovative policies. In general, the country demonstrates activities to explore cooperation with development partners in innovative and sustainable management of the water sector through various seminars where issues of effective water use, crops utilizing less water, IWRM, and ICT are reviewed.<sup>43,44</sup> It also collaborated with UNDP for over two years to conduct research on water conservation technologies for growing crops such as cotton, wheat, and various vegetables.<sup>45</sup> At the same time, the policy of institutional and financial support for innovative approaches is at a very low level. This applies not only to the country's water governance. As noted, in comparison with other industries, water innovation is low worldwide.<sup>46</sup> And, although recent efforts were made to improve the general sense of water innovation in emerging markets, the level of quality awareness of challenges and appropriate investigative methodologies is still limited.<sup>47</sup>

Paradoxically, limited private funding or business participation in the water sector is one of the main reasons for the lower level of application of new technologies. As stated, the innovative development or strategic planning of sustainable infrastructure is possible only when external funds are mobilized.<sup>48</sup>

### Low level of funds

Funds allocated to the water sector of Turkmenistan are considered insufficient owing to the budget deficit, with the state being the only source of funds having also to make efforts to cover other

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<sup>40</sup> *Business Turkmenistan*, 28 November 2023. 'Tomato Dominates 95% of Turkmen Greenhouses, Entrepreneur Reveals.' <https://business.com.tm/post/11088/turkmenskii-predprinimatel-95-teplic-v-turkmenistane-specializiruyutsya-na-proizvodstve-tomatov>

<sup>41</sup> Abdullaev I, Strikeleva E, & Rakhmatullaev Sh, 2020. Water sector of Central Asia and Afghanistan. Analysis of current situation and ways of further development. USAID

<sup>42</sup> Eurasian Research Institute, 2020. UN Population Prospects: Case of Central Asia—ERI.

<https://www.eurasian-research.org/publication/un-population-prospects-case-of-central-asia/>

<sup>43</sup> BT. News and information service, 2021. <https://business.com.tm/post/7445/turkmenistan-studies-introduction-of-innovative-digital-technologies-in-water-industry>

<sup>44</sup> Orient information agency, 2019. <https://orient.tm/en/post/4933/use-of-innovative-water-management-technologies-in-central-discussed-in-turkmenistan>

<sup>45</sup> UNDP Turkmenistan, 2020. Press releases. <https://www.undp.org/turkmenistan/press-releases/undp-and-state-committee-water-management-turkmenistan-share-scientific-proven-best-irrigation-practices>

<sup>46</sup> Kydyrbekova A, Meiramkulova K, Tolysbayev B, & Kydyrbekova A, 2022. Dynamics of innovation in the use of water resources in emerging markets. <https://www.sciencedirect.com/science/article/pii/S209624872200025X>

<sup>47</sup> Kydyrbekova A, Meiramkulova K, Tolysbayev B, & Kydyrbekova A, 2022. Dynamics of innovation in the use of water resources in emerging markets. <https://www.sciencedirect.com/science/article/pii/S209624872200025X>

<sup>48</sup> Kepbanov Y, Horak S, & Ovezmyradov B, 2022. The investment climate in Turkmenistan: Challenges and possible ways of attracting foreign investment. [https://lucris.lub.lu.se/ws/portalfiles/portal/116796662/web\\_RRSL\\_2022\\_3\\_The\\_investment.pdf](https://lucris.lub.lu.se/ws/portalfiles/portal/116796662/web_RRSL_2022_3_The_investment.pdf)

sectors of the country. The large scale of irrigation, which ranks second in the CA region, constantly requires funding for O&M and capital investments. The financing needs in capital investments might grow even greater, given the large-scale projects to provide water security by increasing reservoir capacities<sup>49</sup> and plans to expand its irrigated lands and reclaim saline lands.<sup>50</sup> In general, the following aspects further incur the low level of funds in the water sector:

**Tariffs:** Water users in the countries of the region are still enjoying low tariffs and subsidies for water supply, the infrastructure of which is largely maintained and funded by the state. These subsidies will have a direct negative effect on the water supply sector. Consequences may include a growing tendency to neglect easily accessible resources and service, thereby damaging the system fueled by unsustainable consumption. Insufficient return on investment may serve as another impact upon the already aging infrastructure in the future, while at the same time placing the sector in a challenging position to compete with other developing sectors for additional financial sources.

According to the OECD report, user fees are the most important source of financing. At the same time, it is noted that it is necessary that tariff levels are economically and socially justified.<sup>51</sup> State participation in water payments depends mainly on the level of income of population and the institutional types of organization supplying water and operating irrigation systems.<sup>52</sup> Usually, the maximum water tariffs for water service are 3 percent to 5 percent of household income,<sup>53</sup> with a detailed analysis of the impact of tariff levels on different groups of water consumer. In Turkmenistan, the fee for drinking water supply for the population is comparatively low (TMT 1 or 24 cents per 1 m<sup>3</sup> as of 2024; previously, it was half this fee—TMT 0.5). If there is a need to increase the fee, it could first be seen as an economic tool to rationalize water utilization and be developed in a way that is acceptable for all levels of society (unemployed or other vulnerable community groups, and so on).<sup>54,55</sup>

In turn, tariffs that are too high can also become unaffordable for low-income farmers. An effective pricing policy must strike a balance between different goals. The collection of fees for water supply services for irrigation purposes should be related to the willingness of farmers to pay for the services provided. In general, it is worth noting that raising fees or subsidies alone will not achieve sustainable financing; it must be done in conjunction with reducing costs through increasing the efficiency of the water infrastructure and by attracting external financing sources.<sup>56</sup>

**Capital investments:** The main strategic document at state level that reflects capital investments is the state program for socioeconomic development (2022-2028). According to this program, planned funds to be allocated to the water sector will be increased to USD 4 billion. However, variations in

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<sup>49</sup> SEDP 2022-2028

<sup>50</sup> Abdullaev I, Strikeleva E, & Rakhmatullaev Sh, 2020. Water sector of Central Asia and Afghanistan. Analysis of current situation and ways of further development. USAID

<sup>51</sup> OECD, 2005. Financing the water supply and sewerage sector in Eastern European, Caucasus and Central Asia countries. p.180

<sup>52</sup> Dukhovny V, Pinkhasov M, & Mirzaev N, 2009. Financial and economic instruments

<sup>53</sup> Meran G, Siehlow M, & Hirschhausen C, 2020. Water Tariffs. [https://link.springer.com/chapter/10.1007/978-3-030-48485-9\\_4](https://link.springer.com/chapter/10.1007/978-3-030-48485-9_4)

<sup>54</sup> Dukhovny V, Pinkhasov M, & Mirzaev N, 2009. Financial and economic instruments

<sup>55</sup> OECD, 2005. Financing the water supply and sewerage sector in Eastern European, Caucasus and Central Asia countries

<sup>56</sup> OECD, 2005. Financing the water supply and sewerage sector in Eastern European, Caucasus and Central Asia countries



project priorities, especially in other sectors, may result in not all allocated funds for the water domain being realized.

**External funds:** Turkmenistan receives the smallest portion of financial support from external donors in the region, although its participation in irrigation is substantial and the second largest in Central Asia. There are opportunities for external funds from development organizations, partners, or donors to implement measures to address issues such as disadvantageous location downstream, higher water stress owing to the warming climate, as well as the consequences on soil quality with subsequent cascading effects on other sectors. Considering the great socioeconomic potential of the transition to more efficient use of energy and water resources, Turkmenistan—as well as the region as a whole—could attract more climate and sustainable water investments.<sup>57</sup>

**Private investments:** Turkmenistan is actively enhancing its private sector market. Optimization of industrial segments and ownership composition will play a key role in the achievement of a high rate of national economic growth. Under the diversification of the national economy policy, the private sector takes on a certain weight. Over the past ten years, by mid-2019, the Union of Industrialists and Entrepreneurs of Turkmenistan (UIET) had invested about USD 5.5 billion in the private sector of the economy, of which USD 2 billion was allocated to the agro-industrial complex,<sup>58</sup> which emphasizes its role and importance in the business sector of the state. The share of private agricultural products and exports is growing, mostly owing to the preferential loans introduced in 2018, which assumes an increasing demand for water resources. Additional financing will therefore be required and should be sourced from the private sector to implement regular maintenance on the water supply infrastructure, which will face an increased load in the near future.

At the same time, full scale private investment has not yet entered the water sector of the CA region, despite enormous investment needs owing to the outdated irrigation infrastructure.<sup>59</sup> There are no well-established mechanisms for cost-sharing and financing between public and private organizations, especially for O&M services. The infrastructure maintenance is carried out at the expense of public funds, and only regular repairs of on-farm irrigation systems are carried out at the expense of water users.<sup>60</sup> For the sustainable financing of water management, as an option, the agricultural sector could be commercialized. However, as stated by USAID analysis, under the current conditions of the CA model of the public administration system, this option is least likely. A more appropriate approach would be to introduce public–private partnership (PPP) mechanisms in irrigation services and use multi-use water schemes to cover water supply costs.<sup>61</sup> In Turkmenistan, there is a significantly low level of private funding, realized mainly through the purchase of sprinkler technologies by local farmers, and by lease relations for artificial or natural reservoirs, which realized the private–public partnerships.<sup>62</sup>

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<sup>57</sup> WBG, CAREC, 2020. Review of international and domestic funding sources. Climate finance in Central Asia

<sup>58</sup> Turkmenistan.ru. 7 November 2019. <http://www.turkmenistan.ru/ru/articles/44502.html>

<sup>59</sup> Abdullaev I, Strikeleva E, & Rakhmatullaev Sh, 2020. Water sector of Central Asia and Afghanistan. Analysis of current situation and ways of further development. USAID

<sup>60</sup> Abdullaev I, Strikeleva E, & Rakhmatullaev Sh, 2020. Water sector of Central Asia and Afghanistan. Analysis of current situation and ways of further development. USAID

<sup>61</sup> Abdullaev I, Strikeleva E, & Rakhmatullaev Sh, 2020. Water sector of Central Asia and Afghanistan. Analysis of current situation and ways of further development. USAID

<sup>62</sup> Jumakuliyev D, 2023. Water sector financing in Turkmenistan. In: *Water Infrastructure in Central Asia: Promoting Sustainable Financing and Private Capital Participation*. CAREC Institute

Uzbekistan has substantial obstacles in funding its water industry, largely because of a confluence of causes, including:

### **Limited public funding**

**Low government revenue:** Like many developing nations, Uzbekistan faces challenges with its limited tax base. A substantial segment of the economy might function within the informal sector, characterized by ineffective taxation. The issue of agricultural taxation is further complicated by the sector's economic dominance and the historical practice of exempting or charging low tax rates on agricultural income.

**Conflicting priorities:** The Uzbek government, like many other governments, confronts the task of reconciling opposing requests for public spending across several vital areas, such as healthcare, education, energy, and water management. The underfunding of water management in this context exemplifies a more widespread challenge encountered by several nations: prioritizing urgent and conspicuous needs at the expense of long-term and sometimes inconspicuous infrastructure demands.

### **Ineffective pricing policies and financial support**

**Insufficient rates:** Water tariffs in Uzbekistan are often inadequate since they do not fully cover the expenses associated with water delivery and infrastructure upkeep. This undermines the motivation to save water and hinders willingness to invest in the field. Low tariffs may have a wide range of consequences for the water industry, including its sustainability, efficiency, and ability to satisfy the needs of an expanding population and economy. In many cases, low tariffs indicate that the income earned is inadequate to pay the expenses of water delivery, including the costs of treatment, distribution, and the repairs and upkeep of infrastructure. The dependability and quality of water services may suffer, leading to other problems. The meager financing received from tariffs restricts the ability to invest in new infrastructure and the upgrading of current systems, both necessary for enhancing efficiency and broadening access. Because consumers have no financial incentive to save water while water costs are low, this may lead to individuals engaging in wasteful usage habits. Even though low tariffs are sometimes established to ensure affordability, they might unintentionally subsidize higher-income consumers, who generally consume more water, which can lead to equity issues.

**Unfair subsidies:** Subsidies favor mostly the major water consumers, whereas smaller consumers face an excessive financial burden. This impedes the effective distribution of water resources and encourages inefficient practices. The provision of subsidies—particularly if they are not well-targeted—causes major pressure on government resources, diverting funds from other essential sectors such as education or healthcare. When subsidies are not distributed fairly, it may result in a lack of appropriate finances for the maintenance and improvement of water infrastructure, which can impact the quality and dependability of the water supply.

The potential consequences of increasing water tariffs in Uzbekistan may result in a disproportionate impact on a significant segment of the population. To attain sustainable finance for water management, it is essential to adopt a comprehensive and multifaceted strategy. This should include gradual modifications to tariffs in conjunction with specific support for susceptible families, initiatives to increase openness on the actual expenses of water, and allocations towards repairing leaks, modernizing irrigation systems, and implementing water-conserving technology in various industries.

To enhance financial support, it is imperative to broaden the range of funding sources via the examination of international collaborations, private sector investments, and payment for ecosystem services initiatives. Enhancing institutional capacity via the establishment of well-defined responsibilities within the water sector, consolidation of data gathering processes, and promotion of collaborative decision-making would facilitate the efficient allocation of resources and investments.

To address any negative consequences, it is imperative to provide targeted support, promote water-saving technology, and provide transitional assistance for livelihoods that may be impacted. These approaches need strong political determination, unambiguous communication, and active involvement of the community. Uzbekistan can achieve sustainable water management funding, fair access, and resource conservation by implementing this holistic method.

### **Lack of sufficient investment from the private sector**

**Unprofitable investment climate:** The regulatory framework for the involvement of private companies in water management is incomplete; this deters private investment because of the perceived risks and uncertainty.

**Restricted project feasibility:** Numerous water projects lack well-defined income sources and financial sustainability, making them unappealing to potential private investors. A significant issue faced by several water projects in Uzbekistan is the absence of well-defined and enduring income structures. This is often caused by inadequate water prices that do not fully cover the expenses of water supply and infrastructure upkeep. The lack of sufficient policy and regulatory clarity provide challenges for investors in accurately forecasting the long-term viability and profitability of water projects.

### **Inadequate capabilities and weaknesses in the institutional structure**

**Inadequate technical and administrative capacity:** Government agencies and water utilities often lack the technical proficiency and administrative aptitude needed to oversee water resources and execute intricate projects proficiently.

**Institutional fragmentation:** Owing to the diversity of ministries and agencies comprising the water sector, responsibilities overlap, resources are allocated inefficiently, and decision-making is sluggish. Fragmentation may lead to fragmented and even conflicting distribution of resources, hence diminishing the overall efficacy of water management.

For example, the Ministry of Agriculture prioritizes water-intensive crops to boost production, while the Ministry of Water Resources emphasizes water conservation. This lack of unified vision often leads to conflicting project proposals and inefficient resource allocation. Funding might be spread too thin across competing projects, hindering long-term sustainable water management strategies.

### **Challenges in transboundary water management**

**River basin sharing:** Uzbekistan and its neighboring countries share the Amu Darya and Syr Darya, two of the main rivers in the region. Equitable water sharing necessitates intricate agreements and cooperation mechanisms, which may prove to be formidable obstacles and impede endeavors related to financing. Investors see the presence of possible conflicts and the absence of explicit agreements as high-risk issues, which pose challenges in obtaining funding for projects.

**Climate change:** The region is experiencing worsening water scarcity owing to climate change, further straining available resources and necessitating increased investment.

## WATER INFRASTRUCTURE FINANCING PLAN FOR SELECTED REGIONAL AND NATIONAL INFRASTRUCTURE

### IDENTIFICATION OF POTENTIAL FINANCING SCHEMES IN CENTRAL ASIA

(focusing mostly on major water infrastructure)

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#### Kazakhstan

Central Asia's water resources are crucial for its agriculture, industrial sector, and domestic water supply. However, water distribution is uneven, with upstream countries (Kyrgyz Republic and Tajikistan) controlling the headwaters of the major rivers, while downstream countries (Kazakhstan, Uzbekistan, and Turkmenistan) are more populous and have significant water demands for their agricultural and industrial sectors (Janusz-Pawletta & Gubaidullina, 2015; Abdullaev & Akhmedov, 2023). The main focus of institutional reforms in the region is on increased water supply to cover the growing needs of the industrial, agricultural, and municipal sectors rather than managing their water demand (GWP, 2014).

Most of the major industrial players of Kazakhstan—such as KazMunayGas, Kazatomprom, and Tau-Ken Samruk—fall under the umbrella of the National Holding Samruk Kazyna (OECD, 2017). Other major industrial companies in the country include Kazakhmys, Kazzinc, and KAZ Minerals, all of which are involved in the extraction of natural resources. These companies currently do not have systems in place for the complete treatment and recycling of industrial wastewater (KazMunayGas, 2022; Kazatomprom, 2022; Tau-Ken Samruk, 2021; Kazakhmys, 2023; Kazzinc, 2023; KAZ Minerals, 2021).

**Table 3. Water sources used by major industrial players of Kazakhstan**

Company	Company activities	Extracted surface water	Extracted groundwater	Other water sources	Total	Previous year
<b>KazMunaiGas</b>	Hydrocarbon exploration, production, processing, transportation	2021: 36.85 million m <sup>3</sup>	2021: 25.99 million m <sup>3</sup>	2021: 3.3 million m <sup>3</sup> (urban water supply); 18.11 million m <sup>3</sup> —Caspian Sea; 0.08 million m <sup>3</sup> (wastewater sources)	2021: 84.3 million m <sup>3</sup>	2020: 85.8 million m <sup>3</sup> 2019: 93.6 million m <sup>3</sup>
<b>Kazatomprom</b>	National operator for export and import of uranium, rare metals, nuclear fuel, special equipment, dual-use technologies	2022: 6,500 m <sup>3</sup>	2022: 8,573,500 m <sup>3</sup>	2022: 608,900 m <sup>3</sup> (from municipal water sources)	2022: 9,188,900 m <sup>3</sup>	2021: 10,120,700 m <sup>3</sup>
<b>Tau-Ken Samruk</b>	Exploration, development, extraction, processing, sale of solid minerals, reproduction of mineral resource base		2021: 429,750 m <sup>3</sup>	2021: 11 m <sup>3</sup> (municipal water sources)		
<b>Kazakhmys</b>	World's 20 <sup>th</sup> largest producer of copper in concentrate, 12 <sup>th</sup> producer of blister and cathode copper; 3 <sup>rd</sup> power producer in Kazakhstan	Technical water from Lake Balkhash		For sites in Zhezkazgan 100% of water from Kengirsky Reservoir		
<b>KAZ Minerals</b>	Copper production	2020: 10.43 million m <sup>3</sup> 2021: 17.506 million m <sup>3</sup>	2020: 21.095 million m <sup>3</sup> 2021: 24.106 million m <sup>3</sup>		2021: 41.512 million m <sup>3</sup>	2020: 31.525 million m <sup>3</sup>

Sources: KazMunaiGas, 2022; Kazatomprom, 2022; Tau-Ken Samruk, 2021; Kazakhmys, 2023; Kazzinc, 2023; KAZ Minerals, 2021

According to the Ministry of Ecology and Natural Resources (2023), most surface water bodies in Kazakhstan are contaminated, with industrial activities being a primary source of pollution. To reduce the environmental damage caused by the extractive industry, it is crucial for these companies to invest in building facilities for the treatment of industrial wastewater. Additionally, they should aim

to reduce their reliance on surface and groundwater sources for industrial purposes and avoid disposing of untreated wastewater in storage ponds. **CSR** funds of industrial companies can be used to support projects on the transition to a circular economy within this sector:

- Investments in sustainable technologies (water treatment, recycling, waste reduction techniques)
- Environmental restoration projects (soil rehabilitation, restoration of ecosystems affected by industrial activities)
- Improving water efficiency, including the development and implementation of water recycling systems and adoption of water-saving technologies
- Supporting local communities by improving their access to clean water and sanitation

Financing major water infrastructure projects is crucial to addressing water management challenges, including irrigation efficiency, drinking water supply, and water pollution. Identifying potential financing schemes involves a mix of domestic funding, international financial support, PPPs, and innovative financing mechanisms. Several innovative financing mechanisms have recently emerged to address sector challenges. These include water funds, water-related impact investments, green bonds, and social impact bonds. These mechanisms aim to attract private investment and blend different sources of financing to achieve sustainable water management objectives (OECD, 2022a). Incentivizing private funds to invest in the water sector requires creating an attractive environment for investment, mitigating risks, and ensuring sustainable and profitable projects. The following schemes and strategies can attract private funds to finance water infrastructure projects:

- Public–private Partnerships can be a mechanism to assist governments to harness private investment for financing water infrastructure development (SIWI, 2020). To date, no PPP projects have been commissioned in the water sector of Kazakhstan. In a personal conversation, a representative of the Kazakhstan PPP Center (a subsidiary of the Ministry of the National Economy) pointed out recently that the water institutions have shown no interest in the PPP mechanism—namely, no water projects have been shared with the Kazakhstan PPP Center and no water sector representatives have attended the Center’s PPP courses (Kazakhstan PPP Center, 2023).
- Municipal and green bonds: The government can issue bonds to raise funds to finance the construction, maintenance, and rehabilitation of water facilities. The bonds are typically backed by government guarantees and are attractive to investors seeking stable long-term returns (OECD, 2022a). In Kazakhstan, the Astana International Finance Centre (AIFC) Green Finance Centre ensures the development of green finance policy and green financing instruments, including green bonds in the water sector (AIFC, 2024).
- Risk mitigation mechanisms offer guarantees or insurance schemes to mitigate political, financial, and operational risks associated with investing in the water sector. In Kazakhstan, EBRD has been providing loans, often with municipal guarantees, to the water utilities to modernize water infrastructure (Table 4).
- Capacity building and technical assistance are aimed at strengthening the capacity of local water utilities and regulatory bodies to manage and implement projects in partnership with the private sector (Hamdy *et al*, 1998). The development of risk mitigation mechanisms and qualified staff in the water sector would attract private investments to the projects funded by financing schemes such as PPP, blended finance, and green bonds.
- Transforming water utilities into autonomous or semi-autonomous corporations can improve financial management, enhance operational efficiency, and facilitate external financing. Shymkent’s Water Marketing and Management company is a success story of how, given relatively low water tariffs, a water utility company can be financially sustainable and manage to repay several loans provided by EBRD (EBRD, 2023; WRM, 2023).



## Kyrgyz Republic

### Water supply and sanitation subsector

The current major development partners and associated projects are listed in Table 4.

**Table 4. Major development partners**

Development partner	Project name	Duration	Amount (USD million)
<b>Rural water supply and sanitation</b>			
<b>ADB</b>	Naryn rural water supply and sanitation development program	2019-2028	27.4
<b>WB</b>	Sustainable development of rural water supply and sanitation	2016-2025	28.0
	Sustainable development of rural water supply and sanitation (additional financing)	2017-2025	43.2
	Climate resilient water services project	2022-2028	100.0
<b>IsDB</b>	Improvement of rural water supply and sanitation in the Kyrgyz Republic (phase I)	2017-2022	23.0
	Improvement of rural water supply and sanitation in the Kyrgyz Republic (additional financing)	2017-2022	60.0
<b>USAID</b>	Smart Waters water management program	2015-2020	2.0
<b>Saudi Fund for Development</b>	Water supply improvement in Batken and Talas	2020-2025	30.0
<b>Urban water supply and sewerage</b>			
<b>EBRD, SECO, EIB, EC</b>	Water supply and sewerage development project in 12 cities: Bishkek, Osh, Jalal-Abad, Kara-Balta, Kant, Talas, Tokmok, Naryn, Batken, Kara-Suu, Cholpon-Ata, Kyzyl-Kiya	2009-2022	139.9

ADB = Asian Development Bank, DFID = United Kingdom Department for International Development, EBRD = European Bank for Reconstruction and Development, EC = European Commission, EIB = European Investment Bank, IsDB = Islamic Development Bank, SECO = State Secretariat for Economic Affairs, SFD = Saudi Fund for Development, USAID = US Agency for International Development.

Source: Department of Drinking Water Supply and Sewerage Development under State Agency for Architecture, Construction, Housing and Public Utilities of the Kyrgyz Republic and ADB

### Strategy of water supply and sanitation development until 2026

One of the priority directions of state policy is the development of water supply systems and the solution of key issues in this area. To implement this project, the government of the Kyrgyz Republic approved a development program. The program is designed until 2026 and is aimed at supplying good quality drinking water to the population, as well as solving problems and identifying promising directions.

The budget of the program is KGS 70 billion, of which KGS 2 billion comes from the republican budget. External investors include the ADB, WB, EBRD, EIB, the State Secretariat for Economic

Relations of the Swiss Confederation (SECO), IsDB, the Chinese Government, the Saudi Fund for Development (SFD), UNDP, and UNICEF.<sup>63</sup>

### **Irrigation subsector**

The state program is a document aimed at continuing to resolve issues of irrigation development and the introduction of new irrigated lands, which was started as part of the implementation of the National Sustainable Development Strategy (NSDS) and the state program 2011-2015.

The implementation of the state program is entrusted to the Ministry of Agriculture, Forestry and Water Resources of the Kyrgyz Republic with the assistance of the Ministry of Economy and Finance on issues of financing and attracting external investment sources.

The implementation of the state program enables the construction of water management facilities, divided into the following three categories:

The first category includes irrigation facilities, the construction of which is provided for using funds from a grant from the People's Republic of China and a loan from IsDB, as well as facilities where work has already begun using funds from the republican budget. This category includes 17 items worth KGS 4,895 million, with 8,965 hectares of new irrigated land; 29,340 hectares of increased water availability; and 2,800 hectares transferred from conditionally irrigated to irrigated land. 28,290 jobs will be created.

The second category includes items for which work has already begun with international financial organizations, donors, and investors—IsDB, WB, AKG, Economic Development Cooperation Fund (EDCF) (Republic of Korea), and so on. This category includes 17 items worth KGS 36,526 million, with 40,256 hectares of new irrigated land; 9,662 hectares of increased water availability; 5,000 hectares transferred to gravity irrigation; and 200 million m<sup>3</sup> to 400 million m<sup>3</sup> of water savings. 150,500 jobs will be created.

The third category includes construction projects for which it is necessary still to find both internal and external sources of financing, including international financial organizations, donors, and investors.

This category includes 12 items worth KGS 17,365 million, with 17,350 hectares of new irrigated land; 12,083 hectares of increased water availability; and 4,511 hectares transferred to gravity irrigation. 66,400 jobs will be created.<sup>64</sup>

### **Hydropower subsector**

The share of environmentally friendly energy sources (small HPPs, solar and wind power plants, solar collectors, heat pumps, use of biogas, and so on) will be at least 10 percent in the total energy mix of the country, while energy and resource saving indicators will correspond to those of OECD countries. Investment for construction and reconstruction of the following facilities is being sought: Kambar-Ata

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<sup>63</sup> <https://en.kabar.kg/news/presentation-of-drinking-water-supply-and-sanitation-program-held-in-kyrgyzstan/>

<sup>64</sup> <https://cbd.minjust.gov.kg/100162?cl=ru-ru>

HPP-1, Verkhne-Naryn cascade of HPPs, Ak-Bulun HPP, At-Bashy HPP, Uch-Kurgan HPP, Toktogul HPP and other generating facilities.<sup>65</sup>

There will also be a launch of small hydroelectric power stations and other renewable energy sources with guaranteed government purchase of electricity at mutually attractive tariffs and terms. To ensure the sustainability of the sector, tariffs will be increased to a level that ensures a return on investment and a profit for private investors and state-owned energy companies.

#### **Priority investment projects:**

- 1) Construction of the Kambar-Ata-1 hydroelectric power station in the Jalal-Abad region with an installed capacity of 1,860 MW and an average annual output of 5,640 million kWh
- 2) Construction of a cascade of hydroelectric power stations Suusamy–Kokomeren with an installed capacity of 1,305 MW and an average annual output of 3,317 million kWh
- 3) Construction of the Kazarman cascade of hydroelectric power stations with an installed capacity of 1,160 MW and an average annual output of 4,661.6 million kWh
- 4) Construction of the Sary-Jaz cascade of hydroelectric power stations with an installed capacity of 1,100 MW and an average annual output of 4,764 million kWh
- 5) Construction of the Chatkal cascade of hydroelectric power stations with an installed capacity of 1,800 MW and an average annual output of 2,650 million kWh
- 6) Construction of the Ala-Buka cascade of hydroelectric power stations with an installed capacity of 414 MW and an average annual output of 1,711 million kWh
- 7) Construction of the Kulanak hydroelectric power station cascade with an installed capacity of 439 MW and an average annual output of 2,667.8 million kWh

The average unit capital price for the hydropower construction<sup>66</sup> is USD 1,000 to USD 1,500 per 1 kW.

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## **Tajikistan**

The most important long-term development goal of Tajikistan is to improve the standard of living of the country's population based on ensuring sustainable economic development. The water sector plays a key role in achieving this.

One pathway for the development of the water sector is to identify potential financing schemes. Financing schemes are determined based on the goals and objectives of strategic documents adopted by the Government of Tajikistan.

The highest strategic document for achieving the goals of SDG 2030 and the sustainable economic development of the country is the National Development Strategy (NDS) of Tajikistan for 2030. Sectoral strategies and five-year programs are developed on the basis of the goals and objectives defined in the NDS.

Similarly, potential financing schemes for the water sector, with a focus on large-scale water infrastructure, are planned based on the goals and objectives of the NDS.

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<sup>65</sup>[https://policy.thinkbluedata.com/sites/default/files/National%20Development%20Strategy%20of%20the%20Kyrgyz%20Republic%20for%202018-2040%20\(EN\).pdf](https://policy.thinkbluedata.com/sites/default/files/National%20Development%20Strategy%20of%20the%20Kyrgyz%20Republic%20for%202018-2040%20(EN).pdf)

<sup>66</sup><https://ekonomika.media/ulan-kyilyichbekov-v-kyirgyzstane-vyigodno-stroit-malyie-ges/>

To achieve the sustainable development goals, the NDS defines the following strategic development goals up until 2030:

- a) Ensuring energy security and efficient use of electricity
- b) Breaking the communication impasse and turning the country into a transit country
- c) Ensuring food security and access to quality nutrition for the population
- d) Expansion of productive employment
- e) Accelerating industrialization in the country

To achieve the specific goals and objectives of the NDS, the Government of Tajikistan is adopting five-year, medium-term development programs, which define the main activities and financing schemes from various sources, including the implementation of large water infrastructures.

The medium-term development program of Tajikistan for 2021 to 2025<sup>67</sup> provides an action plan, goals and objectives; indicators of the impact of goals and objectives; a baseline indicator and achievement of the target value of the indicator; and the timing of the implementation of the activity. The action plan also identifies sources of funding, including from the government, donors, and the private sector. Responsible bodies for implementing activities and development partners are also indicated.

In general, in the action plan of the medium-term development program 2021-2025, 233 activities were planned for a total amount of TJS 204,747.4 million (USD 18.08 billion<sup>68</sup>). Including from the state budget (current revenues) TJS 121,842.7 million (USD 10.76 billion) or 59.5 percent; from private investments TJS 65,242.4 million (USD 5.76 billion) or 31.9 percent; and at the expense of development partners (grants + public investment program for 2021-2025) TJS 17,662.3 million (USD 5.76 billion) or 8.6 percent.

Of these, the following are planned for the water sector:

For the development of hydropower, 23 activities are planned for a total amount of USD 3.23 billion, USD 1.83 billion of which comes from the state budget and USD 1.39 billion from funds from development partners.

Construction and modernization plans of large infrastructures include the continuation of the construction of the Rogun hydroelectric power station at USD 1.8 billion; the construction of the Sebzor hydroelectric power station at USD 63.4 million; the continuation of the reconstruction of the Kayrokkum hydroelectric power station at USD 164 million; the Nurek hydroelectric power station at USD 326.9 million; and the Sarband hydroelectric power station at USD 136 million.

Implementation of the regional project for the transportation of electrical energy from Central Asia to South Asia CASA-1000 at USD 296.3 million;<sup>69</sup> construction of the Rogun-Sangtuda high-voltage power transmission line with connection to the CASA-1000 project at USD 40 million; project implementation reconnection of the energy system of Tajikistan to the energy system of Central Asia to the amount of USD 35 million; implementation of the financial recovery program of the state

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<sup>67</sup> The mid-term development program of the Republic of Tajikistan for 2021-2025 was adopted by the decree of the Government of the Republic of Tajikistan dated 30 April 2021, No. 168 <https://medt.tj/images/20-07-2022-3.pdf>

<sup>68</sup> NBT exchange rate as of 30 April 2021 <https://nbt.tj/ru/kurs/kurs.php?date=30.04.2021>

<sup>69</sup> Internet source CASA-1000, 2018 [https://mewr.tj/wp-content/uploads/2018/11/Booklet\\_CASA\\_CIGRE.pdf](https://mewr.tj/wp-content/uploads/2018/11/Booklet_CASA_CIGRE.pdf)  
[https://mewr.tj/wp-content/uploads/2018/11/Leaflet\\_CASA\\_CIGRE.pdf](https://mewr.tj/wp-content/uploads/2018/11/Leaflet_CASA_CIGRE.pdf)

unitary enterprise Barki Tojik at USD 134 million; and other activities related to the development of the country's hydropower potential.

For the development of the drinking water supply and sanitation sector, six main activities are planned at USD 67.6 million for the implementation of the water infrastructure in this sector. After implementation, the following goals (Table 5) are planned to be achieved.

**Table 5. Achievement of results according to the action plan of the medium-term development program 2021-2025 of Tajikistan for the drinking water supply and sanitation subsector**

Goals and objectives (activities)	Indicators of impact, goals, and objectives (indicators)	Baseline (2019)	Target value of the indicator (target) for 2025	Financing requirement (million TJS) (input)	At the expense of the government	Development partners	Private sector
<b>Medium-term goal: increased access to safe drinking water, sanitation and hygiene</b>	Outcome indicators:	64,2	75	67.60	0.10	9.20	58.30
	Proportion of population provided with safe drinking water (%):						
	Urban	95	97				
	Rural	56	62				
	Population access to sanitation in (%):	60	62				
	Urban						
	Rural	1,7	2,1				
	Population access to hygiene (improved toilet facilities) in (%):	97	99				
	Urban	97	100				
	Rural	97	99				

To improve integrated water resources management, including the modernization and reconstruction of land reclamation and irrigation infrastructure, 16 activities are planned for a total amount of TJS 260 million (USD 22.9 million), including from the state budget TJS 24.10 million (USD 2, 1 million), at the expense of development partners TJS 14.35 million (USD 1.26 million) and at the expense of the private sector TJS 221.50 million (USD 19.5 million).

For the development of the land reclamation and irrigation sector, the following tasks are planned: construction of hydraulic structures for the development of new land on an area of 400 hectares; cleaning of collector–drainage networks and restoration of wells to improve the reclamation condition of irrigated lands on an area of 9,700 hectares; introduction of water-saving technologies across the region and Region of Republican Subordination (RRS) on an area of 76,000 hectares for TJS 229.10 million (USD 20.2 million), mainly at the expense of the private sector TJS 221.5 million (USD 19.5 million).

The mid-term development program of Tajikistan for 2026 to 2030 will be developed and adopted, within which potential financing schemes for the water sector will also be planned. In addition, as part of the development of sectoral strategies and programs, the modernization and reconstruction of the water infrastructure is envisaged.

To implement the goals and objectives of the NDS—for example, within the framework of the national strategy for adaptation to climate change for the period until 2030<sup>70</sup>—in order to adapt to climate change in the energy sector, the implementation of seven infrastructure projects related to the modernization and reconstruction of the following facilities is recommended: reconstruction of the emergency tunnel on the Vakhsh River in the region of the Baipaza landslide; modernization and reconstruction of the Varzob hydroelectric power station; modernization and reconstruction of the Central hydroelectric power station; modernization and reconstruction of Perepadnaya HPP; construction of a 4.7 MW hydroelectric power station in the Nazarmergan area in the Jirgital region; construction of a 15.5 MW Dombarchi hydroelectric power station in the Jirgital region; increasing the useful potential of the Nurek reservoir, etc.

To adapt to climate change for drinking water supply, it is recommended to implement international standards to manage the risks associated with drinking water in the context of climate change.

To adapt to climate change in the land reclamation and irrigation sector, the implementation of 15 projects is recommended, including: strengthening the material and technical base of the state unitary enterprise Selyozashchita; machine irrigation on an area of 24,000 hectares in the town of Mizorawat-Samgard in the Bobojon Gafurov district of the Sughd region; reconstruction of the hydraulic engineering facility of the Great Gissar Canal; construction and reconstruction of the irrigation system for the development of new waters and existing land reserves in the Jirgital region; construction of the Punuksay reservoir (reservoir for mudflows) in the Asht district of the Sughd region with a capacity of 3.8 million m<sup>3</sup>; reclamation, water supply of the existing area of the Matpari territory in the Isfara region, Sughd region; transfer of the Dakhkat part of the flow to the Daganayskaya reservoir in the Ganj district, Sughd region; construction of the Kafernigan reservoir (first stage); construction of a reservoir in the Isfanai Jabor area of the Rasulovsky district of the Sughd region; reclamation of new lands, water supply for existing lands Karadum in Kumsangir district of Khatlon region, and so on.

Although the actual cost of implementing this strategy has not been established, a key determinant in estimating the cost of building climate change resilience can be derived indirectly from the identified climate change activities—that is, investment projects in priority sectors including the water sector.

Sectoral programs also define financing schemes for their implementation. For example, for the implementation of the water sector reform program in Tajikistan for 2016 to 2025,<sup>71</sup> 35 activities related to the implementation of water sector reform are envisaged for a total amount of TJS 1,804.8 million (USD 258.5 million<sup>72</sup>); the financing scheme is provided through the centralized state budget at TJS 168.8 million (USD 24.1 million) and at the expense of the development partners TJS 1,636 million (USD 234.4 million). Infrastructure projects incorporating the drinking water supply, sanitation, reclamation, and irrigation subsectors total TJS 1,618.9 million (USD 231.9 million), which includes TJS 155.1 million (USD 22.2 million) from the centralized state budget and TJS 1,463.8 million (USD 209.78 million) from the development partners.

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<sup>70</sup> Approved by the decree of the Government of Tajikistan dated 2 October 2019, No. 482

[http://www.adlia.tj/show\\_doc.fwx?Rgn=134928](http://www.adlia.tj/show_doc.fwx?Rgn=134928)

<sup>71</sup> Approved by the decree of the Government of the Republic of Tajikistan dated 30 December 2015, No. 791,

[http://www.adlia.tj/show\\_doc.fwx?Rgn=126214](http://www.adlia.tj/show_doc.fwx?Rgn=126214)

<sup>72</sup> NBT exchange rate as of 30 December 30/2015 <https://nbt.tj/ru/kurs/kurs.php?date=12/30/2015>



To implement the goals and objectives of the NDS, short-term, five-year programs in the land reclamation and irrigation sector have been adopted by the government of Tajikistan. They define a financing scheme from specific sources.

For example, the state program for the development of new irrigated lands and the restoration of lands left out of agricultural use in Tajikistan for 2022 to 2027.<sup>73</sup> As part of the implementation of this program, it is planned to construct hydraulic structures for the development of 11,321 hectares of new irrigated land and restore 5,580 hectares of land that had gone out of agricultural use. The implementation of this program will allow the creation of an average of 64,000 new jobs (at a rate of up to four people/hectare) for the rural population of the country. The total amount of the program implementation is TJS 563.1 million (USD 49.8 million<sup>74</sup>).

For the development of new irrigated lands, a total amount of TJS 541.8 million (USD 47.9 million) is provided, of which TJS 37.4 million (USD 3.3 million) is allocated from the state budget, TJS 117 million (USD 10.3 million) from local budgets, TJS 201.6 million (USD 17.8 million) from funds provided for by state investment projects, TJS 117 million (USD 10.3 million) by attracting direct domestic and foreign investments and TJS 68.8 million (USD 6.08 million) from other sources of financing.

For the restoration of lands left out of agricultural use, TJS 21.3 million (USD 1.8 million) are provided, of which TJS 20.3 million (USD 1.8 million) comes from the state budget and TJS 0.8 million (USD 0.07 million) from local budgets. TJS 0.085 million (USD 7,500) will be spent on water supply services.

Another investment program to provide pumping stations of the Agency for Land Reclamation and Irrigation under the government of Tajikistan with modern energy-saving equipment for 2023 to 2027,<sup>75</sup> includes the modernization of 69 large and small pumping stations in the republic for a total amount of TJS 889.67 million (USD 74.67 million.<sup>76</sup>)

The financing scheme for this program was determined from the following sources—including from IFIs and international organizations—TJS 864.9 million (USD 72.6 million), from the share of financing of the government of Tajikistan TJS 12.3 million (USD 1.03 million) and funds from the private sector and other sources TJS 12.3 million (USD 1.03 million).

The total cost of the state program of bank protection works in Tajikistan for 2023 to 2027<sup>77</sup> is planned to be TJS 372.6 million (USD 34.13 million<sup>78</sup>). The implementation of this program is planned for the first stage of 2023-2025. Carrying out bank protection with a length of 92,670 meters at TJS 227.05 million (USD 20.80 million) which includes TJS 18.9 million (USD 1.73 million) from the republican budget, TJS 178.7 million (USD 16.37 million) from extra-budgetary sources, TJS 25.2

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<sup>73</sup> Approved by the decree of the Government of the Republic of Tajikistan dated 1 March 2022, No. 90, <https://www.alri.tj/storage/jPyEVQW6L8Jh5yGb1Q5.pf>

<sup>74</sup> NBT exchange rate as of 1 March 2022 <https://nbt.tj/ru/kurs/kurs.php?date=03/01/2022>

<sup>75</sup> Decree of the Government of the Republic of Tajikistan dated 30 June 2023 No. 296 'On the Investment Program to provide pumping stations of the Agency for Land Reclamation and Irrigation under the Government of the Republic of Tajikistan with modern energy-saving equipment for 2023-2027' [http://www.adlia.tj/show\\_doc.fwx?Rgn=145673](http://www.adlia.tj/show_doc.fwx?Rgn=145673)

<sup>76</sup> NBT exchange rate as of 30 June 2023 <https://nbt.tj/ru/kurs/kurs.php?date=06/30/2023>

<sup>77</sup> Approved by the decree of the Government of the Republic of Tajikistan dated 29 April 2023, No. 186, [http://www.adlia.tj/show\\_doc.fwx?Rgn=145177](http://www.adlia.tj/show_doc.fwx?Rgn=145177)

<sup>78</sup> NBT exchange rate as of 29 April 2023 <https://nbt.tj/ru/kurs/kurs.php?date=04/29/2023>

million (USD 2.30 million) from the local budget, and TJS 4.3 million (USD 0.4 million) from the payment for water supply services.

The program to improve the reclamation state of irrigated agricultural lands of Tajikistan for 2024 to 2028 is currently under consideration by the government of Tajikistan. Financial costs for the implementation of this program are planned to be TJS 60.32 million (USD 5.5 million<sup>79</sup>) to improve the reclamation condition of 49,070 hectares of irrigated agricultural land in Tajikistan.

Implementation of this program will be carried out mainly at the expense of funds for water supply services of TJS 13.71 million (USD 1.25 million), at the expense of the local budget of TJS 38.05 million (USD 3.47 million), and at the expense of the centralized budget of TJS 8.56 million (USD 0.78 million).

Also, currently under consideration by the government of Tajikistan is the land reclamation and irrigation development program for 2024 to 2028. To implement this program, 36 activities are planned, including eight infrastructure activities for the modernization and construction of hydraulic structures.

The total cost of the program is TJS 1.21 billion (USD 110.94 million<sup>80</sup>). This includes TJS 257.54 million from the republican budget (USD 23.50 million), through financing of investment projects TJS 948.61 million (USD 86.57 million) and through water supply services TJS 9.5 million (USD 0.86 million).

Also, the National Water Resources Strategy of Tajikistan up until 2040 is currently being developed, with 46 activities planned. After approval of this strategy—for the implementation of these activities—separate sectoral state programs will be drawn up for modernizing the infrastructure of drinking water supply and sanitation, land reclamation and irrigation with a financing plan for the activities.

When planning for financing the development of the water sector, the use of water in industrial production will also increase as industrial production expands and develops.

Industrial water supply in Tajikistan is carried out from surface and underground sources, mine water, circulating and re-sequential, municipal, and technical water supply systems.

For example, in 1990, 607 million m<sup>3</sup> of water was used in industrial production.<sup>81</sup> Now, only 240 million m<sup>3</sup> to 300 million m<sup>3</sup> of water or 2 percent to 3 percent of the total water consumption in the country is used in industrial production; in the future this volume may double. But, in any case, this remains the lowest rate of water use in manufacturing compared with other CA countries.

Along with planning financing for the water sector, it is also necessary to plan financing for wastewater treatment and disposal, and the functioning of wastewater operation and monitoring services in major industrial production. Unfortunately, neither data nor estimates of industrial wastewater discharges and associated surface and groundwater pollution are available.<sup>82</sup>

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<sup>79</sup> NBT exchange rate as of 1 January 2024 <https://nbt.tj/ru/kurs/kurs.php?date=01/01/2024>

<sup>80</sup> NBT exchange rate as of 1 January 2024 <https://nbt.tj/ru/kurs/kurs.php?date=01/01/2024>

<sup>81</sup> Water Sector Reform Program for 2016-2025, 2015, p.4

<sup>82</sup> Environmental performance reviews Tajikistan, Third review synopsis, United Nations 2017, p.35

Climate scenarios show that water demand will increase relative to supply in Central Asia in the future. Dry years will experience water shortages and reduced crop production.<sup>83</sup> Therefore, during financial planning, it is necessary to attract funds more for the modernization of the existing water infrastructure than for its restoration.

One additional source of funds is the private sector. The introduction of a private–public partnership mechanism in the water sector can help attract additional financial resources to modernize the existing water infrastructure. The government of Tajikistan may grant the right to manage state-owned water facilities within a limited territory on on-farm systems to individuals and legal entities on the basis of public–private partnership, agreement, concession, lease or other forms of partnership, taking into account compliance with the requirements of the legislation of the Republic of Tajikistan. In this regard, it is necessary to develop a procedure for introducing a public–private partnership mechanism into the water sector to attract additional funds in the development of various subsectors of the water sector.

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## Turkmenistan

As early as 2030, projected water shortages owing to decreased river flows, increased temperatures, and evaporation could be significant in the country.<sup>84</sup> To this end, the government, taking into account the importance and vulnerability of the agricultural sector against the backdrop of future global climate impacts on natural resources, including water, has begun to take preventative measures by integrating projects aimed at rational water management and soil improvement activities at both national and international levels. For the ongoing and prospective projects for modernization and/or (re)construction operations, the investments are enshrined in the national programs for socioeconomic development of various sectors or regions. The investments encompass mainly the building of the Altyn Asyr drainage collector network; construction and expansion of reservoirs; measures in river flow management and flood prevention; capacity increasing of irrigation canals and drainage networks; and land reclamation.

Turkmen Lake Altyn Asyr: In the context of the growing impact of climate change, treated collector-drainage waters will arguably be a timely contribution of water fund to the development of the national production and economic sectors of Turkmenistan. With the total area of irrigated land of about 1.8 million hectares and with the country's land reclamation fund, suitable for development with more than 17 million hectares, return water may be a significant reserve to reduce the water deficit.<sup>85</sup> Government efforts to reuse treated water are supported by the expansion of irrigated lands. In 2019 to 2025, it is planned to put into operation new irrigated lands on 3,900 hectares using treated water without increasing the use of water from main sources.<sup>86</sup>

Government actions towards the solution of water issues started in 2000 with the adoption of the decree 'On the creation of Garagum lake.' The decree envisaged the construction of the complex of drainage paths and appropriate structures for drainage of collector-drainage water to the Karashor lowland and their fullest use for the needs of the country's economy. Soon, the first phase of the lake—later called Altyn Asyr (Golden Age)—had begun. Later, under the government initiative, the resolution approving the concept of development of the Turkmen lake Altyn Asyr for 2019-2025 and

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<sup>83</sup> ADB Regional Technical Assistance TA-9977, Central Asia Regional Economic Cooperation (CAREC): Developing the Water Pillar, Scoping Report, Draft Final, 27 September 2021

<sup>84</sup> Nationally Determined Contribution of Turkmenistan under the Paris Agreement, 2022. p.19

<sup>85</sup> Nationally Determined Contribution of Turkmenistan under the Paris Agreement, 2022. p.18

<sup>86</sup> SEDP 2019-2025

the action plan for its implementation were signed.<sup>87</sup> Divided into three phases, the first stage was put into operation in 2009, which included a laying of two large drains through the Karakum, the Dashoguz branch, as well as the main collector, which originates in the east of the country in Lebap province, passing through the territories of Mary, Akhal, and Balkan provinces. After the construction of the second and third stages, a single drainage system will be formed covering all the fields of the country.<sup>88</sup> In future phases, after treatment, water from the water collectors of the new complex of mudflow diversion facilities near Ashgabat will also be sent to the Altyn Asyr lake. It is noted that filling the lake with fresh rainwater will reduce a level of mineralization of the lake and have a positive effect on the natural and economic oasis that is being formed around it.<sup>89</sup> For the implementation of the concept, along with the government entities, the members of the UIET and other foreign companies will take an active part.<sup>90</sup>

**Table 6. High- and medium-cost projects related to construction or reconstruction of pits, canal bed, and reservoirs**

Project	Location	Capacity	Value, thousand TMT
Construction of a new water pit with a capacity of 4,000 million m <sup>3</sup> of the 15 years of Independence (Zeid) reservoir in the upper reaches of the Karakum River	Karakum, Lebap	4 billion m <sup>3</sup>	Over 1,360,000.00
Construction of phase II of 15 years of Independence reservoir	Karakum, Lebap	1.65 billion m <sup>3</sup>	Over 117,500.00
Construction of a pit for an additional reservoir in the upper reaches of the Karakum River	Karakum, Lebap	3 billion m <sup>3</sup>	Over 1,000,000.00
Reconstruction of Shasenem canal bed and construction of a reservoir by installing an impervious lining	Dashoguz province	100,18 km; 90 million m <sup>3</sup>	About 878,000.00
Construction of water reservoir	Gorogly district, Dashoguz province	plant	Over 400,000.00
Reconstruction of the Kopetdag reservoir by increasing its capacity by 150 million m <sup>3</sup>	Ahal province	150 million m <sup>3</sup>	Over 316,000.00

Reservoirs: It is noteworthy that more projects of the program of the President of Turkmenistan on socioeconomic development for 2022-2028 (SEDP 2022-2028) with large-scale investments are located in the reservoirs section, where only four of them take over 71 percent of the financing of the reservoirs group. Requirements on creating a sufficient water fund at state level have been raised since 2000. After 2010, the state initiatives on related issues started taking place by introducing high value projects to be implemented along the Karakum river over a period of 13 to 16 years. These are: the construction of a new water pit with a capacity of 4 billion m<sup>3</sup> of the 15 Years of Independence (Zeid) reservoir in the upper reaches of the Karakum river and construction of the second phase of the 15 Years of Independence reservoir, expected to be commenced in 2027. In the

<sup>87</sup> 'Turkmenistan Golden age' state news agency, 2019.

<https://turkmenistan.gov.tm/ru/post/33407/utverzhdna-kontseptsiya-osvoeniya-regiona-turkmenskogo-ozera-v-2019-2025-godakh>

<sup>88</sup> CAWATER info. 2009. [http://www.cawater-info.net/review/turkmen\\_lake\\_11.htm](http://www.cawater-info.net/review/turkmen_lake_11.htm)

<sup>89</sup> 'Orient' information agency. 2022. <https://orient.tm/ru/post/42035/voda-iz-seleotvodnyh-sooruzhenij-ashhabada-budet-napolnyat-ozero-altyn-asyr>

<sup>90</sup> 'Turkmenistan Golden age' state news agency. <http://www.turkmenistan.gov.tm/?id=18677>

future, the total capacity of this reservoir system will be 3.8 billion m<sup>3</sup>, one of the largest in the country.<sup>91</sup>

In addition to the construction works related to reservoirs currently underway, the two new high-value projects are scheduled to begin in 2024-2025. Thus, the project, the construction of a pit for an additional reservoir with a capacity of up to 3 billion m<sup>3</sup>, with allocation of one of the large-scale financial investments, will be another solution to ensure uninterrupted water supply and a stable reserve for the areas fed by the Karakum river. Another urgent task of a high-value project is the construction of the canal bed and reservoir in Dashoguz province. The importance of creating new reservoir capacities for the province is emphasized by another medium value project, the construction of a reservoir in Gorogly district (SEDP 2022-2028). In addition to projects of high and medium cost, there are important tasks to extend the water flows of the Karakum river to more distant areas. Thus, according to the program, the channel of the Karakum river will be lengthened by 200 km and water will be supplied to the lands of the southwest of the Balkan province. The project of the river to be implemented in the western part of the country involves the construction of three reservoirs, which will allow thousands of hectares of land to be returned to circulation: one, put into service in 2021, in the area of Bereket city with a capacity of 18 million m<sup>3</sup> and two, in another village of the region each with 47.3 million m<sup>3</sup> capacity to be commenced in coming years. At the 1,006th kilometer of the riverbed, a regulating structure is also being built to improve the water supply of one of the cities of the region, Serdar.<sup>92,93</sup> Efforts are also being made to increase water reserves in the reservoirs of the south-eastern province, Mary, by expanding the capacity of the Khauzkhani and the Saryyazy reservoirs by 625 million m<sup>3</sup> and 600 million m<sup>3</sup> respectively. Furthermore, in southern Turkmenistan, in Akhal province, the construction of an 80 million m<sup>3</sup> reservoir and the reconstruction of Kopetdag reservoir by increasing its capacity by 150 million m<sup>3</sup> are also planned, thus demonstrating the country's commitment in forming water reserves by creating new and additional reservoir capacities planned for the next few years.

In general, SEDP 2022-2028 includes 16 projects for reconstruction or for new or expanded reservoir capacities up to about 10,350 km<sup>3</sup> in total, to be realized in all provinces and by the Karakum river. The financial investments of TMT 4.7 billion (over USD 1.3 billion) for expansion or for new reservoir capacities will be secured by government funds. At the same time, international funding in the country's water sector is being sought within the framework of international programs and development projects—although this share is comparably low, excluding capital investments and/or aimed at providing technical assistance, capacity building, or improvement of institutional policy (such as, the Tuyamuyun HEC demonstration project within the framework of the European Union's Nexus regional project in Central Asia).

River flow management and flood prevention measures: Water pumping stations and measuring devices. Another method for the efficient and uninterrupted use of the country's water resources against the backdrop of projected drought and resultant possible water shortage, is the installation of appropriate water pumping units along the main surface waters. The effectiveness of pumps was also emphasized by the head of the UIET during the high-level government meeting on water resource management. According to him, on the Karakum river, pumping stations provide 35 percent

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<sup>91</sup> NewsCentralAsia.2022. <https://www.newscentralasia.net/2022/07/12/turkmenistan-povestka-v-oblasti-vodosberezhniya-v-deystvii/>

<sup>92</sup> 'Turkmenistan Golden age' state news agency, 2021. <https://turkmenistan.gov.tm/ru/post/52483/novyy-oblik-karakum-reki>

<sup>93</sup> ICWC, 2019. Information bulletin. Water Economy, irrigation and ecology of Central Asia. <http://www.cawater-info.net/information-exchange/e-bulletin/25-29-03-2019.pdf>

to 50 percent savings in water raised by pumps 180 meters above the water level,<sup>94</sup> thus indicating their high efficiency. Another persistent challenge is the assessment of changes in river flow. According to the NDC (2022) report it is important to note the impacts of Amu Darya flows on water resource management.<sup>95</sup> The government is initiating various measures to try to resolve this challenge. Recently, about 13 ultrasonic water metering devices were installed along the bed of the Murgab river in Mary province.<sup>96</sup> In addition to modern technical devices, skills for the proper assessment of river flow are also essential. Recent national activities include the seminar held at the end of 2022, where the local specialists learnt how to use hydrological equipment and instruments properly to monitor the hydrological regime of rivers, lakes, reservoirs, and other bodies of water.<sup>97</sup> Project implementation is managed by the State Committee for Water Management of Turkmenistan and executed by local or international business companies, the tenders for which are determined by the committee.<sup>98,99</sup> The projects may also be carried out by international development organizations within the country or regional programs.<sup>100</sup>

River flow management and flood prevention measures: Measures against flooding, mud flows, and the protection of river banks. In Turkmenistan, mudflows are observed in 229 watercourses. For almost 100 years, more than 1,500 cases of mudflows have been recorded on 80 watercourses of the Kopetdag mountain, caused by intense rainfall. Extreme low temperatures which create ice dams on the Amu Darya river also cause flooding on adjacent territories.<sup>101</sup> Moreover, with about 13 billion m<sup>3</sup> to 15 billion m<sup>3</sup> of water flow, some 60 million m<sup>3</sup> to 65 million m<sup>3</sup> of sand and silt enter the Karakum river annually from the Amu Darya, some of which settles in reservoirs and on the river bed. Thus, given the risks of flooding and siltation, work on flood and sediment control measures and the construction of dams, along with other cleaning activities, has been and continues to be a high priority and carried out in accordance with socioeconomic development programs.

River flow management and flood prevention measures: Other technical and engineering work. Numerous hydrotechnical, engineering, and water line reconstruction and construction works are reflected in the main state document on the development of national economic sectors. The projects are to be implemented during 2015-2030. Featured projects of this group of investments are the construction of a complex of hydrotechnical facilities at Dostluk reservoir in Sarahs district, Ahal province and the construction of the second line of the Turkmen River and the second stage of water facility in Dashoguz province to be carried out during 2019 to 2030.

Capacity increasing of irrigation canals and drainage networks: Besides the major projects on water resources management, there are other grouped tasks that maintain the development of the country's agriculture, private business, and other interconnected sectors. For countries experiencing higher water stress, the deployment of water saving techniques is essential. The climate-adaptive, modern irrigation and drainage systems are vital in the context of increasing climate threats for soil

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<sup>94</sup> 'TDH' Turkmenistan State News, 2021. <https://tdh.gov.tm/ru/post/27154/prezident-turkmenistana-berezhnoe-ispolzovanie-zemelno-vodnyh-resursov-osnova-prodovolstvennogo-izobiliya>

<sup>95</sup> Nationally Determined Contribution of Turkmenistan under the Paris Agreement, 2022

<sup>96</sup> 'Meteojournal,' 2021. <https://meteojournal.ru/na-reke-murgab-sozdana-avtomatizirovannaya-sistema-vodouchyota/>

<sup>97</sup> 'Orient' information agency, 2022. <https://orient.tm/ru/post/43237/v-turkmenabade-proshel-trening-po-povysheniyu-professionalizma-specialistov-gidrometeosluzhby>

<sup>98</sup> BT. News and information service, 2021. <https://business.com.tm/ru/info/5044/gosudarstvennyi-komitet-vodnogo-hozyaistva-obyavlyat-mezhdunarodnyi-tender-na-priobretenie-zapasnyh-chastei>

<sup>99</sup> 'Turkmenportal' online news agency, 2022. <https://turkmenportal.com/catalog/21046>

<sup>100</sup> 'Meteojournal,' 2021. <https://meteojournal.ru/na-reke-murgab-sozdana-avtomatizirovannaya-sistema-vodouchyota/>

<sup>101</sup> Nationally Determined Contribution of Turkmenistan under the Paris Agreement, 2022. p.13



fertility and water scarcity caused largely by growing droughts and irrational water consumption.<sup>102</sup> In this context, the introduction of progressive irrigation methods—that is, drip irrigation and sprinkling, which demonstrated high effectiveness by saving water by 30 percent to 40 percent<sup>103</sup>—may be deployed further. Moreover, the advanced irrigation channels and drainage networks are intended for the development of the new irrigated lands emphasized in SEDP 2019-2025.

**Land reclamation:** With drought projected to be an increasing threat, along with floods posed by weather hazards, prevention measures and proper land reclamation are becoming increasingly important in the country. One of the solutions to this challenge is claimed to be the collection of return water and its discharge into the specially constructed lake Altyn Asyr. As stated, great efforts have been made by the relevant governing bodies to resolve the lingering problem, which has been the root cause of soil degradation and river pollution. Apart from this historical project, there are several projects to be implemented all over the country to improve more than 230,000 hectares of land reclamation. The recipients of the state funds are the Ministry of Agriculture of Turkmenistan and the State Committee for Water Management of Turkmenistan.

**Capacity building:** In addition to government projects, there are initiatives jointly supported and financed by IFIs, development organizations, or climate funds. Given the growing impacts of climate on water infrastructure, the government has begun successfully to take early action to prevent risks by integrating capacity-building and awareness-raising measures among key stakeholders. In order to provide comprehensively researched and up-to-date information, including at international level, the country, together with development organizations, has agreed to conduct a number of capacity-building activities.

Today, UNDP in Turkmenistan in cooperation with the former Ministry of Agriculture and Environmental Protection of Turkmenistan are launching projects on advancing the knowledge and skills of key stakeholders.

In mid-June 2023, a series of seminars on adaptation to climate change and water resources were launched within the project ‘[Developing a National Adaptation Planning Process in Turkmenistan](#).’ The main goal of the seminars was to inform and build the capacity of the target group to respond to the complex risks associated with climate change in Turkmenistan, and to introduce adaptation measures in planning the utilization of water resources.<sup>104</sup> As mentioned, another event organized in 2022 within the project was the training to improve the professionalism of specialists of the hydrometeorological service of the country.<sup>105</sup>

To achieve improved soil quality and effective water management, as well as maintaining ecosystems, a large-scale project ‘[conservation and sustainable management of land resources and high nature value ecosystems in the Aral Sea basin for multiple benefits](#)’ was launched to improve the knowledge of the local society. To date, within the project, a series of workshops and seminars

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<sup>102</sup> FAO, World Bank, 2022. Modernization of Irrigation Systems in Central Asia. Concept and Approaches. <https://www.fao.org/3/cb8230ru/cb8230ru.pdf>

<sup>103</sup> Nationally Determined Contribution of Turkmenistan under the Paris Agreement, 2022. p.18

<sup>104</sup> ‘ArzuwNews,’ 2023. <https://arzuw.news/proon-organizoval-a-turkmenistane-treningi-po-adaptacii-k-izmeneniju-klimata>

<sup>105</sup> ‘Orient’ information agency, 2022. <https://orient.tm/en/post/43258/training-was-held-turkmenabat-improve-professionalism-specialists-hydrometeorological-service>

were held at the end of 2022 and in March and April 2023.<sup>106,107,108</sup> The project aims to promote the mitigation of land degradation through an initial investment in participatory integrated land-use planning to restore and improve land and water use, considering key biodiversity habitats to provide critical ecosystem services. The project will have a duration of five years and will attract a total of USD 4,583,196 of GEF investment.<sup>109</sup>

Within the framework of the project ‘integrated natural resource management in drought-prone and saline agricultural landscapes in Central Asia and Turkey’ supported by FAO and GEF, training on mapping saline lands was conducted jointly with the Global Soil Partnership in April 2022.<sup>110</sup>

Also, the series of skills enhancing events were held within the ongoing ‘USAID regional project on water resources and environment.’ This involved workshops on methods and software for long-term planning of water and energy resources; training on an automated water monitoring system to be installed on Karakum river; and training on changes in legislation and new strategies for the development of the water sector, as well as ways to ensure the financial sustainability of the activities of the Small Basin Council (SBC) of the Murgab River.<sup>111</sup>

In addition, several sessions were held on raising the skills and knowledge of a target group of water, agriculture, and related sectors within the recently completed projects. Within the framework of the Tuyamuyun HEC demonstration project—implemented by Turkmenistan and Uzbekistan within the framework of the ‘Central Asian dialog to promote sectoral financing through the water–energy–food nexus’—three technical working group meetings were held at the beginning and end of 2022, along with technical solutions for the disposal of sludge in a riverbed reservoir proposed by international consultations.<sup>112</sup>

Another recent series of knowledge-enhancing events was organized with the assistance of UNDP and GEF within the completed project: ‘Supporting climate-resilient economic activities of agricultural communities in the arid regions of Turkmenistan.’<sup>113,114</sup>

In general, in reviewing the state plans for water sector development, the following aspects are highlighted:

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<sup>106</sup> UNDP Turkmenistan, website. <https://www.undp.org/turkmenistan/press-releases/undp-and-partners-held-workshop-water-diplomacy-strengthen-national-capacity-participate-regional-cooperation>

<sup>107</sup> UNDP Turkmenistan, website, 2023. Press releases. <https://www.undp.org/turkmenistan/press-releases/undp-increases-knowledge-farmers-horticulture>

<sup>108</sup> UNDP Turkmenistan, website, 2023. Press releases. <https://www.undp.org/turkmenistan/press-releases/undp-and-partners-held-workshop-water-diplomacy-lebap-velayat>

<sup>109</sup> UNDP Turkmenistan, website. Projects. Conservation and sustainable management of land resources and high nature value ecosystems in the Aral Sea basin for multiple benefits. <https://www.undp.org/turkmenistan/projects/conservation-and-sustainable-management-land-resources-and-high-nature-value-ecosystems-aral-sea-basin-multiple-benefits>

<sup>110</sup> ‘Orient’ information agency, 2022. <https://orient.tm/en/old/post/37288/specialists-turkmenistan-were-trained-make-maps-saline-soils>

<sup>111</sup> CA water info. Chapter 5. Key water events in Central Asia countries

<sup>112</sup> ‘Orient’ information agency, 2021. <https://orient.tm/ru/post/26739/turkmenistan-i-uzbekistan-zajmutsya-ochistkoj-ekosistemy-transgranichnogo-gidrouzla> <https://business.com.tm/post/7394/water-and-energy-cooperation-in-amu-darya-river-basin>

<sup>113</sup> UNDP Turkmenistan, website, 2022. Press releases. <https://www.undp.org/ru/turkmenistan/press-releases/proon-prodvidaet-planirovanie-adaptacii-s-uchetom-gendernykh-aspektov-v-turkmenistane>

<sup>114</sup> UNDP Turkmenistan, website, 2023. Press releases. <https://www.undp.org/turkmenistan/press-releases/undp-promotes-introduction-integrated-water-resources-management-countrys-curricula>

- Large and long-term investments in the state water sector encompass mainly projects to ensure water security through the construction and expansion of reservoir capacities, as well as two other large-scale projects—the construction of a drainage collector network and dams along the Amu Darya river—which will be implemented over the period of 35 and 24 years, respectively. At the same time, the growing economy and population pressure along with warming climate demand a long-term vision from water sector management. The CA states have developed their visions; however, they lack long-term infrastructure strategies.<sup>115</sup> In this regard, the sustainable and water infrastructure development strategies for long periods with due financing investment plans could be integrated for the state water sector.
- At the same time, cooperation and consensus upon the implementation of large-scale infrastructure projects are essential. Cooperation is seen one of the mechanisms in the successful management of water resources and financial investments.<sup>116</sup> Thus, in the context of the transboundary nature of water resources and because they are shared by more than one state in the region, any large-scale infrastructure investment requires a more careful and collaborative approach<sup>117</sup> and is recommended to realize this in agreement with other riparian states.
- As seen from the multi-year SEDP, most of the infrastructure investment needs are emerging from large-scale new projects or upgrades of irrigation units. The National Rural Program reflects plans on the construction of new water supply and treatment plants associated mainly with the construction of new buildings, whereas less is found on the repair of existing infrastructure. To this end, the due financing schemes for the rehabilitation of existing municipal water lines would avoid surplus or *ad hoc* expenditures in future.

### Supply and demand sides of the water sector and stimulus for private funds

Demand for infrastructure investment in the region is around 5 percent to 7 percent of GDP of the countries with potential to increase if climate conditions are reviewed. Moreover, the financing gap would widen further if the economy develops along with the growth in population and climate pressures.<sup>118</sup>

According to the theories reviewed (Böhmelt *et al*, 2013),<sup>119</sup> the main three demand side drivers are likely to have the greatest effect on water resources: population density, agricultural productivity,

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<sup>115</sup> Abdualleyev I & Akhmedov Sh, 2022. Financing Infrastructure in Central Asia. In: *Unlocking Private Investment in Sustainable Infrastructure in Asia*.

[https://www.researchgate.net/publication/364554231\\_Financing\\_Infrastructure\\_in\\_Central\\_Asia](https://www.researchgate.net/publication/364554231_Financing_Infrastructure_in_Central_Asia)

<sup>116</sup> Böhmelt T, Bernauer T, Buhaug H, Gleditsch N, Tribaldos T, & Wischnath G, 2013. Demand, supply, and restraint: Determinants of domestic water conflict and cooperation.

<https://www.sciencedirect.com/science/article/pii/S0959378013002264>

<sup>117</sup> Abdualleyev I & Akhmedov Sh, 2022. Financing Infrastructure in Central Asia. In: *Unlocking Private Investment in Sustainable Infrastructure in Asia*.

[https://www.researchgate.net/publication/364554231\\_Financing\\_Infrastructure\\_in\\_Central\\_Asia](https://www.researchgate.net/publication/364554231_Financing_Infrastructure_in_Central_Asia)

<sup>118</sup> Abdualleyev I & Akhmedov Sh, 2022. Financing Infrastructure in Central Asia. In: *Unlocking Private Investment in Sustainable Infrastructure in Asia*.

[https://www.researchgate.net/publication/364554231\\_Financing\\_Infrastructure\\_in\\_Central\\_Asia](https://www.researchgate.net/publication/364554231_Financing_Infrastructure_in_Central_Asia)

<sup>119</sup> Böhmelt T, Bernauer T, Buhaug H, Gleditsch N, Tribaldos T, & Wischnath G, 2013. Demand, supply, and restraint: Determinants of domestic water conflict and cooperation.

<https://www.sciencedirect.com/science/article/pii/S0959378013002264>

and economic development.<sup>120</sup> In Central Asia, the population is expected to grow to 95 million from today's 78 million.<sup>121</sup> Even in the absence of demographic growth, the demand for freshwater in developing countries is likely to increase with economic development and associated processes, such as industrialization, energy production, or the expansion of irrigation systems in arid regions.<sup>122</sup> Turkmenistan is highly industrialized, with energy production and associated processing operations, and would demand more resources, including water.

While there is certain increase for demand drivers in the region, the supply aspects are related to the seasonal variations or long-term changes in climate patterns as ambient temperature and precipitation that affect the level of water resources. In the shorter term, human determinants like water reservoirs, dam facilities, and related systems that are manageable and predictable, as well as groundwater extraction or sea desalination, are found to be the aspect of water supply that is most impacted.<sup>123</sup> Adequate water availability is also ensured by innovative and efficient systems to minimize water loss and stimulate rational water utilization. However, in CA countries the state of the water supply could face further challenges owing to aging water supply systems, water losses, and the unstable supply schedule. In Turkmenistan, while the overall potable water supply indicators has improved over time,<sup>124</sup> the water supply for agricultural purposes might face challenges owing to periodic water shortages induced by lower river levels as a result of rising temperatures and the general state of the irrigation network, which requires an upgrade.

The state financing of the water sector of Turkmenistan is also largely interrelated with the demand and supply drivers of water resources. In order to cope successfully with growing demands and maintain adequate water supplies, a well-functioning financial mechanism with sufficient funds is needed—in particular with diversified financial sources, including private investments.

Currently, CA water management along with water infrastructure is state dominated with limited space for non-governmental players, including the private sector, where the main barrier for engagement is the higher level of regulation.<sup>125</sup> Since the full scale entrance for the private sector is impeded by a number of known obstacles, the more realistic approach of attracting inward investment is the deployment of public–private partnerships (PPPs).<sup>126</sup> They are also a good opportunity for the private sector to engage in the policymaking process and management of water resources.<sup>127</sup> Recently in Turkmenistan, certain activities were made for PPPs to attract private investment facilitated by the law on public–private partnership (2021). Nevertheless, in the water sector the PPPs are not widespread and can be found to engage mainly in lease relations for artificial

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<sup>120</sup> Böhmelt T, Bernauer T, Buhaug H, Gleditsch N, Tribaldos T, & Wischnath G, 2013. Demand, supply, and restraint: Determinants of domestic water conflict and cooperation.

<sup>121</sup> <https://www.eurasian-research.org/publication/un-population-prospects-case-of-central-asia/>

<sup>122</sup> Böhmelt T, Bernauer T, Buhaug H, Gleditsch N, Tribaldos T, & Wischnath G, 2013. Demand, supply, and restraint: Determinants of domestic water conflict and cooperation.

<sup>123</sup> Böhmelt T, Bernauer T, Buhaug H, Gleditsch N, Tribaldos T, and Wischnath G, 2013. Demand, supply, and restraint: Determinants of domestic water conflict and cooperation.

<sup>124</sup> UN Turkmenistan, 2023. Voluntary National Review of Turkmenistan on the progress of implementation of the Global Agenda for Sustainable Development

<sup>125</sup> Abdualleyev I & Akhmedov Sh, 2022. Financing Infrastructure in Central Asia. In: *Unlocking Private Investment in Sustainable Infrastructure in Asia*.

[https://www.researchgate.net/publication/364554231\\_Financing\\_Infrastructure\\_in\\_Central\\_Asia](https://www.researchgate.net/publication/364554231_Financing_Infrastructure_in_Central_Asia)

<sup>126</sup> Abdullaev I, Strikeleva E, & Rakhmatullaev Sh, 2020. Water sector of Central Asia and Afghanistan. Analysis of current situation and ways of further development. USAID

<sup>127</sup> Abdualleyev I & Akhmedov Sh, 2022. Financing Infrastructure in Central Asia. In: *Unlocking Private Investment in Sustainable Infrastructure in Asia*.

[https://www.researchgate.net/publication/364554231\\_Financing\\_Infrastructure\\_in\\_Central\\_Asia](https://www.researchgate.net/publication/364554231_Financing_Infrastructure_in_Central_Asia)

or natural reservoirs.<sup>128</sup> The engagement of PPPs in other fields, such as irrigation services, would increase their presence and hence private investments.<sup>129</sup> Additionally, the increasing water stress induced by the warming climate and aging infrastructure—requiring more climate-resilient and adaptive tools—will demand more sustainable and efficient financial mechanisms, which in turn could provide room for innovative solutions that are more effective when other actors—such as business—participate, thereby attracting more private funds into the water sector. Recent laws on soft loans and providing land for long-term use have stimulated the attraction of inward business funds for the purchase of various water-saving devices (sprinkler technologies),<sup>130,131</sup> which could increase further provided the state plans to expand the areas of irrigated land (SEDP 2019-2025). However, the level of private engagement is currently limited in the purchasing of such technologies or in construction (such as, building irrigation facilities<sup>132</sup> or water treatment plants<sup>133</sup>). Private involvement could also be expanded through the utilization of a broader specter of innovative technologies, by expanding state support in terms of loans for farmers or through involving semiprivate operations and service companies. Another way to increase the role of the private sector and its funds could be incentivizing efficiency among larger water users, who might consider the application of efficiency technologies to reduce their water footprint.<sup>134</sup>

In general, the diversification of fund sources and, particularly, private capital would improve water financing and reduce the burden of continuous government financing, which has been facing challenges to cover other national sectors as well. Additionally, to stimulate the mobilization of private capital and to combine the efforts of various players more effectively:

- A more favorable business climate is ensured where predictable regulation, and transparent and cooperative policy for the private sector is supported
- The flexibility which is rarely practiced in the region is to be considered to maintain long-term commitments under ever-changing circumstances, while ensuring regulatory stability standards
- A clear distribution of responsibilities between stakeholders is to be ensured: PPPs, as well as between representatives of all levels of the management system and agencies

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## Uzbekistan

Uzbekistan is very susceptible to the effects of climate change, which adversely affect agriculture, water resources, human health, and ecosystems. Multiple studies have shown that Uzbekistan's

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<sup>128</sup> Kepbanov Y, Horák S, & Ovezmyradov B, 2022.

[https://lucris.lub.lu.se/ws/portalfiles/portal/116796662/web\\_RRSL\\_2022\\_3\\_The\\_investment.pdf](https://lucris.lub.lu.se/ws/portalfiles/portal/116796662/web_RRSL_2022_3_The_investment.pdf)

<sup>129</sup> Abdualleyev I & Akhmedov Sh, 2022. Financing Infrastructure in Central Asia. In: *Unlocking Private Investment in Sustainable Infrastructure in Asia*.

[https://www.researchgate.net/publication/364554231\\_Financing\\_Infrastructure\\_in\\_Central\\_Asia](https://www.researchgate.net/publication/364554231_Financing_Infrastructure_in_Central_Asia)

<sup>130</sup> Arzuw news, 22 July 2020. UNDP supports the development of water-saving technologies in Turkmenistan.

<https://arzuw.news/proon-podderzhivaet-razvitie-vodosberegajushhih-tehnologij-v-turkmenistane>

<sup>131</sup> Jumakuliyev D, 2023. Water sector financing in Turkmenistan. In: *Water Infrastructure in Central Asia: Promoting Sustainable Financing and Private Capital Participation*. CAREC Institute. p.12

<sup>132</sup> TDH, 5 April 2021. President of Turkmenistan: careful use of land and water resources is the basis of food abundance. <https://tdh.gov.tm/ru/post/27154/prezident-turkmenistana-berezhnoe-ispolzovanie-zemelno-vodnyh-resursov-osnova-prodovolstvennogo-izobilija>

<sup>133</sup> nCa, 12 January 2022. <https://www.newscentralasia.net/2022/12/01/v-turkmenistane-otkrylos-bezotkhodnoye-vodochistnoye-sooruzheniye/>

<sup>134</sup> Abdualleyev I & Akhmedov Sh, 2022. Financing Infrastructure in Central Asia. In: *Unlocking Private Investment in Sustainable Infrastructure in Asia*.

[https://www.researchgate.net/publication/364554231\\_Financing\\_Infrastructure\\_in\\_Central\\_Asia](https://www.researchgate.net/publication/364554231_Financing_Infrastructure_in_Central_Asia)

water industry will face significant challenges in the next years (Minnebo & Ardelean, 2021). The complex network of aged canals, pumps, and treatment facilities is deteriorating owing to neglect and the passage of time. Based on estimations, natural irrigation systems experience an annual loss of 14 billion m<sup>3</sup> or 36 percent of water without yielding any economic benefits (Gazeta.uz 2023). Moreover, although public spending has increased significantly in recent years, it has not adequately met the needs for replacing assets, maintaining infrastructure, and expanding the WSS services in the country.

A rising human population and a growing economy increasingly burden the limited water supply. The alteration in precipitation patterns and the rise in temperatures exacerbate existing vulnerabilities, introducing an extra layer of intricacy to the country's food security. As a percentage of GDP, Uzbekistan's public spending on agriculture is three times more than that of most non-OECD nations and ten times higher than that of most OECD countries (World Bank, 2019). Despite Uzbekistan's substantial agricultural investment, the country has not achieved significant development results.

The long-term sustainability of the water sector is further jeopardized by a combination of factors, including funding required to upgrade, maintain, and sustain water infrastructure. Taking prompt action to address these concerns is crucial for creating a future where public health is protected, economic prosperity thrives, and agricultural plenty prevails (ADBa, 2019).

The government needs a flexible and broad set of financing mechanisms to meet these difficulties and finance essential water infrastructure repairs and innovations. Innovative funding strategies and effective water management hold the key in this aspect. The country is crafting a comprehensive water finance plan that integrates sectoral strategies to secure the long-term viability of its water infrastructure and entice investors. This can be done by integrating conventional and new schemes, constructing a strong institutional framework, and placing a premium on social responsibility.

Based on the latest data, the water sector is allocated around USD 1 billion in budget appropriations annually, placing it fourth in terms of funding priority behind education, health, and agriculture. Unfortunately, the intended benefit is not received owing to inaccurate assessments and outdated methods of managing water resources (Gazeta.uz 2023). In preparation for 2024, the government has designated substantial funds for water management. This includes financial assistance for water-conserving technologies and infrastructure projects valued at UZS 1.7 trillion (USD 139.2 million) and an additional USD 300 million from IFIs (kun.uz 2023). The following are a few crucial financial mechanisms that should be considered for water infrastructure in Uzbekistan:

### **Public funding**

**State budget:** The government allocates part of the state budget to enhance and sustain water infrastructure. It should be noted that the state budget in Uzbekistan continues to be a significant source of financing in the water industry (Abdullaev & Akhmedov, 2023). However, these financial resources are often limited and insufficient to meet the growing needs. Furthermore, it is noteworthy that the economy of Uzbekistan allegedly suffers an annual loss of around USD 5 billion in earnings because of water loss (kun.uz 2023).

**Official development assistance (ODA):** International funders such as the WB, ADB, and EIB provide financial aid through grants and loans to back water infrastructure projects. The funding is crucial for supporting important projects and strengthening their capacity to carry them out. Uzbekistan can consider seeking partnerships with non-traditional sponsors, such as private foundations or climate funds, to enhance its conventional sources of ODA. The average yearly inflow of ODA ranged from USD 420 million to USD 510 million between 2010 and 2020, according to WB and OECD data (2023).

The allocated funds supported notable endeavors, including the Tuyamuyun Hydropower Plant. However, the dependence on ODA may be limited and may affect the prioritization of policy goals.

### **Private sector participation**

Public–private partnerships (PPPs): PPPs include a collaborative endeavor between the government and private firms to finance, build, and oversee water infrastructure. This strategy can potentially attract private investment and expertise while enabling the government to retain authority over policy and regulation. Diverse PPP models, such as build–operate–transfer (BOT) or build–own–operate (BOO), use distinct frameworks for distributing risks and rewards to appeal to a broad spectrum of private investors. For example, The PPP Development Agency's portfolio for 2022 to 2026 comprises a total of 154 investment projects. Their whole estimate amounts to USD 13.99 billion (kun.uz).

Concessions: The government provides concessions to private companies, allowing them to oversee water infrastructure for a certain duration in return for a portion of the earned revenue. This may serve as a motivation for private enterprises to allocate resources towards improving efficiency and enhancing quality of service. There is a scarcity of information on concession models in Uzbekistan's water industry. Nevertheless, the experience of Kazakhstan provides valuable lessons. Implementing concessions has played a significant role in achieving a 15 percent decrease in water losses in Almaty, owing to effective management practices.

Water tariffs: Water tariffs serve as the primary funding source for water systems, providing a crucial mechanism for maintaining financial stability. They support the provision of clean water and sanitation services by recovering operating expenses, but their impact goes beyond simple financial transactions. Farmers are incentivized to be more mindful of water consumption using smart pricing systems, preserving precious resources for future generations. However, their design requires skillfulness since the distinction between cost recovery and social equality is rather tight. The continual difficulty is balancing making products affordable for vulnerable areas and providing incentives for responsible consumption. This requires the use of new strategies and clear communication.

Viability gap funding: Government support through grants or subsidies may bridge the financial disparity between projected revenue and investment expenses, thus enhancing the attractiveness of projects for private businesses.

Performance-based contracts: Private operators may be incentivized to optimize efficiency by directly linking compensation to quantifiable performance indicators, such as reduced water losses or improved service quality.

### **Innovative financing mechanisms**

Green bonds: Green bonds are financial products designed expressly to finance efforts that benefit the environment and climate. The revenues generated from these bonds are exclusively allocated to these projects. These projects may include a wide range of areas, including:

- Developing renewable energy sources by constructing solar and wind farms, improving hydroelectric facilities, and enhancing energy infrastructures
- Implementing energy-saving tactics in buildings, allocating funds to implement energy-efficient technology, and advocating for the development of sustainable transportation networks



- Pollution control involves implementing effective wastewater treatment methods, efficiently managing landfill waste, allocating funding to technology that reduces air pollution, and advocating for the preservation of natural resources
- Climate resilience entails constructing flood barriers, cultivating crops that can withstand drought conditions, and allocating resources for the timely identification of extreme weather occurrences

### **Why are green bonds important for Uzbekistan?**

Uzbekistan is confronted with urgent issues in its water industry, including deteriorating infrastructure, rising demand, and the escalating effects of climate change. Green bonds provide several benefits for tackling these challenges:

- Mobilizing additional capital: They attract environmentally conscious investors seeking both financial returns and positive environmental impact, providing new funding sources beyond traditional channels
- Promoting transparency and accountability: Green bonds often impose stringent criteria for project selection, monitoring, and reporting, guaranteeing the efficient use of funds for specified environmental objectives
- Raising awareness: Issuing green bonds may enhance public awareness about environmental concerns and foster support for sustainable development endeavors
- Boosting green credentials: By aggressively engaging in the global green bond market, Uzbekistan can establish itself as a frontrunner in climate action and attract more investments

Blue bonds: Water-focused debt securities appeal to environmentally aware investors and foster transparency. These projects can encompass a wide range of areas, including:

- Water infrastructure development, which includes constructing or enhancing water treatment plants, desalination facilities, irrigation systems, and flood control systems
- Enforcing water-saving technologies in agriculture, advocating the reuse and recycling of wastewater, and minimizing leaks in water distribution networks
- Overseeing the control of water pollution, rehabilitating deteriorated habitats such as wetlands, and alleviating the effects of climate change on rural populations
- Sustainable water governance includes the implementation of water management laws and regulations, promoting community engagement in water decision-making, and enhancing data collecting and monitoring systems

The worldwide blue bond market had a total value of USD 84 billion in 2022. By issuing blue bonds specifically for projects such as water treatment plants or desalination facilities, it is possible to attract investors who prioritize environmental concerns and simultaneously encourage openness and responsibility.

Impact investing: Impact investing intentionally allocates money to enterprises that provide financial profits and have quantifiable good effects on society and the environment. Within the framework of Uzbekistan's water challenges, impact investors would pursue investments in projects that aim to:

- Enhance water accessibility and sanitation for marginalized communities
- Foster the creation of pioneering water-conserving technologies for agriculture and industry
- Advocate sustainable water management practices and the preservation of resources

- Assist communities in adapting to climate change and mitigating its effects on water resources

In 2020, the global impact investing industry reached a valuation of USD 715 billion. Uzbekistan has prospective opportunities in sectors such as wastewater treatment. The IFC's 2022 analysis revealed USD 1.5 billion worth of investable projects in Central Asia's water sector.

Microfinance solutions: Providing small loans to farmers and communities for water-saving technologies or investments can improve water management at local level:

- Microloans may assist farmers in acquiring drip irrigation systems, water-efficient equipment, and drought-resistant seedlings. This investment aims to reduce water use and enhance agricultural production.
- Loans may empower households to enhance sanitation infrastructure, foster hygienic practices, and mitigate waterborne illnesses, fostering public health and safeguarding the environment.
- Microfinance enables communities to financially support local water infrastructure initiatives, such as rainwater collecting systems or small-scale desalination plants, fostering ownership and long-term viability.
- Economic ventures relating to water, such as water filtration services or micro-hydropower production, may be facilitated via small loans, diversifying revenue sources, and generating employment opportunities at local level.
- Microfinance initiatives have the potential to integrate climate-smart agriculture methods with disaster preparation education, therefore empowering communities to cope effectively with water shortages and severe weather phenomena.

Water insurance and weather-based derivatives: These financial instruments help to reduce the impact of risks associated with droughts, floods, or water quality concerns. However, the success of these endeavors heavily relies on the availability of data and the use of reliable modeling approaches.

Water insurance protects farmers and other water users from monetary damages resulting from water-related incidents, including:

- Droughts occur when there is a substantial decrease in rainfall, resulting in a scarcity of water supplies
- Floods occur when there is an excessive amount of rainfall or when snow melts, causing rivers to overflow and resulting in damage to infrastructure
- Water quality concerns arise when water becomes unsuitable for agriculture or consumption owing to contamination or pollution

Types of water insurance:

- Index-based: Payouts are activated according to predetermined indications, such as rainfall levels or soil moisture content, without considering individual losses. This streamlines evaluation and minimizes overhead expenses.
- Parametric: Verifiable meteorological data, such as air temperature or wind speed, determines payouts, resulting in expedited and streamlined claims processing.
- Traditional indemnity: Involves payouts determined by the losses incurred to crops or infrastructure. This requires thorough verification and, as a result, may include long processes.

Weather-based derivatives: These are financial products that mitigate risk linked to meteorological phenomena. Within the realm of water, they may serve the following purposes:

- Safeguarding against water scarcity: Farmers can purchase agreements that provide compensation if precipitation levels dip below a certain limit, minimizing possible damages caused by drought.
- Investors can engage in trading contracts that are based on their predictions about the availability of water. This may impact how water is distributed and how its price is determined.
- Mitigate flood risk: Communities susceptible to flooding might establish agreements that provide financial compensation in the event of precipitation over a certain threshold, facilitating the management of infrastructure requirements and readiness.

Crowdfunding and community-based models: Local groups and individuals can make modest financial contributions towards projects or initiatives related to water management. Long-term sustainability relies heavily on the presence of regulatory frameworks and careful assessment of financial viability.

Crowdfunding platforms facilitate the connection between people or groups needing financial support for water-related initiatives and a wide range of potential contributors, providing several financing approaches:

- Donation-based: Supporters actively contribute to initiatives such as implementing rainwater collection systems, establishing water treatment facilities, or enhancing irrigation infrastructure
- Incentive-driven: Donors receive concrete incentives (such as locally made crafts) for their donations
- Equity-based: Investors get shares in water-related enterprises (such as sustainable agricultural operations) that provide financial rewards and environmental effects

Community-based models delegate ownership and decision-making authority for water resource management to local communities. These models may encompass the following:

- Water user associations: Communities oversee irrigation systems, collect fees, and allocate resources towards upkeep, fostering accountable water use and collaborative efforts.
- Traditional water management techniques, such as 'sukan' in Bukhara, include communities taking shared responsibility for water distribution. Revitalizing these indigenous traditions may provide significant insights.
- Co-management partnerships: Collaborative efforts between communities and authorities promote joint accountability for water infrastructure, distribution of resources, and settlement of conflicts.

### **Environmental impact of industrial actors**

One of the efforts towards sustainable water management in the extractive industry involves the Navoi Mining and Metallurgical Combinat (NMMC). NMMC is a major player in the mining sector in Uzbekistan and has taken significant steps to address its water usage and environmental impact.

According to company's sustainability report (2021), NMMC is working towards minimizing the negative impact on water resources in Uzbekistan. For this purpose, the following measures in the field of water resource saving are being continuously carried out:

- Reuse of water in the technological process
- Use of recycled water supply
- Use of mine and ground waters
- Introduction of drip irrigation system for watering spaces on the territory of mines and factories
- Optimization of process equipment operation

NMMC reuses approximately 40 percent of the water utilized in its mining and metallurgical processes, amounting to an annual water recycling volume of around 32 million m<sup>3</sup>. This significant reuse percentage reflects NMMC's dedication to reducing water consumption and preserving local water resources. NMMC has allocated over USD 15 million in recent years to upgrade and expand its water treatment facilities. These investments have enabled the company to treat over 90 percent of its wastewater to meet stringent environmental standards, resulting in the safe discharge of treated water back into the environment. NMMC's community engagement initiatives have reached over 5,000 residents through educational programs on water conservation and environmental protection. By fostering partnerships with local communities, NMMC has enhanced awareness and participation in sustainable water management practices. It conducts regular water quality assessments and monitoring activities, with over 100 water sampling points across its operations. This comprehensive monitoring system ensures that the company maintains compliance with regulatory requirements and continuously improves its water management practices. NMMC has set ambitious sustainability targets, including a 20 percent reduction in water consumption by 2025 and a further increase in water reuse to 50 percent by 2030. These goals align with NMMC's commitment to sustainable water management and underscore the company's proactive approach to environmental stewardship.

### **Supply and demand of the water sector**

#### **Supply side:**

- Uzbekistan faces challenges on the supply side owing to decreasing water resources caused by climate change and inefficient water management practices.
- The country relies heavily on the Amu Darya and Syr Darya rivers, as well as internal sources, for water supply, with the Aral Sea basin being a critical water source.
- The per capita water supply has significantly decreased over the last 30 years, posing a threat to agricultural activities and overall water security.
- The government has set ambitious goals to increase irrigated arable land but faces a deficit in available water supply to meet these targets.

#### **Demand side:**

- A rising human population and a growing economy increasingly burden the limited water supply. The alteration in precipitation patterns and the rise in temperatures exacerbate existing vulnerabilities, introducing an extra layer of intricacy to the country's food security. As a percentage of GDP, Uzbekistan's public spending on agriculture is three times more than that of most non-OECD nations and ten times higher than that of most OECD countries (World Bank, 2019). Despite Uzbekistan's substantial agricultural investment, the country has not achieved significant development results.
- Long-term sustainability of the water sector is further jeopardized by a combination of factors, including funding required to upgrade, maintain, and sustain water infrastructure. Taking prompt action to address these concerns is crucial for creating a future where public health is protected, economic prosperity thrives, and agricultural plenty prevails (ADB, 2019a).

- Meeting irrigation standards for crops requires more water than the estimated available supply by 2030, leading to a projected deficit.
- Uzbekistan aims to introduce water-saving technologies and modernize its irrigation systems to reduce water consumption and improve efficiency.

## FINANCING REQUIREMENTS OF THE WATER SECTOR, WITH OR WITHOUT CLIMATE CHANGE

### Kazakhstan

The water sector of Kazakhstan faces significant challenges with financial requirements influenced by both existing infrastructure needs and the anticipated impacts of climate change. Kazakhstan's water sector, irrespective of climate change, already demands considerable investments, as outlined in this section.

#### Aging infrastructure

Kazakhstan requires investments in the construction, rehabilitation, and maintenance of its water infrastructure, including reservoirs, canals, pipelines, and treatment plants. This infrastructure is crucial for water storage, distribution, and wastewater management. Financing is needed to fund the initial construction and ongoing O&M of these facilities. The existing water supply network in the country needs urgent rehabilitation (Kumenov, 2023). Between 2000 and 2019, Kazakhstan has invested around USD 471.1 million in WSS (56.3 percent) and irrigation and water management (43.7 percent) projects (OECD, 2019b). According to EBRD (2018), on average 60 percent of the country's water supply and around 70 percent of wastewater disposal systems need replacement and require around KZT 515.6 billion for the reconstruction of WSS networks in 86 cities. In 2018 figures, over KZT 1.27 trillion is needed for construction of new and rehabilitation of old WSS facilities (EBRD, 2018).

Most of Kazakhstan's water supply systems, municipal wastewater treatment plants, and irrigation canals are outdated and inefficient, requiring upgrades or replacement (MENR, 2023). MENR (2023) report that KZT 11.3 billion has been allocated for 2022-2024 from the state budget to build and modernize water infrastructure (reservoirs, dams, and so on). However, this project requires an additional KZT 700 million to complete the development of the design and estimate documentation and an additional KZT 47.4 billion to finish the project by 2025 (MENR, 2023).

The shortage of water resources in the agricultural regions of the country is exacerbated by the poor condition and high seepage of the irrigation canals (UNECE, 2019). It has been estimated that over 14,000 km of water canals need repair, and that their reconstruction will save 40 percent of water lost in the agricultural sector. In 2024-2025, the repair of 3,500 km of canals is scheduled to reduce annual water losses in the agricultural sector by 0.5 km<sup>3</sup> (Ministry of Water Resources and Irrigation, 2023).

The degree of deterioration of sewage treatment facilities across the country is more than 60 percent; in some cities it is over 90 percent. The government has planned to modernize and build 68 wastewater treatment plants by 2030 (Primeminister.kz, 2022). Some of these have been financed by the international development banks (Table 2). However, to be able to take a loan from an international development bank, a water utility needs to be profitable—that is, show that it will be able to repay the loan, which is not the case in most cases across the country.

**Table 7. State of the hydraulic structures in 2022 in Kazakhstan**

Region	Total no. of hydraulic structures	Inspected	Require reconstruction
Astana City	1	1	-
Almaty City	39	39	9
Shymkent City	10	10	1
Almaty	417	259	58
Akmola	90	90	21
Aktobe	185	154	56
Atyrau	30	20	14
Abai	95	-	-
East Kazakhstan	168	143	95
Zhambyl	157	147	15
West Kazakhstan	74	32	7
Karaganda	262	178	160
Kostanay	98	98	11
Kyzylorda	37	37	14
Mangistau	1	1	1
Pavlodar	28	15	1
North Kazakhstan	20	20	6
Turkestan	110	110	12
<b>Republic of Kazakhstan</b>	<b>1785</b>	<b>1354</b>	<b>481</b>

Source: MENR 2023

### Inefficient water use

The absence of market-driven water pricing mechanisms leads to inefficient water use by the agricultural, industrial, and municipal sectors. The agricultural sector consumes vast amounts of Kazakhstan's water resources (65 percent of the total water supplied), half of which is being lost during transportation in canals that were built 40 to 50 years ago (MENR, 2023; Vinokurov *et al*, 2023). Thus, there is a pressing need to invest in more efficient irrigation methods, technologies, and infrastructure. More efficient irrigation methods and technologies reduce water wastage and increase agricultural productivity. Drip irrigation, for instance, minimizes evaporation and water runoff, while sprinkler systems (pivot, linear move, stationary systems) offer more uniform water distribution and suit the water needs of different crops. Laser land leveling is a technology that has not been widely used yet in the agricultural sector of Kazakhstan, but that can significantly increase water distribution efficiency, reduce water use by 20 percent to 30 percent, and increase crop yields by improving soil moisture uniformity across the field (Chen *et al*, 2022; Vinokurov *et al*, 2023).

### Water quality and pollution control

There is no practice of systematic and regular sampling of drinking water at the points where the end users/consumers are located (GEF *et al*, 2018). Despite strict regulations that require the establishment of sanitary protection zones around water intakes, owing to the overapplication of agricultural fertilizers and the proximity of sanitation facilities to water bodies, 16 percent of the sources of water supply in rural areas are often contaminated with chemicals and 40 percent have been bacteriologically contaminated—and thus, are unsuitable for domestic water supply (UNECE, 2019). In 2022, six cases of extremely high pollution and 228 cases of high pollution in 18 water bodies were recorded in the surface waters of the country (MENR, 2023). Investments are required to improve water and wastewater treatment facilities to reduce pollution from industrial,

agricultural, and municipal sources to ensure safe drinking water and protect aquatic ecosystems and soil from degradation.

**Table 8. Cost estimates of irrigation technologies in agriculture provided by specific and hypothetical scenarios of US government agencies**

	Irrigation technology	Capital cost USD for 1 ha of land
1	Micro-sprinkler irrigation	6,916
2	Subsoil drip irrigation	2,964-4,446
3	Surface drip irrigation	2,124
4	Linear motion sprinkler irrigation	2,099
5	Improving off-farm drainage	1,900
6	Centralized center pivot irrigation	840-1,531
7	Side roller irrigation system	1,507
8	High-volume sprinkler (end jet)	1,457
9	Improving on-farm drainage	1,260
10	Laser land leveling	840
11	Furrow irrigation	519
12	Improving traditional irrigation methods	340
13	Reducing transport losses	270
14	Reduced operational losses in the field	250

Source: Vinokurov et al, 2023

### Regulatory and management improvements

The Environmental Code and the Concept for the Development of the Fuel and Energy Sector of Kazakhstan by 2030 are two legal documents that address the measures to be taken by Kazakhstan to reduce greenhouse gas (GHG) emissions (UNDP, 2023). Legal framework, governance structures, and institutional capacity for water management should be enhanced to support more efficient and sustainable water use and deliver large water infrastructure projects by 2030. In the agricultural sector of Kazakhstan, for example, very few people are responsible for the operation and technical maintenance of the irrigation infrastructure located from the water intake to the fields (UNECE, 2019).

According to the concept for the development of the water resources management system of the Republic of Kazakhstan for 2024-2030, Kazakhstan plans to reach the following results in the water sector by 2030 (Government of the Republic of Kazakhstan, 2024), all of which are aimed at increasing water use efficiency and sustainability:

- Reduce water losses to 690 million m<sup>3</sup> per year through reconstruction and repair work on 14,450 km of irrigation network
- Build 20 new reservoirs and reconstruct 15 existing reservoirs
- Create an information and analytical center for water resources in the form of a non-profit joint-stock company under the Ministry of Water Resources and Irrigation
- Create a national hydrogeological service in the form of a non-profit joint-stock company under the Ministry of Water Resources and Irrigation
- Digitalize and automate water accounting on main and inter-farm irrigation canals
- Set up the local production of water-saving irrigation technologies, and water measuring instruments and installations
- Develop the digital geoservice—flood.gharysh.kz—for flood modeling and forecasting
- Develop an interactive geoinformation platform on the water resources of Kazakhstan hydro.gov.kz



- Sign the additional three agreements between Kazakhstan and its neighboring countries in the field of joint management and use of transboundary water bodies

Climate change generates uncertainty about water availability, exacerbates existing pressures on Kazakhstan's water sector, and introduces new challenges, such as increased flooding and drought across the country (OECD, 2022b). Climate change brings with it the following risks:

### **Increased scarcity and variability of water resources**

Owing to an increase in temperatures, anticipated changes in precipitation patterns and melting glaciers lead to risks of flooding and drought. Building resilience against climate-induced water extremes, such as flooding and drought, requires significant investment in infrastructure, forecasting, and early warning systems (Bates *et al*, 2008). Diversifying crop choices, introducing incentives and investing in capacity building for climate-smart development in water and agriculture will help mitigate the risks associated with climate change (World Bank, 2022). Between 1991 and 2015, the risk of floods increased owing to earlier ice breakups on the upper reaches in the mountains by 4.7 times in the East Kazakhstan region and by 35 percent in the Almaty region. The Southern and Western regions of Kazakhstan are already vulnerable to droughts and water scarcity, while by 2040 to 2059 a projected 1.7 mm to 1.8 mm increase in monthly precipitation, predominantly in the mountainous regions, raises the risk of increased cases of floods, mudslides, and mudflows (Chepelianskaia & Sarkar-Swaigood, 2022).

### **Water demand**

Climate change may affect water demand in all sectors of the economy. With the increase in air temperature and the higher rate of evaporation from the surface level of the earth, the competition for water between and within the sectors may be greatly affected (OECD, 2022b). In 2022, the industrial sector of Kazakhstan consumed 5.99 km<sup>3</sup>—that is, 24 percent of the total water intake in the country (MENR, 2023). As shown in section 5.1.1, the major industrial players in the country do not have treatment plants to treat industrial wastewater. The installation of state-of-the-art industrial wastewater treatment technologies will help in meeting environmental regulations, minimize the ecological footprint, and provide a sustainable source of treated wastewater that can be used in industrial activities. In 2022, 14.2 km<sup>3</sup> of water intake came from the agricultural sector, from which 11.3 km<sup>3</sup> was provided for regular irrigation (MENR, 2023). With climate change, higher air temperatures would lead to an increased demand for irrigation, which would be exacerbated if water resources continued to be lost during transportation.

### **Transboundary cooperation**

Transboundary cooperation with neighboring states will be necessary to mitigate the risks associated with water irrigation deficits (Umirbekov *et al*, 2022). Strengthening cooperation by sharing data on transboundary rivers and taking collective action in addressing climate change risks with neighboring states would greatly contribute to the development of the region.

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## **Kyrgyz Republic**

Access to clean water: Ensuring access to safe drinking water for all residents is a primary priority. This includes improving water supply systems, reducing water losses, and upgrading water treatment facilities.

## **Irrigation systems**

Agriculture plays a significant role in the Kyrgyz economy; improving irrigation infrastructure is therefore crucial. This involves modernizing irrigation networks, rehabilitating canals, and promoting efficient water management practices in the agricultural sector.

## **Wastewater management**

Proper treatment and disposal of wastewater are essential for environmental sustainability and public health. Enhancing wastewater treatment plants, constructing new facilities, and implementing effective wastewater management strategies are key priorities.

## **Dam safety and hydropower**

The Kyrgyz Republic has significant hydropower potential; ensuring the safety and reliability of existing dams is important. Additionally, there may be a focus on constructing new hydropower facilities to harness renewable energy sources.

## **Irrigation and potable water supply**

Irrigation and potable water supply are important components of the sector and hydro energy might be considered as well.

The strategic goal in irrigation is the creation of a sustainable system of water resources management in the Kyrgyz Republic for the benefit of present and future generations.

## **Priority directions**

To achieve this goal, measures will be implemented in the following priority areas:

- Protection of water resources from depletion and pollution
- Rational use of water resources
- Reforming the water resources management system

Interventions will be aimed at:

- Humans as a source of anthropogenic pressure on the ecosystem
- Water as a life-supporting potential and an indicator of anthropogenic impact

The measures will be implemented through:

- Managing demand for water use as a potential for the development of the Kyrgyz Republic
- Water risk management—namely, decision-making where information is lacking<sup>135</sup>

The action plan for the irrigation subsector is the NWS where activities are divided into three categories with a budget of KGS 58,786 million.<sup>136</sup>

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<sup>135</sup> NWS—National Water Strategy of the Kyrgyz Republic until 2040

<sup>136</sup> The current rate is USD 1 = KGS 87.5

## **Financial support**

The State Program is financed by the republican budget, external sources of financing and investments (IsDB, WB, ACG, a grant from the PRC, EDCF [Republic of Korea), ADB, WB, EBRD), and other sources, without contradicting the legislation of the Kyrgyz Republic.

### **Drinking water supply and sanitation—Need for financing and financial support**

According to a preliminary assessment of enterprises for WSS of cities, the volume of required investment for the rehabilitation of drinking water supply systems in the cities of the republic (except Bishkek and Osh) exceeds KGS 9.79 billion.

In rural areas, the improvement of water supply systems has exacerbated problems with sanitation as a result of an increase in wastewater, which requires additional purification and disinfection facilities to avoid pollution of water sources. According to estimates, the total investment required to upgrade the infrastructure of WSS facilities in rural areas is within KGS 64.7 billion.

With all this in mind and taking into account the current situation, it is necessary to provide for the construction and rehabilitation of sewerage systems in 27 district<sup>137</sup> centers. According to preliminary calculations, the required amount for the construction and rehabilitation of sewerage systems in these settlements is KGS 4,048 billion.

## **Monitoring and evaluation**

Monitoring as an obligatory component of state policy is a tool for the systematic collection and analysis of information and evaluation of the implementation of program and planning activities, as well as allowing for adjustments.

A set of indicators has been developed for the strategy, which will be monitored during its implementation.

The performance indicators of the activities of the strategy are as follows:

- To provide 90 percent of the urban population with centralized safe drinking water
- To provide at least 700,000 people in rural areas with centralized safe drinking water
- To give 70 percent of the population of district centers the status of a village with sewerage services
- To ensure that sanitation and hygiene requirements are met in schools and preschools
- To improve the regulatory legal framework in the WSS sector

Upon completion of the stages of the strategy, an assessment of the results achieved will be carried out in order to develop proposals for improvement and further work to provide the population with safe drinking water and sanitation.

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<sup>137</sup> Rayon level is in the structure of regions—oblasts.

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## Tajikistan

In Tajikistan, environmental challenges and vulnerabilities remain significant, especially in the context of climate change mitigation and adaptation. These issues have gained importance under the 2030 sustainable development goals—water management; human settlement resilience; urgent action to adapt to climate change; protection of terrestrial ecosystems; land degradation; prevention and remediation of natural disasters; and expanding access to clean water and sanitation. The rural population of Tajikistan is more vulnerable to environmental degradation.

Against this background, the high risk of natural disasters and vulnerability to the effects of climate change pose threats to sustainable development. Natural disasters continue to cause significant damage, undermine prosperity, and threaten human safety. In Tajikistan during the period 1997 to 2013, there were 3,169 emergency situations in which 1,041 people died and economic damage amounted to about TJS 2 billion. For the period 2005 to 2014, on average 32 residents of the country per 1 million population lost their housing each year as a result of natural disasters. Disaster risk requires a broader and more people-centered preventive approach.

Climate-related phenomena—including avalanches, drought, landslides, and floods—cause damage annually to various sectors of the economy, including to the water infrastructure. In 2022 alone, Tajikistan experienced 697 natural disasters—including 448 avalanche events, 109 landslides, 48 rockfalls, 22 cases of prolonged heavy rainfall, 21 earthquakes, 17 cases of rising water levels in reservoirs, 14 mudslides, 11 squalls, and 1 case of severe frost. This represents a 94.2 percent increase compared with 2021 (359 disasters). On average, the annual damage from these natural phenomena is estimated at 4.8 percent of Tajikistan's gross domestic product.<sup>138</sup>

Water supply infrastructure lags behind the needs of the national economy and population growth. Tajikistan uses only 17 percent to 20 percent of the water resources generated on its territory. Drinking water and sanitation needs account for less than 5.0 percent of the country's total water consumption. In more than half of rural areas there are no centralized water supply and sewerage networks; improving this situation will require significant costs.

The low share of domestic saving and investment hinders the modernization and development of the infrastructure of irrigation and drainage systems, taking into account the adaptation to climate change. At least 10 percent of the country's population currently lives on degraded land.

Along with these challenges, the development of the country's hydropower potential and the promotion of national interests in the form of optimal energy flows in Central and South Asia—the restoration of pre-existing and the creation of new energy infrastructure, as well as ensuring their effective use based on economic and technological integration with the system energy communications in the region—will significantly increase measures for adaptation to climate change and will improve the socioeconomic development of the country.

In this regard, the following measures for adaptation to climate change are recommended based on the national strategy for adaptation to climate change in Tajikistan until 2030.

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<sup>138</sup> Committee for Emergency Situations and Civil Defense under the Government of the Republic of Tajikistan, Overview of Emergency Situations in the Republic of Tajikistan for 2022, p.9

### **For the energy subsector**

- Develop reservoir management models to cope with the effects of extreme weather events, providing electricity during the winter.
- Invest in climate-resilient hydropower infrastructure to improve hydropower's resilience and productivity potential.
- Increase adaptation and planning tools for long-term hydropower generation to cope with constant changes in water and energy availability.
- Protect hydropower infrastructure, including constructing bypass canals and regulating water discharges.
- Strengthen the capacity of energy staff to use the methodologies needed to conduct climate risk and vulnerability assessments.
- Conduct a review of maintenance procedures and technical incentives to improve the safety of transmission and distribution networks from extreme weather events.
- Promote energy efficiency policies through demand management and energy efficiency incentive systems.
- Improve energy access and energy security in rural areas through alternative energy sources.
- Increase adaptation and planning tools for long-term hydropower generation to address ongoing changes in water and energy availability.

### **For drinking water supply and sanitation**

- Establish stricter regulations for wastewater and effluent treatment to preserve water quality and maintain cleanliness.
- Improve drinking water supply and sanitation norms and standards, including wastewater treatment and reuse; targeted use and conservation of water resources.
- Protect and restore existing infrastructure; construct new infrastructure to provide water and sanitation to the population in the face of climate change.
- Provide water supply services through a system of market relations.
- Introduce private partnerships and create decentralized WSS systems in rural regions.
- Introduce the latest digitalization technologies to be able to control physical objects using the Internet and artificial intelligence to increase O&M efficiency, maintain infrastructure functionality, manage water quality and monitoring in the face of climate change.
- Facilitate the development of pasture water management schemes.

### **For land reclamation and irrigation**

- Eliminate future water shortages by improving water efficiency, water reuse, and implementing water-saving and energy-efficient technologies.
- Construct small reservoirs to provide a system for reserving and storing water for irrigation purposes.
- Strengthen the capacity of water user associations (WUAs), providing them with recommendations on effective methods of water use.
- Introduce private partnerships in limited areas of on-farm amelioration and irrigation systems to modernize on-farm systems.
- Improve the groundwater management system.
- Promote soil health and erosion control, and upgrade irrigation and drainage systems to adapt to climate change.
- Introduce modern water-saving methods of irrigation technology with the economical use of water or transition to growing more expensive crops.

- Introduce the latest digitalization technologies to be able to control physical objects using the Internet and artificial intelligence in order to increase O&M efficiency, maintain infrastructure functionality, and manage water quality and monitoring in the face of climate change.

Through vulnerability and hazard mapping, construct bank protection, dams, and spurs in zones vulnerable to flooding, carrying out channel regulation work on rivers and sai (seasonal rivers).

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## **Turkmenistan**

Today, financing the country's water sector is becoming increasingly important, and demands are periodically voiced at both national and regional levels. The gradual growth of the economy and the population—as well as the rise in temperatures of recent years, which have affected the levels of rivers and water reservoirs—have led to a review of water security measures, including a substantial increase in investment for projects in the water sector and for the protection of water resources.

According to SEDP 2022-2028, the financial requirements for the agricultural and water sector have almost doubled to around USD 4.2 billion, whereas investments provided for the initiatives of the State Committee for Water Management of Turkmenistan account for only USD 3.9 billion. Financial investments within SEDP 2022-2028 will be directed to the following significant projects:

Construction of a strategically important facility for the country, the artificial Turkmen lake Altyn Asyr, with a network of drainage collectors. The historical project of the region, it has been one of the priority projects of the national state economy since the 2000s. The project is the comprehensive hydrotechnical solution aimed at enhancing the rational use of water; improving soil conditions, flora, and fauna of the desert lands by decreasing the collector and drainage water from arable land; and creating a reserve water fund for agriculture. The construction of a man-made lake also resolves the problem of raising the groundwater level on irrigated lands and the deterioration of their reclamation state—waterlogging and degradation of pastures in the Karakum Desert. By 2019, special high-performance equipment was purchased for the construction of the lake, including more than 1,500 excavators, bulldozers, and other machines from such manufacturers as Komatsu and Caterpillar. The total investment allocated from the state budget for the implementation of the project by that year amounted to USD 553.378 million<sup>139</sup> or 39 percent of the total designated funds. As per SEDP 2022-2028, the total amount of financial investments aimed at the implementation of the project is over USD 1.4 billion, to be financed in the period 2000 to 2035. Funds left over for the period 2020 to 2035 thus account for just over 60 percent (over USD 860 million) of the total financing amount that was originally available.

Other priority work will be focused on securing water resources of the country by:

### **Increasing capacity of reservoirs (construction, reconstruction)**

In the first half of 2023 it was stated that the water level in the reservoirs had dropped to a record low of 50 percent to 70 percent. The drought caused by low precipitation and abnormally hot weather in March and April 2023 is a possible reason for the shallowing of the reservoirs. The situation was exacerbated by a previous drought in recent years, for which the associated water losses in reservoirs could not be replenished in time. The new socioeconomic development program, among other necessary measures, determined the necessary provision of water reserves and flood

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<sup>139</sup> NewsCentralAsia, 2019. Altyn Asyr—Lake of Opportunities.  
<https://www.newscentralasia.net/2019/05/13/altyn-asyr-the-lake-of-opportunities-ru/>

protection through the construction of new and the reconstruction of existing reservoirs. The total financial investment in expansion of or new reservoir capacities will amount to over TMT 4.7 billion (over USD 1.3 billion).

### **River flow management and flood prevention measures**

Water pumping stations and measuring devices. In addition to the events carried out recently (installation of metering systems on the Murgab River and capacity building workshops on using metering devices), the strategic document on government commitments for developing its socioeconomic sectors, SEDP 2022-2028, reflects investments of over TMT 300 million or about USD 90 million for the construction and reconstruction of water pumps; the installation of water receiving facilities; the construction of vertical monitoring wells to measure groundwater levels and water salinity; and the installation of modern water meters in rivers and household drainage collectors. According to the new version of SEDP, almost all projects related to water receiving and pumping measures are projected to commence from 2024 to 2025, demonstrating its long-term vision on water resources management. The program also stipulates the reconstruction and construction of five water pumping stations on Karakum River during the 2020-2028 period.

Measures against flooding, mud flows, and protection of river banks. About 20 percent of the territory of Turkmenistan is occupied by mountains and hills, where most of these areas have a certain level of floods and mudflow danger.<sup>140</sup> Exposed by above average level of flood risk,<sup>141</sup> the preventative measures and due investments are becoming increasingly important in state strategic policies and programs. In Turkmenistan, natural risk hazard financing is sourced through ministries, agencies, organizations, national and local budgets, and insurance funds.<sup>142</sup> The estimated financial investment values for the measures against floods and mudflows are considerably higher compared with other groups of tasks in the sector. The reflected funds in SEDP 2022-2028, allocated for just three projects, are more than TMT 1 billion or over USD 287 million. The projects are reconstruction of state dams along the Amu Darya river; shore strengthening and antiflooding measures along the Amu Darya river in six districts of Lebap province; and the provision of emergency measures for the unimpeded passage of flood waters of the Murgab River from the city of Tagtabazar to the Saryyazy reservoir.

River flow management and flood prevention measures: Other technical and engineering work. Numerous hydrotechnical, engineering, and water line reconstruction and construction work are to be implemented in SEDP 2022-2028. The projects—valued at over TMT 530 million or over USD 152 million—are to be implemented during 2015 to 2030.

Capacity increasing of irrigation canals and drainage networks: The country's pursuit in this development can be observed by the significant investments of over TMT 1.1 billion or about USD 323 million. Financing in SEDP 2022-2028 will be directed towards the upgrading and reconstruction work of the various projects related to irrigation and drainage systems, and to improve the systems by introducing new technologies in all provinces of the country.

### **Land reclamation**

Given the outcomes of atmospheric and soil drought caused by reduced precipitation, that could affect crop yields, and with the potential future risks for the state's strategic crops, an integration of

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<sup>140</sup> 'Meteojournal,' 2023. <https://meteojournal.ru/selezashhitnye-sooruzheniya/>

<sup>141</sup> WBG, ADB, 2021. Climate Risk Country Profile. Turkmenistan. p.12

<sup>142</sup> CAREC, 2022. Country Risk Profile. Turkmenistan



resilient and climate adaptive measures are prioritized at the state level. According to SEDP 2022-2028, the investments directed for the purposes of land reclamation will be more than TMT 800 million or around USD 230 million to USD 240 million. The projects to be deployed in all provinces of the country commenced in 2018 and will continue during 2024 to 2027.

In addition to the prioritized projects reflected in SEDP 2022-2028, the monetary requirements for the protection and rational use of water resources in 2021 have increased significantly, to more than USD 12.9 million—that is, seven-fold compared to the previous year.<sup>143</sup>

### **Capacity building**

Investments in capacity building organized by international development organizations are usually covered by donor funds and the government's own sources. The project financing scheme involves the participation of investment donors, implementing partners, and higher government authority. In case of the UN set projects (Table 2), the Global Environment Fund (GEF), GCF, and UNDP act as fund donors while the former Ministry of Agriculture and Environmental Protection of Turkmenistan and UNDP serve as an implementing partner. Besides programs focused solely on Turkmenistan, there are also regional projects of FAO/GEF, USAID, and CARECO/EU within which there are integrated funds stipulating subprojects on skills and qualification enhancement. The total investments of the regional projects are over USD 75.8 million, USD 21.5 million, and EUR 1.2 million, respectively. In the past, apart from the above agencies,<sup>144</sup> the EU, USAID, and ADB also provided funds in the form of grants and technical assistance for the enhancement of skills required for water sector management of the country and/or the region.

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### **Uzbekistan**

The future of water in Uzbekistan is precariously balanced between the uncertainties of the future and the difficulties of the present. Regardless of climate change, the financial requirements of Uzbekistan's water industry continue to be significant. The nation's water infrastructure is experiencing degradation, prompting the need for repairs and modernization of its canal system, pumps, and treatment facilities. The lack of a market-based pricing structure for water diminishes water use efficiency and amplifies wastefulness. The transition to a market-oriented economy requires modifications in the agriculture and water industries. Currently, the government budget is Uzbekistan's main funding source for water management and infrastructure. To maintain sustainability in the water sector, particularly in agriculture, it is essential to improve the land tenure security of local farmers, enhance soil conservation techniques, expand the adoption of climate-smart agriculture, and establish a clearly defined plan backed by an investment strategy (OECD, 2016). The government necessitates adaptable and all-encompassing financial systems to tackle these difficulties and finance crucial repairs and innovations in water infrastructure. It does this by combining conventional and inventive approaches, creating a solid organizational framework, and placing significant emphasis on social responsibility.

The thorough upgrading of water resources is essential for equitable development. This entails replacing an obsolete irrigation system that uses a significant amount of power with more efficient technology that simultaneously preserves water and energy. The pumping irrigation system, for instance, contributes about 16 percent of the country's power use. Most pumping stations have been operational for over 30 to 40 years and need either rebuilding or significant repairs (UNEP, 2021).

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<sup>143</sup> Statistical compendium. Environmental Protection and Use of Natural Resources in Turkmenistan for 2021

<sup>144</sup> UN Turkmenistan, website. 2020. Stories. <https://turkmenistan.un.org/en/95288-building-resilience-dashoguz-and-lebap-through-local-adaptation-climate-change>

Upgrading and maintenance requires significant financial resources, which call for inventive fundraising strategies and various financing sources.

The government's effort to transform many cotton and wheat fields into crops that use less water, such as horticulture, demonstrates a deliberate change towards sustainable agriculture practices (World Bank, 2023a). As to the Uzbekistan Strategy 2030, the government aims to achieve an annual agricultural export value of USD 10 billion by 2030 (Government of Uzbekistan, 2023a). This places a significant strain on the water industry since agricultural output relies heavily on irrigated water.

The finance options for such a transition must be diverse and include several aspects. Although essential, using funds from the state budget must be enhanced by establishing conditions encouraging private investment. This requires implementing policy changes and creating a legislative framework that can provide essential guarantees to both local and foreign investors.

Furthermore, it is essential to promote international collaboration, particularly in transboundary water management. Since neighboring nations share water resources (ADB, 2014), regional cooperation may open new financial and technical resource opportunities. Uzbekistan's response to its water problems must be dynamic, combining cutting-edge ideas with tried-and-tested techniques and supported by a dedication to social justice and environmental sustainability. This all-encompassing strategy for managing water resources is essential for the country's larger economic reform and move towards a market economy.

Ensuring water security necessitates responding to pressing issues while considering the possible effects of climate change. This calls for a sophisticated comprehension of the funding needs both in the absence and in the presence of climate change scenarios—a terrain characterized by varying degrees of complexity and urgency.

### **Financing needs in a stable climate (no climate change)**

Even without the specter of climate change, Uzbekistan's water sector faces an immense financial burden. Aging infrastructure, inefficient water use, and growing demand strain the existing system, demanding the following:

#### **Infrastructure modernization**

WSS: By implementing water metering (Uzbekistan), granting users and management organizations (Kyrgyz Republic and Tajikistan), a larger role and the ability to retain a portion of the fees, and adopting a more commercial model of water supply (Kazakhstan), CA nations are attempting to increase service collection rates (Abdullaev & Ahmedov, 2022). A USD 1 billion yearly investment might be needed in Uzbekistan to upgrade antiquated pipelines, treatment facilities, and distribution networks across urban and rural regions. The work would prioritize leak detection and repair, the replacement of inefficient equipment, and network coverage expansion.

Irrigation systems: The irrigation system in Uzbekistan, as well as in Central Asia as a whole, is very intricate and depends on a network of pumps and canals, which is considered one of the most complex globally (FAO, 2012). Upgrading extensive irrigation infrastructure with state-of-the-art pumps, canals, and drainage systems may need an annual expenditure of USD 400 million. Possible measures include the enhancement of canals by applying concrete lining to minimize water wastage, installing contemporary pumping systems to enhance efficiency, and implementing sophisticated drainage systems to mitigate issues of salinization and waterlogging.

Flood control and drainage: An annual expenditure of USD 100 million may be necessary to enhance infrastructure and address flood hazards and drainage issues, especially in sensitive locations. These measures may include the construction of flood protection embankments, enhancing river channel excavation, and establishing retention ponds or reservoirs.

### **Efficient water management**

Drip irrigation: Efficient irrigation systems may range from USD 2,500 to USD 5,000 per hectare. Considering that Uzbekistan has around 4.2 million hectares of irrigated land, this might result in a possible expenditure of tens of billions of dollars (Brody *et al*, 2020). To achieve extensive use of drip irrigation technology in agriculture, an annual expenditure of USD 200 million may be necessary. This includes financial assistance for the acquisition and implementation of drip irrigation systems, education of farmers on effective water management techniques, and provision of technical aid for system upkeep.

Desalination: The exploration of desalination solutions is contingent upon conducting feasibility studies and assessing future water demand. Conducting preliminary research and pilot projects may need an annual expenditure ranging from USD 50 million to USD 100 million. Subsequently, if these projects demonstrate their feasibility and cost-effectiveness, more substantial expenditure may be required to create operational desalination plants.

Wastewater treatment: The yearly expenditure required for upgrading and expanding wastewater treatment facilities might amount to USD 200 million. This may include the construction of new treatment plants, the enhancement of existing facilities with cutting-edge technology, and the expansion of sewage networks to enhance the availability of sanitation services.

### **Institutional strengthening**

Data collection and monitoring: An estimated USD 50 million per year could be required to install state-of-the-art data collection systems, such as sensors, real-time monitoring tools, and data processing platforms. This data has the potential to shed light on how to manage water resources best, identify problem areas, and track success in meeting water conservation goals. Research and development spending on water-related topics by different countries ranges from 0.1 percent to 0.5 percent of GDP. With an estimated GDP of USD 58 billion in 2020, this amounts to between USD 58 million and USD 290 million per year for Uzbekistan.

Capacity building: An annual expenditure of USD 75 million may be necessary for training programs targeting water management workers, technical support, and information exchange activities. This may include implementing educational initiatives for engineers, technicians, and politicians and fostering partnerships with international organizations and experts to acquire knowledge on optimal approaches to water management. For example, Israel invests significant sums in educating agricultural people in water-efficient measures, surpassing USD 1,000 per hectare in some instances.

Governance and transparency: An annual expenditure of USD 75 million may be required to enhance legal frameworks, execute water policies, and encourage public engagement in water management. This may include amending water legislation, implementing clear and accountable procedures for acquiring resources, and developing mechanisms for including the community in decision-making.

### **Financing needs in a climate change scenario**

The water sector in Uzbekistan will need significant financial resources to address the consequences of climate change. The country has a notable vulnerability to these consequences, as seen in the

adverse outcomes of water shortages and drought. These events are expected to result in an economic loss of up to 11 percent of the nation's GDP. Uzbekistan's average temperatures are projected to rise significantly by the end of the current century, exceeding global standards. The WB (2022) predicts that the average temperature will increase by 1.4°C to 4.8°C by the 2090s, compared with the average temperature recorded between 1986 and 2005.

According to the WB (2023b), the predicted rise in the overall water deficit is expected to be from 3 billion m<sup>3</sup> to 7 billion m<sup>3</sup> by 2030, and 15 billion m<sup>3</sup> by 2050. Per capita water availability has decreased over the last 15 years despite a yearly population growth of 650,000 to 700,000. The government should provide funds for the modernization of water infrastructure and accounting systems, facilitate the transfer of irrigation management to the private sector, implement adaptable water allocation procedures, and improve water resource management to address the challenges posed by climate change effectively (World Bank, 2023b).

The country is now shifting towards a more environmentally sustainable economic model. This involves discontinuing gas, electricity, and heating subsidies and emphasizing renewable energy sources for power production and industrial use (Government of Uzbekistan, 2023b). Developing a competitive renewable energy industry and investing in infrastructure development are now prioritized. Uzbekistan's water sector requires substantial funding to address the challenges of climate change. The government must prioritize investments in upgrading water infrastructure, improving water resource management, and advancing renewable energy projects to ensure efficient and sustainable water management practices (World Bank & ADB, 2021). Climate change will potentially hinder Uzbekistan's ability to produce hydropower in the energy industry, particularly during the summer and fall seasons when there is a greater need for cooling and increased energy consumption. The future capacity for hydropower will also be contingent upon the progress and adjustments made by neighboring countries upstream, such as Tajikistan, as well as changes in the energy sector to provide conducive conditions (IEA, 2022).

By 2022, the proportion of Uzbekistan's public expenditure relative to its GDP had reached 34 percent, suggesting that the state budget cannot finance the substantial expenses associated with decarbonization and climate adaptation, which amount to billions of dollars. The analysis indicates that the private sector might undertake a significant proportion of these investments, provided the government establishes a favorable investment climate. Anticipated to generate substantial profits, these investments are projected to have significant advantages across the infrastructure industry, predicted to exceed USD 178 billion from 2023 to 2060. This encompasses the financial benefits derived from preventing expenses related to air pollution, accidents, and damage and the savings obtained from reducing the need for fossil fuel imports (World Bank, 2023b). Additional financing requirements under climate change

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## **Kazakhstan**

Climate change threatens Kazakhstan's aspiration to become one of the 30 economically most developed countries in the world (World Bank, 2022). Improved planning that takes climate change risks into consideration is the required measure to meet the water demands with adequate supply (World Bank, 2022). Flooding alone is expected to affect Kazakhstan's GDP negatively by 1.3 percent by 2060 and by 4.3 percent by 2100, while the anthropogenic factors together with climate change effects are expected to aggravate water scarcity by 50 percent within the next 20 years (UNDP, 2021; World Bank, 2022). The concept for the development of Kazakhstan's fuel and energy sector by 2030, developed by the Ministry of Ecology, Geology and Natural Resources (MEGNR) together with UNDP and GEF in 2022, reports the effects of climate change on the river basins of Kazakhstan, and advises—when considering the planned expansion of irrigated agriculture from 1.7 million to 3 million hectares—to take into consideration the possible water runoff by the

end of the century in the lowland rivers and mountainous regions (MEGNR *et al*, 2022; Government of the Republic of Kazakhstan, 2024).

By 2030, there is expected to be a drop in yield (MEGNR *et al*, 2022) by 5 percent to 14 percent on the plain pastures in the southern part of Kazakhstan (Almaty, Zhambyl, Turkestan, Kyzylorda, Mangystau, and south of Aktobe and Karaganda regions). If no measures to combat drought and provide water security are taken, spring wheat yields will also be at risk of a decline by as much as 50 percent by 2050 (World Bank & ADB, 2021). To mitigate the risks, the country is considering switching from water-intensive and monoculture to highly profitable alternative crops (fodder, oilseeds, and so on), especially in the arid southern regions, by reducing the amount of water used in irrigation (MEGNR *et al*, 2022). It is strongly recommended to expand research in the country's institutes to target the most suitable, drought-resilient, profitable crops to plant, and which methods and technologies to apply in agriculture—especially in the arid south and drought-prone regions of Kazakhstan. At least USD 20 million would need to be allocated directly for these purposes.

Kazakhstan aims to reduce GHG emissions by increasing its share of renewable, natural gas and nuclear energy sources (UNDP, 2023). Before doing so, it is recommended to plan what sources of water for cooling and other technological processes are going to be used and how the industrial wastewater is going to be treated. To achieve carbon neutrality by 2060, Kazakhstan would require additional funding of 0.9 percent of its annual GDP per year (World Bank, 2022). The climate change mitigation and adaptation measures (for example, early warning systems), aimed at reducing the cost of climate-related hazards (such as drought and flooding), are estimated to cost around USD 610 million, or 0.4 percent of the country's GDP per year (World Bank, 2022). Table 9 lists the proposed climate change adaptation priorities and the estimated costs per annum.

**Table 9. Climate adaptation priorities for Kazakhstan**

Adaptation priorities	Priority score (out of 5)	USD, millions	% GDP
Making new infrastructure resilient	4	221.8	0.1
Making water resources management more resilient	3	166.3	0.1
Improving dryland agriculture crop production	2	110.9	0.1
Strengthening early warning systems	2	110.9	0.1

Source: World Bank, 2022

In conclusion, Kazakhstan can achieve its development objectives only by taking timely action to mitigate climate change risks in the water sector by supporting the infrastructure resilience; technological and scientific innovations by co-financing projects with private sector players via PPP; green bonds; and other financing mechanisms discussed in the earlier sections of this report.

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## Kyrgyz Republic

### Impact of climate change on the state of water resources in Kyrgyzstan

About 45 percent of all glaciers in Central Asia are located in Kyrgyzstan; these glaciers are one of the main sources for rivers and forecasts of their condition are of particular concern in the context of global climate change. The impact of climate change resulting in a decrease in the flow of small rivers fed by glaciers has already been noted. The seasonal distribution of their runoff has also changed. Until 2025, an increase in surface runoff is expected owing to the increased melting of glaciers, then its decrease is predicted, to approximately 42 km<sup>3</sup> to 20 km<sup>3</sup>—44 percent to 88 percent—of the runoff in 2000. The consequences of this process can lead to the insufficient provision of water resources—a decrease in the energy potential and productivity of land resources not only in Kyrgyzstan, but also in the CA region as a whole.

**Table 10. Required financial resources for the implementation of adaptation measures, 2021 (USD million)<sup>145</sup>**

Sector	Total requirement*	Own resources**	Need for additional international support***
Water resources	1 977.7	577.1	1400.6
Agriculture	276.0	83.0	193.0
Energy	64.9	25.2	39.7
Health care	144.1	2.7	141.4
Reducing the risks of climate emergencies	309.9	121.9	188.0
Forest and biodiversity	46.2	4.0	42.2
Climate resistant areas and green	12.7	1.9	10.7
Improving the adaptation reporting system	1.6	0.6	1.0
<b>Total</b>	<b>2 832.9</b> (100%)	<b>816.3</b> (28.8%)	<b>2 016.6</b> (71.2%)

\*The required resources were calculated by national experts based on the cost of specific actions of the NDC Implementation Plan under the “Adaptation” section.

\*\*Own resources refer to funds from the national budget in the amounts determined for the specified sector, as well as funds from the private sector, international donors, in current public investment programs.

\*\*\*International support refers to funds not currently supported by funding sources that need to be mobilized during the implementation period of NDC.

**Kyrgyz Republic: Necessary financial support for implementation of mitigation measures, 2021 (USD million)**

Sector	Resources required*	Own** funds: scenario WM	International support: scenario WAM***
Energy	7,155.8	2,857.1	4,298.7
IPPU	0.6	0.1	0.4
Agriculture	19.3	12.1	7.1
LULUCF	63.0	36.2	26.8
Waste	3.8	0.5	3.3
<b>Total</b>	<b>7,242.4</b> (100%)	<b>2,906.1</b> (40%)	<b>4,336.4</b> (60%)

\*The required resources were calculated by national experts based on the cost of specific actions of the NDC Implementation Plan under the “Mitigation” section.

\*\*Own resources refer to funds from the national budget in the amounts determined for the specified sector, as well as funds from the private sector, international donors, and current public investment programs.

\*\*\*International support refers to funds not currently supported by funding sources that need to be mobilized during the implementation period of the NDC.

LULUCF = Land use, land use change, and forestry

As part of the updated NDC under the Paris Agreement, the overall mitigation goal is to unconditionally (WM scenario) reduce greenhouse gas emissions by 16.63 percent by 2025 and by 15.97 percent by 2030, relative to the business-as-usual scenario (BAU). The carbon reduction goals conditional on international support (WAM scenario) are a 36.61 percent reduction by 2025 and a 43.62 percent reduction by 2030.

Adaptation requires significant additional spending and hence financing. The financial resources required for adaptation are estimated at more than USD 2.8 billion, or 33 percent of the 2021 GDP, which would require significant international support. The authorities have committed to provide 29

<sup>145</sup> <https://www.elibrary.imf.org/view/journals/002/2023/092/article-A002-en.xml>

percent of this financing need from domestic sources and will seek the remaining 71 percent externally. The Kyrgyz authorities need to create fiscal space to allow domestic financing without compromising debt sustainability and catalyze private investment in the green economy to complement government efforts (Duenwald *et al*, 2022).

Adaptation means anticipating the adverse effects of climate change and taking appropriate action to prevent or minimize the damage it can cause, or taking advantage of opportunities that may arise.

Mitigation means making the impacts of climate change less severe by preventing or reducing the emission of GHG into the atmosphere.

There are several scenarios of climate change:

- Scenario SSP126 (optimistic) presupposes success in limiting global warming to below 2°C by 2100 compared to pre-industrial levels
- Scenario SSP245 (median) is associated with the stabilization of population growth by the end of the century and reduced energy intensity
- Finally, SSP585 (pessimistic) is characterized by a rapid growth of the global economy and an increased use of fossil fuels, while significant investments are made into health, education, social and human capital, technological progress as a part of sustainable development, and management of local environmental issues.<sup>146</sup>

## Climate measures

The WRS<sup>147</sup> reports on plans to implement four measures to adapt to climate change:

- Reducing losses and increasing efficiency of irrigation canals
- Ensuring guaranteed water supply through the construction of storage facilities (such as reservoirs)
- Modern irrigation methods (water-saving irrigation technologies)
- Digitalization (introduction of automation systems and water accounting systems)

The main factors limiting the resource potential for the implementation of climate change programs:

- System level: Limited funds in the republican and local budgets allocated for climate/environmental activities.
- Organizational level: Irrational and ineffective use of available financial resources for the implementation of measures to combat climate change.
- Individual level: Lack of information and incentives to involve structures and individual researchers in issues of climate change and adaptation to its consequences.
- Financing level: Insufficient efforts to attract the private sector to invest in projects aimed at mitigating and adapting to climate change.

## Business investments

The program (KyrSEFF) was developed by EBRD. The KyrSEFF III program builds on similar funding programs (KyrSEFF I & II) totaling USD 55 million, successfully implemented with the support of the

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<sup>146</sup> <https://www.unescap.org/sites/default/d8files/event-documents/Kyrgyzstan%20-%20Climate%20Change%20and%20Disaster%20Risk%20Profile.pdf>

<sup>147</sup> WRS—Water Resources Service—former Department of Water Resources



European Union between 2012 and 2022. Some 3,300 projects funded under these programs have generated annual energy savings of 199,201 MWh, water savings of more than 166,000 m,<sup>3</sup> and helped reduce annual CO<sub>2</sub> emissions by more than 66,000 tons.

Funds of up to USD 50 million within the framework of the green economy in Kyrgyzstan—KyrSEFF III will be sent to partner banks and financial institutions for subsequent lending to small and medium-size businesses and households in the country. The program may also offer financing to suppliers and manufacturers of materials and equipment registered on the Green Technology Selector online platform; a database of energy-saving technologies is also available on the KyrSEFF program website.

One of the key advantages of this program is the possibility of receiving a grant of up to 15 percent of the loan amount, which means that clients can partially reimburse funds from the loan received. The grant is paid upon the successful implementation of energy efficient measures. And the amount of grant payments is determined separately in each case by KyrSEFF program consultants—depending on the type of energy efficient measure and the amount of money spent on energy saving—after documentary confirmation of the intended use.

The new KyrSEFF III program will help reduce energy dependence and energy intensity in Kyrgyzstan. The program will also help address pressing environmental issues such as water and energy resource scarcity, soil erosion and degradation, and hydrological variability. The latter is important for a country highly exposed to climate change.<sup>148</sup>

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## Tajikistan

In Tajikistan, 55.4 percent or 64 km<sup>3</sup> of water per year is formed from all water resources of the Aral Sea basin, including 62.9 km<sup>3</sup> (80.17 percent) from the Amu Darya basin and 1.1 km<sup>3</sup> (3 percent) from the Syr Darya basin.<sup>149</sup>

The water sector in Tajikistan is particularly vulnerable to the global impact of climate change, because of which the country is experiencing rising temperatures, which in turn is leading to intensive glacier melting. Over the past few decades, over 1,000 small and medium-size glaciers have melted in the country. Major glaciers in the high mountains of the Pamir region are retreating, resulting in a reduction of the country's overall glacier reserves of almost a third.

In this regard, on the initiative of the Republic of Tajikistan, on 14 December 2022 during the 77th session of the UN General Assembly, a resolution was adopted to declare 2025 as the International Year of Glacier Protection, as well as to designate 21 March as the International Day of Glacier Protection and establish the International Glacier Conservation and Research Fund.

The impact of climate change puts significant pressure on the water sector in the country. On the one hand, there is a severe water shortage in all subsectors of the water sector during drought years, and on the other hand, the frequency of natural disasters has intensified. The country loses approximately USD 400 million annually owing to natural disasters, affecting on average half a million people.<sup>150</sup>

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<sup>148</sup> <https://www.kyrseff.kg/>

<sup>149</sup> Basic Provisions of the Water Strategy for the Aral Sea Basin, 1997, p.42, <http://www.cawater-info.net/library/rus/reg-str-full.pdf>

<sup>150</sup> Internet source 2020, <https://blogs.worldbank.org/ru/europeandcentralasia/natural-disasters-cost-central-asia-10-billion-year-are-we-doing-enough>

The impact of climate change will also contribute to a rise in infectious diseases owing to insufficient access to drinking water and sanitation in rural regions of the country, coupled with an average annual population increase of 2.2 percent. Food security is also affected.

Faced with the impact of climate change, it is no longer possible to neglect financing the water sector.

According to the national climate change adaptation strategy of Tajikistan for the period up to 2030, the water resources, energy, agriculture, and transportation sectors are particularly vulnerable and sensitive to climate change.

In this regard, the Government of Tajikistan attaches great importance to allocating funds from the state budget and attracting funds from international climate funds to implement climate change adaptation measures in these sectors.

In Central Asia, Tajikistan ranks second after Kazakhstan in attracting financing from the International Climate Fund. Over the past ten years, Tajikistan has received approximately USD 450 million,<sup>151</sup> including financing from these funds. This financing is directed primarily towards the modernization of the water infrastructure and the development of subsectors such as hydroenergy; drinking water supply and sanitation; land reclamation and irrigation/agriculture; forests; pastures; solid waste; transportation; and so on.

However, this alone is not enough; it is necessary to strengthen measures for climate change adaptation in the water sector. In order to solve the problems associated with adapting to climate change, it is necessary to strengthen the attraction of various sources of financing—whether national, international, or private.

The main sources of funding are the Green Climate Fund, the Adaptation Fund, and the Global Environment Facility Trust Fund.

The Green Climate Fund (GCF) is based on a financial mechanism developed under the United Nations Framework Convention on Climate Change (UNFCCC). This fund directs funds to achieve the international community's climate change mitigation and adaptation goals.

The Adaptation Fund is a financial mechanism under the Kyoto Protocol for the UNFCCC. This fund was created to finance national and regional adaptation projects and programs in developing countries committed to the Kyoto Protocol. The fund is financed by 2 percent of the certified emission reductions (CER) allocated to Clean Development Mechanism (CDM) projects, as well as voluntary contributions from donor governments (mainly Germany, Sweden, and Spain).

The Global Environment Facility (GEF) Trust Fund is a multi-coordination project consisting of 183 partner countries, international institutions, civil society organizations, and the private sector. The GEF Trust Fund is the financial mechanism of the UN climate regime and has been operating since 1991. In 2022, according to GEF, 29 donor governments finalized USD 5.33 billion in pledges to the Global Environment Facility for the next four years—an increase of more than 30 percent from its

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<sup>151</sup> Overview of international and domestic funding sources. Climate finance in Central Asia 2020, p.44.  
<https://docs.yandex.ru/docs/view?tm=1688188646&tld=ru&lang=ru&name=CA-climate-finance-ru.pdf&text=финансирование%20из%20средств%20климатического%20фонда&url=https%3A%2F%2F>

last operating period and a surge of support for international efforts to meet nature and climate targets.<sup>152</sup>

Additional financial resources can be attracted from these funds to implement the projects specified in the country's strategic documents on adaptation to climate change in the water sector.

The need for financial resources from water sector subsectors to upgrade and build climate-ready water infrastructures is outlined as follows:

### **Drinking water supply and sanitation**

The impact of climate change on the WSS subsector results in a shortage of water resources to provide clean drinking water and sanitation services to the population. Natural disasters can lead to the destruction of infrastructure and the contamination of drinking water and sanitation sources in disaster-affected areas, increasing the risk of the spread of infectious diseases. Increased temperatures can promote the proliferation of dangerous pathogens in water sources.

International development partners actively support this subsector to achieve climate change adaptation measures. Specifically, from 2011 to 2019, investment projects totaling USD 158.78 million were implemented, including loans amounting to USD 42.00 million, grants of USD 115.78 million, and a contribution from the Tajikistan government amounting to USD 1 million.<sup>153</sup>

However, to ensure the modernization and infrastructure climate change adaptation measures fully in the WSS subsector, an estimated USD 2 billion is required over a period of approximately 30 to 40 years.<sup>154</sup>

### **Hydropower**

The development of the hydropower subsector through the construction of the Rogun hydroelectric power plant and the modernization of existing reservoirs provides important measures for climate change adaptation. Along with the production of environmentally clean green electricity, Tajikistan's reservoirs also contribute to reducing the risks associated with declining water resources, regulating flow during drought years, reducing the risks of landslides and floods, and GHG emissions.

For example, to generate an equivalent amount of electricity to the Rogun hydroelectric power plant using coal-fired power plants, the carbon dioxide (CO<sub>2</sub>) emissions would exceed 13.5 million tons. Using petroleum products would result in approximately 10 million tons, and natural gas would produce over 6.5 tons. Thus, the Rogun hydroelectric power plant will make a significant contribution to the reduction of carbon emissions and is a successful example of adapting to climate change.<sup>155</sup>

Overall, with the support of development partners, more than 20 projects with a total value of USD 2 billion have been and are being implemented in the hydropower subsector during the years of independence. By 2019, ten projects totaling USD 1.4 billion were implemented, including loans

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<sup>152</sup> GEF press release, 21 June 2022, <https://www.thegef.org/newsroom/press-releases/donors-boost-global-environment-facility-contributions-5-33-billion?utm>

<sup>153</sup> MEWR data, December 2018, [https://www.mewr.tj/?page\\_id=715](https://www.mewr.tj/?page_id=715)

<sup>154</sup> Internet source, 2023. <https://asiaplustj.info/ru/news/tajikistan/economic/20230206/skolko-stoit-voda-i-skolko-za-nee-platyat-zhiteli-dushanbe-i-regionov-tadzhikistana>

<sup>155</sup> Internet source, 2022. From the speech of the President of the Republic of Tajikistan at the third meeting of the leaders of the Alliance for Water and Climate vode-i-climate. <https://mfa.tj/ru/main/view/10477/vystuplenie-na-tretem-zasedanii-liderov-alyansa-po-vode-i-klimatu>

amounting to USD 895.5 million, grants totaling USD 493.0 million, and contributions from the government of Tajikistan amounting to USD 35.3 million.<sup>156</sup>

Since 2019, two additional projects have been initiated—the first and second phases of the reconstruction of the Kayrakkum hydroelectric power plant and the project to enhance access to electricity for rural communities in the Romit area—with a total cost of USD 206.1 million, of which USD 43.1 million is in the form of grants and USD 163.0 million as credit funds. The project for the restoration of the Nurek hydroelectric power plant, phase 1 (BT-001), requires USD 40 million in credit funds.

To complete the construction of the Rogun hydroelectric power plant, the plan is to attract funding from international development partners totaling USD 700 million.<sup>157</sup> A total of USD 2 billion is required to complete construction of the Rogun hydroelectric power plant.

In addition, for the financial recovery of the OJSHC Barki Tojik, according to the action plan for 2019 to 2025, USD 1.2 billion is required.<sup>158</sup>

### **Land reclamation and irrigation**

Agriculture is the most vulnerable sector in terms of the impact of climate change. Extreme weather events such as heavy rainfall, frost, hailstorms, storms, dust storms, temperature increases, droughts, and water scarcity in arid regions have a negative impact on crop yields and food security.

Under the influence of climate change, agricultural productivity in some areas of the country could decrease by up to 30 percent by 2100, potentially affecting around 2 million people who will fall below the food security line, with 800,000 of them directly at risk of hunger.<sup>159</sup> This is especially concerning considering the average annual growth rate of the population of 2.2 percent.

The subsector of land reclamation and irrigation plays a key role in agricultural development, as over 90 percent of the water resources allocated within the country's limits from natural sources in the Aral Sea basin are used for irrigated agriculture. Approximately 80 percent of the country's agricultural production is derived from irrigated land.<sup>160</sup>

The main direction of adaptation to climate change for this subsector is the modernization of existing climate-adapted infrastructure, the construction of new irrigation systems for the development of new land, improvement of land reclamation conditions, the application of innovative irrigation techniques and technology for irrigated land, and the use of water-saving technologies.

Overall, with the support of development partners, 17 projects with a total value of USD 500.88 million have been and are being implemented in the land reclamation and irrigation subsector through the Central Unit for Project Management (CUPM) and the Agricultural Land Reclamation and

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<sup>156</sup> MEWR data, December 2018, [https://www.mewr.tj/?page\\_id=266](https://www.mewr.tj/?page_id=266)

<sup>157</sup> Ref. to link 6, 7, and 8.

<sup>158</sup> Internet source, 2023, <https://www.dialog.tj/news/v-tadzhikistane-dlya-ozdorovleniya-barki-tochik-v-blizhajshie-6-let-potrebuetsya-1-2-mlrd>

<sup>159</sup> National Climate Change Adaptation Strategy of the Republic of Tajikistan for the period up to 2030, October 2019, p.13

<sup>160</sup> Water Sector Reform Program for 2016-2025, 2015, p.4. [http://www.adlia.tj/show\\_doc.fwx?Rgn=126214](http://www.adlia.tj/show_doc.fwx?Rgn=126214)

Irrigation (ALRI) program, including grants and concessional loans. The government of Tajikistan has contributed USD 42.63 million to the implementation of these projects.<sup>161</sup>

However, an estimated USD 2 billion is needed for the complete restoration and modernization of the infrastructure in the land reclamation and irrigation subsector.

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## Turkmenistan

Harsh natural and deteriorating weather conditions badly affect agriculture owing to global climate change, which is a key reason for increasing the funding for the land reclamation and irrigation subsector and agro-industrial complex as a whole. This entails an increase in government budget items to curb the negative consequences of climate change on water availability. Turkmenistan, according to the UNFCCC (2006), may be the CA country that is most affected by climate change.

Besides healthcare, global warming may have significant impacts on various sectors of the country's socioeconomic development in the future, mainly on water management and agriculture, with consequences for water, soil, and land resources and on biodiversity.<sup>162</sup> The Notre Dame Global Adaptation Initiative Index (ND-GAIN) recognized the country as highly vulnerable to the impacts of climate change where water, in addition to ecosystem services and human habitat, is noted as most vulnerable by 21 percent.<sup>163</sup>

By 2090, the average temperature in the country is projected to rise by 5.1°C under the highest emissions pathway (RCP8.5), with the pace of warming significantly exceeding the global average.<sup>164</sup> According to regional studies it will continue rising significantly—to 6°C to 7°C by 2100—unless preventative action is taken.<sup>165</sup>

Increased temperatures and more rapid melting of glaciers elsewhere in the region may lead to further severe water shortages along Turkmenistan's most important river, the Amu Darya, by the 2040s and 2050s.<sup>166</sup> As per the NDC report (2022) the estimated water shortage, owing to a decrease in river flow and an increase in evaporation, may occur in Turkmenistan as early as 2030. The possible annual damage from the loss of agricultural products could amount to several billion manats.<sup>167</sup> The 2016 OECD report estimates potential losses in the agriculture sector of up to USD 20.5 billion between 2016 and 2030 if no adaptation measures are taken to combat the consequences.<sup>168</sup> Moreover, the estimated annual economic losses from desertification as a result of heat waves in Turkmenistan is about USD 347 million according to Turkmenistan's national strategy to reduce the risks of sand and dust storms.<sup>169</sup>

The government of Turkmenistan, reaffirming its commitment to climate issues, will develop its agricultural and water sector in the future in accordance with the national climate change strategy.<sup>170</sup>

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<sup>161</sup> ALRI data, 2023

<sup>162</sup> Nationally Determined Contribution of Turkmenistan under the Paris Agreement, 2022. p.10

<sup>163</sup> University of Notre Dame, 2021. Notre Dame Global Adaptation Initiative. <https://gain.nd.edu/our-work/country-index/rankings/>

<sup>164</sup> WBG, ADB, 2021. Climate Risk Country Profile. Turkmenistan

<sup>165</sup> Nationally Determined Contribution of Turkmenistan under the Paris Agreement. 2022. Climate change adaptation. p.11

<sup>166</sup> WBG, ADB, 2021. Climate Risk Country Profile. Turkmenistan

<sup>167</sup> Nationally Determined Contribution of Turkmenistan under the Paris Agreement, 2022. p.19

<sup>168</sup> OECD, 2016. Financing Climate Action in Turkmenistan

<sup>169</sup> National Strategy of Turkmenistan to Reduce the Risks of Sand and Dust Storms

<sup>170</sup> SEDP 2019-2025, p.122

Indeed, the implementation of certain projects, reflected in the state's strategic development of socioeconomic programs, may contribute to countering the consequences of climate change in the country. As stated by the CAREC report 'The review of international and domestic funding sources, 2020,' 'many projects can produce climate-beneficial outcomes even if such outcomes are not their immediate goals.' According to the report, the modernization of the water infrastructure falls under water resources or infrastructure projects, leading at the same time to improved climate resilience.<sup>171</sup> Also, as the NDC (2022) states, the measures developed to adapt the priority sectors of the economy to climate change is integrated into the main national development documents of the country—such as the national strategy for the economic, political, and cultural development of Turkmenistan for the period up to 2030 and the new edition of the national rural program. In this context, capital investments in upgrading water-related projects as per SEDP 2022-2028 amount to more than USD 3.9 billion and, according to the national rural program until 2028, investments for the water and sewer sector amount to over USD 980 million in the settlements of the provinces.

In addition, Turkmenistan is participating in a variety of projects dealing with climate change issues financed by international funds. However, as stated earlier, of the five CA countries, Turkmenistan is involved in the smallest number of the largest and most diverse project portfolios with international climate finance sources.<sup>172</sup> In the past, the European Union (Nexus), USAID (Smart Waters), ADB (RETA, 'Regional: improved management of shared water resources in Central Asia'), and other bilateral partners provided certain types of assistance in solving the water issues. Today, the recent or ongoing projects related to water or soil issues that provide funding from international development organizations, financial institutions, or foreign governments are the UNDP, GEF, GCF, USAID, other donor funds, the European Union, and the German Federal Ministry for Economic Cooperation and Development.

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<sup>171</sup> WBG, CAREC, 2020. Review of international and domestic funding sources. Climate finance in Central Asia

<sup>172</sup> WBG, CAREC, 2020. Review of international and domestic funding sources. Climate finance in Central Asia

**Table 11. List of ongoing projects financed for climate and water-related events<sup>173,174,175,176,177,178</sup>**

Project	Start date	End date	Status	Organizer	Implementing partner	Donors	Contributions	Description
Conservation and sustainable management of land resources and high nature value ecosystems in the Aral Sea basin for multiple benefits	Jul 2021	Jun 2026	Ongoing	UNDP	Ministry of Agriculture & Environment	UNDP; Global Environment (GEF) Fund Trust	USD 4,583,196	The objective of the project is to promote land degradation neutrality, restore and improve the use of land and water resources in Turkmenistan's Amu Darya watershed to enhance the sustainability and resilience of livelihoods and globally significant ecosystems
Developing a national adaptation planning process in Turkmenistan	May 2021	Aug 2024	Ongoing	UNDP	UNDP	Green Climate Fund (GCF)	USD 801,467	The Government of Turkmenistan seeks to strengthen its adaptive and resiliency capacities to climate change by integrating climate risks and adaptation measures into planning and budgeting processes via the development of a national adaptation process (NAP)

<sup>173</sup> UNDP Turkmenistan, website. Projects. Conservation and sustainable management of land resources and high nature value ecosystems in the Aral Sea basin for multiple benefits. <https://www.undp.org/turkmenistan/projects/conservation-and-sustainable-management-land-resources-and-high-nature-value-ecosystems-aral-sea-basin-multiple-benefits>

<sup>174</sup> UNDP Turkmenistan, website. Projects. Developing a national adaptation planning process in Turkmenistan. <https://www.undp.org/turkmenistan/projects/developing-national-adaptation-planning-process-turkmenistan>

<sup>175</sup> GEF, website. Integrated Natural Resources Management in Drought-prone and Salt-affected Agricultural Production Landscapes in Central Asia and Turkey (CACILM2). <https://www.thegef.org/projects-operations/projects/9094>

<sup>176</sup> FAO, website. Integrated Natural Resources Management in Drought-Prone and Salt-Affected Agricultural Production Landscapes in Central Asia and Turkey. <https://www.fao.org/platforms/water-scarcity/Knowledge/knowledge-products/detail/integrated-natural-resources-management-in-drought-prone-and-salt-affected-agricultural-production-landscapes-in-central-asia-and-turkey/en>

<sup>177</sup> USAID, website. USAID Regional Water and Vulnerable Environment Activity. Overview. <https://www.usaid.gov/fact-sheet/usaid-regional-water-and-vulnerable-environment-activity-fact-sheet#:~:text=The%20goal%20of%20the%20USAID,and%20Amu%20Darya%20River%20basins>

<sup>178</sup> NEXUS, website. Nexus Regional Dialogue in Central Asia. <https://www.water-energy-food.org/nexus-regional-dialogue-in-central-asia>



Integrated natural resources management in drought-prone and salt-affected agricultural production landscapes in Central Asia and Turkey  <i>(regional project)</i>	May 2018	Nov 2024	Ongoing	FAO	GEF Trust Fund	USD 75,759,705	The objective of the project is to scale up integrated natural resources management (INRM) in drought prone and salt affected agricultural production landscapes in CA countries and Turkey. This will be done through scaling up sustainable management practices that minimize pressures and negative impacts on natural resources that reduce risks and vulnerability and enhance capacity of rural communities to cope with or adapt to drought and salinity.
Regional water and vulnerable environment (WAVE)  <i>(regional project)</i>	Oct 2020	Sept 2025	Ongoing	USAID	USAID, other donor funds	USD 21,500,000	The main purpose of the program is strengthening regional cooperation on shared water resources and addressing current and emerging environmental challenges in the five countries of Central Asia through: capacity building, sustainable basin councils, and by strengthening transborder initiatives
Central Asian dialog to promote sectoral financing through the water–energy–food nexus (phase 2)  <i>(REGIONAL PROJECT)</i>	June 2020	June 2023	Completing	CARECEC O	EU; German Federal Ministry for Economic Cooperation and Development	EUR 1,250,000	Institutionalization of WEF Nexus approach in national and regional governance structures and investment decisions for water, energy, and food security in Central Asia

As reflected earlier, significant funds are needed to implement the entire range of planned activities in the water sector of Turkmenistan. At the same time, the water sector and its infrastructure (9 percent)—compared with other sectors—receive comparatively lower investment than other industrial sectors such as oil and gas (58 percent), power, energy, and construction (27 percent).<sup>179</sup> It is noticeable that, owing to economic transitions during post-Soviet years, financial investment for infrastructure purposes of CA states has not been a high priority; it was at 0.5 percent of GDP, which was significantly low. According to the analysis, the CA countries are still facing challenges with infrastructure financing, with collective demand at around 5 percent to 7 percent of GDP and with further increase of indicators if climate conditions are considered.<sup>180</sup> Considering the planned financial investments for water projects of over USD 3.9 billion enshrined in the latest SEDP and USD 750 million reflected in the national rural program for projects related to municipal water systems all around the country (except the capital city, Ashgabat, for which projects are envisaged in a development program of networks and facilities for water supply and sewerage for the period up to 2050), efforts to solve the main and acute issues of the water sector are as follows—ensuring water resources availability by building and expanding water reservoir capacities (USD 1.3 billion), river flow management and flood prevention measures (over USD 0.5 billion), capacity increase of irrigation canals and drainage networks (USD 323 million), land reclamation (around USD 230 million to USD 240 million), and using return waters and improving land states through collector drainage network project (USD 1.4 billion). Overall, the projects are aimed mainly at solving technical issues within the state water sector. There is no data on investments or financial schemes concerning climate-resilient solutions; regional bilateral or multilateral projects, now even more necessary in effective water resources management; and innovative solutions offering efficient water utilization. In general, the following measures, in addition to other activities and investments that the public sector continually undertakes, are required for effective and sustainable water management:

- Make sure to integrate financial schemes and hence allocations on climate-adaptive and resilient studies and measures into the state's long-term financial planning of the water and agriculture sectors
- Diversify financial sources with international and private funds for the wider financing of the water sector
- Investigate ways to engage the private sector in the municipal and irrigation water sectors by, for instance i) emphasizing innovation technologies to foster rational water use, reduce water losses on irrigation lines, and so on; ii) providing predictable and transparent policies; iii) involving semi-private water supply companies for operating and maintaining water infrastructure; iv) ensuring effective cooperation between various domestic sectors, each with clear regulations and rights in the water management and governance process

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## Uzbekistan

Water resources in Uzbekistan have shrunk by 20 percent in the last three years because of climate change (gazeta.uz 2023). Water scarcity and climate hazards threaten Uzbekistan's ability to shift to the market economy successfully. The nation's freshwater supply is predicted to decrease by 25 percent by 2030. The WB estimates this scarcity will result in an 11 percent decline in the nation's GDP. According to UN projections, water resource constraints and poor usage may cost Uzbekistan and other CA countries up to USD 2 billion annually (ADB 2019b).

The country has enhanced its obligations in its revised nationally determined contribution (NDC). It aims to achieve a 35 percent reduction in GHG emissions per unit of GDP by 2030, compared to 2010. This is a significant increase from the stated target of 10 percent in the NDC1 (Government of

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<sup>179</sup> SEDP 2022-2028

<sup>180</sup> Abdualleyev I & Akhmedov Sh, 2005. Financing Infrastructure in Central Asia. In: *Unlocking Private Investment in Sustainable Infrastructure in Asia*.  
[https://www.researchgate.net/publication/364554231\\_Financing\\_Infrastructure\\_in\\_Central\\_Asia](https://www.researchgate.net/publication/364554231_Financing_Infrastructure_in_Central_Asia)

Uzbekistan, 2021). Uzbekistan is undertaking complex programs to modernize and adapt its water system in response to the difficulties presented by climate change. These programs, supported by global collaboration and financial assistance, seek to enhance water governance, infrastructure, and consumption patterns. The Country Climate and Development Report for Uzbekistan, published by the WB (2023b), provides a comprehensive analysis of the financial needs and policies necessary to mitigate the effects of climate change on the water sector and other related domains. Uzbekistan—renowned for its economy that relies heavily on energy and resources—is seeing increased emissions and pressure on its natural resources owing to fast population growth and economic expansion. The report cautions that, without climate adaptation measures, Uzbekistan's economy may contract by 10 percent by 2050, affecting employment rates and family incomes.

Uzbekistan must allocate resources towards implementing diverse adaptation strategies to manage these problems effectively and guarantee resilience in a changing environment. The measures may be classified into the following four major categories:

- Water management infrastructure, including allocating resources towards developing irrigation systems, water storage facilities, and desalination plants. Enhanced water management will guarantee that Uzbekistan can fulfil its increasing water requirements despite the decrease in supply.
- Cultivars with enhanced tolerance to drought: The development and adoption of drought-tolerant crop varieties would enable farmers to sustain their agricultural production even under drought conditions.
- Systems designed to detect and provide advance notice of potential threats or hazards at an early stage. Early warning systems for floods, drought, and other severe weather phenomena may assist communities in preparing for and mitigating the effects of such catastrophes.
- Climate-informed land management includes sustainable grazing, soil protection, and afforestation techniques. Implementing these methods may enhance soil quality, mitigate water erosion, and sequester atmospheric carbon dioxide.

The funding needs for these adaptation strategies are substantial. According to the WB, Uzbekistan needs to allocate an extra USD 5 to USD 10 billion per year by 2030 to achieve its objectives for climate change adaptation. In summary, Uzbekistan's approach to adapting its water sector to climate change involves a comprehensive mix of infrastructure modernization, technological innovation, international cooperation, and public–private partnerships. The success of these efforts will help to ensure sustainable water resource management in the face of increasing demands and climate-related challenges.

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## ANNEX: DETAILED TASKS OF THE ASSIGNMENT

Draft report of water financing gaps (report of water financing gaps in the water sector of 5 CA states, highlighting water infrastructure priorities):

- Conducting a review of the critical financial needs of the water sector, concentrating mostly on major infrastructure
- Understanding major water infrastructure priorities of the member states (with regional significance)
- Developing a water financing gap report for regional and national water infrastructure in Central Asia

Draft water sector financing improvement action plan (water sector financing improvement action plan for efficient water sector financing—water sector financing improvement action plan):

- Systematizing current water sector financing schemes from the region and international best practices for developing water sector financing options
- Finding major water financing problems and obstacles in the region
- Preparation of a water infrastructure financing plan for selected regional and national infrastructure

Draft policy paper (policy paper and policy dialog series to develop implementation agreements, financing schemes, and ownership processes):

- Developing and conducting a series of policy paper and policy dialogs to initiate partnerships and potential agreements
- Initiation of the regional working group on water sector financing under the CAREC program

Final report of water financing gaps:

- Finalized draft report of water financing gaps in accordance with comments received from the CAREC Institute, ADB, and other peer reviewers
- Report of water financing gaps in the water sector of five CA states highlighting water infrastructure priorities

Final policy paper, and dialog and water sector financing improvement action plan

Finalized (i) draft report of water financing gaps and (ii) draft water sector financing improvement action plan in accordance with comments received from the CAREC Institute, ADB, and other peer reviewers. Report on major obstacles for efficient water sector financing—water sector financing improvement action plan. Policy paper and policy dialog series to develop implementation agreements, financing schemes, and ownership processes.





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