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Tensions Over Hydroelectric Developments in Central Asia: Regional Interdependence and Energy Security

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ABSTRACT

Hydroelectric advancements in Kyrgyzstan and Tajikistan have led to increased tension in Central Asia over the allocation of water resources. The use of Kyrgyz Toktogul Reservoir for hydroelectricity and the construction of Tajik Rogun Dam challenge the Soviet era water quota system, which affords Uzbekistan the greatest geopolitical power. As the two upstream states explore possible ways to expand electricity markets outside Central Asia, Kyrgyzstan and Tajikistan may permanently alter the geopolitical balance of power.

Central Asia is an understudied region of the world (see Appendix A) that will become increasingly important because of historical shifts, emerging energy potential, geographical proximity to South Asia, strategic location and battling spheres of influence. Historically, the Central Asian States (CAS) were contained within the Soviet Union as Socialist Soviet Republics (SSR). The shift from a closed domestic system of governance to competing international interests has led to post-independence political and economic upheaval, which could lead to violence in a region prone to ethnic tensions. With the proximity to South Asia, namely Iran, Afghanistan and Pakistan, and the current war in Afghanistan already spilling over the border into Tajikistan, stability in Central Asia is of great importance, and the biggest destabilizing factor is natural resource allocation and energy security. Should there fail to be cooperation in concern to resources and energy production between the CAS, the entire region could slide into violence and further destabilize Central and South Asia.

The CAS have an arid climate, which leads to a small amount of arable land. In order to support the agricultural enterprise of the Soviet Union and now the downstream states of Uzbekistan, Kazakhstan and Turkmenistan, there were large irrigation projects to create arable land, which resulted in the depletion of local water sources, environmental degradation and ecological disasters, most notably the desertification of the Aral Sea. Water is seen as such a national treasure in the CAS because the downstream states are reliant upon water for agriculture

List of Abbreviations

ADB: Asian Development Bank	EIA: Energy Information Administration
CAS: Central Asian States	IFI: International Financial Institution
CASA 1000: North-south transmission grid between Central Asia-South Asia	kW-h: Kilowatt-hours
CASAREM: Central Asia-South Asia Regional Electricity Market	RFE/RL: Radio Free Europe/Radio Liberty
CAPS: Central Asian Power System	SCO: Shanghai Cooperation Organization
CSTO: Collective Security Treaty Organization	SSR: Soviet Socialist Republic
	WB: World Bank

and cotton production, which feature heavily in their economic earnings, and the upstream states need water to produce hydroelectricity to provide energy for their citizens and for export. The importance of water for hydroelectricity is a post-independence occurrence accompanying the breakdown of Soviet resource allocation. The original role of upstream states Kyrgyzstan and Tajikistan was to regulate water flows for downstream irrigation. Under this Soviet system, the downstream states would send natural gas to the upstream countries to help with heating during the winter because they were rich in gas. It is most helpful to view the CAS in terms of location, resources and energy because the country lines are the legacy of Joseph Stalin to divide the region such that ethnic allegiances were unclear so that the CAS could not unite and challenge Soviet rule (Tolipov, 2001). Now that water is becoming even scarcer due to drought and the upstream states do not have the same access to natural gas as during the Soviet Union, tensions regarding resources and energy are on the rise as each country attempts to maintain their current level of consumption.

Although the Soviet Union collapsed in 1989, two Soviet era leaders are still in power: Uzbek President Islam Karimov and Kazakh President Nursultan Nazarbayev. Following independence, there was a period of political turmoil in which the former Soviet Tajik president was forced to resign, and President Imomali Rakhmon (Emomali Rakhmon) was elected and subsequently led Tajikistan through a civil war. Turkmen President Kurbanguly Berdimukhamedov took over in 2006 following the death of the former Soviet President Saparmyrat Niyazov. Niyazov was an eccentric president with a personality cult that led the country into isolationism post-independence and spent large sums on personal projects. The new President Berdimukhamedov has taken several steps to ease back the isolation and find new markets for its natural gas (BBC, 2010). Kyrgyz Interim President Roza Otunbayeva was placed in office after the popular uprising that removed President Kurmanbek Bakiyev from power. Interim President Otunbayeva was charged with dealing with ethnic violence outbreaks in Jalalabad in July 2010. Even though three of five presidents are not from the Soviet time period, this does not mean there has been movement away from Soviet policy. In fact, energy policy – including the regulation of water resources – is a direct result of a Soviet infrastructure that is not easily changed. This entrenched Soviet policy for resource allocation has left upstream states with limited options for energy advances and an uneven balance of power favoring those states with the biggest water quota.

Even though the CAS gained their independence in 1991 with the fall of the Soviet Union and have their own national interests, they are still heavily influenced by Russia due to its regional power and diplomatic reach. The CAS are members of the Commonwealth of Independent States that was created in December 1991 with political and economic functions, a regional body comprised of Armenia, Azerbaijan, Belarus, Kazakhstan, Moldova, Russia, Tajikistan, Turkmenistan, Uzbekistan and formerly Georgia. The CAS, excluding Turkmenistan, are also members of the Shanghai Cooperation Organization (SCO) and Russian dominated Collective Security Treaty Organization (CSTO), although little cooperation between the CAS has stemmed from these organizations.

Due to limited cooperation between the CAS coupled with political instability and recent ethnic violence, there is the potential for more violence if energy

and resource issues are not resolved. These issues must be resolved because the CAS don't have the option of isolationism when it comes to resources like water, which is a transnational resource. The destabilization of the CAS could cause a ripple effect throughout the already unstable region of South Asia, which is not in international interests. The focus of this paper will be on Uzbekistan, Tajikistan and Kyrgyzstan. Uzbekistan will be the only downstream state discussed in detail because of their its majority water quota and perceived regional power over the other four states. Tajikistan and Kyrgyzstan, as the only upstream states in the CAS, are quintessential in illustrating the complex issues surrounding the breakdown of Soviet policies, the continuation of water quotas, downstream and upstream economic needs relating to water, and interdependence. CAS regional interdependence is directly influenced by a nation's access to energy security, as illustrated by Uzbekistan's negative response to Kyrgyzstan's hydroelectric advances and the unfolding tensions between Uzbekistan and Tajikistan over the construction of a hydroelectric dam which could alter the Central Asian balance of power. While specific national developments in energy capabilities can be seen as a positive economic development, national developments can lead to regional political tensions which may be more harmful than the benefits of expanded economic and energy capacity.

Literature Review: Interdependence

The theory of interdependence focuses on the consequences of one state's actions upon another. Richard Rosecrance argued "that interdependence is a state of affairs where what one nation does impinges directly upon other nations" (as cited by Ferguson & Mansbach, 2003, p. 167). Interdependence can also be measured through "sensitivity", which measures the domestic susceptibility to international events (Ferguson et al., 2003, p.168). Rosecrance, Keohane and Nye Jr. all agree that interdependence rests upon nation-to-nation interactions. This state-centric view is also found in the realist perspective of interdependence, which concentrates on "dominance-dependence, with the dependent party particularly vulnerable to the choices of the dominant party" (Kauppi & Viotti, 1993, p. 55-56). Dominance-dependence can easily be seen in the power play between Uzbekistan and the two upstream states of Tajikistan and Kyrgyzstan. For example, the Central Asian Power System (CAPS), or a regional electricity grid, has its main location in Tashkent, Uzbekistan. This makes the upstream states dependent on Uzbekistan's political goodwill to allow Tajikistan and Kyrgyzstan to use CAPS to sell their electricity surplus. Uzbekistan may also use access to CAPS as leverage over the two upstream states.

To realists, there is an additional idea of vulnerability, or the presumed disproportionate power of states. To offset a state's vulnerability caused by interdependence, a state must reduce outside dependency. In the case of international resources, it would be beneficial to have domestic alternatives so as not to be as reliant on imports (Kauppi et al., 1993, p. 56). Keohane and Nye Jr. define vulnerability as "the ability of an actor to insulate itself from events occurring elsewhere" (Ferguson et al., 2003, p. 168). In the case of Central Asia, the upstream states are attempting to minimize vulnerability by being able to provide their own energy for their citizens. Increased energy security would allow Tajikistan and Kyrgyzstan

to provide heat during the winter months without relying on imports of natural gas. At the same time, increased energy security for the upstream states results in heightened vulnerability in Uzbekistan because of their dependency on water in the summer for agriculture, which is curtailed by upstream advances. Competing national interests within a once domestic system of allocation makes it clear that interdependence is not based on inherent equality nor does it automatically connote peaceful collaboration; it has never been proven that interdependence leads to cooperation (Ferguson et al., 2003, p. 170). Interdependence in Central Asia should be seen as a necessary byproduct of shared transnational resources and a high reactivity to supranational decisions, as well as a historical Soviet legacy.

The Soviet system was specifically designed to promote resources, most importantly water and natural gas. Under Soviet rule, agriculture in the downstream riparian states was increased, which led to a complex irrigation system regulated by the upstream states through reservoirs and dams along the two main rivers (MacKay, 2009, p.18; Kemelova & Zhalkubaev, 2003, p.480), the Syr Darya, which runs through Kyrgyzstan, and the Amu Darya, which runs through Tajikistan (see Appendix B). The agricultural practices, mostly the production of cotton, necessitated summer releases of water to irrigate crops. Kyrgyz SSR and Tajik SSR were responsible for these summer releases to fill Soviet-inspired water quotas, and in return, since the two upstream riparians were not rich in natural resources, the downstream states would send shipments of natural gas during the winter months to help defray the costs of maintaining the water allocation system. Regionally, Uzbek SSR had the most power because it was given the biggest water quota. During the Soviet Union, this was left unchallenged because energy security was a domestic concern comprising all five SSR, and as such the balance of power was preserved.

However, following the collapse of the Soviet Union, the irrigation and water allocation systems, which used to be contained within domestic Soviet borders became a complex coordination between five new states, and transitioned into an international issue. The introduction of resource allocation into the international sphere drew attention to the region's vulnerability to resources that directly opposed new national interests. Without supranational guidance, the CAS allowed national interests to interfere with the allocation of resources that have led to increasing regional tensions. The current degradation of the Aral Sea serves as an additional example of the CAS' inability to cooperate to solve the depletion and desertification of the sea, which is a tragic outcome of Soviet irrigation policies implemented for agricultural purposes. The Aral Sea is fed by the Syr Darya and Amu Darya rivers which flow through Kyrgyzstan and Tajikistan, respectively, and would eventually join at the sea in the northern region of Karakalpakstan, Uzbekistan and southwestern Kazakhstan after the Amu Darya went through Turkmenistan and Uzbekistan, and the Syr Darya went through Uzbekistan and Kazakhstan (see Appendix B). Now domestic irrigation practices in the downstream states have drained the rivers such that they never meet in the sea, and the Aral Sea has become two separate lakes (MacKay, 2009, p.18; Sievers, 2002, p.365).

The environmental disaster surrounding the Aral Sea is exacerbated by the unwillingness of downstream governments to change agricultural practices even after independence (MacKay, 2009, p.18) despite evidence of environmental deg-

radation. Due to the emphasis placed on water by Soviet policy, in the upstream states for summer water releases and in downstream states for agriculture, there is resistance to reform post-independence, which in turn makes the CAS even more interdependent on water resources. After independence there was hope that the CAS would reform Soviet policy and make appropriate changes, yet many of the same policies are in use; because of this, it is believed by some that “reference to the previous ‘guilt’ of Moscow...no longer can explain events” (Sievers, 2002, p.365-367). The two main differences from Soviet policy are, one, that the upstream states have begun to use their dams and reservoirs for hydroelectricity and, two, that there is no compensation in the form of natural gas given to the upstream states by downstream states (Kemelova et al., 2003, p.480-481; Sievers, 2002, p.372). There is a great possibility of conflict and destabilization within Central Asia as a result of water and environmental policies in the post-Soviet era (Sievers, 2002, p. 357), especially with no governing body to regulate water allocation to account for both hydroelectric and agricultural needs.

International Water Law

Post-independence, the international community expected the CAS to draw on international law to regulate transnational water sources, yet to a large extent this expectation has been unfulfilled. It is important to keep in mind the historical impact of Soviet water and fuel interdependence on post-independence national interests to foster agriculture, for the downstream states, and for the upstream states to place such importance on hydroelectricity due to the existing infrastructure of dams and reservoirs. These factors have often prevented the implication of international water law because the two divisions of states have opposing national interests. Even so, directly following independence the CAS instituted the “five-State Agreement on Cooperation in the Joint Use and Protection of Water Resources of Interstate Significance” or the “1992 Agreement” that maintained Soviet water quotas to riparian states, yet the compensation with energy halted (Kemelova et al., 2003, p. 480-481; Sievers, 2002, p. 372) because the downstream states deemed the exchange unnecessary. The halt in compensation from the downstream states led to severe energy shortages in Kyrgyzstan and Tajikistan during the winter months, when energy would have been delivered, since they continued to operate their reservoirs and dams in accordance with the Soviet system of summer water releases to support agriculture.

In response to the downstream states’ expectation of summer releases and refusal to help contribute to the cost of maintenance, Kyrgyzstan unilaterally switched the primary focus of the reservoirs and dams along the Syr Darya from serving downstream agriculture to hydroelectric capabilities to provide for its own citizens. The main reservoir in question is the Toktogul Reservoir (see Appendix B), located in Kyrgyzstan on the Syr Darya River (see Appendix C). The reservoir’s original purpose was to control water releases during the summer months to aid with agriculture; in return, “Kazakhstan and Uzbekistan supplied Kyrgyzstan with a billion cubic meters of natural gas, a million tons of coal, and 400,000 tons of heating oil annually” (Kemelova et al., 2003, p.480), in addition to funds from the USSR. Without these resources, Kyrgyzstan was forced to use Toktogul Reservoir to generate heat during the winter to compensate for the natural gas, coal

and heating oil. The change in seasonal water releases has led to tensions between Uzbekistan and Kyrgyzstan over summer irrigation issues and damages from released water in the winter (Kemelova et al., 2003, p.480-481).

To compound issues, in 2001 the Kyrgyz government came out with a controversial law called the 2001 Kyrgyzstan Law on Interstate Water Use that “states that Kyrgyzstan’s state policy with regard to transboundary waters is that water in Kyrgyzstan is the property of Kyrgyzstan, that water is a good with a market price, that sales of this water should consider world prices, and that Kyrgyzstan has a right to be compensated by the other states of the region for the expenses and losses suffered by Kyrgyzstan in operating its water facilities” (MacKay, 2009, p.24; Sievers, 2002, p.389-390). According to Kemelova et al. (2003, p.491), Kyrgyzstan cannot be seen as acting contrary to international law because operating Toktogul Reservoir in the winter is “the product of necessity” as evidenced by the failure to adhere to the 1992 Agreement, which upholds Soviet-era quotas and compensation, but through which Kyrgyzstan has not received recompense. This 2001 Law on Interstate Water Use “compensates for a post-Soviet dilemma” (MacKay, 2009, p.24), yet has been met with significant resistance.

There are three main opposition points to the 2001 Kyrgyzstan Law on Interstate Water Use. First, the sale of water is illegal because the Convention on the Protection and Use of Transboundary Watercourses and International Lakes doesn’t permit water to be sold (Sievers, 2002, p.390). Kyrgyzstan responded that the new law only demands payment for water services, not the actual water (Sievers, 2002, *ibid.*). However, because of the scarcity of water in the region, the use of water as leverage to achieve desired results – even maintenance – can be seen as harmful to surrounding states (MacKay, 2009, p. 24). Customary international water law such as the 1972 Stockholm Declaration on the Human Environment attempts to make states recognize that their “actions must not damage the environments of other states or of areas outside their boundaries” (MacKay, 2009, *ibid.*), which could be interpreted to mean Uzbekistan’s agricultural enterprises.

Second, that the law departs from conventional understandings of international law, since the 2001 law de-stresses impact on other states and emphasizes water as Kyrgyzstan’s national resource (MacKay, 2009, p.24; Sievers, 2002, p.391). The same principles gleaned from the Stockholm Declaration declaring a state must not make decisions regarding water resources that negatively impact downstream states are challenged. There is a general agreement among Central Asian water experts that upstream riparians do not, or should not, have the power to unilaterally take actions that might cause harm to downstream states, but there is little condemnation because the Soviet-style system of water allocation was seen as inequitable and the termination of such practices post-independence is seen as equitable (Sievers, 2002, p.392).

Third, Bishkek (capital of Kyrgyzstan) can stop water flows to the downstream states in the event they do not receive payment, which to most would be considered extortion and outright illegal (MacKay, 2009, p.24; Sievers, 2002, p.391-392). This is why the case of the CAS must be viewed through the historical lens of the Soviet water allocation system and water-for-fuel exchange between downstream and upstream riparians. Kyrgyzstan was compensated for Toktogul’s summer usage with natural gas and other resources during the winter to be able to maintain

the facility. And while Kyrgyzstan has been criticized for its unilateral decision to institute the 2001 Kyrgyzstan Law on Interstate Water Use because of the disregard for human rights, not seeking a legal remedy, and the violation of previously existing agreements stating that water will not be sold, Kyrgyzstan can be seen as acting to correct post-Soviet shortfalls (MacKay, 2009, p.24). Taken as a whole, Kyrgyzstan's actions must be viewed in relation to the failure to successfully implement international law to effectively regulate resource allocation in Central Asia after independence (MacKay, 2009, *ibid.*).

It can be seen through the case of Toktogul Reservoir that the collapse of the Soviet Union has not ameliorated the transnational distribution of resources despite shared regional dependency, and the induction into international law has not taken control of the situation either. Kyrgyzstan viewed the 2001 Law on Interstate Water Use as the strongest response to the lack of compensation under the 1992 Agreement, and the use of Toktogul Reservoir as the best way to achieve greater energy security through increased hydroelectricity production. Uzbekistan stands to lose the most if Kyrgyzstan truly begins to enforce their 2001 law because of reliance on cotton production during the summer. Since independence, tensions have been on the rise between the two states over water use due to scarcity and vulnerability. Furthermore, there is a lethargic take on water policy because the general sentiment in the CAS is that the Soviet Union is to blame for the current problems. This has led to an intrinsic support of current irrigation policies (MacKay, 2009, *ibid.*), which in turn attributes to the reluctance to join binding treaties on the issue and outrage at the 2001 Kyrgyzstan Law on Interstate Water Use. Kyrgyzstan is challenging the traditional system of water allocation, which automatically challenges the balance of power and creates a regional paranoia over any attempted reform or further developments on part of the upstream riparians.

Emergent Hydro-Hegemony

Post-independence, regional power appeared to be allocated based on the concept of hydro-hegemony in absence of an effective governing body or binding international law. Wegerich (2008) explores hydro-hegemony, the prevailing idea in Central Asia that whichever state controls the biggest water quota is the hegemon and wields the most regional influence. It is possible to argue that Uzbekistan, with the highest Soviet-era water quota, largest population and most irrigated land, would be the clear hydro-hegemon (Wegerich, 2008, p.80). This would explain Uzbekistan's critical response to Kyrgyzstan's shift in use of Toktogul Reservoir from water allocation to hydroelectricity because it challenges Uzbekistan's perceived hydro-hegemony. In addition to receiving the largest water quota, the Central Asian electricity grid, CAPS, has its center in Tashkent, the capital of Uzbekistan, and the majority of natural gas pipelines must pass through Uzbekistan to reach other states (Wegerich, 2008, p. 82-83). With the amount of control Uzbekistan has on the distribution of natural resources, any switch in facility function or addition of new facilities for greater water control in upstream states directly impacts Uzbekistan's ability to control the most regional influence, which is evidenced in Uzbekistan's negative political response to Kyrgyzstan's use of Toktogul Reservoir and the similar unfolding response to the construction of Tajikistan's Rogun Dam.

Methodology

In order to assess the ongoing tensions over water allocation and energy security between Uzbekistan and Tajikistan, historical writings, government publications, U.S. data analysis, and international and local news sources were reviewed to compile information. International financial agencies are also useful sources for water project information, data and joint ventures as well as proposed projects. Sources with historical aspects were used to inform the Soviet-era Central Asian policies so that post-independence shifts in policy could be recognized and compared, as well as lasting influences. These resources clearly illustrated emerging trends in escalating tensions over resource allocation in Central Asia and potential political ramifications. News sources were especially useful because it was possible to see new developments emerging between countries in Central Asia but also South Asia, which led to international investments and the relation to construction of a hydroelectric dam in Tajikistan. Some drawbacks to conducting research were the inability to find a source in English, or local news sources in Russian or a local language, which could have provided more in-depth information than the English counterpart. Inability to travel to the region and conduct additional research led to a dependency on local news sites.

Research Findings

Tajikistan shares many of the same characteristics as Kyrgyzstan in relation to their dependency on water for hydroelectricity. According to the U.S. Energy Information Administration (U.S. EIA), right after independence Uzbekistan was producing 4, 533 billion cubic feet of natural gas, while Tajikistan and Kyrgyzstan were both producing 12 billion cubic feet (see Appendix D). This large disparity is the reason during the Soviet Union the upstream states needed shipments of natural gas during the winter to be able to survive. In the year 2008, this disparity has grown to where Uzbekistan now produces 7,161 billion cubic feet, while Tajikistan and Kyrgyzstan's production fell to 3 billion cubic feet (see Appendix E). This means that during the Soviet Union, Tajikistan and Kyrgyzstan had higher levels of natural gas production in addition to the natural gas received from downstream states. Post-independence, their natural gas production fell 9 billion cubic feet while the resource allocation system disintegrated after the 1992 Agreement. The upstream state's dependency on natural gas heightened and forced them to find another way to generate the heat and energy needed for the winter months: hydroelectricity. Of Tajikistan's total electricity net generation of 15.971 billion kilowatt-hours (kW-h) (see Appendix F), 15.688 billion kW-h are generated by hydroelectricity (see Appendix G), which is 98% of all electricity generation. Kyrgyzstan also has a high electricity dependency rate of 90% (see Appendix F, Appendix G). While Kyrgyzstan turned to Toktogul Reservoir to meet their hydroelectricity needs, Tajikistan turned to an old Soviet project called Rogun Dam.

Rogun Dam

The construction of Rogun (Roghun) Dam in Tajikistan (see Appendix H) is another catalyst behind the dispute over water resource allocation and challenge to regional hydro-hegemony. Rogun Dam is the product of the Soviet Union, just like Toktogul Reservoir. The main difference is that Rogun Dam was not completed

under Soviet rule, so Rogun Dam is an implicit continuation of Soviet policy and an example of Soviet plans being enacted post-independence. It could be argued that if Rogun Dam had been completed under Soviet rule with the water-for-fuel system in place, the downstream states would have no quarrel with its construction because it would not have disturbed regional power. However, since it is being constructed post-independence, Rogun Dam has warranted the same harsh criticism and resistance from Uzbekistan that it had towards the switch in utilization of Toktogul Reservoir, especially because Rogun Dam will be used specifically for hydroelectric purposes.

As mentioned earlier, during Soviet rule, water allocation was decided by Moscow as a domestic issue, heavily favoring downstream Turkmen SSR and Uzbek SSR (Wegerich, 2008, p.72-73). Tajik SSR was utilized in controlling the River Vakhsh, and Rogun was another initiative to harness hydropower, although it was never realized, while its downstream counterpart, Nurek Dam, was finished before independence (Wegerich, 2008, *ibid.*) (see Appendix I). After independence, the original purpose of Rogun – to aid in downstream agriculture by further control of the Vakhsh – warped into a national Tajik project for energy and electricity because Tajikistan could no longer expect energy shipments during the winter from downstream states (Wegerich, 2008, *ibid.*). When Rogun Dam is complete, it will be the first in a system of hydroelectric facilities on the River Vakhsh in Tajikistan (see Appendix I), which will give the upstream riparian enormous influence over the downstream states of Turkmenistan and Uzbekistan (Wegerich, 2008); influence that, the two downstream states believe, will lead to detrimental impact on their agricultural practices.

Rogun Dam's construction and completion hold several implications for regional interdependence and energy security in Central Asia. From the construction of the dam, it is possible to assume that the infrastructure put into place by the Soviet Union created tight regional interdependence based on resource allocation that has hindered energy development in the upstream states post-independence, which in turn creates negative political interactions when national interests are at stake, and mounting tensions. As the dam is an extension of old Soviet plans, the Soviet infrastructure is still growing within Central Asia. It can already be seen with Kyrgyzstan's hydroelectric use of Toktogul Reservoir that the infrastructure can allow for energy development but is heavily hampered by downstream interests concerning water. Rogun Dam is an extension of the same issues relating to water.

While Uzbekistan had national interests opposed to Toktogul Reservoir's winter hydroelectric usage, the facility was already built and therefore Uzbekistan could only deal with the Kyrgyz government. Since Rogun Dam is under construction, Uzbekistan has reportedly taken other steps to make its disapproval known, namely impounding trains delivering supplies to Rogun through Uzbekistan and calling for environmental safety investigations about the dam. In February 2010, Tashkent (capital of Uzbekistan) began to impound trains bound for Rogun Dam, but news agencies reported on October 15th 2010 that the impound was lifted and trains could once again cross the Uzbek-Tajik border (Rogers, 2010). This was a day after the RFE/RL reported that the Tajik ambassador to the Organization for Security and Cooperation in Europe formally requested assistance dealing with Uz-

bekistan; according to Tajik authorities, “Uzbekistan has held up the transit of rail freight bound for Tajikistan in retaliation for Dushanbe’s determination to proceed with construction of the Roghun hydropower system” (RFE/RL, 2010).

Additionally, Tajikistan’s desire for energy security through Rogun Dam was hampered by their removal from the CAPS (World Bank 2010; Demytrie, 2010). CAPS is centered in Tashkent, Uzbekistan, and as such contributes to Uzbekistan’s ability to leverage its political will and remain the supposed hydro-hegemon. The exclusion from CAPS forced Tajikistan to rely on a faulty, expiring electrical system and resulted in severe hardship on top of already existing problems with the lack of fuel from downstream states. These direct interferences with Rogun Dam’s construction and the removal of Tajikistan from CAPS demonstrates Uzbekistan’s trepidation to the dam’s completion because Tajikistan will have more power over regional water that will diminish Uzbekistan’s hydro-hegemony and shift the balance of power. The fight over national interests and transnational resources could push Tajikistan into closer ties with upstream Kyrgyzstan and towards a policy similar to the 2001 Kyrgyz water law.

Tajikistan would consider a similar law because of the parallels between Tajikistan and Kyrgyzstan in regards to the legal right to water for the development of energy security. If Tajikistan did institute a law claiming the water on their territory as a national resource, it would be after Rogun Dam was completed because they would have more leverage over water sources and therefore more regional clout in dealing with Uzbekistan and downstream riparians. The same three arguments against Kyrgyzstan’s 2001 water law can be raised if Tajikistan ever institutes a similar law. First, the sale of water is illegal and could draw negative international attention should both states begin to demand monetary compensation (Sievers, 2002, p.390) and, second, that water is a national resource rather than transnational (MacKay, 2009, p.24; Sievers, 2002, p.391). What was once seen as a perfectly acceptable domestic solution to defraying costs through fuel and financial obligations is now an unacceptable international solution, and Kyrgyzstan and Tajikistan are attempting to continue to support their side of Soviet infrastructure. Through the upkeep of the dams and reservoirs and the construction of a Soviet designed improvement to the water system on the river Vakhsh, Tajikistan is ironically attempting to increase their individual energy security with a system meant to promote regional interdependence. By demanding money of downstream states in an international dispute, potential human rights violations and environmental implications can be used against Tajikistan’s bid for greater independence.

Third, Kyrgyzstan reserved the right to stop the flow of water to downstream states in the event of nonpayment (MacKay, 2009, p.24; Sievers, 2002, p.391-392); it remains unclear if Kyrgyzstan would actually do so. Uzbekistan’s concern over Kyrgyzstan’s threat to withhold water would be heightened in the event that Tajikistan followed suit. If both upstream riparian states had the ability – or perceived ability – to withhold water, tensions would spike and there could be the potential for violence. With a destabilized region in South Asia and some of the conflict in Afghanistan spilling over the border into Tajikistan, tensions over water will exacerbate the situation and could lead to the Central Asian balance of power crumbling.

There is another concern that as Kyrgyzstan and Tajikistan move further away from the widely accepted notions of international law, for example, that states do not have the ability to unilaterally disrupt water flows, their actions could have a detrimental impact on international law. The violation of perceived international regulations could lead to a permanent lack of global conventions in Central Asian water law. In turn, this could lead to a separation between Central Asian policies and international law, which would make the situation harder to resolve if the current tensions escalate.

Tehran and Dushanbe

As Toktogul Reservoir was already constructed before the start of political tensions with Uzbekistan over the use of water, many international actors were not involved in the beginning. There is the potential, however, to see the influence of outside regional actors in Tajikistan, especially that of Iran and International Financial Institutions (IFIs). Iran shares a border with Turkmenistan (see Appendix A), and is considered part of South Asia along with Afghanistan and Pakistan. At the eighth meeting of the Joint Commission on Trade, Economic, Technical and Cultural Cooperation in Dushanbe, Tajikistan, Tajikistan and Iran entered into a Memorandum of Understanding concerning cooperation in “energy, water, industry, mining engineering and technical services...” (Fars News, 2010). According to Tajik President Imomali Rakhmon, “Tehran and Dushanbe have had a growing trend of cooperation over the past five years” (as cited by Press TV, 2010a), which would explain the Iranian funding of Tajikistan’s Sangtoudesh II (Sang-Tuda 2) Power Plant, also located on the River Vakhsh, although it will be twelve years before Tajikistan can take over control of Sangtoudesh II from Iran (Press TV, 2010b).

This means that Tajikistan is being heavily influenced by Iran’s investment in its energy sector. As tensions grow between Tajikistan and Uzbekistan, Tajikistan must find other ways to satisfy their need for energy security and increased economic capabilities, and moving outside the region of Central Asia may be one possibility. Iran represents the opportunity to break the Central Asian balance of power in that Uzbekistan has no control over the amount of money entering Tajikistan from Iran, unlike supplies that went through Central Asia. Also, Iran’s support of Tajikistan in areas such as the aforementioned energy, water and industry could discourage any harsh action on Uzbekistan’s part. While Iran’s involvement could serve as a deterrent to extreme responses, deepening ties with a country outside Central Asia will only hinder regional relations in the future because of the interests of countries outside the region still invested in Soviet energy infrastructure.

Central to South Asia

Afghanistan and Pakistan are two such countries that could have a stake in the future of Tajikistan’s hydroelectric sector if the Central Asia – South Asia Regional Electricity Market (CASAREM) project is implemented. The Asian Development Bank (ADB), European Bank for Reconstruction and Development, the International Finance Corporation, the Islamic Development Bank, and the World Bank (WB) should be involved in the funding of CASAREM if the project is approved (World Bank, 2009). The main goal of CASAREM is to allow the four borrowing countries

– Tajikistan, Kyrgyzstan, Afghanistan and Pakistan – to enter into electricity trade. Tajikistan expects Rogun Dam to be the powerhouse behind their electricity supply to generate enough electricity to potentially sell through CASAREM. Without the completion of Rogun Dam, there is concern that the WB might not invest in CASA 1000 (U.S. Department of State, 2010), which would pejoratively affect Tajikistan's bid for greater regional power through energy self-sufficiency.

As there is no existing electricity grid for selling electricity to South Asia from Central Asia, and Tajikistan was removed from CAPS, there are plans to create a north-south transmission grid,

“which would run ‘through Tajikistan to Kyrgyzstan and through Kyrgyzstan to Kazakhstan, then Tajikistan would be able to export electrical energy directly north to Kazakhstan, Russia and possibly China. In addition, the construction of transmission lines south from Tajikistan would enable Tajikistan, and eventually Kyrgyzstan, to sell hydropower to Afghanistan and further south’ ” (as cited by Wegerich, 2008, p.83).

This energy grid would completely bypass Uzbekistan, further weakening Uzbekistan's regional power, as well as increase the two upstream states' energy self-sufficiency and decrease vulnerability due to existing energy structures. The operation of Toktogul Reservoir, and eventually Rogun Dam, as primarily hydroelectric facilities is only the first step towards energy sustainability – Kyrgyzstan and Tajikistan must find a way to sell surplus electricity, unfortunately in a way that bypasses Central Asia systems due to high levels of tension and hostility from downstream states.

CASAREM seeks to construct CASA 1000, a north-south transmission grid between Central and South Asia. CASA 1000 must be completed for the entire CASAREM project to be viable. There are acknowledged risks because of destabilization in the region and war in Afghanistan, yet there are huge potential benefits, such as the possibility of increased regional cooperation and “the linking of the Kyrgyz Republic with Tajik system through high voltage lines could help break the ‘Water-Energy Nexus’ that exists in the Syr Darya basin” (World Bank, 2009). That is, allowing Kyrgyzstan and Tajikistan to have separate modes of selling electricity than the CAPS centered in Tashkent would give them more opportunities for development. According to the World Bank (2009), Kyrgyzstan and Tajikistan have not been able to “realize their potential, in part because of (a) significant resources needed to develop the hydropower plants and associated transmission lines; (b) limited regional cooperation; and (c) the lack of clarity about the main electricity export market”, which CASAREM and CASA 1000 seek to address. CASA 1000 is also hoped to ameliorate the tension in Central Asia because South Asia will import electricity during the summer months, letting the upstream states release water while the downstream riparians need it for agriculture (Asian Pulse Data Source, 2010).

Even though the project sounds beneficial for all involved, whether directly or simply by geographical proximity, the ADB released a statement making it explicit that there was a feasibility study in progress before the ADB would earmark funds for CASA 1000 (Hasanova, 2010). An interim report for the CASA 1000 feasibility study came out on September 25, 2010 assessing Tajikistan and Kyrgyzstan's potential supply alongside Afghanistan and Pakistan's potential demand. The interim report by SNC Lavalin (2010) assumes CASA 1000 functionality by 2016.

According to the report, Pakistan's demand is set to increase significantly due to ambitious long-term development plans, and while Afghanistan will not have as much demand as Pakistan, there will still be an increase in electricity demand but the main need will be to rehabilitate the current system. Another key assumption for CASA 1000 is that Uzbekistan and Tajikistan will not be exchanging power (SNC Lavalin, 2010, slide 17), which upholds the exclusion of Tajikistan from the CAPS with the center in Tashkent, Uzbekistan.

The exclusion from the CAPS creates greater opportunities for Tajikistan and Kyrgyzstan to expand into new markets, whether or not it was a voluntary choice. Regrettably, the north-south market must be created before it can be utilized, leaving Tajikistan and Kyrgyzstan vulnerable to current hydro-hegemony. Movement towards CASA 1000 by the upstream states will mean even more reliance on hydroelectric power in Kyrgyzstan, and even more money being poured into the construction of Rogun Dam in Tajikistan. Rogun Dam's importance as a national honor will skyrocket if the WB does in fact want Rogun to be completed for CASA 1000 (U.S. Department of State, 2010). CASA 1000 and by extension CASAREM would mean more development for the upstream states but would still entrench the reliance on hydropower because the new market is built on selling electricity. Toktogul Reservoir and Rogun Dam's original purposes would never return to agricultural releases, as Uzbekistan and other downstream states have realized. However, since CASA 1000 will allow Kyrgyzstan and Tajikistan to produce hydroelectricity for sale during the summer months, summer agricultural needs of the downstream states would also be met. This could help assuage the tensions over water allocation and could allow the upstream states to purchase the natural gas needed during the winter months so that winter releases of water are not necessary. In this way, some of the tensions could be released, but the balance of power would shift so that the upstream states would have more leverage over downstream states through the control of the rivers. So the real tensions might not be over the downstream states receiving their fair share of water for agriculture. The real issue might be the possible shift in balance of power.

Upstream Hydro-Hegemony

The basis of regional power among access to and control of transnational resources such as water has created the term hydro-hegemony (Wegerich, 2008). During the Soviet Union, there was no hydro-hegemon because the entire region was controlled by Moscow. Following post-independence there has been a period of time where Uzbekistan emerged as the hydro-hegemon because of Soviet water quotas, which were preserved in the 1992 Agreement. Now that period of Uzbekistan's hydro-hegemony is being challenged and, based off of Kyrgyzstan and Tajikistan's emphasis and devotion to hydroelectric developments, will be replaced with upstream hydro-hegemony. Kyrgyzstan appeared to threaten Uzbekistan first by changing Toktogul Reservoir's purpose from agricultural water releases to winter hydroelectric releases and by passing the 2001 Kyrgyzstan Law on Interstate Water Use. Now Tajikistan is constructing Rogun Dam and courting international investments for the developing energy sector, which would give Kyrgyzstan and Tajikistan more control over Central Asia's transnational water resources.

Since hydro-hegemony is based on control of water, and more hydroelectric advances mean more control of the rivers, it is fair to conclude that Kyrgyzstan and Tajikistan will emerge as the new geopolitical hydro-hegemons if CASAREM is implemented. Rogun Dam is the Tajik key to entrance into a new electricity market that CASAREM would create through the electricity grid of CASA 1000. With Kyrgyzstan and Tajikistan's collaboration in regard to CASAREM and potential energy exports, the two countries' national interests indicate that they could form a powerful alliance against Uzbekistan if Uzbekistan attempted to wrest back political power. Kyrgyzstan and Tajikistan also have international actors from outside of the region that are investing in what is essentially the hydro-hegemony of the upstream states. At the core of the issue, energy developments are creating political upheaval in a region known for volatile relations post-independence, which will lead to a destabilization of the Central Asian balance of power. For this reason, Uzbekistan has tried to preserve their political stronghold by objecting to Kyrgyzstan's 2001 water law on the basis of human rights and environmental grounds, impounding freights bound to Rogun Dam, removing Tajikistan from the CAPS and drawing international criticism to the dam's construction. However, Uzbekistan's efforts will only exacerbate the situation and will further geopolitical instability instead of reinforcing their its dominance.

Conclusion

Destabilization of Central Asia due to water allocation is not in the interest of the international community. Resource allocation may seem to be a small matter, but because of the scarcity between the CAS, the country with the largest water quota controls more regional power. In this case, Uzbekistan's perceived hydro-hegemony, in addition to controlling the CAPS and a vast amount of natural gas pipelines, is being challenged by hydroelectric advances in the upstream states. The upstream states seek to improve their geopolitical standing through increased hydroelectric capabilities, which will lend greater control of the water in their territory, which will lead to further water scarcity, and by seeking outside investments for their energy infrastructure. By engaging Iran and IFIs in their energy sector, Kyrgyzstan and Tajikistan are finding ways outside of Central Asian interdependence to develop. While positive for Kyrgyzstan and Tajikistan, the ramifications of their advances are upsetting the balance of power.

CASAREM and CASA 1000's affect on Central Asia has yet to be seen, and the feasibility report for the IFIs has not been completed, but the decision to fund or not to fund CASAREM will have a huge impact on geopolitical structures. Should the IFIs fund CASAREM, Kyrgyzstan and Tajikistan would have a new market to sell their hydroelectricity, and there is the potential for the two upstream states to emerge as the hydro-hegemons. Should the IFIs chose not to fund CASAREM, Tajikistan and Kyrgyzstan's current hydroelectric advancements could have been for naught. Without a new market to sell hydroelectricity, or an electricity grid aside from the CAPS, Tajikistan's Rogun Dam could have little uses. The further development of CASAREM and CASA 1000 should be watched to help determine the future stability of the region.

If the balance of power, based on resources, is upset, then the region has the potential for violence. Mounting tensions could ignite into violence because of

past political turmoil, recent ethnic violence in Kyrgyzstan against ethnic Uzbeks, and the fact that Stalin drew the state borders of Central Asia through tribal zones. Political sparring over hydroelectric advances could lead to violence if Kyrgyzstan ever decided to withhold water from the downstream states, as their 2001 water law threatens. With the entire region of Central Asia on edge about water distribution, it doesn't help that Tajikistan shares a border with Afghanistan and Central Asia is an important strategic point for both the U.S. and Russian military forces. If violence erupted in Central Asia, it could worsen the situation in South Asia and prevent CASAREM and CASA 1000 from being implemented.

In addition to the potential for violence, there is also a definite ripple effect from perceived harmful management of the water facilities along the Amu Darya and Syr Darya to continue the damage to the Aral Sea. This holds devastating implications for the entirety of Central Asia, as it is thought that the depletion of the Aral Sea is changing the region's climate. There is the possibility for citizen marginalization among the Karakalpak population in Uzbekistan, economic crisis as fishing communities become deserts, health risks, and disempowerment not only in Uzbekistan but also in northern Kazakhstan. If the five states do not negotiate concerning hydroelectric advancements, Soviet water quotas, agricultural practices and the Aral Sea, it could be ecologically, economically and politically disastrous for future generations.

With resource allocation at the forefront of geopolitical tensions, efforts should be made to explore alternative sources of energy in Central Asia, specifically in the upstream states. Not only to take some pressure off of the use of water, and therefore alleviate some of the tensions surrounding its use, but also because Central Asia has been experiencing problems with drought, so putting a lot of effort into a hydropower system that might not have enough water to function in the future would be a horrible turn of events. Wind power could be explored due to the mountainous regions in Tajikistan, or crop diversification methods could be suggested because cotton is a very water-intensive, salt-sensitive crop. Rising salinization levels in the water also create a worrisome atmosphere downstream because of the economic reliance on cotton for subsistence. Environmental factors may force the CAS to make decisions they are not prepared to make in regards to shrinking cotton production and sufficient water levels for hydroelectricity.

There are larger implications that can be gathered from the Central Asian experience. First, a region once under the control of a supranational power is very vulnerable to the policies once implemented under that rule. The CAS are not able to move away from Soviet policy because of the infrastructure that effectively tied them together in resource dependence even after they gained their independence. Even with the introduction of national interests, the countries are not able to agree upon a new and efficient way to allocate water aside from water quotas. Second, the application of international law – in this case international water law – is ineffective because there is no body to enforce it, and because international water law fails to take into account the experiences of developing countries that may be heavily reliant on that resource to a point where it impinges upon another state's sovereignty.

Third, resource allocation in an area experiencing scarcity will lead to political strife and could lead to destabilization to the point of violence. And fourth, be-

cause resource scarcity can put a strain on national interests, energy sustainability and diversification need to be addressed. If energy sustainability is possible in the region, then IFIs should attempt to fund responsible, sustainable programs while being culturally sensitive to the needs of the people. Tajikistan may want Rogun Dam for hydroelectric purposes, but is an old Soviet plan really the answer? Are there any other options to more efficient water control capacity? Diversification could also lead to energy security, for example, because Tajikistan would not be vulnerable to outside actors if they had wind-generated electricity or power during a drought that prevented hydroelectricity. Obviously wind power is not as powerful as hydropower, but it would be a beginning to exploring possible outcomes away from Soviet era planning.

In the case of Central Asia, a supranational body to regulate water could be a possible solution, with a couple noticeable problems. First, that there are regional bodies to regulate water resources that are not having any actual impact in Central Asia other than to confuse the situation. Second, that political tensions are such that the mere creation of a governing body would mean negotiations, which have the potential to aggravate the situation. The recommendation for a supranational governing body to regulate water resources does not refer to current bodies in relation to the disaster of the Aral Sea. Rather, the recommendation would be to create an entirely new body, whose purpose is to represent each of the five countries' national interests related to water, but in terms of economics. Each country wants their water quota for agriculture, cotton production or hydroelectricity, widely speaking. If the issue was approached from an economic standpoint, efficiency and equity could put the allocation of resources into a different light and encourage maximum cooperation for the greater good of the region.

Energy security is quintessential in understanding both the upstream states of Kyrgyzstan and Tajikistan's interest in hydroelectricity and on a broader scale regional geopolitical interdependence. While energy security has become focused on utilizing water resources, energy sustainability and diversification possibilities should be explored in the upstream states to take some stress off of water dependency, such as aforementioned wind turbine possibilities in Tajikistan. There is regional vulnerability to water. It is in the national interests of all actors involved to acknowledge this vulnerability because destabilization and war are not in any country's national interests. The geographical reality of Central Asia is such that the interdependence of the region has to be negotiated for greater stability and progress to occur.

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Appendix A

A political map of Central Asia, as well as Russia, China, and South Asia: Iran, Afghanistan and Pakistan.

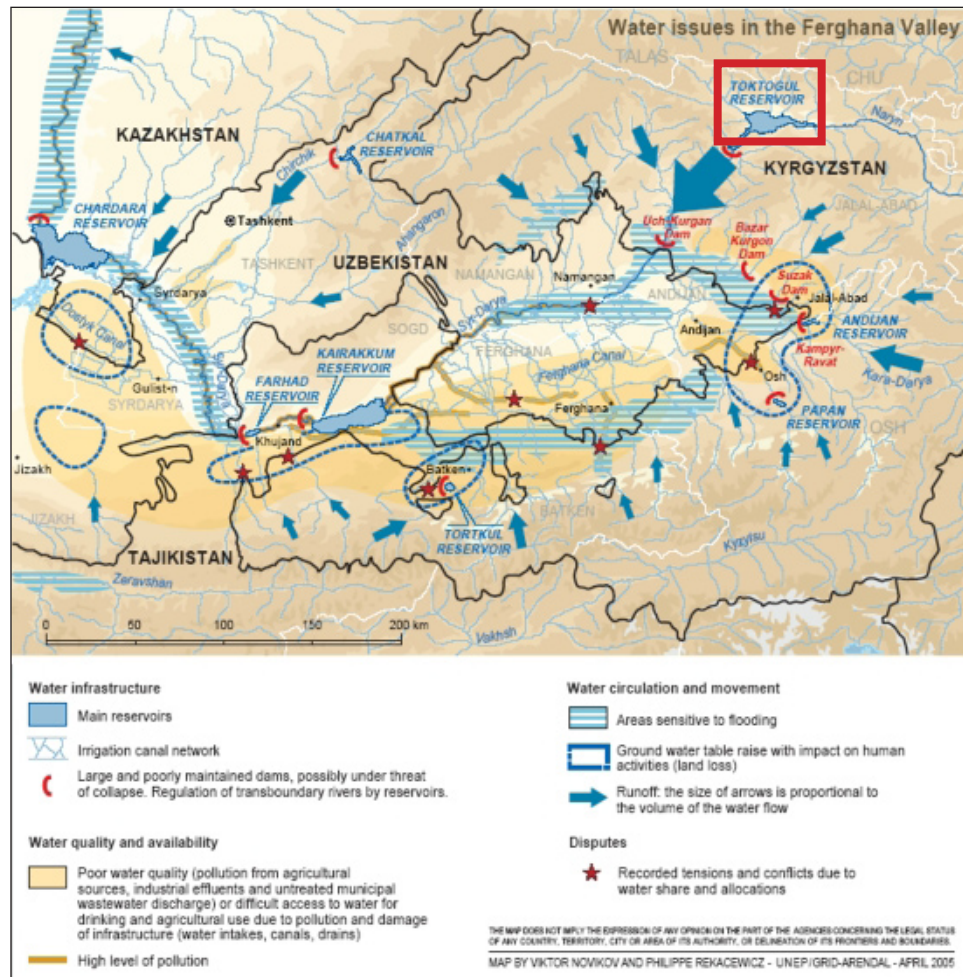


Retrieved 5 September 2010 from: <https://www.cia.gov/library/publications/cia-maps-publications/maps/802868.jpg>

Downloaded from <http://www.usfca.edu/pacificrim/perspectives/>

Appendix B

A map of the region. The red box (added) indicates the location of Toktogul Reservoir.



Retrieved 25 September 2010 from: http://maps.grida.no/go/graphic/water_issues_in_the_ferghana_valley

Downloaded from <http://www.usfca.edu/pacificrim/perspectives/>

Appendix C

A map of the Syr Darya and Amu Darya rivers in Central Asia, from the Earth Institute, Columbia University.



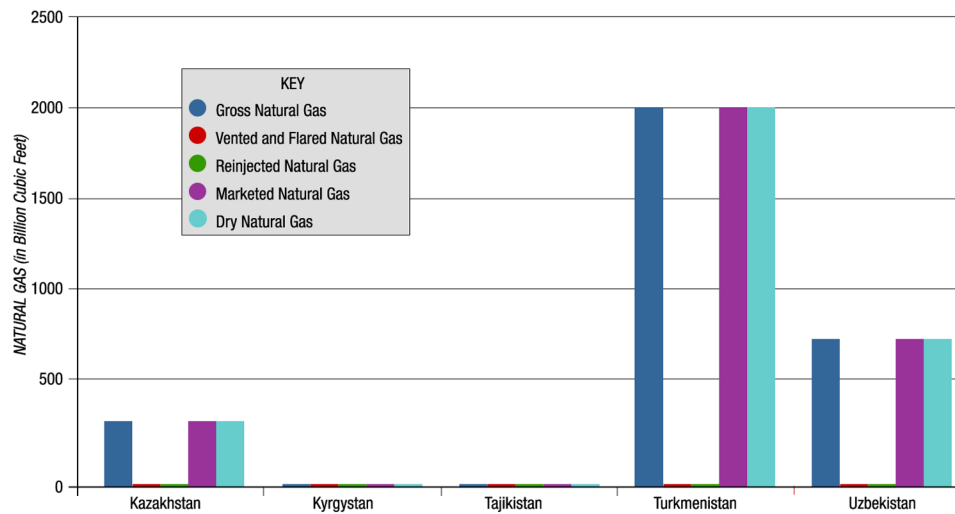
Retrieved 2 Nov. 2010 from: <http://blogs.ei.columbia.edu/2009/08/18/water-and-energy-conflict-in-central-asia/>

Downloaded from <http://www.usfca.edu/pacificrim/perspectives/>

Appendix D

The data below is gathered from the U.S. Energy Information Administration, Independent Statistics and Analysis (<http://www.eia.doe.gov/>). They gather information on international energy statistics, and it is possible to create data sets based on certain parameters. The parameters for the following data are: Natural Gas, Product: All Products (single year), Year: 1992. 1992 because it is the year following Central Asian independence and the first year the U.S. EIA has a separate breakdown for individual countries. Before 1992, all information is together under the Former USSR. This table and graph illustrate the disparities in natural gas production, and the fact that the downstream states are rich in natural gas and as such were able to supply the upstream states during the winter months during the Soviet era.

Natural Gas Production by Type, 1992 (in Billion Cubic Feet)



Retrieved 11 Nov. 2010 from: <http://tonto.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=3&pid=alltypes&aid=1&cid=regions&syid=1991&eyid=1992&unit=BCF>

Downloaded from <http://www.usfca.edu/pacificrim/perspectives/>

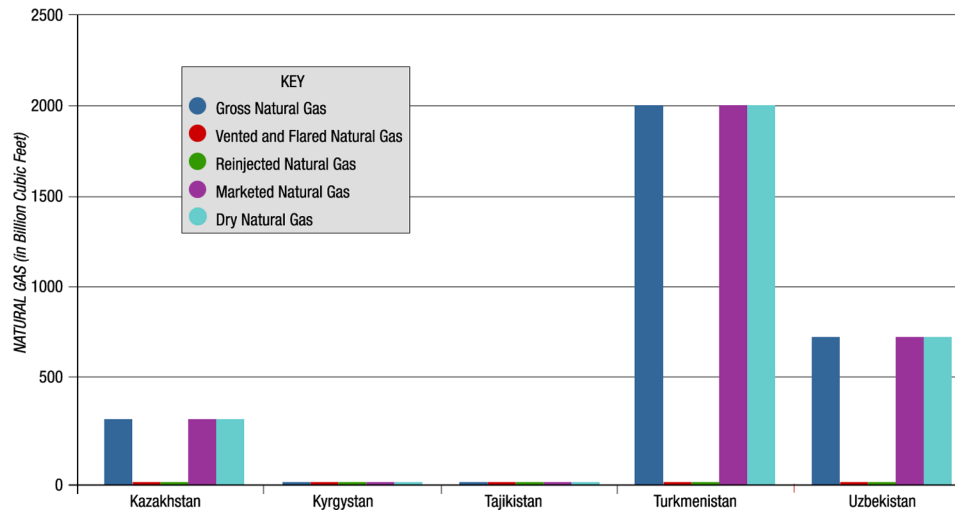
Appendix E

The data below is gathered from the U.S. Energy Information Administration, Independent Statistics and Analysis (<http://www.eia.doe.gov/>). They gather information on international energy statistics, and it is possible to create data sets based on certain parameters. The parameters for the following data are: Natural Gas, Product: All Products (single year), Year: 2008. It is possible to see from the data that production in Kyrgyzstan and Tajikistan fell in the years after independence, increasing vulnerability to energy shortages during the winter and reliance on outside sources of natural gas.

TABLE: Natural Gas Production By Type, 2008 (in Billion Cubic Feet)

TYPE OF GAS	KAZAKHSTAN	KYRGYZSTAN	TAJIKISTAN	TURKMENISTAN	UZBEKISTAN
Gross Natural Gas	1179	1	1	2490	2387
Vented and Flared Natural Gas	0	0	0	0	0
Reinjected Natural Gas	781	0	0	0	0
Marketed Natural Gas	398	1	1	2490	2387
Dry Natural Gas	398	1	1	2490	2387

GRAPH: Natural Gas Production By Type, 2008 (in Billion Cubic Feet)



Retrieved 11 Nov. 2010 from: <http://tonto.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=3&pid=alltypes&aid=1&cid=regions&syid=1991&eyid=2008&unit=BCF>

Appendix F

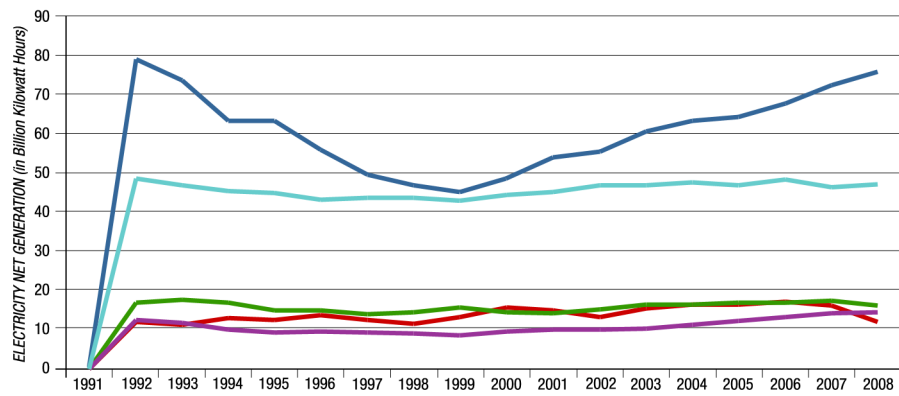
The data below is gathered from the U.S. Energy Information Administration, Independent Statistics and Analysis (<http://www.eia.doe.gov/>). They gather information on international energy statistics, and it is possible to create data sets based on certain parameters. The parameters for the following data are: Electricity: generation, all countries: Eurasia. From the Eurasian data set, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan's data was selected. Start year: 1991 (independence), end year: 2008. 2009 data is either n/a or incomplete for all five countries.

From this data, it is possible to see the total amount of electricity generated in Central Asia from several sources: Total Renewables: Hydroelectricity, Total Non-Hydroelectric Renewables (geothermal; wind; solar, tide and wave; biomass and waste), Total Conventional Thermal, and Hydroelectric Pumped Storage. This data, in conjunction with the data in Appendix F, illustrates hydroelectric dependency based on how much of total electricity net generation is hydroelectric generation.

TABLE: Total Electricity Net Generation (Billion Kilowatthours)

	KAZAKHSTAN	KYRGYZSTAN	TAJIKISTAN	TURKMENISTAN	UZBEKISTAN
1991	--	--	--	--	--
1992	78.557	11.725	16.609	12.392	48.17
1993	73.56	11.051	17.533	11.879	46.568
1994	63.243	12.743	16.798	9.866	45.289
1995	63.176	12.164	14.612	9.212	44.907
1996	55.953	13.545	14.842	9.495	43.02
1997	49.49	12.426	13.85	8.928	43.579
1998	46.604	11.416	14.265	8.852	43.433
1999	44.956	12.975	15.621	8.329	42.866
2000	48.621	15.708	13.983	9.255	44.323
2001	53.849	14.662	14.229	9.974	44.949
2002	55.286	12.84	15.142	10.058	46.661
2003	60.466	15.317	16.336	10.152	46.817
2004	63.331	16.038	16.319	11.205	47.404
2005	64.233	16.143	16.913	12.051	46.68
2006	67.746	16.801	16.754	12.831	48.322
2007	72.409	15.961	17.3	13.987	46.333
2008	75.879	11.702	15.971	14.138	47.004

GRAPH: Total Electricity Net Generation (Billion Kilowatt hours)



Retrieved 11 Nov. 2010 from: <http://tonto.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=2&pid=2&aid=12&cid=regions&syid=1991&eyid=2008&unit=BKWH>

Appendix G

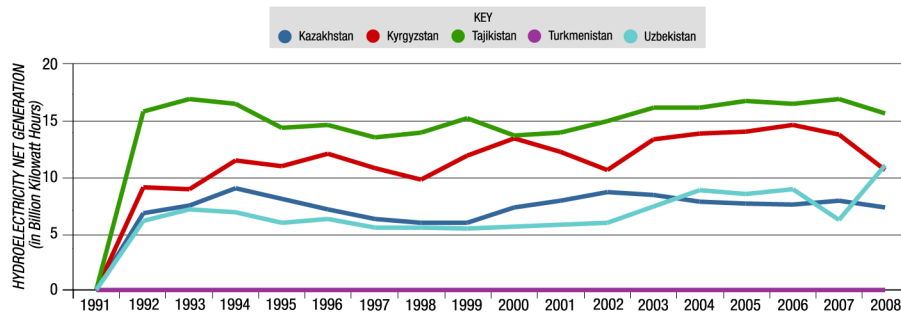
The data below is gathered from the U.S. Energy Information Administration, Independent Statistics and Analysis (<http://www.eia.doe.gov/>). They gather information on international energy statistics, and it is possible to create data sets based on certain parameters (<http://tonto.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=2&pid=2&aid=12>). The parameters for the following data are: Electricity: generation, product: Total Renewables > Hydroelectric, all countries: Eurasia. From the Eurasian data set, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan's data was selected. Start year: 1991 (independence), end year: 2008. 2009 data is either n/a or incomplete for all five countries.

From this data, it is possible to see how much of the total electricity net generation is generated by hydroelectricity. For Kyrgyzstan, Total Electricity Net Generation is 11.702 billion kW-h. Hydroelectricity Net Generation for Kyrgyzstan is 10.633 billion kW-h. 10.633 billion kW-h divided by 11.702 billion kW-h = .908, or 90% of total electricity net generation is hydroelectric. Tajikistan is 15.688 billion kW-h divided by 15.971 billion kW-h = .982, or 98% of total electricity net generation is hydroelectric. These are the numerical reasons why Kyrgyzstan and Tajikistan are so dependent on hydroelectricity in their resource policies. Due to their lack of natural gas, abundance of water and the existing infrastructure to create hydroelectricity, the two upstream states are highly dependent on hydropower plants to generate enough electricity to supply the country.

TABLE: Hydroelectricity Net Generation (Billon Kilowatthours)

	KAZAKHSTAN	KYRGYZSTAN	TAJIKISTAN	TURKMENISTAN	UZBEKISTAN
1991	--	--	--	--	--
1992	6.797	9.195	15.769	0.004	6.218
1993	7.553	8.994	16.947	0.005	7.284
1994	9.087	11.607	16.524	0.004	7.084
1995	8.248	11.007	14.45	0.004	6.126
1996	7.258	12.132	14.677	0.005	6.46
1997	6.434	10.825	13.576	0.005	5.719
1998	6.08	9.844	14.008	0.006	5.7
1999	6.071	12.021	15.273	0.005	5.626
2000	7.456	13.546	13.774	0.005	5.817
2001	8	12.306	14.064	0.003	5.899
2002	8.801	10.679	15.012	0.003	6.124
2003	8.539	13.381	16.173	0.003	7.544
2004	7.976	13.953	16.176	0.003	8.92
2005	7.777	14.116	16.797	0.003	8.544
2006	7.69	14.738	16.534	0.003	9.068
2007	8.089	13.809	16.943	0.003	6.336
2008	7.385	10.633	15.688	0.003	11.246

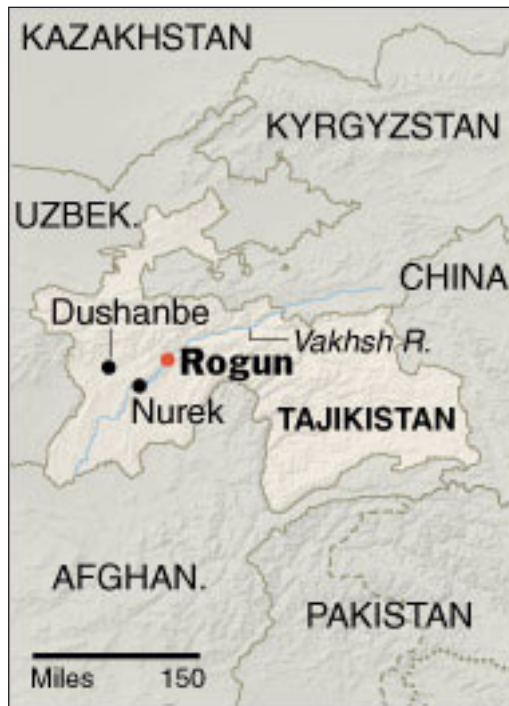
GRAPH: Hydroelectricity Net Generation (Billion Kilowatt hours)



Retrieved 11 Nov. 2010 from: <http://tonto.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=2&pid=33&aid=12&cid=regions&syid=1991&eyid=2008&unit=BKWH>

Appendix H

This map shows Rogun Dam in relation to its sister dam Nurek inside Tajikistan on the River Vakhsh.

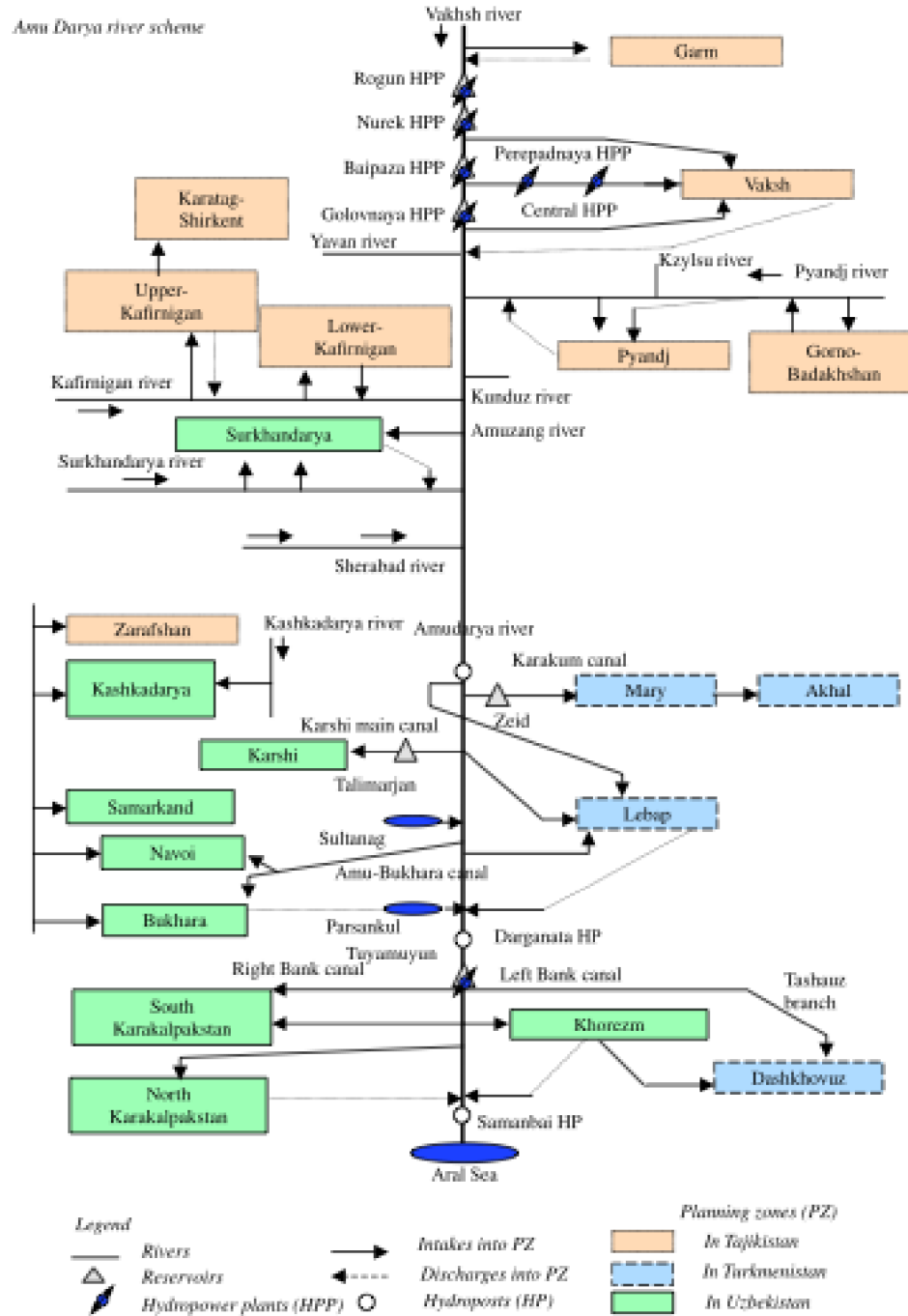


Retrieved 1 December 2010 from: <http://www.nytimes.com/2008/09/01/world/asia/01tajikistan.html>

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Appendix I

This is the layout of hydroelectric infrastructure along the River Vakhsh. Rogun Dam (red arrow, added) will be at the beginning, followed by its sister dam, Nurek Dam (blue arrow, added), which was built during the Soviet era. (Wegerich, 2008).



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Katherine J. Bowen-Williams focuses her studies on water rights and regional interdependence as a graduate student at George Mason's School for Conflict Analysis and Resolution. She is a member of the Central Asian Working Group and involved in a project to create teaching materials about the region and make non-Western style mediation techniques available to undergraduates. Summer 2012 she plans to enter the Peace Corps as part of her Master's International degree, and hopes that her time in the Peace Corps will help shed further light on conflict resolution, interdependence, and communities.