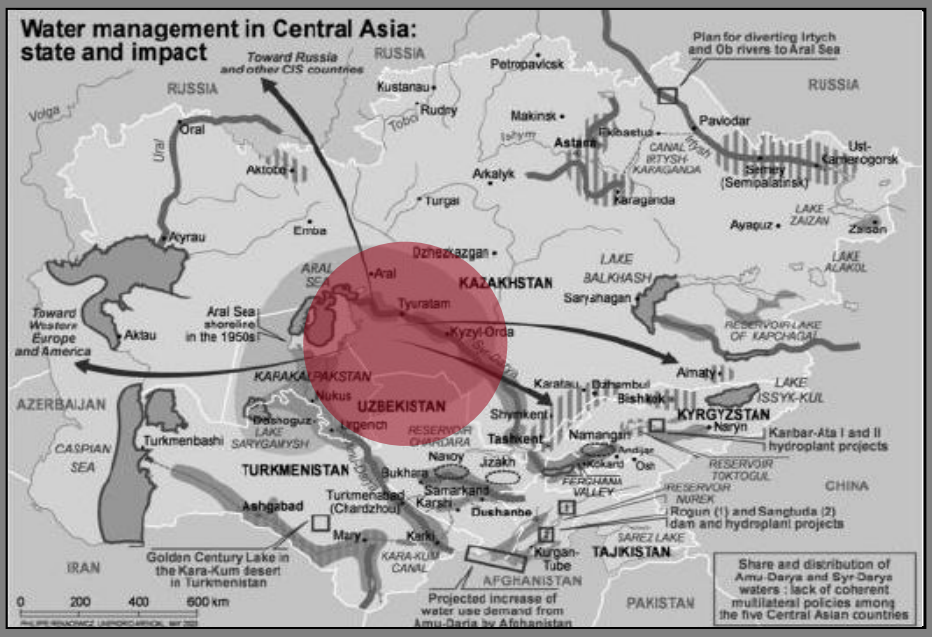

Climate Change and the Water-Energy-Agriculture Nexus in Central Asia

Scenario Workshop Background Paper

October 2011

Kerstin Fritzsche, Gulzhamal Issayeva, Achim Maas and Lukas Rüttinger

With financial support from

In cooperation with

Cover map: Water Management in Central Asia, Rekacewicz 2005

List of Contents

List of Tables and Figures

List of Abbreviations

ADB	Asian Development Bank
CAREC	Regional Environmental Centre for Central Asia
CBA	Community-Based Adaptation
CIS	Commonwealth of Independent States
EC	European Commission
EEA	European Environment Agency
EuRaSec	Eurasian Economic Community
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GHG	Greenhouse Gases
ICSD	Interstate Commission on Sustainable Development
ICWC	Interstate Commission for Water Coordination
IFAS	International Fund for Saving the Aral Sea
IPCC	Intergovernmental Panel on Climate Change
IWRM	Integrated Water Resource Management
OCEEA	Office of the Co-ordinator of OSCE Economic and Environmental Activities
OSCE	Organisation for Security and Co-operation in Europe
PPCR	Pilot Program for Climate Resilience
TA	Technical Assistance
UN	United Nations
UNDP	United Nations Development Program
UNFCCC	United Nations Framework Convention on Climate Change

1 Introduction

The 2007 Madrid Ministerial Declaration on Environment and Security (OSCE 2007) recognizes that "climate change is a long-term challenge" and acknowledges that "the United Nations climate process is the appropriate forum for negotiating future global action on climate change, and the Organisation for Security and Co-operation in Europe (OSCE), as a regional security organization under Chapter VIII of the United Nations (UN) Charter, has a complementary role to play within its mandate in addressing this challenge in its specific region."

Launched at the Chairmanship conference in Bucharest in October 2009, the Office of the Co-ordinator of OSCE Economic and Environmental Activities (OCEEA) established an extra-budgetary project – which will run until 2012 – to address the security implications of climate change in the OSCE region.

The project is divided into two main phases: First, conducting a scoping study on climate change's possible security implications in the OSCE region. Second, producing regional scenarios and identifying how the OSCE could contribute to mitigating these challenges. The project is jointly implemented with the European Environment Agency (EEA).

This Paper has been developed for a scenario workshop in Central Asia in November 2011. This region includes Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan. The workshop will primarily focus on the implications of climate change for water, food and energy security in CA. The overarching question of this paper is:

➔ **What are the impacts of climate change on the water-energy-agriculture nexus in Central Asia?**

In the following chapters, the Background Paper provides information on: a) the inter-linkages between water, energy and agriculture in Central Asia as well as key socio-economic, regional and geo-political trends and aspects (chapter 2); b) climate change projections and their implications for water resources, agriculture and energy production (chapter 3); and c) existing adaptation and mitigation measures on the national and regional level as well as relevant policy processes (chapter 4).

2 The Nexus: Key Factors and Trends

Exploring the Interlinkages between Water, Energy and Agriculture

Transboundary water resources play a crucial role for economic development in Central Asia, creating **strong interdependencies between upstream and downstream countries**. During the Soviet era, management and infrastructure of the shared water resources was centralized to satisfy both the irrigation and hydropower needs of the former Soviet Union republics and to balance **differences in the regional distribution of natural resources**. After the dissolution of the Soviet Union, the

Central Asian republics developed national approaches to water management. Given the varying distribution of water and fossil fuels, economic models and development priorities differ between the Central Asian states:

- **Kazakhstan** is, both geographically and economically, the largest Central Asian state with large fossil fuel and mineral reserves. These also account for 60 per cent of Kazakhstan's total exports. On the other hand, Kazakhstan depends on China and other neighbouring countries for about 50 per cent of its water supply (Ministry of Environment Protection 2009). The Syr Darya is a major fresh water resource for Kazakhstan, used mainly for irrigation in the agricultural sector. Being a down-stream country, Kazakhstan struggles with high pollution of the Syr Darya and diminishing waters in the Aral Sea. Kazakhstan also faces severe environmental degradation and pollution – a legacy of the former Soviet era (Granit et al. 2010).
- **Kyrgyzstan** is the most up-stream country on the Syr Darya. Being highly dependent on fossil fuel imports from neighbouring countries, Kyrgyzstan has focused on developing its hydropower capacities (Schatz 2011; Granit et al. 2010). Hydropower makes up about 75 per cent of Kyrgyzstan's energy consumption with the largest share coming from the Toktugul dam (Granit et al. 2010), but the country uses only 10 per cent of its hydropower potential (Peyrouse 2007). Exploiting this potential further is dependent on the construction of additional power lines.
- **Tajikistan** relies mainly on hydroelectric sources for energy production due to its very limited fossil fuel resources. In 2008, the country produced 98 per cent of its total energy from hydropower (World Bank 2011). Still, there is a power deficit of 3 to 3.5 billion kW/h/year. Aside from power generation, 91 per cent of total water withdrawal is used by the agricultural sector, compared to 5 per cent by the industrial sector (Aquastat 2011). Agriculture accounts for about one fourth of the national Gross Domestic Product (GDP).
- **Turkmenistan** has abundant fossil fuel reserves which also provide the largest share of its exports. Being a down-stream country, Turkmenistan is highly dependent on water flowing through its neighbours. The Amu Darya is Turkmenistan's major source of surface water and crucial for irrigation in agricultural production. In 2007, agriculture accounted for 19 per cent of the national GDP and is considered a major base of domestic food security and a supplier of raw materials to national industries (Ministry of Nature Protection 2010).
- **Uzbekistan** covers its energy demand to a large extent from its fossil fuel resources, with natural gas accounting for 85 per cent of primary energy production (Main Administration of Hydrometeorology 2008). Moreover, it is a major supplier of natural gas to the region (Granit et al. 2010). For its agricultural sector and especially the production of cotton, it depends largely on the Syr Darya and its tributaries. Over 80 per cent of the population's food demand is met by the domestic agricultural sector (Main Administration of Hydrometeorology 2008).

If the UN definition of 1,000m^3 of water available per capita per year is applied, water is thus not actually scarce in the region. However, as table 1 shows, consumption rates are very high and even exceed in some cases available renewable freshwater resources:

Table 1: Selected water statistics for Central Asia

Country / Indicator:	Kazakhstan	Kyrgyzstan	Tajikistan	Turkmeni-stan	Uzbekistan
Dependency ratio (%)*	31.19	0	16.72	97.09	77.37
Total water withdrawal per capita (m^3/inhab/yr) 2002	2 218	2 015	1 903	5 415	2 358
Water resources: total renewable per capita (m^3/inhab/yr) 2002	7 355	4 613	2 542	5 374	1 994
Population growth 2002-2010 in per cent	+7.54	+6.62	+9.43	+9.61	+8.59
Water resources: total renewable per capita (m^3/inhab/yr) 2010**	6 839	4 327	2 323	4 903	1 836

Source: Aquastat 2011, UNPD 2010. * Indicator expressing the percent of total renewable water resources originating outside the country. ** Estimated change based on extrapolations from UNPD 2010 data (population growth 2002-2010).

Challenges and Trends

Due to the shared water resources, agricultural and energy production are closely interlinked between the Central Asian states and impact a wide range of **economic, social and environmental issues**. Downstream countries have experienced severe flooding and shortages, due to both extreme weather events such as droughts and water released by upstream countries. Additionally, the water quality of the trans-boundary rivers diminishes on the way from their source to the Aral Sea. **Inefficient water use, outdated infrastructure as well as environmental pollution and degradation** put heavy stress on Central Asia's water-energy-agriculture nexus. This could be further aggravated by a set of interlinked regional socio-economic and global trends. For example, **Central Asia's population is growing** at moderate but steady rates; by 2050 it will have increased by one third (UNPD 2010). Table 2 shows the main trends:

Table 2: Overview selected demographic indicators of Central Asian states

Country / Indicator:	Kazakhstan	Kyrgyzstan	Tajikistan	Turkmenistan	Uzbekistan
Population in Mio. (2010/2050)	16 / 21.2	5.3 / 7.8	6.9 / 10.7	5 / 6.6	27.4 / 35.4
% of Population between 14-25 years in 2010*	18.7	22.7	23.5	21.8	22.4
Urban population in % (2010/2050)	58.5 / 75.9	34.5 / 53.6	26.3 / 46.4	49.5 / 71.6	36.2 / 56.0

Source: UNPD 2010

Unemployment is a major concern in all five Central Asian states and economic growth and development will be essential for satisfying the demands and expectations of the young and increasingly urbanized citizens. This will **significantly increase resource and energy demand**, e.g. by raising the need for electricity production as well as water for irrigation in agriculture.

The **regional and global economic integration of Central Asia** is evolving (Pomfret 2009), yet the global economic downturn and recent price hikes have not left the region unaffected. In 2008, Kazakhstan experienced the negative impacts of decreasing prices for oil and other commodities as well as declining global demand for metals (The Economist 2008). The recent global crisis did not leave Tajikistan, Kyrgyzstan and Uzbekistan untouched either: Their **dependency on remittances from labour migrants** led to economic losses when labour migrants returned from erstwhile booming Kazakhstan and Russia to their home countries (Crisis Group 2010). In 2008, sharp increases in global food prices along with a drought in Central Asia led to **food and energy shortages** in Kyrgyzstan and Tajikistan and highlighted their dependency on imported natural resources.

Wider Political Context of Central Asia

Central Asia **gained international attention** after the fall of the Soviet Union. Three major aspects contributed to this development: 1) Central Asia's endowment with vast natural gas and oil resources; 2) its strategic position in the heart of Asia and at the intersection of the spheres of influence of several major powers; and 3) its proximity to conflict-prone and conflict-ridden countries such as Afghanistan and Pakistan.

Kazakhstan and Turkmenistan, both having abundant fossil fuel reserves, play a **major role as energy exporters,** especially to Europe (via Russia) and other neighbouring countries. Their high potentials to further increase hydrocarbon production and the development of alternative export routes to China and Europe enhance their position as global energy exporters (IEA 2010). Economic development in adjacent regions, such as in Russia and China, stimulate exports, lead to economic gains and reduce the pressure on domestic labour markers in Central Asia. However, as mentioned above, the economic crisis of 2008 showed that dependency on neighbouring countries for migrant remittances and exports makes Central Asian countries more prone to external price effects and economic downturns.

Negative impacts on the region could further rise from conflict and destabilization in its Southern neighbour states, such as Afghanistan and Pakistan. This increases the importance of economic and social development for the sake of overall stability and prosperity in Central Asia and adjacent regions.

3 Implications of Climate Change

Climate Change Projections and Impacts

Climate change is a fact; rising temperatures have already been reported throughout Central Asia, affecting resources such as water, soil and vegetation in various ways. In its 2007 report, the Intergovernmental Panel on Climate Change (IPCC) stated that by end of the 21st century, global average temperature may rise by 1.8°C to 4.0°C (IPCC 2007). In the case of balanced reliance on all energy sources – i.e. fossil fuels and renewable energies, known as the "A1B scenario" – the world may warm by 2.8°C, well above the internationally agreed target of 2°C. Central Asia, however, would warm far more rapidly: According to the IPCC, Central Asia would warm in the A1B scenario by 3.7°C, or about 30% more. Global research also indicates that climate change may accelerate, making the impacts more severe than the IPCC outlined (Allison et al. 2009).

Workshop: Climate Scenarios

For the scenario workshop the IPCC "A1B scenario" will be used. This scenario will be discussed in its two extremes:

1. Low impact of climate change: Although temperatures have risen and the effects of climate change are considerable in Central Asia, early action and adaptation has helped to prepare the region, making the impacts of climate change relatively low.
2. High impact of climate change: Temperatures have risen and the effects of climate change are considerable and felt throughout the region. A lack of action and adaptation has left states and populations vulnerable, making the impacts of climate change severe.

Based on the wide range of climate change scenarios developed, the following climatic, hydrological and meteorological effects would likely be observed:

- It is projected that due to climate change, **average temperature will further increase** as well as the number of extremely hot days (Makhmadaliev et al. 2008). This will spur evaporation and advance soil degradation and salinization.
- Although some regions may experience increased rainfalls (Ministry of Environment Protection 2009), **average precipitation will decrease** throughout the region and especially in arid areas. This also holds true for snowfall in the Greater Himalayan region.
- **Extreme weather events** such as droughts and heavy thunderstorms will become more likely due to rising temperatures.
- High temperatures and decreased snowfall will contribute to a slow but **steady melting of the Tajik and Kyrgyz glaciers** feeding the Amu Darya and Syr Darya and their tributaries. Decreases in water run-off could range from 2 to 5 per cent for the Syr Darya Basin and 10 to 15 percent for the Amu Darya Basin (Main Administration of Hydrometeorology 2008). This will significantly alter the water

regime in Central Asia, severely impacting water run-offs and the seasonality of surface water resources.

- The **risk of natural disasters** such as inundation or mud floods as well as the overflows of mountain lakes will increase with severe consequences for human health, livelihoods and infrastructure (Main Administration of Hydrometeorology 2008). However, the risk of avalanches could diminish due to climate change (ibid.).

Central Asia is vulnerable to climate change due to its dependence on renewable natural resources for economic development and agriculture. However, its vulnerability is exacerbated by inefficient resource use and aging infrastructure, limited implementation of regulations and the already severely degraded environment and pollution as a legacy of the Soviet era. It is thus likely that the projected climate change impacts outlined above will significantly affect the complex linkages of the water-energy-agriculture nexus:

- **Water resources** will decrease in quantity as well as quality all over Central Asia due to decreasing precipitation, lowered river run-offs and increased evaporation. Glacial meltdown may lead to periods of increased run-offs and even flooding before significant decreases in run-off and the ebbing of rivers and seasonal streams could occur. Water resources will also come under increased pressure from the demand side: Rising temperatures will most likely increase the need for irrigation to sustain agricultural production levels. Cooling for industrial plants could further drive water demand, aggravating water shortages throughout the region and posing a challenge for energy generation as well as agricultural production. Additionally, the levels of both the Aral Sea and the Caspian Sea could further drop with the decrease in river run-off (Perelet 2007).
- **Energy supply** from hydropower will most likely be affected by decreasing water availability. This will particularly impact upstream countries like Tajikistan and Kyrgyzstan that rely heavily on their water resources for energy supply. Hydropower stations would run with low efficiency and output, while electricity demand rises due to increased need for cooling. Additionally, hot temperatures and extreme weather events as well as natural disasters could severely damage energy infrastructure in Central Asia.
- **Agricultural production** would suffer from soil degradation from climate change as well as potential shortages in water supply. Many crops may suffer from increased temperatures, particularly if less water is available for irrigation. Substantial decreases in agricultural production will most likely be the result. In Uzbekistan, adverse climate change impacts could lead to deficits in agricultural production of 10 to 15 per cent in 2050 (Main Administration of Hydrometeorology 2008).

The decrease in water availability and quality and its interlinked effects on the water-energy-agriculture nexus in Central Asia would collide with projected increases in resource and energy demand due to population and economic growth.

Especially Tajikistan and Kyrgyzstan, which are less endowed with fossil fuel resources, could face severe impacts on their economic development. Combined energy and food shortages as occurred in 2008 in both countries could become more frequent due to the accentuation of **"compound crisis risks"** resulting from climate change (Granit et al. 2010). The compound crises in 2008/2009 occurred when

extremely cold weather triggered breakdowns in the electricity net while at the same time winter crops and livestock suffered heavy damage from the frost (ibid.)

Additionally, **unsustainable practices and the depletion of natural resources may be further exacerbated** due to climate change impacts. Tajikistan is for instance already heavily deforested, but increased regional warming and soil degradation may accelerate the process further.

Climate change converging with pre-existing environmental pollution could **further increase health threats from toxic and radioactive waste** and decreased water quality throughout the region. As natural disasters such as landslides become more frequent, poorly stored toxic materials could penetrate rivers and groundwater resources (Granit et al. 2010). Additionally, toxic waste disposed of in the Aral Sea could be uncovered as water levels further drop. Already, contaminated soils are being exposed with rising temperatures and desertification increasing the likeliness of toxic particles being carried into the air by winds and dust storms spreading further across the region. Figure 1 highlights the multiple interactions at the case of the Ferghana Valley:

Figure 1: Climate change and natural disaster impacts in the Ferghana Valley

Source: UNEP/GRID-Arendal 2005

Impact of Global Adaptation and Mitigation Measures

The **transition to a low-carbon economy and decreases in global fossil fuel consumption** could also impact Central Asian economies, especially those dependent on oil exports. While economic losses from decreased export rates could occur, the demand for natural gas – being less greenhouse-gas intensive than oil – could increase.

On the other hand, global and regional **mitigation efforts could be very beneficial** to Central Asian countries. Due to their carbon-intensive industries, especially Kazakhstan and Turkmenistan are major emitters of carbon dioxide and have great potentials for attracting investments for reducing emissions. Global mitigation measures such as the Clean Development Mechanism could **stimulate the development of clean and resource-efficient technologies and modes of energy production** in the region, thus raising the level of foreign direct investments, encouraging technology transfer and decreasing the pressure on domestic and trans-boundary natural resources. Such developments would contribute to food and energy security in Central Asia and **strengthen the region's resilience to the adverse effects of climate change**.

4 Measures and Policy Processes on Climate Change

National and Regional Adaptation and Mitigation Efforts

As Non-Annex I countries under the United Nations Framework Convention on Climate Change (UNFCCC), all five Central Asian states have submitted their second National Communications in recent years including a GHG inventory, an assessments of climate change impacts on their territories and priority needs for adaptation measures. Given the sensitivity of water resources, all Central Asian countries with the exception of Turkmenistan have **launched processes to develop integrated water resources management (IWRM) policies** (Granit et al. 2010).

Climate change impacts and concrete adaptation and mitigation measures are thus receiving increased attention, but the potential for investments from international **adaptation and mitigation funds remains largely untapped**. In 2010, Tajikistan with support of the Asian Development Bank (ADB) launched a project to strengthen the ability of its hydrometeorological and water sector institutions to better anticipate climate impacts and develop suitable adaptation measures (ADB 2010). The ADB is contributing to the measure with a $750,000 technical assistance grant (TA) as part of the Pilot Program for Climate Resilience (PPCR) under the Strategic Climate Fund. Further projects on sustainable land management and the sustenance of agricultural biodiversity in Tajikistan have been implemented by the UN Development Program (UNDP) with the financial support of the Global Environmental Facility (GEF).

In Kazakhstan, several Community-Based Adaptation (CBA) Programmes facilitated by UNDP and financed by the Global Environmental Trust Fund were launched in recent years targeting rural communities in order to better integrate climate change issues into irrigation schemes and encourage climate-resilient and sustainable agriculture (ALM 2011).

In Turkmenistan, Uzbekistan and Kyrgyzstan, adaptation efforts are in the very early stages. A UNDP project proposal was put forward in 2011 with the objective to

strengthen institutional capacity in Turkmenistan in order to encourage the development of climate-resilient water policies in agriculture (ALM 2011). The project is to be financed by the Adaptation Fund.

Renewable energy and the implementation of energy efficiency measures could play a major role in mitigating regional GHG emissions and increasing energy security. However, **opportunities for both are only marginally exploited**. Aside from hydropower, renewable energy contributes a very limited share to the national energy mix of the Central Asian countries (IEA 2010). However, Kazakhstan has shown increased interest in tapping its wind and solar energy resources. It is also the only regional country that has submitted a quantified economy-wide emissions target under the Copenhagen Accord to the UNFCCC (IEA 2010). In early 2011, a renewable energy consortium announced plans for a potential $1 billion investment to construct two wind farms in southern Kazakhstan (Paxton 2011). Kyrgyzstan also has high potential for solar and wind power, although limited financial means restrict the funding of such power plants.

Adaptation is, however, not perceived as a high-priority issue at the political and institutional level. Existing state policies and sectoral programs do not yet integrate adaptation imperatives, which to a certain degree is linked to insufficient scientific assessment of climate change in the region and evaluation of its consequences (CAREC 2010). While some advancements have been made by research institutions and academia, gaps remain in terms of capacity and adaptation remains a non-urgent issue on the political level.

Regional Organizations and Political Processes

All Central Asian countries are members of the OSCE and have agreed to the Madrid Declaration (see Introduction). In addition, multiple organisations and initiatives have been launched during the past years to address regional cooperation on economic issues as well as on topics related to shared water resources and environmental challenges. Relevant institutions and initiatives include:

- The **Commonwealth of Independent States (CIS)** was formed by the former Soviet republics in 1991 and comprises the following member states: Azerbaijan, Armenia, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Turkmenistan, Uzbekistan and Ukraine. Originating from the CIS, the **Eurasian Economic Community (EurAsEc)** was founded in 1996 with Belarus, Kazakhstan, Kyrgyzstan, Russia, Tajikistan and Uzbekistan as members. In 2009, the UN Industrial Development Organization and EurAsEc signed a Memorandum of Cooperation providing prospects for new cooperation between the two organizations on energy and climate change in areas such as: energy and climate change; the environment, including water management; agro-industries; trade capacity building; and private sector development (IISD Reporting Service 2009).

- Given the severe degradation of the Aral Sea and its socio-economic impacts on the region, the **International Fund for Saving the Aral Sea (IFAS)** was established in 1993 by the heads of the Central Asian states. IFAS is tasked with attracting funds from regional and international donors for projects to ameliorate the environmental situation and rehabilitate the Aral Sea, as well as to improve water and land management in the Aral Sea Basin.

- In 1992, the Ministers of Water Resources of the five Central Asian republics signed the Almaty Agreement on cooperation in the joint management, use and protection of interstate sources of water resources, creating the **Interstate Commission for Water Coordination (ICWC)**. Aside from coordinating and improving the management of trans-boundary water resources, the ICWC also addresses environmental challenges arising from the exhaustion of the Aral Sea. It has furthermore been included in the IFAS since 1993.

- The **Interstate Commission on Sustainable Development (ICSD)** was established in March 1993 in accordance with Article 2 of the "Agreement on joint actions to address the problems of the Aral Sea and Aral, environmental rehabilitation and socio-economic development of the Aral Sea region", signed by the Central Asian heads of states. The work of ICSD is guided by decisions of the heads of the commissions of sustainable development of the member states, the IFAS (see above), and the UN Conference on Environment and Development. The main goal of ISCD is to coordinate and manage regional cooperation in the field of the environment and sustainable development in Central Asia.

- The **Regional Environmental Centre for Central Asia (CAREC)** is an inter-governmental, non-profit organization established in 2001. CAREC was founded by the Central Asian countries of Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan, as well as UNDP and the European Commission (EC). The mission of the CAREC is to promote multi-sector cooperation in addressing environmental problems in Central Asia at the local, national and regional levels.

In addition to these selected organisations and commissions, the Central Asian states are members of a number of other regional initiatives have been launched in recent years to enhance water cooperation in Central Asia, such as the Shanghai Cooperation Organisation, the German-funded Water Initiative "Water Unites" and the EU Water Initiative.

In conclusion, several regional cooperation efforts have been undertaken since 1991 to ease tensions over the water-energy-agriculture nexus. As a result the governments of the five Central Asian states have signed several multilateral and bilateral agreements (see above) aimed at establishing a coordinated operation of power generation facilities and water releases. Unfortunately, no single agreement has been highly successful due to the limited implementation of commitments and the challenge of overcoming political discrepancies. Most external observers conclude that the self-sufficiency policy towards water and energy supply pursed by the Central Asian states is one of the main reasons for the continuous failures to solve the issue.

References

Adaptation Learning Mechanism (ALM) 2011: ALM Country Profiles. Available at: http://www.adaptationlearning.net/country-profiles (17 October 2011).

Allison, I., N.L. Bindoff, R.A. Binschadler, P.M. Cox, N. de Noblet, M.H. England, J.E. Francis, N. Gruber, A.M. Haywood, D.J. Karoly, G. Kaser, C. Le Quéré, T.M. Lenton, M.E. Mann, B.I. McNeil, A.J. Pitman, S. Rahmstorf, E. Rignot, H.J. Schellnhuber, S.H. Schneider, S.C. Sherwood, R.C.J. Somerville, K.Steffen, E.J. Steig, M. Visbeck, A.J. Weaver 2009: The Copenhagen Diagnosis. Updating the World on the Latest Climate Science. Available at http://copenhagendiagnosis.org/ (17 October 2011).

Aquastat Database 2011. Available at: http://www.fao.org/nr/water/aquastat/data/query/index.html?lang=en (17 October 2011).

Asian Development Bank (ADB) 2010: ADB Supports Tajikistan's Preparations for Climate Change Adaptation. Available at: http://www.adb.org/Documents/News/TJRM/tjrm201024.asp?p=tajmain (17 October 2011).

CAREC 2010: Gapa Analysis in the area of Climate Change and Energy Efficiency in Central Asia: Defining opportunities for CAREC. Almaty: CAREC.

Crisis Group 2010: Central Asia: Migrants and the economic crisis. Asia Report N°183 – 5 January 2010. Available at: http://www.crisisgroup.org/~/media/Files/asia/central-asia/183%20Central%20Asia%20Migrants%20and%20the%20Economic%20Crisis.pdf (17 October 2011).

Granit, Jakob, Anders Jägerskog, Rebecca Löfgren, Andy Bullock, George de Gooijer, Stuart Pettigrew and Andreas Lindström 2010: Regional Water Intelligence Report Central Asia. Baseline Report. Available at: http://www.watergovernance.org/documents/WGF/Reports/Paper-15_RWIR_Aral_Sea.pdf (17 October 2011).

International Energy Agency (IEA) 2010: World Energy Outlook 2010. IEA, France.

IISD Reporting Service 2009: UNIDO and EurAsEC to Cooperate on Climate Change, Energy and the Environment. Available at: http://climate-l.iisd.org/news/unido-and-eurasec-to-cooperate-on-climate-change-energy-and-the-environment/ (17 October 2011).

IPCC 2007: Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Available at: http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_wg2_report_impacts_adaptation_and_vulnerability.htm (17 October 2011).

Main Administration of Hydrometeorology 2008: Uzbekistan. Second national communication of the Republic of Uzbekistan under the United Nations Framework Convention on Climate Change. Tashkent: Main Administration of Hydrometeorology.

Makhmadaliev, B., A. Kayumov, V. Novikov, N. Mustaeva, I. Rajabov 2008: The Second National Communication of the Republic of Tajikistan under the United Nations Convention on Climate Change. Dushanbe: State Agency for Hydrometeorology of the Committee for Environmental Protection.

Ministry of Environment Protection 2009: Kazakhstan's Second National Communication to the Conference of the Parties to the United Nations Framework Convention on Climate Change. Astana: Ministry of Environment Protection.

Ministry of Nature Protection of Turkmenistan 2010: Second National Communication of Turkmenistan under the United Nations Framework Convention on Climate Change (UNFCCC). Ashgabat: Ministry of Nature Protection of Turkmenistan.

OSCE 2007: Madrid Declaration on Environment and Security. MC.DOC/4/07. Available at: http://www.osce.org/documents/mcs/2007/12/28657_en.pdf (17 December 2009).

Paxton, Robin 2011: Kazakh region plans $1 billion wind farm projects. Available at: http://www.reuters.com/article/2011/03/24/us-energy-kazakhstan-wind-idUSTRE72N4FY20110324 (17 October 2011).

Perelet, Renat 2007: Central Asia: Background Paper on Climate Change. Human Development Report Office, Occasional Paper. Available at: http://hdr.undp.org/en/reports/global/hdr2007-8/papers/Perelet_Renat.pdf (17 October 2011).

Peyrose, Sebastien 2007: The Hydroelectric Sector in Central Asia and the Growing Role of China. China and Eurasia Forum Quarterly, Vol. 5, No. 2, pp. 131-148. Available at: http://www.silkroadstudies.org/new/docs/CEF/Quarterly/May_2007/Peyrouse.pdf (17 October 2011).

Pomfret, Richard 2009: Central Asia and the Global Economic Crisis. EU-Central Asia Monitoring (EUCAM), Policy Brief no. 7, June 2009. Available at: http://aei.pitt.edu/11481/1/1880.pdf (17 October 2011).

Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat (UNDESA) 2010: World Population Prospects: The 2010 Revision. Available at: http://esa.un.org/unpd/wpp/index.htm (17 October 2011).

Rekacewiz, Philippe/UNEP/GRID-Arendal 2005: Water Management in Central Asia: State and Impact. Available at: http://maps.grida.no/go/graphic/water_management_in_central_asia_state_and_impact1 (25 October 2011).

Schatz, Edward: Central Asia 2011: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan. In: Moran, Daniel (ed.): Climate Change and National Security. A Country-Level Analysis. Washington D.C.: Georgetown University Press, p. 129-139.

Shanghai Cooperation Organization 2008: Dushanbe Declaration of Heads of SCO Member States. Available at: http://www.fmprc.gov.cn/eng/zxxx/t513027.htm (17 October 2011).

The Economist 2008: After the boom. Wondering if the good times are over. Available at: http://www.economist.com/node/12523888 (17 October 2011).

The World Bank 2011: The World Bank Data. Available at: http://data.worldbank.org/ (19 September 2011).

UNEP/GRID-Arendal 2005: Climate change and natural disaster impacts in the Ferghana Valley. UNEP/GRID-Arendal Maps and Graphics Library. 2005. Available at: http://maps.grida.no/go/graphic/climate_change_and_natural_disaster_impacts_in_the_ferghana_valley. (20 September 2011).

UNDP Office of the Senior Economist 2011: Kyrgyzstan: Food price inflation drops as economy recovers and remittances soar. “Fast facts” from Kyrgyzstan’s official socio-economic data. Available at: http://europeandcis.undp.org/senioreconomist/show/DA969AB4-F203-1EE9-BDDD709AB03459ED (17 October 2011).

UNPD 2010: World Population Prospects: The 2010 Revision. Available at: http://esa.un.org/unpd/wpp/Excel-Data/population.htm (24 October 2011).