The Upstream-Downstream Energy Trade-Off: How the Water-Energy Nexus Dictates Central Asia's Stability

Qoshayev Dilshod Shamsiddin ugli
Master of Water Diplomacy, University of World Economy and Diplomacy
doi:https://doi.org/10.5281/zenodo.23036324

Abstract: Central Asia's post-Soviet stability rests on an unresolved seasonal contradiction. The upstream states of the Aral Sea Basin, Kyrgyzstan and Tajikistan, control the reservoirs that regulate the Syr Darya and Amu Darya but lack fossil fuels, and therefore want to release water in winter to generate electricity and heat. The downstream states, Uzbekistan, Turkmenistan and Kazakhstan, hold substantial hydrocarbon reserves but depend on irrigated agriculture, and therefore need that same water stored until the summer growing season. Under the Soviet Union this conflict was internalised through a centrally planned barter in which downstream republics supplied gas, coal and fuel oil in exchange for summer releases. This article traces how the collapse of that swap after 1991 produced three decades of unilateral reservoir operation, megaproject rivalry and securitised rhetoric, and how, since roughly 2017, a shift toward trilateral co-investment and grid reintegration has begun to reframe hydropower as a shared regional asset. It argues that two exogenous stressors, accelerating glacier mass loss in the Tian Shan and Pamir and the Afghan Qosh Tepa Canal, now threaten to overwhelm institutions designed for a closed, five-state system of stable supply. Drawing on hydro-hegemony theory (Zeitoun & Warner, 2006; Wegerich, 2008), the compliance literature on basin agreements (Bernauer & Siegfried, 2008) and the benefit-sharing paradigm (Sadoff & Grey, 2002), the article evaluates the International Fund for Saving the Aral Sea (IFAS) and the Interstate Commission for Water Coordination (ICWC) and proposes a nexus-based governance architecture built on enforceable energy-for-water compensation, joint asset ownership and a liquid regional electricity market.

Keywords: water-energy nexus; Aral Sea Basin; hydro-hegemony; Rogun; Kambarata-1; CAPS; Qosh Tepa; benefit-sharing

1. Introduction: The Hydro-Political Geography of the Aral Sea Basin

The Aral Sea Basin is defined by a sharp spatial mismatch between where water is generated and where it is used. The Amu Darya, formed by the confluence of the Panj and Vakhsh rivers, carries a mean annual flow of roughly 78 to 79 km³, while the Syr Darya, formed by the Naryn and Kara Darya in the Fergana Valley, carries roughly 37 km³ (Dukhovny & de Schutter, 2011). Runoff is overwhelmingly generated in the high mountains of the Pamir, Alai and Tian Shan. Tajikistan contributes around three-fifths of the Amu Darya's surface flow, with Afghanistan contributing a significant further share from the Panj, Kokcha and Kunduz headwaters, while Kyrgyzstan generates around three-quarters of the Syr Darya's flow (McKinney, 2004).

Consumption follows the opposite gradient. More than 90% of basin withdrawals serve irrigation, concentrated in the lowland oases and deltas of Uzbekistan, Turkmenistan and southern Kazakhstan. The Soviet hydraulic mission expanded irrigated area in the basin from roughly 4.5 million hectares in 1960 to around 7 million by the late 1980s, primarily for

cotton (Micklin, 1988). The consequence, the desiccation of the Aral Sea, remains the canonical example of anthropogenic basin collapse; by the 2000s the sea had lost roughly 90% of its volume and split into separate northern and southern water bodies (Micklin, 2007).

Overlaid on this hydrological asymmetry is an inverse endowment of energy resources. Turkmenistan holds some of the world's largest proven natural gas reserves, Uzbekistan possesses significant gas and a domestic thermal power fleet, and Kazakhstan is a major oil and coal producer. Kyrgyzstan and Tajikistan, by contrast, have negligible commercially exploitable hydrocarbons but among the highest per-capita hydropower potential in the world, and derive more than 90% of their electricity from hydro. Water is therefore simultaneously an energy commodity upstream and an agricultural input downstream. This duality is the essence of the Central Asian water-energy nexus, and it explains why the region's water disputes have always been energy disputes as well (Granit et al., 2012).

The analytical challenge is not scarcity in the aggregate but timing. Upstream and downstream demand for the same cubic metre peaks in opposite seasons. The remainder of this article examines the mechanics of that seasonal trade-off, the institutional history of attempts to manage it, the new stressors reshaping it, and the governance options for stabilising it.

2. Mechanics of the Seasonal Trade-Off

The hydrological year in the Aral Sea Basin is conventionally divided into a non-vegetation period (October to March) and a vegetation period (April to September). Natural runoff peaks between May and August as snow and glacier melt arrive, broadly coinciding with irrigation demand. Large multi-year and seasonal reservoirs were built precisely to reshape this hydrograph: to capture spring flood peaks and release them during the late-summer irrigation deficit. The two critical regulating structures are Toktogul on the Naryn and Nurek on the Vakhsh.

Reservoir / plant	River (country)	Dam height (m)	Installed capacity (MW)	Total storage (km³)	Status
Toktogul	Naryn (Kyrgyzstan)	215	1,200	19.5	Operating since 1975
Nurek	Vakhsh (Tajikistan)	300	c. 3,000	10.5	Operating since 1972
Rogun	Vakhsh (Tajikistan)	335 (design)	3,780 (design)	13.3 (design)	Partially operating; under construction
Kambarata-1	Naryn (Kyrgyzstan)	c. 256 (design)	1,860 (design)	c. 5 (design)	Pre-construction; trilateral JV

Figures are approximate design or nameplate values compiled from Dukhovny and de Schutter (2011), Bekchanov et al. (2015) and World Bank project documentation.

2.1 The summer irrigation regime

Toktogul was designed as a multi-year irrigation reservoir, not primarily as a power station. Under the Soviet operating rule, roughly 75% of annual releases occurred in the vegetation period and only about 25% in winter (World Bank, 2004). Summer releases fed the Fergana Valley, the Hungry Steppe (Mirzachul) and the Chardara reservoir in Kazakhstan, sustaining cotton and, increasingly after independence, winter wheat that requires spring and early-summer irrigation. Downstream irrigation norms are high: cotton on saline, poorly drained lowland soils commonly receives 10,000 to 12,000 m³ per hectare over a season, reflecting conveyance losses in unlined canals and leaching requirements as much as crop evapotranspiration (Varis, 2014). The electricity generated during summer releases was surplus to Kyrgyz needs and was exported through the Soviet Unified Energy System.

2.2 The winter hydropower regime

After 1991 the calculus inverted. Kyrgyzstan and Tajikistan lost access to cheap Soviet-era fuel and could not afford hydrocarbons at world prices. Winter heating in Bishkek and Dushanbe became electricity-dependent, and winter peak demand rose sharply. Operators accordingly shifted Toktogul releases toward winter, with the winter share rising at times to between 55% and 65% of annual discharge (Wegerich, 2004; Bernauer & Siegfried, 2008). Nurek has followed a similar pattern, drawing down reservoir levels through the winter to meet Tajik demand.

The downstream consequences were twofold. First, less water remained in storage for the summer, generating irrigation shortfalls in dry years. Second, large winter releases arrived when the Syr Darya's lower channel was frozen or had reduced conveyance capacity. Flood waters could not pass Chardara and were diverted into the Arnasai depression in Uzbekistan, turning the Aidar-Arnasai lake system into a vast sink that swallowed water which neither reached the North Aral Sea nor served any productive purpose. Winter flooding also damaged settlements along the lower Syr Darya in Kazakhstan.

2.3 A structural zero-sum under current institutions

The tension is structural rather than merely political. A cubic metre released from Toktogul in January produces electricity worth far more to Kyrgyzstan than the same cubic metre released in July, when Kyrgyz demand is low and export markets are thin. Conversely, that cubic metre is worth far more to an Uzbek or Kazakh farmer in July than in January. Absent a mechanism that pays the upstream operator for the opportunity cost of storing water through winter, rational national optimisation produces a collectively inferior outcome. Jalilov et al. (2016) and Bekchanov et al. (2015) show through hydro-economic modelling that basin-wide welfare is maximised only under cooperative operation with compensation, and that the distribution of gains, not their existence, is the binding constraint. The acute Tajik energy crisis of winter 2007-2008, when extreme cold, low reservoir levels and interrupted gas imports coincided, illustrated how quickly the trade-off can escalate into a humanitarian emergency upstream and an irrigation emergency downstream the following summer.

3. The Collapse of the Soviet Swap and the Evolution of Megaprojects

3.1 The Soviet barter and its post-1991 unravelling

Within the USSR, basin allocation was fixed by technical protocols of the Ministry of Land Reclamation and Water Management. Protocol 566 (1987) allocated Amu Darya water approximately as Uzbekistan 48.2%, Turkmenistan 35.8%, Tajikistan 15.4% and Kyrgyzstan

0.6%, while a 1984 scheme for the Syr Darya assigned approximately 51.7% to Uzbekistan, 38.1% to Kazakhstan, 9.2% to Tajikistan and 1.0% to Kyrgyzstan (Dukhovny & de Schutter, 2011). These quotas encoded the priority of downstream cotton. The energy side of the bargain was never a contract between sovereigns; it was an intra-ministerial transfer within a single command economy.

Independence converted this internal plan into an international problem. The 1992 Almaty Agreement froze Soviet-era allocations and created the ICWC, but it contained no energy provisions. The 1998 Framework Agreement on the Use of Water and Energy Resources of the Syr Darya Basin, signed by Kazakhstan, Kyrgyzstan and Uzbekistan (Tajikistan acceded in 1999), attempted to recreate the swap: downstream states would purchase surplus Kyrgyz summer electricity and supply equivalent volumes of coal, gas or fuel oil for winter. Implementation proceeded through annual intergovernmental protocols. Bernauer and Siegfried (2008) demonstrate that compliance was chronically poor: fuel deliveries were late or short, electricity purchases were negotiated down, and Kyrgyzstan responded by increasing winter releases. Because each annual protocol had to be renegotiated, the agreement lacked the credibility of a multi-year commitment and collapsed into bilateral bargaining by the late 2000s.

Wegerich (2008) interprets this period through the lens of hydro-hegemony. Uzbekistan, as the most populous and militarily capable state, positioned in the middle and lower basin, exercised hegemony not through geography but through material and bargaining power: it controlled regional transit routes, gas supply and the Tashkent-based dispatch centre of the power grid. Upstream states, lacking comparable power, sought to convert their positional advantage into leverage by building new storage.

3.2 Unilateral megaprojects: Rogun and Kambarata-1

Rogun, begun in 1976 and abandoned after the Soviet collapse, became the emblem of Tajik statehood and energy independence (Menga, 2015). Its design height of 335 m would make it the tallest dam in the world, with 3,780 MW of capacity and seasonal storage upstream of Nurek. For Uzbekistan under Islam Karimov, Rogun represented an existential risk: a Tajik capacity to withhold summer water from the Amu Darya, compounded by seismic concerns. The dispute securitised the basin. Uzbekistan restricted rail transit of freight to Tajikistan from 2009, and in 2012 Karimov publicly warned that upstream dams could provoke not merely serious confrontation but even wars. The World Bank's Techno-Economic Assessment Study and Environmental and Social Impact Assessment (2014) concluded that the project could be built and operated safely, conditional on operating rules that protected downstream flows, but did not resolve the political impasse. Bekchanov et al. (2015) showed that Rogun's downstream impact depends almost entirely on its operating regime: filled slowly and operated for summer release, it could increase dry-year water availability; filled rapidly and run for winter power, it would exacerbate downstream scarcity.

Kambarata-1 on the Naryn followed a parallel trajectory. Kyrgyzstan's 2012 agreement with Russia for the Kambarata-1 and Upper Naryn cascade projects stalled over financing and was denounced by Bishkek in January 2016. Throughout this period, Uzbekistan opposed upstream construction without prior downstream consent, invoking the 1997 UN Watercourses Convention, to which it acceded in 2007, and the principle of no significant harm (Rahaman, 2012).

3.3 From rivalry to co-investment

The decisive shift followed the leadership transition in Uzbekistan in late 2016. President Shavkat Mirziyoyev's foreign policy of good-neighbourliness removed Tashkent's veto posture. Uzbekistan softened its opposition to Rogun, the first Rogun unit was commissioned in November 2018, and the World Bank approved financing for the Rogun programme in December 2024 under a revised safeguard and benefit-sharing framework.

Kambarata-1 has become the clearest expression of the new model. Kazakhstan, Kyrgyzstan and Uzbekistan signed a roadmap in January 2023 and a cooperation agreement in Vienna in June 2024 establishing a joint venture in which Kyrgyzstan holds 34% and Kazakhstan and Uzbekistan 33% each (World Bank, n.d.). Construction is estimated at USD 5 to 6 billion, with the founders' equity supplemented by international financial institutions, and ownership reverting fully to Kyrgyzstan at the end of the project term (Times of Central Asia, 2024a). The World Bank has provided USD 13.6 million in concessional IDA financing for technical preparation, and ministerial roundtables in Dubai (May 2025) and Brussels (September 2025) reviewed the updated feasibility study, environmental and social assessment and financial model (24.kg, 2025). An intergovernmental agreement defining governance, financing and operation was expected to be signed and ratified during 2025-2026, and the Eurasian Development Bank signalled its willingness to participate in the financing syndicate in December 2025 (Interfax, 2025).

The significance of this structure is that it internalises the seasonal trade-off within a single asset. Downstream equity holders acquire a formal voice in operating rules and a claim on output, converting what was once a hostile upstream reservoir into a jointly owned regulating facility. Whether the joint venture's statutes bind it to downstream-friendly release schedules, and how disputes over those schedules will be resolved, remain the critical open questions.

3.4 Reactivating the Central Asian Power System

The institutional twin of co-investment is grid reintegration. The Central Asian Power System (CAPS), coordinated from the Energiya dispatch centre in Tashkent, allowed Soviet-era operators to balance upstream hydro against downstream thermal capacity. It fragmented after independence: Turkmenistan withdrew in 2003, and in 2009 Uzbekistan's disconnection from the ring isolated Tajikistan's grid, eliminating the physical basis for any seasonal electricity exchange. Reconnection of the Tajik and Uzbek grids in 2018, Turkmenistan's subsequent resynchronisation, and the CASA-1000 project linking Kyrgyz and Tajik summer surpluses to South Asian markets have begun to restore the infrastructure of exchange. A functioning CAPS matters for the water-energy nexus because it allows summer hydro output to be monetised, reducing the upstream incentive to hoard water for winter, and allows downstream thermal and emerging solar capacity to substitute for upstream winter generation. The widespread grid blackout across Kazakhstan, Kyrgyzstan and Uzbekistan in January 2022 also exposed the system's fragility and the need for investment in dispatch, reserves and interconnector capacity.

4. Climate Stressors and Emerging Catalysts

4.1 Glacial retreat in the Tian Shan and Pamir

The Aral Sea Basin's rivers are fed by some of the most climate-sensitive water towers on Earth. Immerzeel et al. (2020) rank the Syr Darya and Amu Darya among the most

important and most vulnerable of the world's 78 mountain water towers, owing to the combination of high downstream dependence and high exposure to warming. In the Tian Shan, the main source region of the Syr Darya, Farinotti et al. (2015) estimate that glaciers lost approximately 27% of their mass and 18% of their area between 1961 and 2012. Sorg et al. (2012) document consistent retreat across the range and warn of a declining glacier buffer in dry, hot summers, precisely when irrigation demand peaks. The Pamir presents a more heterogeneous picture: glaciers in the eastern Pamir and adjoining Karakoram have been relatively stable, a phenomenon often described as the Karakoram-Pamir anomaly, while those in the western and southern Pamir that feed the Panj and Vakhsh have lost mass.

4.2 Peak water and altered runoff timing

Glacier mass loss initially increases runoff as stored ice melts, before contributions decline once glaciers shrink below a threshold, the point known as peak water. Huss and Hock (2018) project that many Central Asian catchments are at or approaching peak water, with glacier-derived runoff declining through the second half of the century. Two hydrologically distinct effects follow. First, total annual flow may be broadly stable or even slightly higher for several decades, masking the long-term decline. Second, and more immediately consequential, the seasonal hydrograph shifts: warmer springs advance snowmelt, raising April-June flows and reducing the late-summer (July-September) glacier contribution on which irrigation in the lower basin depends (Siegfried et al., 2012).

This shift intensifies the upstream-downstream trade-off in two ways. Earlier melt increases the value of storage for carrying water from spring into late summer, raising the downstream stake in upstream reservoir operations. At the same time, hotter summers raise crop evapotranspiration and urban cooling demand downstream, while warmer winters may marginally reduce heating demand upstream. Bernauer and Siegfried (2012) conclude that climate change is most likely to raise conflict risk in the Syr Darya through this seasonal channel, but stress that the outcome is mediated by institutions: robust allocation and compensation rules can absorb considerable hydrological stress. The recurrent droughts of the 2020s, including the severe low-water year of 2021 and the dry conditions reported again in 2023 and 2025, offer a preview of the variability the basin must now plan for.

4.3 Afghanistan and the Qosh Tepa Canal

The most significant new catalyst is not climatic but political. Afghanistan, a riparian contributing a meaningful share of Amu Darya flow, was never party to the 1992 Almaty Agreement or to ICWC, and historically withdrew relatively little water owing to decades of conflict. The Soviet-Afghan arrangements of 1946 and later Soviet planning documents are frequently cited as recognising an Afghan entitlement of roughly 9 km³ per year, but this entitlement was never fully exercised or formally integrated into the post-Soviet allocation system.

The Taliban administration began construction of the Qosh Tepa Canal in 2022. The canal runs approximately 285 km from Kaldar District in Balkh Province to Andkhoy in Faryab Province and is intended to irrigate around 550,000 hectares of new and existing farmland (Faizee et al., 2026). The first phase was completed in 2023, the second phase began in February 2024, and Afghan authorities target completion in 2028 (Times of Central Asia, 2024b; Times of Central Asia, 2026). Estimates of eventual diversion vary widely. Analysts commonly cite around 20% of Amu Darya flow at the intake point, while one assessment

places the upper bound at about 13 km³ per year, close to a quarter of average flow (Times of Central Asia, n.d.). Reported early problems, including a large breach visible in satellite imagery in December 2023, also raise concerns about seepage losses, waterlogging and secondary salinisation of the kind that accompanied the Karakum Canal.

The canal alters the basin's strategic structure in three ways. First, it introduces a new upstream consumptive user whose withdrawals, unlike hydropower releases, are not returned to the river. Second, it falls entirely outside existing institutions: because no Central Asian state formally recognises the Taliban government, a binding water treaty is currently unattainable. Uzbekistan's water minister acknowledged in 2025 that Afghanistan has a right to its share and that armed confrontation is no option, a statement that captures the region's constrained choices (Times of Central Asia, 2026). Third, Qosh Tepa increases the downstream value of every cubic metre that Tajikistan's reservoirs can deliver in summer. It therefore raises the stakes of Rogun's operating rules and, paradoxically, may strengthen downstream incentives to reach a compensated operating agreement with Dushanbe. Turkmenistan and Uzbekistan's Karakalpakstan and Khorezm regions, at the tail of the system, are the most exposed.

5. Governance Frameworks and the Strategic Path Forward

5.1 ICWC and IFAS: a critical evaluation

The ICWC, created by the February 1992 Almaty Agreement, is the operational core of basin governance. Through its two Basin Water Organisations (BWO Amu Darya in Urgench and BWO Syr Darya in Tashkent) and its Scientific Information Centre, it sets seasonal withdrawal limits, monitors diversions at interstate headworks and preserves a remarkable degree of technical continuity with Soviet practice (Dukhovny & de Schutter, 2011). IFAS, founded in 1993 and restructured in 1997, sits above the ICWC as a political umbrella with a rotating presidency among the five heads of state, and is responsible for the successive Aral Sea Basin Programmes.

The merits of this architecture are real. It has prevented open interstate conflict for more than three decades, maintained data exchange through periods of acute political tension and provided a forum for heads of state. Its limitations, however, map precisely onto the nexus problem. First, ICWC is a water body with no energy mandate; the ministries that operate Toktogul and Nurek answer to energy ministers, not water ministers, so the institution that allocates water cannot negotiate the electricity and fuel flows that determine release decisions (Granit et al., 2012). Second, allocation remains anchored in Soviet quotas that reflect 1980s cropping plans rather than equitable and reasonable use under contemporary international law. Rahaman (2012) shows that the region's agreements largely omit the core principles of the UN Watercourses Convention, including equitable utilisation, the no-harm obligation, prior notification and dispute settlement. Third, IFAS lacks a permanent secretariat with independent technical capacity, its executive committee rotates with the presidency, and Kyrgyzstan suspended its participation in IFAS activities in 2016, undermining its claim to basin-wide legitimacy. Fourth, neither body includes Afghanistan. Abdullaev and Rakhmatullaev (2015) characterise the resulting system as one in which water management was transformed from a state-centric hydraulic mission into an instrument of socio-political control, rather than into genuine transboundary governance.

5.2 Integrated Water Resources Management

Since the early 2000s, donors have promoted IWRM, defined by the Global Water Partnership (2000) as a process that coordinates the development and management of water, land and related resources to maximise economic and social welfare equitably without compromising vital ecosystems. All five states have adopted elements of the approach: Uzbekistan reorganised its irrigation administration along hydrographic rather than administrative boundaries in 2003, Kyrgyzstan's 2005 Water Code introduced basin councils, and Tajikistan's Water Sector Reform Programme for 2016-2025 established basin-based management. Water user associations have been created widely at the farm level.

Implementation has nonetheless remained shallow. Rahaman and Varis (2005) warned early that IWRM risks becoming a normative slogan rather than an operational framework, and Central Asian experience largely confirms the concern. Hydrographic units exist on paper but often lack budget authority; water user associations are frequently dominated by local elites or state production targets; and state crop-quota systems, although substantially liberalised in Uzbekistan since the abolition of forced cotton labour and state orders, have historically constrained farmers' ability to respond to price signals. Most importantly for the nexus, IWRM has been applied within states and within the water sector, whereas the binding constraint is between states and between sectors. A nexus-oriented IWRM would treat reservoir operation, electricity dispatch and irrigation scheduling as a single optimisation problem at the basin scale.

5.3 Benefit-sharing: from dividing water to sharing value

The most promising conceptual shift is from allocating volumes to sharing benefits. Sadoff and Grey (2002) distinguish four categories of benefit from cooperation: benefits to the river (ecological), benefits from the river (economic production), reduced costs because of the river (lower political tension) and benefits beyond the river (wider economic integration). Applied to the Aral Sea Basin, this framework suggests that disputes over cubic metres can be reframed as negotiations over the division of a larger joint surplus. Pohl et al. (2017) estimate that the costs of non-cooperation in the region, including lost agricultural output, inefficient energy supply and forgone trade, amount to several billion US dollars annually, far exceeding the cost of compensation schemes.

Four operational models follow from this literature.

1. **Enforceable energy-for-water compensation.** A multi-year successor to the 1998 Framework Agreement should replace annual protocols with a standing contract, price summer water storage explicitly at upstream opportunity cost and back payments with escrow or third-party guarantees from international financial institutions, directly addressing the compliance failures documented by Bernauer and Siegfried (2008).

2. **Joint ownership of regulating assets.** The Kambarata-1 joint venture should serve as a template, provided its charter specifies binding seasonal release schedules, drought protocols and independent dispute resolution. A comparable consortium or operating agreement for the Vakhsh cascade, including Rogun and Nurek, would extend the model to the Amu Darya.

3. **A liquid regional electricity market.** A fully resynchronised CAPS with transparent cross-border tariffs would allow summer hydro surpluses to be sold and winter deficits to be covered by downstream gas-fired and solar generation. Rapid solar and wind deployment in

Uzbekistan and Kazakhstan creates a natural complement: daytime solar in winter can reduce the volume of water that upstream reservoirs must release for power.

4. **Demand-side water productivity.** Conveyance and field-application efficiencies in the lowland systems remain low. Canal lining, drip and laser levelling, and crop diversification away from water-intensive cotton and rice would free volumes that reduce pressure on upstream storage and help absorb Qosh Tepa withdrawals (Varis, 2014).

5.4 Integrating Afghanistan

No basin architecture for the Amu Darya can be stable while its second-largest source contributor remains outside it. In the absence of diplomatic recognition, the realistic path is a graduated, technical track: joint hydrological monitoring at the Qosh Tepa intake, data exchange through neutral facilitators or ICWC's scientific centre, and observer-level participation in BWO Amu Darya meetings. Such arrangements would not settle legal entitlements but would reduce uncertainty, which is itself a major driver of downstream securitisation. Faizee et al. (2026) similarly emphasise donor coordination and Afghanistan's inclusion in basin-wide initiatives as priorities.

6. Conclusion

Central Asia's water question has never been primarily about how much water exists; it has been about when water is released, who pays for storing it and who captures the value it creates. The Soviet Union resolved that question administratively, by subordinating upstream energy needs to downstream cotton and compensating the upstream republics with fuel. Independence dissolved the administrative solution without replacing it with a contractual one. The result was two decades in which upstream states rationally ran their reservoirs for winter power, downstream states rationally opposed new upstream storage, and a hegemonic downstream power used transit, gas and grid access as leverage.

The period since 2017 represents a genuine structural opening. Uzbekistan's change of posture, the World Bank's re-engagement with Rogun, the trilateral Kambarata-1 joint venture and the partial restoration of CAPS show that the region's governments now recognise hydropower as a potentially shared asset rather than a zero-sum weapon. Yet the institutional architecture has not caught up. ICWC and IFAS remain water-only bodies built on Soviet allocations, IWRM has been implemented within rather than across borders and sectors, and the key compensation mechanisms remain annual, informal or unenforceable.

The window for building durable institutions is narrowing. Glacier retreat in the Tian Shan and western Pamir is shifting runoff earlier in the year and eroding the late-summer buffer, while the Qosh Tepa Canal will, by the end of this decade, introduce a large consumptive withdrawal by a riparian outside every existing framework. Both stressors increase the value of upstream seasonal storage and therefore the stakes of the trade-off. The central policy conclusion is that stability in Central Asia depends on converting the water-energy nexus from a bargaining chip into a jointly governed system: binding multi-year compensation, jointly owned and rule-bound reservoirs, a liquid regional power market, aggressive downstream efficiency gains and a pragmatic technical channel to Kabul. Where these elements are in place, the upstream-downstream trade-off becomes a source of mutual gain. Where they are absent, climate change and new withdrawals will turn a manageable seasonal tension into a recurrent regional crisis.

References

1. 24.kg. (2025, September). Kazakhstan, Kyrgyzstan, Uzbekistan agree to accelerate Kambar-Ata 1 project. https://24.kg/english/345090__Kazakhstan_Kyrgyzstan_Uzbekistan_agree_to_accelerate_Kambar-Ata_1_project
2. Abdullaev, I., & Rakhmatullaev, S. (2015). Transformation of water management in Central Asia: From state-centric, hydraulic mission to socio-political control. Environmental Earth Sciences, 73(2), 849–861.
3. Bekchanov, M., Ringler, C., Bhaduri, A., & Jeuland, M. (2015). How would the Rogun Dam affect water and energy scarcity in Central Asia? Water International, 40(5–6), 856–876.
4. Bernauer, T., & Siegfried, T. (2008). Compliance and performance in international water agreements: The case of the Naryn/Syr Darya Basin. Global Governance, 14(4), 479–501.
5. Bernauer, T., & Siegfried, T. (2012). Climate change and international water conflict in Central Asia. Journal of Peace Research, 49(1), 227–239.
6. Dukhovny, V. A., & de Schutter, J. (2011). Water in Central Asia: Past, present, future. CRC Press.
7. Faizee, M. H., Faqiryar, J. N., Mohamed, Y., & Sehring, J. (2026). The Qosh Tepa Canal: Implications for Amu Darya hydrology and regional hydropolitics. Water, Peace and Security Partnership. https://waterpeacesecurity.org/files/636
8. Farinotti, D., Longuevergne, L., Moholdt, G., Duethmann, D., Mölg, T., Bolch, T., Vorogushyn, S., & Güntner, A. (2015). Substantial glacier mass loss in the Tien Shan over the past 50 years. Nature Geoscience, 8(9), 716–722.
9. Global Water Partnership. (2000). Integrated water resources management (TAC Background Paper No. 4). Global Water Partnership.
10. Granit, J., Jägerskog, A., Lindström, A., Björklund, G., Bullock, A., Löfgren, R., de Gooijer, G., & Pettigrew, S. (2012). Regional options for addressing the water, energy and food nexus in Central Asia and the Aral Sea Basin. International Journal of Water Resources Development, 28(3), 419–432.
11. Huss, M., & Hock, R. (2018). Global-scale hydrological response to future glacier mass loss. Nature Climate Change, 8(2), 135–140.
12. Immerzeel, W. W., Lutz, A. F., Andrade, M., Bahl, A., Biemans, H., Bolch, T., et al. (2020). Importance and vulnerability of the world's water towers. Nature, 577(7790), 364–369.
13. Interfax. (2025, December 18). Eurasian Development Bank willing to finance Kambarata-1 hydroelectric power plant project in Kyrgyzstan. https://www.interfax.com/newsroom/top-stories/115360/
14. Jalilov, S.-M., Keskinen, M., Varis, O., Amer, S., & Ward, F. A. (2016). Managing the water–energy–food nexus: Gains and losses from new water development in Amu Darya River Basin. Journal of Hydrology, 539, 648–661.
15. McKinney, D. C. (2004). Cooperative management of transboundary water resources in Central Asia. In D. Burghart & T. Sabonis-Helf (Eds.), In the tracks of Tamerlane: Central Asia's path to the 21st century (pp. 187–220). National Defense University Press.

16. Menga, F. (2015). Building a nation through a dam: The case of Rogun in Tajikistan. Nationalities Papers, 43(3), 479–494.
17. Micklin, P. P. (1988). Desiccation of the Aral Sea: A water management disaster in the Soviet Union. Science, 241(4870), 1170–1176.
18. Micklin, P. (2007). The Aral Sea disaster. Annual Review of Earth and Planetary Sciences, 35, 47–72.
19. Pohl, B., Kramer, A., Hull, W., Blumstein, S., Abdullaev, I., Kazbekov, J., Reznikova, T., Strikeleva, E., Interwies, E., & Görlitz, S. (2017). Rethinking water in Central Asia: The costs of inaction and benefits of water cooperation. adelphi & CAREC.
20. Rahaman, M. M. (2012). Principles of transboundary water resources management and water-related agreements in Central Asia: An analysis. International Journal of Water Resources Development, 28(3), 475–491.
21. Rahaman, M. M., & Varis, O. (2005). Integrated water resources management: Evolution, prospects and future challenges. Sustainability: Science, Practice and Policy, 1(1), 15–21.
22. Sadoff, C. W., & Grey, D. (2002). Beyond the river: The benefits of cooperation on international rivers. Water Policy, 4(5), 389–403.
23. Siegfried, T., Bernauer, T., Guiennet, R., Sellars, S., Robertson, A. W., Mankin, J., Bauer-Gottwein, P., & Yakovlev, A. (2012). Will climate change exacerbate water stress in Central Asia? Climatic Change, 112(3–4), 881–899.
24. Sorg, A., Bolch, T., Stoffel, M., Solomina, O., & Beniston, M. (2012). Climate change impacts on glaciers and runoff in Tien Shan (Central Asia). Nature Climate Change, 2(10), 725–731.
25. Times of Central Asia. (2024a, April). Kyrgyzstan, Kazakhstan and Uzbekistan consider joint stock company to build Kambarata HPP-1. https://timesca.com/kyrgyzstan-kazakhstan-and-uzbekistan-consider-joint-stock-company-to-build-kambarata-hpp-1/
26. Times of Central Asia. (2024b, February 24). Afghan canal will divert water from Uzbekistan. https://timesca.com/?p=15024
27. Times of Central Asia. (2026, April 1). Afghanistan advances Qosh Tepa Canal while urging regional water cooperation. https://timesca.com/afghanistan-advances-qosh-tepa-canal-while-urging-regional-water-cooperation/
28. Times of Central Asia. (n.d.). Afghanistan's Qosh Tepa Canal raises water security concerns. https://timesca.com/afghanistans-qosh-tepa-canal-raises-water-security-concerns/
29. Varis, O. (2014). Resources: Curb vast water use in central Asia. Nature, 514(7520), 27–29.
30. Wegerich, K. (2004). Coping with disintegration of a river-basin management system: Multi-dimensional issues in Central Asia. Water Policy, 6(4), 335–344.
31. Wegerich, K. (2008). Hydro-hegemony in the Amu Darya Basin. Water Policy, 10(S2), 71–88.
32. World Bank. (2004). Water energy nexus in Central Asia: Improving regional cooperation in the Syr Darya Basin. World Bank.
33. World Bank. (2014). Key issues for consideration on the proposed Rogun Hydropower Project. World Bank.

34. World Bank. (n.d.). Kambarata-1 HPP: Frequently asked questions. https://www.worldbank.org/en/programs/kambarata-1-hpp/faqs
35. Zeitoun, M., & Warner, J. (2006). Hydro-hegemony: A framework for analysis of trans-boundary water conflicts. Water Policy, 8(5), 435–460.