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When Water Becomes Glue: Solving Central Asia's Water Dilemma Through Collaboration

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Cover Image: Rusty ships lie in the sand at the former port city of Mujnak, Uzbekistan, in this photo taken on Oct. 21, 2021, decades after the waters of the Aral Sea retreated. The salt and sand desert of Aralkum continues to grow. The region is considered the biggest ecological disaster on Earth. (Ulf Mauder/picture alliance via Getty Images)

Foreword

Central Asia's abundant mineral and energy resources have recently attracted serious attention and vast investments, both domestic and international. It's now time to focus similar attention and investments of comparable scale on the region's already yawning and fast-increasing deficit of water. Failure to invest in Central Asia's minerals and hydrocarbons will seriously retard the region's overall development, but failure to attend to the burgeoning water crisis will call into question the very existence of Central Asia as a viable social-economic zone.

Nature and humankind have combined forces to create Central Asia's life-threatening water shortage. A key and undisputed effect of climate change has been the steady melting of mountain glaciers worldwide. First detected 40 years ago by a Tajik scientist using home-built equipment, the rapid disappearance of glaciers in the Tien-Shan and Pamir mountains is now an accepted fact. Compounding the resulting crisis is the primitive and grossly wasteful system for irrigation and moving water to cities that Soviet Russia imposed on the entire region. According to some assessments of this messy network of unlined canals and leaking concrete channels, fully 40 percent of the region's water is wasted.

The scale of the crisis has given rise over the years to apocalyptic predictions and megalomaniacal schemes to prevent its happening. Two Central Asian scientists working at an institute in the United Kingdom warn of the potential depopulation of the region's capital cities. To prevent this, Russian scientists since the 1930s have proposed diverting water from the Ob River in Siberia southward to Central Asia. This persistent fantasy, which by the 1980s called for using atomic bombs to move impeding mountains, still has its champions.

It's not that more sober analysts have ignored the issue. The United Nations and major international development banks have all tilted at the windmill of Central Asia's water crisis, but without notable success.

Central Asians themselves must take the lead. To do so they must move beyond the now-outdated Soviet definition of their region and include Afghanistan. Their task is to devise a practical solution that is compatible with their own values and way of life. Not only must their solution be valid from a regional perspective, but it must also address the legitimate needs of all the countries concerned. This presents challenges that are technical, economic, social, and political in nature.

As a first step, it will require the creation of a permanent, regionally based, and professionally staffed Central Asia Water Commission that can frame coordinated regional responses to all the technical, economic, and cultural issues involved. Happily, in this formidable endeavor they can look to strong technical and economic support from the international community.

The present study represents a major step along this challenging path. It frames the dilemma facing Central Asian states clearly, aiming to facilitate constructive debate and illuminate a potential way forward toward a durable solution. A viable and effective water-management mechanism can also prove the concept that Central Asian states can engage in mutually beneficial cooperation, infusing momentum into efforts to forge a comprehensive community of states working to advance the region's economic agenda and promote general prosperity.

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EXECUTIVE SUMMARY

Central Asian leaders have ambitious modernization plans. To realize these growth goals, however, they must solve a water-management conundrum: Many of the planned projects require an abundant amount of water, but the region is facing a mounting water deficit. It's too tall an order for any one state in Central Asia to tackle alone. Regional leaders acknowledge they lack the resources and know-how to implement desired reforms. Ultimately, success will depend on their ability to cooperate and establish an efficient organization that balances competing demands for water, ensuring adequate supplies for irrigating agricultural lands, generating electricity, and accommodating economic growth. This report takes an in-depth look at the water-management challenges facing Central Asia, as well as the region's economic development agenda. It also highlights ways the international community can help, enabling technology transfers that produce immediate improvements in water-use efficiency and extending financing for improvements that reduce waste.

Key Recommendations

For Central Asian States

- 1 NEGOTIATE A COMPREHENSIVE WATER-MANAGEMENT TREATY**
- 2 CREATE A UNIFIED ENTITY TO IMPLEMENT TREATY PROVISIONS**
- 3 DEVELOP EFFECTIVE ENFORCEMENT MECHANISMS TO ENSURE TREATY COMPLIANCE**
- 4 MOUNT COORDINATED PUBLIC AWARENESS CAMPAIGNS TO PROMOTE CONSERVATION**
- 5 GRADUALLY ELIMINATE HEAVY SUBSIDIZATION OF WATER USE**

For the International Community

- 1 PROVIDE EXPERTISE, EQUIPMENT, AND FINANCIAL ASSISTANCE TO HELP CENTRAL ASIAN STATES UPGRADE IRRIGATION AND WATER-MANAGEMENT SYSTEMS**
- 2 FUND RESEARCH ON THE IMPACT OF CLIMATE CHANGE ON CENTRAL ASIA**
- 3 WORK WITH CENTRAL ASIAN GOVERNMENTS TO PROSPECT FOR AQUIFERS, POTENTIALLY IDENTIFYING NEW SOURCES OF WATER**
- 4 ASSIST CENTRAL ASIAN STATES IN DEVELOPING SUSTAINABLE WATER-SUPPLY SYSTEMS FOR THE ARTIFICIAL INTELLIGENCE, INFORMATION TECHNOLOGY, AND CRYPTO SECTORS WITHOUT DIMINISHING AMOUNTS FOR HOUSEHOLD USE**
- 5 SUPPORT CENTRAL ASIAN EFFORTS TO ENGAGE AFGHANISTAN IN JOINING A SHARED WATER-USE FRAMEWORK**
- 6 EXPAND INTERNATIONAL FINANCING INSTITUTION SUPPORT FOR INFRASTRUCTURE INITIATIVES TO IMPROVE ACCESS TO CLEAN DRINKING WATER FOR CITIZENS LIVING IN RURAL AREAS OF CENTRAL ASIA**

Central Asia



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Source: USGS, esri

Introduction

Water represents the fundamental building block of Central Asia's economic future, needed to sustain agriculture, produce electricity, and fuel ambitions of turning the region into a manufacturing and high-tech hub. Yet as demand for water explodes, the region's supplies are dwindling at an alarming rate. Climate change is melting glaciers, and existing water distribution systems are antiquated and inefficient, wasting resources. Multilateral water-management arrangements have likewise proved mostly ineffective, as the divergent interests of upstream and downstream states have hindered joint responses to shared challenges.

The pressure on Central Asia's water resources will only intensify in the coming years. The region's population is growing rapidly, and governments are implementing modernization plans centered on water-intensive sectors, including the expansion of the mining sector, along with the development of nuclear energy and artificial intelligence capabilities.

The region's governments are awakening to the threat of a widening water deficit and have adopted plans to make irrigation systems more efficient and introduce water-saving technologies. They have also shown increasing willingness to cooperate on transboundary water issues. So far, however, there has been much more talk than action, due in part to a lack of financial resources and a shortage of human capital.

Given their growing desire to secure a large share of Central Asia's critical minerals, the United States and European Union have a vested interest in helping Central Asian governments solve water-supply dilemmas.

When it comes to water, Central Asia will have to do more with less if development goals are to be reached and social stability maintained. The way forward offering the highest chances of success is through unity via the creation of a comprehensive water-management framework, built and run by the Central Asian states themselves.

The development of a sustainable water-management system can serve as the cornerstone for the creation of a comprehensive regional economic organization that leverages natural resources and human capital in ways that can transform Central Asia into a major player in global trade.

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Part I: Critical Context

Central Asia's Waterscape

The Aral Sea Basin is Central Asia's most important water system, spanning roughly 1.5 million square kilometers (about 579,200 square miles) and touching all five states in the region. Roughly 80 percent of Central Asia's population is economically dependent on the basin's two main river systems, the Amu Darya and Syr Darya.¹ Intensive irrigation drains the rivers of much of their water each year and is the main cause of the disappearance of the Aral Sea, one of the worst artificial environmental disasters in history.

The Amu Darya is formed out of rivers flowing chiefly from the mountains of Tajikistan, including the Vakhsh and the Panj. It supplies water for agriculture in southern and western Uzbekistan, as well as Turkmenistan via the Karakum Canal. The Syr Darya, meanwhile, originates in the Tien Shan Mountains of Kyrgyzstan, feeding major agricultural areas in Uzbekistan's agricultural heartland in the Ferghana Valley and Kazakhstan's Turkestan and Kyzylorda provinces.

Other important river systems are the Chu-Talas Basin, straddling the Kazakhstan-Kyrgyz border, and the Ili Basin, which flows out of the Chinese section of the Tien Shan range, emptying into Kazakhstan's Lake Balkhash. A major waterway in northeastern Kazakhstan, the Irtys River, originates in China and flows into Russia, while the Ural River runs down from the Ural Mountains in Russia to feed areas of northwestern Kazakhstan before emptying into the Caspian Sea.

The Caspian Sea, which demarcates Central Asia's western border, is supplied by inflow from all littoral states (except Turkmenistan). The vast majority of its inflow comes from the Volga, Terek, and Ural rivers.

Central Asia's known groundwater resources are found in four major aquifers, including an estimated reserve of 43.5 cubic kilometers (35,266,024 acre-feet, or about 9.57 billion gallons) in the Aral Sea Basin.² Other major sources of groundwater are the north and south Talas aquifers, which straddle the Kazakhstan-Kyrgyz border.³

Upstream-Downstream Dynamics

A defining characteristic of water resources in Central Asia is its disparate usage patterns. The mountainous upstream states of Kyrgyzstan and Tajikistan

1 Martin Russell, "Water in Central Asia: An Increasingly Scarce Resource," European Parliament, September 2018, [https://www.europarl.europa.eu/RegData/etudes/BRIE/2018/625181/EPRS_BRI\(2018\)625181_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2018/625181/EPRS_BRI(2018)625181_EN.pdf)

2 Jakob Granit, et al., "Regional Water Intelligence Report Central Asia," United Nations Development Programme/Stockholm International Water Institute, Paper no. 15, (March 2010): 16, <https://siwi.org/publications/regional-water-intelligence-report-central-asia>; Sylvia Schmidt, Ahmad Hamidov & Ulan Kasymov "Analysing Groundwater Governance in Uzbekistan through the Lenses of Social-Ecological Systems and Informational Governance," *International Journal of the Commons* 18, no. 1, (March 2024): 203-217, <https://thecommonsjournal.org/articles/10.5334/ijc.1322>

3 Yu Liu, et al. "Sustainable Use of Groundwater Resources in the Transboundary Aquifers of the Five Central Asian Countries: Challenges and Perspectives," *Water* 12, no. 8 (2020), <https://doi.org/10.3390/w12082101>

hold the vast majority of Central Asia's water,⁴ while the downstream states of Kazakhstan, Turkmenistan, and Uzbekistan are the primary consumers of water released from reservoirs, used for irrigation during the agricultural growing season.

The upstream-downstream dynamic is intertwined with electricity generation, creating a water-energy nexus. Although they possess abundant water, upstream states lack other natural resources needed for generating heating and electricity. The downstream states, on the other hand, possess natural gas and coal, while water is scarcer. Accordingly, upstream states' demand for water is highest during the winter, driven by hydropower generation, while downstream nations require more water during the spring and summer to ensure adequate harvests.

Uzbekistan is Central Asia's primary consumer, using about 53 cubic kilometers of water per year,⁵ or roughly 45 percent of the region's annual total, the vast majority of which sustains the country's agricultural sector. At the other end of the water-use spectrum, the upstream states of Kyrgyzstan and Tajikistan combine to use only about one-third of Uzbekistan's amount, or roughly 16 percent of the overall annual total.⁶

The competing interests inherent in the region's water-energy nexus have fueled frequent bouts of upstream-downstream tension. During the Soviet era, the five Central Asian states were part of a unified electricity grid that kept a lid on acrimony via a swap system under which the downstream states received the water they needed for irrigation during the summer and transmitted electricity generated by coal- and gas-powered plants to upstream states in winter.

The swap system broke down following the Soviet Union's collapse, prompting downstream states to eventually withdraw from the region's common electricity grid in the early 2000s. Upstream states then felt compelled to release higher amounts of water from reservoirs than usual during winter months to meet heightened demand for heating and electricity. For example, during the Soviet era, Kyrgyzstan released 75 percent of the water reserves from the Toktogul Reservoir between April and September and 25 percent from October to March. But in recent decades, the percentages have changed to 45 percent and 55 percent, respectively, for the same periods.⁷ Both Tajikistan and Kyrgyzstan also are pursuing large dam construction projects, fanning downstream worries about potential shortages of water for irrigation.⁸ Meanwhile, the use of groundwater contained in transboundary aquifers has increased sharply in recent decades, due mainly to the breakdown of Soviet-era water-management structures that regulated usage.⁹

The breakdown of effective regulation starting in the 1990s raised concerns that water-related disputes could spark armed clashes.¹⁰ Experience has shown those concerns to be valid and that the threat of conflict has not been limited to upstream-downstream differences. Indeed, the most serious water-connected fights over the past two decades have pitted upstream neighbors Kyrgyzstan and Tajikistan against each other. The deadliest incident

4 Eric Rudenshiold, "Central Asia's Future Melts Away: Water Down the Drain?" Caspian Policy Center, August 28, 2025, <https://www.caspianpolicy.org/research/environment/central-asias-future-melts-away-water-down-the-drain>.

5 Victor Dukhovny and Vadim Sokolov, "Lessons on Cooperation Building to Manage Water Conflicts in the Aral Sea Basin," UNESCO, 2003, <https://www.gwp.org/globalassets/global/toolbox/case-studies/supplementary-documents/377-lessons-on-cooperation-building-to-manage-water-conflicts-in-the-aral-sea-basin.pdf>

6 Konur Alp Kocak, "Water Disputes in Central Asia," European Parliament, October 2015, [https://www.europarl.europa.eu/RegData/etudes/BRIE/2015/571303/EPRS_BRI\(2015\)571303_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2015/571303/EPRS_BRI(2015)571303_EN.pdf)

7 Klaus Abbink, et. al., "Sources of Mistrust: An Experimental Case Study of a Central Asian Water Conflict," *Environmental and Resource Economics* 45 (2010): 283-318, <https://link.springer.com/article/10.1007/s10640-009-9316-2>

8 Petr Bologov, "The Rogun Dam: A Source of Division in Central Asia," Carnegie Moscow Center, accessed on January 1, 2026, <https://carnegie.ru/commentary/66334>.

9 "Review of Cooperation on Transboundary Aquifers in Central Asia," UNESCO, accessed on January 1, 2026, https://zoinet.org/wp-content/uploads/2022/06/UNESCO-GGREGTA-policy-brief-2_en.pdf

10 Alp Kocak, "Water Disputes in Central Asia," [https://www.europarl.europa.eu/RegData/etudes/BRIE/2015/571303/EPRS_BRI\(2015\)571303_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2015/571303/EPRS_BRI(2015)571303_EN.pdf)



A view of the western part of the Aral Sea in the evening sun, Oct. 21, 2021. (Ulf Mauder / picture alliance via Getty Images)

occurred in 2021, when a local dispute led to armed clashes that left over 50 dead.¹¹ The numerous instances of violence along the Kyrgyz-Tajik border over the past 15 years have confirmed a correlation between water scarcity and heightened local concerns about access to arable land.

Rising Temperatures, Dwindling Resources

Central Asia is among the most water-stressed regions on Earth, with tens of millions of residents facing water insecurity.¹² The region's warming rate is outpacing that of other areas of the world, exacerbating glacier melt in the Tien Shan and Pamir ranges, magnifying water-management challenges.¹³ Changing weather patterns are also shortening the agricultural growing season in Central Asia.¹⁴

Water resources are generally used in Central Asia for three purposes: household use, agricultural irrigation, and electricity generation. Roughly 80 percent of water used in the region is for irrigation.

Glaciers in Central Asia are receding at an increasing rate, with the peak decline projected to occur between 2035 and 2050.¹⁵ According to some projections, an increase of 4 degrees Celsius (7.2 degrees Fahrenheit) in average temperatures could cause the loss of 80 percent of remaining glacial ice. Warming also can cause shifts in regional river flow patterns, resulting in a significant reduction of water in rivers during the summer growing season.¹⁶

Water flows on the Amu Darya and Syr Darya are proving increasingly erratic. Data published by the Interstate Commission for Water Coordination of Central Asia (ICWC) shows that water volume on the lower reaches of the rivers was less than projected. The commission had forecast that 2.1 cubic kilometers of water would reach the "Aral Region and Aral Sea" in the 2024 growing season via the Amu Darya, but the final total measured only 59 percent of that amount. Syr Darya flows also fell short of expectations.¹⁷ In September 2025, Kyrgyz officials reported that the volume of water in the Toktogul Reservoir, arguably Central Asia's most important source of irrigation and power genera-

11 Shairbek Dzhuraev and Eric McGlinchey, "What Drives Border Conflicts in Central Asia? Roots of the Deadly Violence on the Kyrgyz-Tajik Border," PONARS Eurasia, January 17, 2022, <https://www.ponarseurasia.org/what-drives-border-conflicts-in-central-asia-roots-of-the-deadly-violence-on-the-kyrgyz-tajik-border>

12 Chiara Scissa, "The Troubled Water Resources of Central Asia Need Better Management," Istituto Affari Internazionali, May 31, 2025, <https://www.iai.it/sites/default/files/iaicom2531.pdf>

13 Walid Ali and Utchang Kang, "Climate, Land and Security Risks Go Hand-in-Hand in Central Asia," UNDP, April 15, 2025, <https://www.undp.org/eurasia/blog/climate-land-and-security-risks-central-asia>

14 Lizhou Wu, et al., "Impacts of Climate Change on Vegetation Phenology and Net Primary Productivity in Arid Central Asia," *Science of the Total Environment*, November 20, 2021, <https://doi.org/10.1016/j.scitotenv.2021.149055>

15 David Rounce, et al., "Global Glacier Change in the 21st Century: Every Increase in Temperature Matters," *Science* 379, no. 6627 (January 2023), 78-83, <https://doi.org/10.1126/science.abo1324>

16 "Turn Down the Heat: The Climate Challenge for Central Asia," World Bank, accessed on January 1, 2026, <https://documents1.worldbank.org/curated/en/294131467991967756/pdf/98222-WP-P148173-PUBLIC-ADDSERIES-Turn-down-the-heat-doc-date-6-1-2015-Box393168B.pdf>

17 "Analysis of Water Management Situation in the Syr Darya and Amu Darya River Basins for the Growing Season 2024," SIC ICWC, accessed on January 1, 2026, http://sic.icwc-aral.uz/pdf/analytical_report_2024_en.pdf

tion, had fallen to its lowest level in recent memory at the end of the summer.¹⁸

Meanwhile, the decline of the Caspian Sea,¹⁹ first observed in the 1990s, has accelerated in the 21st century. Its level fell by 2 meters (6.6 feet) between 2006 and 2024.²⁰ By the end of this century, the level may drop by another 9 to 18 meters, exposing shoreline equal to the size of Portugal.²¹ Experts have yet to pinpoint the causes for the brewing environmental disaster, but climate change is believed to play an important role.²²

The Caspian's decline is having a detrimental effect on the shipping industry. Container ships at Kazakhstan's port of Aktau, a key link in the emerging Middle Corridor trade network, can load to only 75 percent of capacity due to shallower waters. Regular dredging is needed at Aktau and Baku.²³ Falling water levels present a challenge to U.S.- and European Union-backed efforts to significantly expand Middle Corridor trade.

Desertification and soil degradation also present growing regional challenges: Seven of Kazakhstan's 17 regions are confronting the threat of desertification. Uzbekistan, meanwhile, has developed a three-year water-management plan to combat soil degradation and restore roughly 460,000 hectares (1,776 square miles) to agricultural production.²⁴

Though agricultural water use dwarfs household use in Central Asia, groundwater plays an outsized role in providing drinking water.²⁵ Uzbekistan and Kazakhstan extract the most groundwater by volume, and usage has been expanding in recent years due to the deterioration or depletion of surface water resources.²⁶ Much of the extraction is unregulated,²⁷ and experts say the rate of usage is unsustainable.

Central Asia's population has grown by almost 60 percent since the 1991 collapse of the Soviet Union and now stands at over 81 million.²⁸ Water demand outstrips supply in several Central Asian states, and given existing demographic trends, the regional water deficit could grow by as much as 30 percent by 2050.²⁹ Annual availability of water has fallen sharply in Central Asia from 8,400 cubic meters per person 40 years ago to 2,500 today. According to some projections, it may fall below 1,700 cubic meters by 2030.

World Bank researchers have warned that without concerted action to address existing challenges, climate change and dwindling access to water could displace more than 5 million Eastern European and Central Asian inhabitants over the next 25 years. "Climate migrants will move from less viable areas with lower water availability and crop productivity," a World Bank policy brief noted.³⁰

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- 18 Alexander Thompson, "Low Reservoir Water Levels Mean Tough Winter for Hydro-Dependent Kyrgyzstan," *Eurasianet*, October 3, 2025, <https://eurasianet.org/low-reservoir-water-levels-mean-tough-winter-for-hydro-dependent-kyrgyzstan>
- 19 "The Caspian Sea's Shrinking Coastline," NASA, October 07, 2022, <https://science.nasa.gov/earth/earth-observatory/the-caspian-seas-shrinking-coastline>
- 20 Aida Amangeldina, "Aral Sea Syndrome: Why Is the Caspian Sea Shrinking?" *Carnegie Politika*, March 4, 2025, <https://carnegieendowment.org/russia-eurasia/politika/2025/03/caspian-environment-crisis?lang=en>
- 21 Simon Goodman, "Climate Change Is Fast Shrinking the World's Largest Inland Sea," *Conversation*, September 15, 2025, <https://theconversation.com/climate-change-is-fast-shrinking-the-worlds-largest-inland-sea-265239>
- 22 "Caspian Sea Fluctuations and Climate Change," UNEP, November 2024, <https://doi.org/10.59117/20.500.11822/46560>
- 23 Emma Collet, "Au Kazakhstan, l'inquiétant recul de la mer Caspienne," *Le Monde*, August 8, 2024, <https://www.lemonde.fr/archives-du-monde/08-08-2024/2/>
- 24 "A Program for Water Resources Management and Irrigation Sector Development Adopted," Press Service of the President of the Republic of Uzbekistan, August 12, 2025, <https://president.uz/en/lists/view/8378>
- 25 Schmidt, "Analysing Groundwater Governance," <https://thecommonsjournal.org/articles/10.5334/ijc.1322>
- 26 Karen Frenken (ed.), "Irrigation in Central Asia in figures," *FAO Water Reports* 39 (Rome: Food and Agriculture Organization, 2012), 44, <https://www.fao.org/4/i3289e/i3289e.pdf>; Schmidt, "Analysing Groundwater Governance," <https://thecommonsjournal.org/articles/10.5334/ijc.1322>; and "Fresh groundwater withdrawal," AQUASTAT, 2022, <https://www.fao.org/aquastat>
- 27 Schmidt, "Analysing Groundwater Governance," <https://thecommonsjournal.org/articles/10.5334/ijc.1322>
- 28 Aibarshyn Akhmetkali, "Central Asia's Growing Population and Youthful Workforce Are Signs of Economic Vitality, Says Latest Study," *Astana Times*, January 21, 2025, <https://astanatimes.com/2025/01/central-asias-growing-population-and-youthful-workforce-are-signs-of-economic-vitality-says-latest-study>
- 29 Ekaterina Khvan, "Останемся без воды? Почему дефицит возник даже в Кыргызстане," *Deutsche Welle*, May 12, 2025, <https://www.dw.com/ru/ostanemsa-bez-vody-pocemu-deficit-voznik-daze-v-kyrgyzstane/a-69049812>
- 30 ¹ "Internal Climate Migration in Eastern Europe and Central Asia," World Bank, accessed January 1, 2026, <https://openknowledge.worldbank.org/server/api/core/bitstreams/1dbab8f5-881d-517c-af10-5315e02f4d44/content>

“Though agricultural water use dwarfs household use in Central Asia, groundwater plays an outsized role in providing drinking water. Uzbekistan and Kazakhstan extract the most groundwater by volume, and usage has been expanding in recent years due to the deterioration or depletion of surface water resources.”

Tracing the Source of Present-Day Problems

Climate change is not the root cause of Central Asia’s water challenges; it is merely exacerbating already existing problems. Central Asia’s water woes can be traced to the shortcomings of Soviet central planning, specifically Communist Party decisions to introduce large-scale monoculture in the region³¹ focused on the Uzbek cotton industry.³²

Before World War II, to facilitate the mass production of cotton and other crops, Soviet planners began to build a network of canals, dams, and reservoirs,³³ expanding the infrastructure in the 1950s and ‘60s.³⁴ Uzbekistan’s canal network alone exceeds 100,000 kilometers.³⁵ Canals were built hurriedly with no regard for water-use efficiency. Thus, many lack linings or other features to reduce seepage and evaporation. The lack of modern irrigation pumping and monitoring technologies compounds wastage. One recent study estimated that “Central Asian states use 150 percent more water for irrigation than the recommended volume” because “irrigation systems are very inefficient and wasteful in delivering water to the fields.”³⁶

The diversion of water from the Syr Darya and Amu Darya to sustain Central Asia’s agro-industrial complex led to the disappearance of the Aral Sea.³⁷ Experts contend the tipping point for the sea occurred in 1961, when the volume of water reaching it plunged by roughly 50 percent over the previous year’s total, amounting to 29.2 cubic kilometers. Over the next few decades, with few exceptions, water discharge into the sea followed a downward trajectory. By 1989, only 4.3 cubic kilometers of water entered the Aral.³⁸ Over roughly the same period, the amount of irrigated land in what was then the Uzbek Soviet Republic increased by a third, and in the Turkmen SSR by nearly 125 percent.³⁹

The combination of water deprivation and evaporation over six-plus decades has caused the Aral Sea, once the world’s fourth-largest lake with a total area of 68,000 square kilometers, to lose 92 percent of its volume and 88 percent of its surface area.⁴⁰ Salt and toxins from the dry seabed kicked up by dust storms continue to poison wide swathes of agricultural land and cause health problems for those living nearby.⁴¹

On Central Asia’s eastern flank, agricultural irrigation by China in recent years has decreased flows on the Irtysh and Ili rivers in Kazakhstan. About 30 percent of Kazakhstan’s estimated 20.9 million inhabitants⁴² live in the Irtysh Basin, and the river is used to generate roughly 10 percent of the country’s electricity supply.⁴³ The Chinese Communist Party’s Sinicization policies have caused an influx of Han Chinese into western Xinjiang Province, resulting in

31 “The Curse of Cotton: Central Asia’s Destructive Monoculture,” International Crisis Group, February 28, 2005, <https://www.crisisgroup.org/sites/default/files/93-the-curse-of-cotton-central-asia-s-destructive-monoculture.pdf>

32 Richard Pomfret, “State-Directed Diffusion of Technology: The Mechanization of Cotton Harvesting in Soviet Central Asia,” *Journal of Economic History*, March 2002, <https://www.jstor.org/stable/2697976>

33 Abigail Gipson, et al., “Moving the Waters in Soviet Uzbekistan,” Davis Center for Russian and Eurasian Studies, January 14, 2023, <https://daviscenter.fas.harvard.edu/insights/moving-waters-soviet-uzbekistan>

34 Igor S. Zonn, Karakum Canal: Artificial River in a Desert. In: Zonn, I., Kostianoy, A. (eds) *The Turkmen Lake Alтын Asyr and Water Resources in Turkmenistan*. *The Handbook of Environmental Chemistry*, vol 28. Springer, 2012, https://doi.org/10.1007/698_2012_194

35 “Uzbekistan: Geography and population,” FAO, accessed January 1, 2026, <https://www.fao.org/4/w6240e/w6240e20.htm>

36 “The Water-Energy-Food Nexus,” Clingendael, January 2025, <https://www.clingendael.org/pub/2025/central-asia-emerging-from-the-shadows/4-the-water-energy-food-nexus>

37 Ben Abbott, “Overview of the Aral Sea Disaster,” Grow the Flow, August 25, 2025, <https://growtheflowutah.org/2025/08/27/overview-of-the-aral-sea-disaster>

38 Reuel R. Hanks, “Louder than Words: A Profile of the Destruction of the Aral Sea and Its Consequences,” Vol. 26:1, *Asia’s Environments: National, Regional, and Global Perspectives*, 2021, <https://www.asianstudies.org/wp-content/uploads/HanksSpring2021WAA.pdf>

39 Ibid

40 Philip Micklin, “The Past, Present, and Future Aral Sea,” *Lakes & Reservoirs* 15, no. 3 (September 2010), 193-213, <https://doi.org/10.1111/j.1440-1770.2010.00437.x>

41 Hanks, “Louder than Words,” <https://www.asianstudies.org/wp-content/uploads/HanksSpring2021WAA.pdf>

42 “Kazakhstan Population,” Worldometer, accessed January 1, 2026, https://www.worldometers.info/world-population/kazakhstan-population/#google_vignette

43 E. Vinokurov, et al., “The Irtysh River Basin: Transboundary Challenges and Practical Solutions,” Eurasian Development Bank, February 2025, https://eabr.org/upload/iblock/a7f/EDB_2025_Irtysh_Report_ENG.pdf

a rapid expansion of canal construction and agricultural production there.⁴⁴ China's canal system currently diverts about 2.5 cubic kilometers of the river's flow but has the capacity to handle almost triple that amount.⁴⁵ A recent Eurasian Development Bank study cautioned that "if all of China's planned projects are implemented, water withdrawals could account for at least 50 percent of the total river flow, leading to a critical level of water stress during dry years."⁴⁶

Ancillary issues exacerbate water-management challenges. Central Asian governments have placed limits on the publication and sharing of research on many water-related issues. Uzbek officials, for instance, denied access without stating a reason to scholars seeking to study the Pritashkent Aquifer.⁴⁷ In another case, Kyrgyz officials in 2024 restricted public access to Toktogul Reservoir water-level data.⁴⁸ Many scholars in the region also struggle to publish their work on water-related topics due to a lack of English-language ability; opportunities to publish in Russian are limited.

Emerging Responses

Awareness about the dangers posed by the growing demand and decreasing supply of water is rising in Central Asia, and individual governments are demonstrating a greater degree of political will to address water issues. Uzbekistan's three-year water conservation strategy, adopted in August 2025, provides for expanded training programs and a public awareness campaign to promote household water conservation. Uzbek officials additionally have plans to introduce drip irrigation technology and upgrade the canal system to reduce seepage and evaporation.⁴⁹ The envisioned improvements, however, don't cover all of Uzbekistan's irrigation infrastructure.

Kazakhstan adopted a water code in early 2025, outlining reforms aimed at improving the efficiency of irrigation systems, reducing the pollution of water resources, and managing transboundary waterflows.⁵⁰ Another priority for the Kazakh government is the revitalization of the Aral Sea, which is now divided into distinct sections. The completion of a dam in 2005 has prevented water flow between the Aral's two main "seas," enabling the smaller, northern sea to gradually refill.⁵¹ A 2024 memorandum of understanding between Kazakhstan and the World Bank will help shape continuing efforts to revive the northern Aral.⁵² Kazakh officials are now also devoting more resources to study the Caspian Sea's falling level.⁵³

The upstream states of Tajikistan and Kyrgyzstan are confronting different types of water-related challenges. Less than a third of Tajik households in rural areas have ready access to safe drinking water.⁵⁴ A similar situation prevails in Kyrgyzstan, where officials recently reported that close to half of the coun-

44 Ibid

45 Ibid, 14

46 Ibid, 15.

47 Abror Gafurov, et al., "Groundwater Resources," in *The Aral Sea Basin*, ed. Stefanos Xenarios, et al. (Routledge, 2019), 39-51, <https://doi.org/10.4324/9780429436475-4>

48 "Данные об объёме воды в Токтогульском водохранилище теперь засекречены," *24.kg*, May 5, 2025, <https://24.kg/obschestvo/330907>

49 "Calculation and Efficiency in Water Management Are the Demands of the Times," *Uza*, November 7, 2024, <https://uza.uz/posts/654808>

50 "How the Government Is Implementing the President's Directive on Large-Scale Modernization of the Water Sector," Press Center of the Prime Minister of the Republic of Kazakhstan, July 9, 2025, <https://primeminister.kz/en/news/reviews/how-the-government-is-implementing-the-presidents-directive-on-large-scale-modernization-of-the-water-sector-30249>

51 "Saving a Corner of the Aral Sea," World Bank, September 1, 2005, <https://www.worldbank.org/en/results/2005/09/01/saving-a-corner-of-the-aral-sea>

52 "World Bank and Kazakhstan Forge Partnership on Water Conservation at One Water Summit," World Bank, December 3, 2024, <https://www.worldbank.org/en/news/press-release/2024/12/03/world-bank-and-kazakhstan-forge-partnership-on-water-conservation-at-one-water-summit>

53 «Казakhstan направил дополнительные деньги на изучение проблем Каспия,» *Ulysmidia.kz*, August 13, 2025, <https://ulysmidia.kz/news/57005-kazakhstan-napravil-dopolnitelnye-dengi-na-izuchenie-problem-kaspiia/>

54 "Water in Tajikistan, Abundant yet Challenging," Acted, accessed January 1, 2025, <https://www.acted.org/en/water-in-tajikistan-abundant-yet-challenging>

Shrinking Aral Sea

1990



2000



2010



2020



Planet Observer/Universal Images Group via Getty Images

try's 2,014 villages lack reliable supplies.⁵⁵ While expressing a desire to widen access to drinking water, officials in both countries admit they lack the funds to undertake large-scale improvements. Kyrgyz officials, for instance, put the price tag for connecting all villages to water supply systems at upwards of \$1.2 billion.⁵⁶

Collective Action

Regional mechanisms to jointly manage water supplies and address common challenges have long existed, but underfunding and a lack of political will have hampered collective action for most of the post-Soviet era. Regional governments have demonstrated a genuine desire to cooperate on water-related issues only very recently as awareness of the threats has grown.

Within months of gaining independence, the five Central Asian states signed the Almaty Agreement in 1992 to manage the shared use of the region's water resources and promote policies "in the interests of economic growth and raising living standards."⁵⁷ The ICWC was established to monitor levels, set water-use quotas and adjudicate disputes. The commission's decisions and policies were supposed to have been binding, but it lacked enforcement powers and quickly proved ineffective as a regulatory body.⁵⁸

A major flaw in the ICWC's structure is the lack of any mechanism to manage the region's water-energy nexus, coordinating upstream states' electricity needs with downstream states' irrigation use. A Soviet-era arrangement, dubbed the Central Asian Power System (CAPS), had proved capable during the last decades of communist rule of ensuring that all five states received adequate supplies of heating and electricity during the winter and sufficient water for irrigation in the summer.⁵⁹ After the Soviet breakup, states began to withdraw from the regional grid.⁶⁰ Bitter personal rivalries among Central Asian leaders during the late 1990s and early 2000s played a key role in hindering cooperation.⁶¹ The collapse of CAPS hit Tajikistan the hardest, causing routine power shortages during winter.⁶²

In 1993, the five Central Asian states established the International Fund for Saving the Aral Sea (IFAS), specifically to finance and promote the "ecological recovery of the Aral Sea and the Aral Sea Basin."⁶³ The fund registered some successes, notably the revival of the northern Aral Sea.⁶⁴ But Kyrgyzstan's withdrawal from IFAS over complaints that it was not paying sufficient attention to irrigation-electricity concerns in upstream areas of the Aral Basin brought its work to a halt.⁶⁵ Kyrgyz officials have yet to revive their full participation in IFAS.⁶⁶

55 "Бакыт Төрөбаев: Суу – стратегиялык жана баа жеткис жаратылыш ресурсу," Ministry of Water Resources, Agriculture and Processing Industry of the Kyrgyz Republic, October 14, 2025, <https://agro.gov.kg/news/923>

56 Sergey Kwan, "Kyrgyzstan Highlights Water Crisis at FAO's Rome Water Dialogue," *Times of Central Asia*, October 15, 2025, <https://timesca.com/kyrgyzstan-highlights-water-crisis-at-faos-rome-water-dialogue>

57 "Agreement Between the Republic of Kazakhstan, the Republic of Kyrgyzstan, the Republic of Uzbekistan, the Republic of Tajikistan and Turkmenistan on Cooperation in the Field of Joint Water Resources Management and Conservation of Interstate Sources," Interstate Commission for Water Coordination of Central Asia, accessed January 1, 2026, <http://www.icwc-aral.uz/statute1.htm>

58 Ibid.

59 Farkhod Aminjonov, "Central Asian Countries' Power Systems Are Now Isolated, but Not Everyone Is Happy!*" Eurasian Research Institute, April 2016, <https://www.eurasian-research.org/publication/central-asian-countries-power-systems-are-now-isolated-but-not-everyone-is-happy>

60 "Energy Connectivity in Central Asia," UNECE, 2023, https://unece.org/sites/default/files/2023-11/EN_Energy%20Connectivity%20in%20Central%20Asia_V2.pdf

61 Edward Lemon, "The Transformation of the Uzbek-Tajik Relationship," Jamestown, March 12, 2018, <https://jamestown.org/transformation-uzbek-tajik-relationship>

62 Aminjonov, "Central Asian Countries' Power," <https://www.eurasian-research.org/publication/central-asian-countries-power-systems-are-now-isolated-but-not-everyone-is-happy>

63 "About IFAS," Agency of IFAS, accessed January 1, 2026, <https://aral.uz/en/about>

64 "Twenty Five Years of Activities of International Fund for Saving the Aral Sea and New Impulses for Development of the Aral Sea Region," Agency of IFAS, 2019, https://aral.uz/doc/25ifas_eng.pdf

65 "Kyrgyzstan Decides to Freeze Its Participation in IFAS," *ASIA-Plus*, May 20, 2016, <https://www.asiaplustj.info/en/news/centralasia/20160520/kyrgyzstan-decides-freeze-its-participation-ifas>

66 "Kyrgyzstan Eyes IFAS Return, but Only If All Countries' Interests Are Considered Equally," *News Central Asia*, September 15, 2023, <https://www.newscentralasia.net/2023/09/15/kyrgyzstan-eyes-ifas-return-but-only-if-all-countries-interests-are-considered-equally>

A major impediment to collective action during the first decades of the post-Soviet era was obstructionism by then-Uzbek leader Islam Karimov, whose regime engaged in long-running feuds with neighboring states over infrastructure projects, including Tajikistan's Rogun Dam⁶⁷ and Kyrgyzstan's Kambarata-1 Dam.⁶⁸ Karimov saw both as potentially threatening Uzbek irrigation needs. Since his death in 2016, the Uzbek government has proved much more open to working within collective frameworks.⁶⁹

In the past few years, Central Asian leaders have acknowledged a growing need for joint action to manage dwindling water resources. In August 2024, Central Asian heads of state adopted a concept document for regional development through 2040 that underscored the need for a collective response to water and energy challenges. In July 2025, Kazakh President Kassym-Jomart Tokayev called for the formation of a regional "Water and Energy Consortium."⁷⁰ And at a meeting of Central Asian heads of state in November 2025, Uzbek President Shavkat Mirziyoyev called for the creation of a Central Asian economic community.⁷¹

Even Turkmenistan, long known for its isolationist tendencies, has expressed interest in joining multilateral efforts to manage water-related issues. During the summer of 2025, Turkmen officials reportedly circulated a proposal to convene a regional summit aimed at preserving the "ecological integrity" of the Caspian Sea.⁷²

In a few recent cases, regional states have forged limited collective agreements covering aspects of the water-energy nexus. Perhaps the most prominent example of such multilateral cooperation is an agreement signed in September 2025 by Kazakhstan, Uzbekistan, and Kyrgyzstan. The three states are now also collaborating on the construction of the Kambarata-1 Dam.⁷³

In late 2025, both Kyrgyzstan⁷⁴ and Tajikistan⁷⁵ introduced emergency energy-saving measures in anticipation of winter heating and electricity shortages, citing low water levels in reservoirs. To avert a severe water shortage during the 2026 growing season, Kazakhstan and Uzbekistan announced that they would transmit additional electricity to Kyrgyzstan during the winter to ensure adequate supplies, enabling Bishkek to preserve water in the Toktogul Reservoir.⁷⁶

67 "Rogun Dam Conflict between Tajikistan and Uzbekistan," Climate Diplomacy, accessed January 1, 2026, <https://climate-diplomacy.org/case-studies/rogun-dam-conflict-between-tajikistan-and-uzbekistan>

68 "Dam Conflict between Kyrgyzstan and Uzbekistan," Climate Diplomacy, accessed January 1, 2026, <https://climate-diplomacy.org/case-studies/dam-conflict-between-kyrgyzstan-and-uzbekistan>

69 Albina Muratbek, "President Mirziyoyev's Pivot to Central Asian Cooperation: Progress Made over Two Years," Eurasian Research Institute, January 2019, <https://eurasian-research.org/wp-content/uploads/2020/07/Weekly-e-bulletin-14-01-2019-20-01-2019-No-194.pdf>

70 "Глава государства наградил работников водного хозяйства," Press Service of the President of the Republic of Kazakhstan, July 9, 2025, <https://akorda.kz/ru/glava-gosudarstva-nagrada-ly-rabotnikov-vodnogo-hozyaystva>

71 "Address by the President of the Republic of Uzbekistan Shavkat Mirziyoyev at the Seventh Consultative Meeting of the Heads of State of Central Asia," Press Service of the President of the Republic of Uzbekistan, November 16, 2025, <https://www.president.uz/en/lists/view/8674>

72 Aman Bakiyev, "Turkmenistan Bids Caspian Environmental Forum as Stepping Stone to Ecology Summit," *Trend*, August 12, 2025, <https://www.trend.az/business/4079861.html>

73 "Kambarata-1 HPP Project," Cabinet of Ministers of the Republic of Kyrgyzstan, accessed January 2, 2025, <https://www.worldbank.org/content/dam/infographics/780xany/2023/apr/presentations/KREF-Kambarata1-fin.pdf>

74 Sadyr Jaraov, "Акыркы күндөрү жалпысынан 35 саат учакта олтуруп бүгүнкү күндө элди түйшөлтүп жаткан 3 маселе боюнча кайрылуу жазып койдум эле," Facebook, November 9, 2025, <https://www.facebook.com/jaraov.sadyr/posts/pfbid0E8e9QV7gfmRGf21WzWhhKfzkGDPJghD9g9CWSP5zKePXdkDPHj8wkWQKva22a2l>

75 «В Таджикистане ввели новые ограничения на подачу электроэнергии», *ASIA-Plus*, November 29, 2025, <https://www.asiaplustj.info/ru/news/tajikistan/economic/20251129/v-tadzhikistane-veli-novie-ogranicheniya-na-podachu-elektroenergi>

76 «Казakhstan, Кыргызстан и Узбекистан договорились о параметрах водно-энергетического сотрудничества и взаимной поддержке», Ministry of Energy of the Republic of Kazakhstan, November 23, 2025, <https://www.gov.kz/memleket/entities/energo/press/news/details/1110532?lang=ru>

People enjoy Lake Balkhash, the second-largest lake in Central Asia. Kazakhmys Smelting plant, Kazakhstan's largest copper producer, sits in the background in June 2024. (Ruslan Pryanikov / AFP via Getty Images)



Part II: Looming Challenges

Economic Development Aspirations Placing Added Stress on Water Supplies

Over the past year, Central Asian governments have articulated plans to transform their countries from suppliers of raw materials into trade and manufacturing hubs and centers of artificial intelligence research and development. In addition, they are launching major infrastructure improvements to meet growing demand for electricity. Meanwhile, the United States and European Union are interested in tapping into the region's vast mineral wealth through joint development of the mining sector.

Implementation of these projects will further strain Central Asia's water supplies; their successful realization hinges on the development of effective water-management mechanisms. Existing structures such as the ICWC have proved ineffective in managing long-standing challenges. To increase the chances of achieving modernization goals, these structures must be substantially reformed or give way to new organizations that can enforce compliance with collective decisions.

Critical Minerals and Rare Earths

Oil, natural gas, and cotton have defined Central Asia's economic trajectory to date. But the region's abundance of critical minerals, including rare earth elements, stands to shape the future economic agenda.

The region is known to be rich in natural resources, including uranium, manganese, lithium, zinc, lead, and tungsten. But the full extent of Central Asia's deposits has not yet been mapped, as large portions of the most mineral- and metal-rich states – Kazakhstan, Tajikistan, and Uzbekistan – remain to be surveyed. A lack of funding, technology, and expertise has hindered surveying in the post-Soviet era.⁷⁷ According to U.S. Geological Survey estimates, these states are thought to hold “substantial undeveloped and undiscovered resources” of rare earths and minerals. The most recent USGS list of rare earths and critical mineral “instances” in Central Asia was compiled in 2016 and is consid-

77 Aruzhan Meirkhanova, “Critical Minerals in Central Asia: Curse or Blessing?” Davis Center for Russian and Eurasian Studies, January 27, 2025, <https://daviscenter.fas.harvard.edu/insights/critical-minerals-central-asia-curse-or-blessing>

ered outdated, noting 384 distinct deposits in various stages of development.⁷⁸

In April 2025, Kazakhstan announced a potentially massive discovery of rare earth elements. Preliminary surveys indicate that deposits of elements including neodymium, cerium, and yttrium – elements needed for car batteries and medical equipment – could exceed 20 million tons. If verified, the discovery means Kazakhstan would possess the world’s third-largest reserves of rare earths behind China and Brazil.⁷⁹

China is presently the dominant player in Central Asia’s mining sector, but the United States and European Union are prioritizing access to critical minerals in their diplomatic engagement with Central Asian states. During a summit in Washington in November 2025, the Uzbek and Kazakh presidents announced a bevy of investment deals concerning the sector, including a \$1.1 billion deal under which a U.S. firm gained the rights to develop large tungsten deposits in Kazakhstan.⁸⁰

Central Asian states are currently striving to maximize mining sector development opportunities. Uzbekistan has launched a three-year, \$2.6 billion initiative to develop 76 projects covering 28 different elements used in the production of durable goods. The initiative aims to stimulate a homegrown supply chain, in which minerals mined in Uzbekistan are processed domestically and used in the production of goods in Uzbek factories that are then exported.⁸¹

Mining is a water-intensive industry. The challenge for regional governments will be to ensure enough water to facilitate the large-scale expansion of mining operations without disrupting household supplies. An analysis of USGS data has shown that in areas under existing water stress, large-scale mining can consume as much as 40 percent of available resources. Many future mining ventures in Central Asia stand to be in water-stressed areas.⁸²

Nuclear Energy

Central Asian states see nuclear energy as a solution to a power conundrum, but it takes huge volumes of water to cool reactors.

At present, electricity-generating capacity in Central Asia is struggling to keep up with economic development ambitions while meeting carbon dioxide emission reduction goals. Nuclear power can help close the gap but poses a water-management challenge. “Nuclear power plants consume vast amounts of water during normal operations to absorb the waste heat left over after making electricity and also to cool the equipment and buildings used in generating that electricity,” according to the Union of Concerned Scientists.⁸³

The region at present is facing a widening power gap. In Kazakhstan, for example, electricity consumption in 2024 reached an annual record of 120.4 billion kilowatt-hours. At the same time, the country produced only 117.9 billion kWh, with hydropower accounting for 10 percent of the total, and coal-fired plants generating the majority.⁸⁴ Government projections show the power deficit may widen in 2025 to over 5 billion kWh.

78 “Rare Earth Element Occurrence Database of the Tien Shan Region, Central Asia,” U.S. Department of the Interior, accessed January 2, 2026, <https://catalog.data.gov/dataset/rare-earth-element-occurrence-database-of-the-tien-shan-region-central-asia>

79 “Карагандинские геологи открыли месторождение редкоземельных элементов,” Ministry of Industry and Construction of the Republic of Kazakhstan, April 2, 2025, <https://www.gov.kz/memleket/entities/mps/press/news/details/967467?lang=ru>

80 “Nvidia, Boeing, OpenAI among U.S. Companies Signing New Agreements with Kazakhstan,” *Kazinform*, November 7, 2025, <https://qazinform.com/news/nvidia-boeing-openai-among-us-companies-signing-new-agreements-with-kazakhstan-260cf1>

81 “Uzbekistan Launches Drive to Develop Minerals & Mining Sector,” *Eurasianet*, March 10, 2025, <https://eurasianet.org/uzbekistan-launches-drive-to-develop-minerals-mining-sector>

82 Shivani Lakshman, “More Critical Minerals Mining Could Strain Water Supplies in Stressed Regions,” World Resources Institute, January 10, 2024, <https://www.wri.org/insights/critical-minerals-mining-water-impacts>

83 “Got Water?” Union of Concerned Scientists, October 2007, <https://www.ucs.org/sites/default/files/2019-10/20071204-ucs-brief-got-water.pdf>

84 “Kazakhstan Sees Record Electricity Consumption and Production Gap in Years,” *Kazinform*, May 2, 2025, <https://qazinform.com/news/kazakhstan-sees-record-electricity-consumption-and-production-gap-in-years-9250f8/amp>

Kazakhstan has the most advanced nuclear program in Central Asia, having broken ground in August 2025 on the first of three planned nuclear facilities. Rosatom, Russia's nuclear entity, is slated to build the first plant featuring two VVER-1200-type reactors on the shores of Lake Balkhash, with a target completion date in 2035-36.⁸⁵ The reactors can produce an estimated 1.2 gigawatts (GW) of power per year. Preliminary agreements are in place with China's National Nuclear Corp. to build the other two nuclear plants.⁸⁶

Uzbekistan has also engaged Rosatom to build two small-scale RITM-200N reactors each with an annual generating capacity of 55 megawatts, as well as two larger VVER-1000 models with a 1 gigawatt generating capacity each.⁸⁷ The smaller reactors could become operational in 2029, while the VVER models are slated for completion in the mid-2030s.⁸⁸ Kyrgyzstan, meanwhile, has a memorandum of understanding in place with Rosatom to explore the feasibility of building RITM-200N units in the country.⁸⁹

All reactor types envisioned for Central Asia require vast quantities of water. The VVER-1200 units in Kazakhstan are considered slightly more water-efficient than older VVER designs. Still, VVERs, which are similar to Western-build large-scale pressurized water reactors, are believed to use at least 91,000 liters (20,000 gallons) of water per minute.⁹⁰

AI, IT and Crypto Development

Central Asian states, in particular Kazakhstan, Tajikistan, and Uzbekistan, have articulated ambitions of becoming high-tech development hubs, silicon valleys on the Silk Road. Accordingly, they are making big bets on developing their respective capabilities in artificial intelligence, internet technology, and cryptocurrency, creating IT parks and building data centers. As with the mining sector, fulfilling the region's digital vision promises to be a water-intensive endeavor.

Kazakhstan has emerged as the early leader in the rush to digitalize. Tokayev set out the country's digital agenda in a September 2025 speech in which he announced the creation of a dedicated Ministry of AI to guide modernization efforts. Another major component of Tokayev's plan is the founding of an entirely new, futuristic city, called Alatau, to serve as a haven for tech innovation and digital asset experimentation.⁹¹

To meet the computational needs to power Kazakhstan's digital transformation, the country is building data centers. The country already has 13 such centers, and a massive, new TIER 4 facility – the most advanced classification for data centers, featuring extensive backup systems to prevent downtime – is slated to open in 2026. When operational, the TIER 4 data center will potentially double existing server capacity in the country.^{92, 93}

Uzbekistan, like Kazakhstan, is racing to build a new innovation hub, dubbed

85 "Ulken Nuclear Power Plant," Global Energy Monitor Wiki, accessed January 2, 2026, https://www.gem.wiki/Ulken_nuclear_power_plant#:~:text=Background,and%20begin%20its%20basic%20design

86 Zhanel Zhazetova, "China to Build Third Nuclear Power Plant in Kazakhstan," *Kursiv*, July 31, 2025, <https://kz.kursiv.media/en/2025-07-31/engk-nknk-china-to-build-third-nuclear-power-plant-in-kazakhstan>

87 "Uzbekistan Plans Two VVER-1000s and Two SMRs," *World Nuclear News*, September 29, 2025, <https://world-nuclear-news.org/articles/uzbekistan-plans-two-vver-1000s-and-two-smrs>

88 "How a VVER-type NPP Works," Rosatom Newsletter, No. 212, October 2018, <https://rosatomnewsletter.com/2018/10/31/how-a-vver-type-npp-works>

89 "Kyrgyzstan Eyes Rosatom NPP Deal," *Nuclear Engineering International*, June 30, 2025, <https://www.neimagazine.com/news/kyrgyzstan-eyes-rosatom-npp-deal>

90 Michael Mariotte, "Nuclear Power and Water," Nuclear Information and Resource Service, accessed January 2, 2026, <https://www.nirs.org/wp-content/uploads/reactorwatch/water/nuclearpowerandwater.pdf>

91 "President Kassym-Jomart Tokayev's State of the Nation Address to the People of Kazakhstan "Kazakhstan in the Era of Artificial Intelligence: Current Challenges and Solutions through Digital Transformation," Press Service of the President of the Republic of Kazakhstan, September 8, 2025, <https://akorda.kz/en/president-kassym-jomart-tokayevs-state-of-the-nation-address-to-the-people-of-kazakhstan-kazakhstan-in-the-era-of-artificial-intelligence-current-challenges-and-solutions-through-digital-transformation-1083029>

92 "Kazakhstan to Become a Regional Hub in Google's Global Cloud Network," *Kazinform*, October 8, 2025, <https://qazinform.com/news/kazakhstan-to-become-a-regional-hub-in-googles-global-cloud-network-c653e9>

93 "Kazakhstan Data Centers," Data Center Map, accessed January 2, 2026, <https://www.datacentermap.com/kazakhstan>

New Tashkent, and plans to add data centers.⁹⁴ Tajikistan and Turkmenistan are likewise aiming to become digital destinations, but both face significant infrastructure hurdles.⁹⁵

The digitalization initiatives have potentially worrisome ramifications for Central Asia's water-energy nexus. Data centers and crypto mining both require huge amounts of electricity. In addition to the power demand, a large-scale data center can use up to 5 million gallons of water per day for cooling, or about the same amount needed for daily use in a town of about 10,000.⁹⁶ Studies have shown that generating a 100-word piece of writing using AI requires the equivalent of a bottle of water.⁹⁷

Rapid and poorly regulated growth of the region's AI, IT, and crypto sectors risk widening the region's power deficit while also further stressing water supplies.

Kazakhstan has already experienced consequences from rapid, unregulated expansion of crypto mining. After China effectively banned crypto mining in 2021, many operations hurriedly moved across the border to Kazakhstan, quickly overwhelming the country's electricity grid and causing recurring black-outs.⁹⁸

The Qosh Tapa Canal

An immediate water-management challenge in Central Asia is Afghanistan's construction of the Qosh Tapa Canal, which started diverting water from the already stressed Amu Darya River in 2023. When completed sometime around 2028, it will irrigate agricultural lands in three northern Afghan provinces. Afghan economists claim the canal will enable a "green revolution" in the country, increasing wheat yields, reducing poppy cultivation, and creating jobs.⁹⁹

The canal could drain about 10 cubic kilometers of water from the Amu Darya, equal to 15-20 percent of the river's flow in an average year.¹⁰⁰ Independent watchdogs have raised alarms, saying that the rudimentary nature of canal construction can result in massive loss through seepage and evaporation. Some sections of the canal reportedly have been lined with concrete and stones, but long stretches appear to be little more than an earthen trench carved through harsh terrain.¹⁰¹ Some estimates project that nearly a quarter of the canal's water flow could be wasted in transit.¹⁰²

The canal represents a tangible threat to water supplies for downstream states Uzbekistan and Turkmenistan. One analysis found that a scenario in which the canal significantly diverts the Amu Darya's flow could have an adverse impact on Uzbek agricultural production resulting in the loss of 250,000 jobs.¹⁰³



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- 94 "New Tashkent Masterplan," Buro Happold, accessed January 2, 2026, <https://www.burohappold.com/projects/new-tashkent-masterplan>
- 95 "With the Help of Advanced Solutions, Turkmenistan is Implementing a Strategic Course Towards Green Energy," *Turkmenistan Golden Age*, November 4, 2025, <https://turkmenistan.gov.tm/en/post/100252/help-advanced-solutions-turkmenistan-implementing-strategic-course-towards-green-energy>
- 96 Miguel Yañez-Barnuevo, "Data Centers and Water Consumption," Environmental and Energy Study Institute, June 25, 2025, <https://www.eesi.org/articles/view/data-centers-and-water-consumption>
- 97 Pranshu Verma and Shelly Tan, "A Bottle of Water per Email: The Hidden Environmental Costs of Using AI Chatbots," *Washington Post*, September 18, 2024, <https://www.washingtonpost.com/technology/2024/09/18/energy-ai-use-electricity-water-data-centers>
- 98 Almaz Kumenov, "Kazakhstan to Restrict Crypto Miners amid Power Shortages," *Eurasianet*, October 18, 2021, <https://eurasianet.org/kazakhstan-to-restrict-crypto-miners-amid-power-shortages>
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Compounding regional worries, the legal framework for managing potential water-supply disputes is vague, as Afghanistan has been largely excluded from regional water cooperation frameworks. A 1946 border treaty and subsequent 1958 agreement give Afghanistan rights to 9 cubic kilometers of water withdrawal from the Panj River, a major Amu Darya tributary. In 1987, the Soviet Union instituted Protocol No. 566 on water distribution from the Amu Darya among the riparian republics. The protocol unilaterally assigned Afghanistan 2.1 cubic kilometers of water withdrawal, which matches what Afghanistan has actually been able to withdraw prior to the Qosh Tepa project. Afghanistan is not a signatory to any U.N. agreements governing water resources, meaning that the Soviet treaties are the only legal agreements defining relations across the Amu Darya.¹⁰⁴

Central Asian states – particularly Uzbekistan, which sits on Afghanistan’s northern border – have stepped up engagement with Kabul on water-related and trade issues, intent on striking a deal on the use of the Amu Darya’s resources. The Taliban government has reciprocated interest in expanding trade and transportation cooperation but has been reluctant to negotiate Qosh Tepa water allotments.¹⁰⁵

The Rogun Dam

The construction of the Rogun Dam in Tajikistan constitutes another water-management challenge for the Amu Darya. If built to its full specifications on the Vakhsh River,¹⁰⁶ the dam will become the world’s tallest at 335 meters, with an annual projected power generation capacity of about 3.8 GW,¹⁰⁷ enabling the Tajik government to meet domestic needs and earn income from exports. The Rogun project also entails the creation of a reservoir with a 13.3 cubic kilometer capacity.¹⁰⁸

The dam project could cost as much as \$9 billion, of which about \$3 billion has been spent, with two of the six planned electricity-generating turbines currently operational. In 2024, the World Bank approved a \$350 million development grant for the project, but it paused disbursements in mid-2025, asking Tajik officials to produce a feasibility plan showing the dam’s operations can generate sufficient revenue to repay construction costs while not significantly expanding public debt.¹⁰⁹

The dam’s implications for Central Asia’s water-energy nexus continue to spark heated debate. Tajik officials argue that Rogun will ensure the country’s energy sovereignty. Watchdog groups, meanwhile, caution that Rogun’s construction carries “catastrophic environmental and social risks” for those living downstream.¹¹⁰ One environmental group has argued that Rogun is a “white elephant” in the making, reasoning that wind and solar generation options may provide more cost-efficient sources of electricity by the time Rogun becomes fully operational, undercutting the dam’s economic rationale.¹¹¹



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- 109 “S&P: Tajikistan Will Receive International Donors’ Money for Rogun After All Conditions Are Fulfilled, ASIA-Plus, August 25, 2025, <https://asiaplus.tj.info/en/news/tajikistan/economic/20250825/sp-tajikistan-will-receive-international-donors-money-for-rogun-after-all-conditions-are-fulfilled>
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Prior to 2016, Rogun aroused strong opposition from downstream states, particularly Uzbekistan. But in 2022, Mirziyoyev signaled Uzbekistan's readiness to purchase Rogun-generated electricity.¹¹² Kazakhstan, Afghanistan, and Pakistan have also indicated interest.¹¹⁵

A 2015 academic study¹¹⁴ showed that if properly managed, Rogun can be a win-win for the regional water-energy nexus, boosting electricity production while having minimal impact on downstream water availability. The report indicated that collective management of Rogun and other major dams would represent the optimal operating structure.

"Cooperative basin-wide maximization of benefits leads to large increases in upstream hydropower production (93 percent), and only minor changes in the value of summer water availability to downstream irrigators (-1 percent)," the report stated.

But the report added: "If upstream stations, including Rogun, are managed unilaterally ... hydropower benefits might more than double (116 percent) while irrigation benefits greatly decrease (-31 percent), thereby substantially reducing overall energy and irrigation benefits (-18 percent)."

RECOMMENDATIONS

NEGOTIATE A NEW, COMPREHENSIVE TREATY

For Central Asian Governments

Treaty designed to manage water supplies, promote the efficient use of resources and promote equitable solutions to water-energy challenges.

The complexity of existing and emerging challenges requires a cohesive and unified response. A new treaty should be negotiated to cover all facets of water-management challenges, including allocations, industrial use, conservation measures, environmental protection, power generation, reservoir management, tourism, Aral Sea revival efforts, Caspian Sea preservation efforts, etc. A model for such a Central Asia pact can be the International Commission for the Protection of the Danube River (ICPDR), which comprises 15 member states all dedicated to preserving the economic and environmental viability of Central and Western Europe's longest river. The ability of Kyrgyzstan, Tajikistan, and Uzbekistan to settle long-standing border disputes in 2024-25 underscores the readiness of Central Asian states to explore a comprehensive water-use and electricity-sharing pact.¹¹⁵

CREATE A UNIFIED ORGANIZATION

To be responsible for implementing treaty provisions and setting water-use, irrigation and hydropower targets.

To promote efficiency and maximize available resources, existing entities, including IFAS and the ICWC, can be folded into a single comprehensive entity. Structurally, the new body could have a rotating presidency and permanent secretariat similar to that of the ICPDR. Decision-making would be consensus-based.

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114 Maksud Bekchanov, et al., "How Does the Rogun Dam Affect Water and Energy Scarcity in Central Asia?" *Water International*, 40(5-6), 856-876, June 16, 2015, <https://doi.org/10.1080/02508060.2015.1051788>

115 "Central Asian Leaders Look to Expand Mutual Trade," *Eurasianet*, January 10, 2025, <https://eurasianet.org/central-asian-leaders-look-to-expand-mutual-trade>

DEVELOP ENFORCEMENT MECHANISMS AND PENALTIES

Develop effective enforcement mechanisms and/or penalties for non-compliance of treaty provisions or organization-approved decisions.

A major reason why existing entities have not been effective is the lack of means to get participating states to adhere to collective decisions and targets.

MOUNT COORDINATED PUBLIC AWARENESS CAMPAIGNS

Coordinated public awareness campaigns to promote conservation, and take action to bring water-use tariffs closer to market rates for businesses and private citizens in the region.

A 2014 study published by the journal *Nature* showed that Central Asian citizens consume more water per capita than in any other region around the globe.¹¹⁶ The average Turkmen citizen, for example, consumes four times more water than his/her U.S. counterpart. Part of the problem is that rates for water and electricity are highly subsidized. Subsidies should be gradually reduced to bring rates more in line with the actual cost of water. Various means should be employed to encourage citizens to use less water.

For the International Community

PROVIDE EXPERTISE, EQUIPMENT AND FINANCIAL ASSISTANCE

Assistance to help Central Asian states upgrade irrigation and water management systems.

As noted, governments in the region are taking steps to prevent water loss in irrigation systems and more efficiently manage water systems. But the states lack funding. Foreign assistance from individual governments, as well as International Financial Institutions (IFIs), can accelerate ongoing processes. Governments can also facilitate foreign investment in water-efficient technologies.

Foreign governments and international financial institutions can take immediate action to prevent water wastage. For example, foreign assistance can be provided to line Turkmenistan's Karakum Canal, which, according to some estimates, perhaps loses over half its water due to leaks and evaporation.¹¹⁷ Taking such action can help offset the impact on the Amu Darya Basin when Afghanistan's Qosh Tepa Canal becomes fully operational.

FUND RESEARCH ON THE IMPACT OF CLIMATE CHANGE ON CENTRAL ASIA

Research that is including trends concerning water resources, glacier melt and the Caspian Sea's decline. Also encourage the wide circulation of relevant data.

A 2022 study¹¹⁸ found that there is a dearth of research on topics relating to the impact of climate change on the region's water resources. The United States and European Union should provide assistance for scholarly work that enables a better understanding of trends and the promotion of more informed and efficient policymaking.

WORK WITH CENTRAL ASIAN GOVERNMENTS TO PROSPECT FOR AQUIFERS IN CENTRAL ASIA

Assist with identifying new sources of water.

As with critical minerals, much of Central Asia has yet to be comprehensively surveyed for aquifers. In September 2025, the Geological Survey of Finland announced¹¹⁹ that it would participate in two pilot projects to identify new sources of groundwater. More work on this is needed.

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FACILITATE THE PROVISION OF EXPERTISE AND ASSISTANCE TO HELP CENTRAL ASIAN STATES DEVELOP SUSTAINABLE WATER-SUPPLY SYSTEMS FOR THE AI, IT AND CRYPTO SECTORS

SUPPORT CENTRAL ASIAN EFFORTS TO ENGAGE AFGHANISTAN IN JOINING A SHARED WATER-USE FRAMEWORK.

ENCOURAGE CHINA TO AGREE ON WATER USE QUOTAS ON TRANSBOUNDARY RIVERS

EXPAND IFI SUPPORT FOR INFRASTRUCTURE INITIATIVES



But without diminishing amounts available for household use. Governments and IFIs can facilitate purchases of sustainable cooling systems diminishing water needs for AI, IT and crypto operations.

Foreign governments and IFIs can support regional investments in systems to cool data centers and crypto mining operations. For example, Microsoft unveiled a new design for a data center cooling system that reportedly uses no water.¹²⁰

Support Central Asian efforts to engage Afghanistan in joining a shared water-use framework.

Central Asian states, particularly Uzbekistan, are trying to work with Taliban authorities in Afghanistan to manage the Amu Darya River's resources, including the concreting of the entire Qosh Tepa Canal to minimize water wastage. IFIs can potentially help provide financing for such a project. U.S. and EU non-recognition of the Taliban government, however, creates potential obstacles to such assistance.

Beijing to date has been reluctant to work with Kazakhstan to negotiate a water-use framework covering the Ili and Irtysh rivers. International advocacy should aim to promote a substantive bargaining process.

Initiatives designed to improve access to clean drinking water for citizens living in rural areas of Central Asia.

AUTHORS

Alexander Thompson is a reporter who writes about Central Asia's politics, cultures, and environment from Bishkek, Kyrgyzstan. He previously worked for American newspapers and speaks Russian and French.

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¹²⁰ Steve Solomon, "Sustainable by Design: Next-Generation Datacenters Consume Zero Water for Cooling," Microsoft, December 9, 2024, <https://www.microsoft.com/en-us/microsoft-cloud/blog/2024/12/09/sustainable-by-design-next-generation-datacenters-consume-zero-water-for-cooling>



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