Water-Food-Energy-Ecosystems Nexus as a Tool towards SDGs in the CACENA Countries

January 2018

Sub-Regional Coordinators:
Global Water Partnership Central Asia and Caucasus (GWP CACENA)
Agency of International Fund for the Aral Sea Saving (Agency of IFAS)

Tashkent

The 8th World Water Forum – Asia-Pacific Regional Process
Central Asia and Caucasus Sub-Region

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The CACENA region geographically should be subdivided into two sub-regions: The Southern Caucasus (three countries – Azerbaijan, Armenia and Georgia), and Central Asia (five countries – Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan and Uzbekistan) and in 2014 Mongolia joined regional network as a neighbor of Central Asia.

Figure 1. The location map of the countries of Central Asia and Caucasus

There is a big differentiation in renewable water resources availability among the countries within each sub-region. The region of CACENA, is very specific within the GWP family, as well as one leg of RWP is standing in the Europe and another in the hearth of Asia.

There could be observed the full range of water related issues which are obvious in many places over the globe, but in CACENA they are the most sharp in the agenda for solutions. For example, climate change processes are going two times faster rather than average over the globe, we faced with widely famous Aral Sea disaster, transboundary cooperation addressing water issues is the most complicated, and water use efficiency in irrigated agriculture (which uses about 85% of total water) is the lowest in the world practice, etc. The biggest part of the territory is located in the arid and semi-arid climate, and irrigated agriculture accounts for about 85-90 % of total water use.

The most common challenging issues for the Caucasian sub-region are the low access to proper drinking water supply and sanitation (as well as for Mongolia), water ecosystems degradation, floods and, in some zones - water scarcity.

For Central Asia they are increasing water deficit and water ecosystems degradation, water-food-energy nexus.

Transboundary water issues are common for all CACENA countries.

The principal efforts undertaken by national water authorities mostly addressing to implementation of the integrated water resources management (IWRM) principles towards Strategic Development Goals achievement in all nine countries. These include public participation in decision making, promoting political will to cooperation among sectors and countries, initiating dialogues among all stakeholders and support to practical actions at local levels. The nexus tool is the key in those efforts.

Table 1.

Key Characteristics of the CACENA Countries

Country	Territory, Km^2	Population (2016)	GDP, Million USD 2015	Renewable Water Resources, km^3 per year
Armenia	29800	3031500	10561	6,500
Azerbaijan	86600	9933200	53047	8,710
Georgia	69700	3929800	13965	53,600
Kazakhstan	2717300	17984700	184361	64,800
Kyrgyz Republic	198500	6068000	6572	47,400
Mongolia	1564116	3026000	11758	34,600
Tajikistan	143100	8726300	7853	60,583
Turkmenistan	488100	5462300	37334	1,549
Uzbekistan	447400	31807000	66733	11,593

Source: CAWATER-info.net (web-portal of the ICWC)

Goals and content of the Sub-Regional process

At the 7th World Water Forum in 2015, an international consensus on the Nexus concept was formed. The most of CACENA countries bold strategic action plans for the Nexus-based national economy and needed resources security.

The **main goal of the CACENA Sub-Regional Process** towards the 8th World Water Forum is to support implementation framework towards water targets under the SDGs, which will be conducted by all nine countries under umbrella of the Global Water Partnership network using Nexus approach as practical tool. To meet the goal it is necessary to improve the inter-resource linkages by the step-by-step inventory build-up in the flow of each sector/resource and the nexus mechanism through which the efficiency and synergy could be achieved.

In most countries of Caucasus and Central Asia, achieving water, energy and food security is among the key policy objectives. Some have included this objective in their National Development Strategies and other policy documents. Almost all

CACENA countries launched National Policy Dialogues (NPDs) aimed at improving water resources management, including its transboundary dimension, with the ultimate objective of achieving water-related Sustainable Development Goals (SDGs).

The NPDs and other policy discussions in the region have so far focused on water, agro-food or energy sectors individually, and at best discussed water-energy and water–agriculture inter-linkages. More comprehensive discussion spanning water and the key sectors (water-food-energy-ecosystems nexus) is needed. Quantitative and qualitative tools that help assess the water-energy-food nexus with accounting of ecosystems will be useful to support and substantiate such discussions.

In order to cope with the increasing disparity in supply and demand of the future due to the increase in demand of essential resources such as water, energy, food and ecosystems, the regional society is trying to reduce the resource consumption through the linkage among resources and to develop additional technology.

To do this, regional countries with support from GWP CACENA are going to analyze various cases in the region and examine the application of the Water-Energy-Food-Ecosystems Nexus evaluation tool for inter-linkage analysis. However, the relevance of the application cases and the approach to the evaluation tools are still insufficient.

The synergy effect and efficiency of each case will be examined and based on the results, a customized technological / policy implementation strategy will be derived for the CACENA region.

GWP CACENA will also provide policy guidelines for promoting Water-Energy-Food Nexus in a country-specific environment through analysis of effects based on mutual linkages.

During the regional process there were analysed the three case studies of the Nexus approach application, which was suggested by different strategic partners of GWP CACENA (UNECE and AWC):

- for Caucasus sub-region - the Alazani/Ganikh river basin (UNECE);
- for Central Asia - the Syrdarya river basin (UNECE), and
- for Mongolia (AWC).

THE SPECIAL CASE STUDY - THE NEXUS APPROACH FOR THE ALAZANI/GANIKH BASIN

The nexus assessment of the Alazani/Ganykh Basin aims to support transboundary cooperation between Georgia and Azerbaijan in the areas of water, energy, food and environmental policies by strengthening the knowledge base for integrated policy development and decision-making.

The specific objectives of this nexus assessment are:

- to describe the governance context;
- to identify key drivers of pressure on the basin's resources;
- to identify and analyze key intersectoral issues;
- to explore the potential solutions to increase the benefits provided by the management of the basins resources that could be achieved through more coordinated policies and actions, and through transboundary cooperation; and
- to identify the benefits that the adoption of a nexus approach can potentially deliver.

The scope of this nexus assessment is limited to testing the nexus assessment methodology developed within the framework of the Water Convention, and to providing a scoping level assessment of the relevant issues and some possible synergetic actions (or nexus solutions) in response. This preliminary analysis (largely qualitative) could serve as the basis for more detailed analyses focusing on some of the specific intersectoral issues identified.

The nexus assessment in the Alazani/Ganykh Basin was carried out at the request of the governments of Georgia and Azerbaijan. The Alazani/Ganykh nexus assessment made use of a multi- stakeholder approach involving Georgian and Azerbaijani representatives of relevant economic sectors (notably agriculture and energy), water and environment administrations, state companies or utilities and civil society.

Information for the pilot nexus assessment of the Alazani/Ganykh Basin was gathered through: (i) a basin-wide multi-stakeholder workshop that took place in Kachreti (Georgia) from 25 to 27 November 2013; (ii) two questionnaires, one factual and one perception-based (both distributed at the workshop); (iii) a desk-review of information from national strategic or policy documents, as well as documentation from relevant studies and projects, notably those prepared as part of the United Nations Development Programme (UNDP) Global Environment Facility (GEF) funded project "Reducing Transboundary Degradation in the Kura Ara(k)s River Basin" (UNDP/GEF Kura project); and (iv) information referred to by the workshop participants.

The pilot nexus assessment of the Alazani/Ganykh River Basin includes the preliminary identification of possible solutions to improve the management of the basin's land, water, energy and environmental resources. These potential solutions have been classified under five headings: institutions, information, instruments, infrastructure, and international cooperation and coordination.

Basin Institutions

Establishment and strengthening of basin governance — a key element would be the finalization and signing of the draft bilateral agreement currently under negotiation on cooperation in the field of protection and the sustainable use of the water resources of the Kura River Basin. At the national level a supporting action would be to complete updating the national water legislation, reflecting the basin principle. Capacity- building at the municipal government level is an important prerogative for success.

Developing mechanisms to identify and incorporate the wider nexus impacts in sector-based policy development – both at national level and at transboundary level (for example in the framework of the impending Kura agreement).

Engaging water-user sectors in the ongoing development of water laws, strategies and plans – such as the updating of the Water Law which has been undertaken in Georgia or the development of the National Water Strategy in Azerbaijan.

Clarifying roles and responsibilities – for example, for repairs and maintenance of irrigation infrastructure.

Leveraging the support of development partners – technical and financial development partners (such as the EU, OECD, UNDP-GEF, UNECE or USAID) play important supporting roles in the development and implementation of sectoral strategies. That support can be channeled to ensure that those sectoral strategies (like the new Energy Strategy for Georgia or intersectoral ones like the Strategic Action Plan for the Kura-Araks River Basin take nexus linkages into account and include cross-sectoral actions.

Information

Improving the monitoring and assessment of basin resources and uncontrolled hotspots, particularly basin resources exposed to increasing pressures (such as groundwater abstraction), and paying special attention to assessing the economic value of ecosystem services. Assessing nexus linkages when developing sectoral plans or assessments – such as energy assessments, agricultural assessments, or health assessments that take into account resource constraints and cross-sectoral impacts. Developing and applying guidelines and drawing upon international experience to improve sustainability in the location, design and construction of hydropower plants. Providing extension services to upgrade agricultural and forestry practices, including crop selection, water management, and application of agro-chemicals, informed by cross-sector knowledge.

Recommended Instruments in the result of nexus assessment

The first priority is improving land use planning. Mapping the current structure of policy instruments (such as subsidies and water allocation rights) and assessing their impacts in order to identify opportunities for improving alignment and coherence of policy instruments with policy objectives across different sectors.

Introducing instruments to apply the "polluter pays principle" for resource management and "beneficiary pays principle" for infrastructure financing, including private companies, public companies and agencies, and households. Well-targeted economic instruments could motivate rational use of water, while at the same time contributing financially towards repairs and extending infrastructure. The need for this is particularly pressing in agriculture.

Implementing a policy mix to promote switching from fuelwood to modern fuels in the basin particularly in the upper basin, and building on the experience of Azerbaijan, which relies on subsidies and the development of gas infrastructure. Since Georgia does not have a similar fossil fuel base, switching from fuelwood would likely require planning for electricity and fuel imports. Small hydropower plants could be developed, taking into account the constraints in the basin, which would seek to keep environmental impacts low.

Reforming agricultural support packages so that they promote improved management of land, water, energy and environmental resources, for example, by moving towards sustainable and responsible use of water, including low-water intensity crops, and preparedness from the effects of climate change, for example, by training farmers in best farming practices.

Introducing instruments to better manage the water supply and sanitation – they could include compulsory metering for households, the promotion of low flow appliances, and regulations for water re-use and recycling.

Developing environmental flow regulations – this is particularly pressing because of the growing interest in developing hydropower in both countries. Environmental flows should be established case by case, taking into account the specificities of the river ecosystem while at the same time seeking consistency.

Stepping up enforcement of existing regulations – for example regarding wastewater discharges or solid waste disposal.

Infrastructure

Investing in built infrastructure to ensure the preservation and protection of the basin's water resources – from modernizing irrigation infrastructure to building new wastewater treatment plants.

Developing an approach to investing in flood management that integrates natural infrastructure – such as ongoing reforestation and afforestation efforts, and built infrastructure.

Ensuring that new hydropower plants, driven by hydropower generation, are designed to maximize the benefits of multiple uses – for example, building them in combination with irrigation or drinking water supply intakes, as well as minimizing impacts on the environment, for example, by preferring run-of-the-river type hydropower station designs.

Promoting the development of renewables (other than hydropower) – such as the currently planned production of electricity and heat from biomass, solar, wind etc. on the Azerbaijan side of the basin.

International coordination and cooperation

Coordinating flood risk management measures, including local infrastructure interventions, regular clearing and maintenance of river banks and emergency responses.

Coordinating water quality protection measures with a focus on determining the type and scale of wastewater treatment facilities needed as well as on other interventions (such as water reuse) to reduce low-quality water discharges.

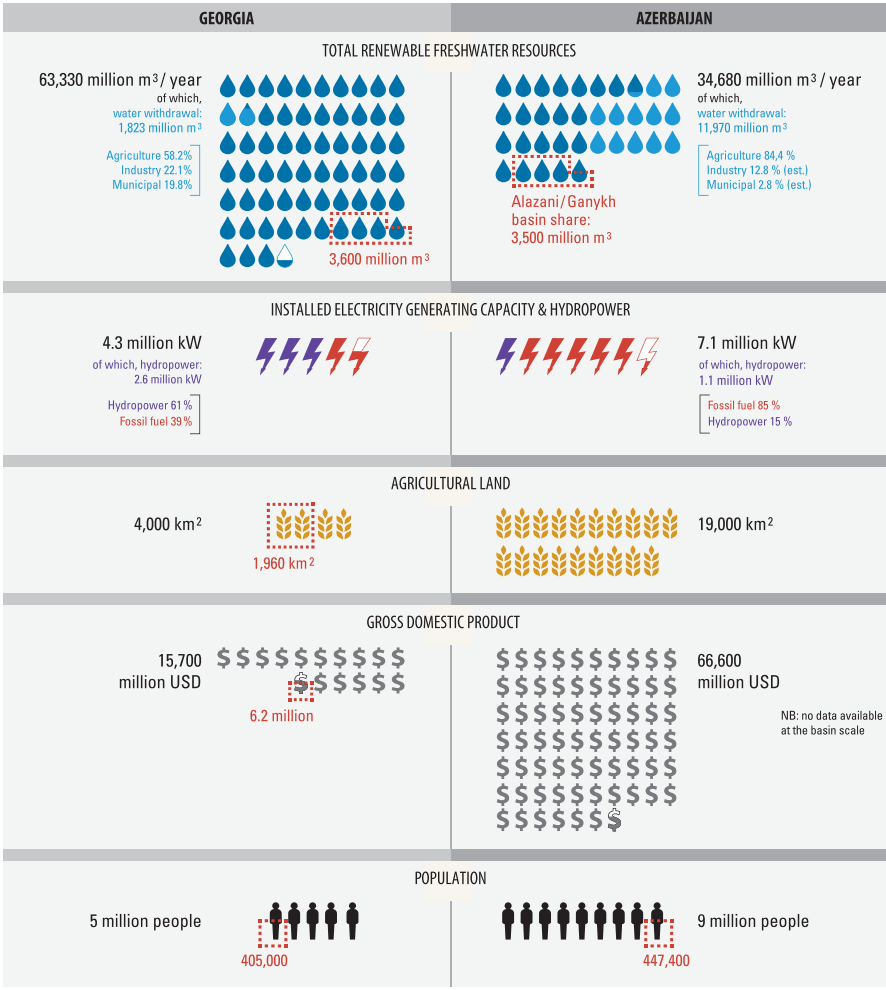
Facilitating information-sharing and mutual learning – for example in the area of economic valuation of ecosystem services where Georgia has developed experience, or for the introduction of water efficient irrigation technology where Azerbaijan has made progress.

Coordinating climate change adaptation plans and measures.

Developing a strategic plan for the development of the hydropower potential that incorporates a nexus approach for the identification of optimal hydropower growth and locations, and takes into account the cumulative effects of multiple hydropower plants. This would likely have benefits beyond the Alazani/Ganykh Basin area.

Sources: Sources: FAOStat, 2012 data; Map "Energy sector of Georgia", USAID, 2013; GlobCover 2009, European Space Agency (http://ionia1.esrin.esa.int); Rapid Assessment of the Rioni and Alazani-Iori River Basins of Georgia, Mariam Shotadze & Eliso Barnovi, USAID, 2011, Technical Assistance for Promoting Small Hydropower in Azerbaijan, UNDP and Ministry of Industry and Energy of Azerbaijan

Figure 2. The map of Alazani/Ganykh Basin



Sources: FAO Aquastat ; US EIA International Energy Statistics ; Word Bank , 2015.

Figure 3. The Alazani/Ganykh Basin characteristics

THE SPECIAL CASE STUDY - THE NEXUS APPROACH FOR THE SYRDARYA BASIN

The nexus approach for the Syrdarya river basin was proposed by GWP CACENA to support national policy, development and transboundary cooperation by the riparian countries in the areas of water, energy, food and environmental policies by strengthening the knowledge base for integrated policy development and decision-making. The specific objectives of the nexus approach are:

- to provide a picture of the status and trends of resource needs and the environmental impact of the main economic activities in the basin
- to identify the main inter-sectoral challenges that call for integrated or at least coordinated planning and management involving different sectors, as well as transboundary cooperation
- to identify current opportunities to improve resource efficiency, reduce negative impact across sectors and/or countries and increase sustainability with an emphasis on practical, mutually-beneficial opportunities.

The Syrdarya's basin resources play a key role in the economy and development of four riparian countries: Kyrgyzstan, Tajikistan, Uzbekistan and Kazakhstan. The basin provides fertile agricultural land, water resources that support hydropower generation and irrigated agriculture, and some of the world's largest oil, coal and natural gas reserves.

The basin's resources are under large and increasing pressures. The drying up of the Aral Sea and the related degradation of the environment graphically describes the dramatic extent of some of those pressures. In addition to water use for irrigation, the basin also experiences pressures from energy development, industrial development, household consumption, and climate change. In turn, this affects the socio-economic development of the basin population, energy and food security, and the sustainability and resilience of economic activities – including agriculture. In the future, environmental and social challenges will become increasingly urgent as resource demands increase with higher living standards.

Energy, water and land resources are closely linked in the Syrdarya basin. Figure 2 provides an overview of the current status of nexus linkages. In the Syrdarya basin water-energy and water-land links are particularly important.

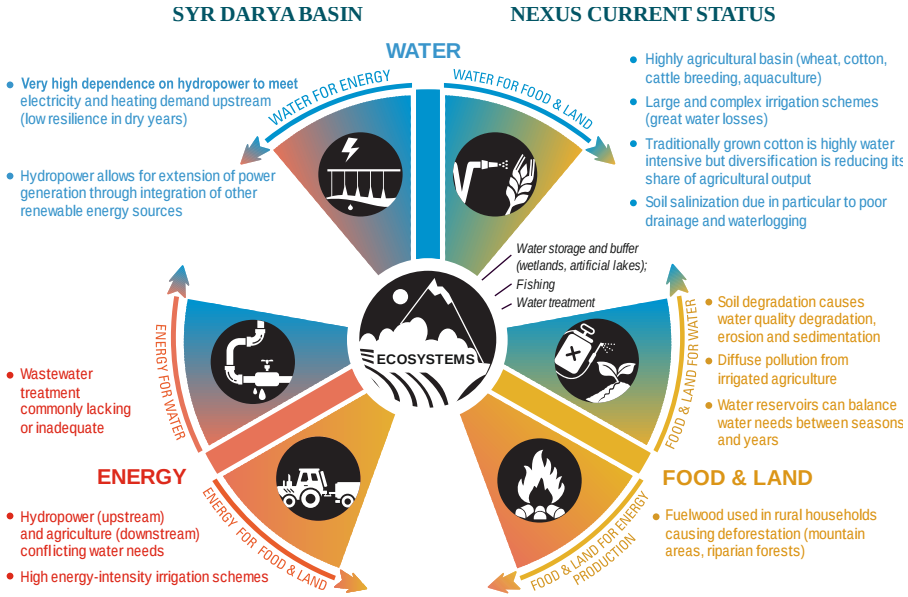


Figure 4. Nexus linkages in the Syrdarya basin

Most links between countries and sectors in the basin take place through water resources. The Syrdarya's water resources are central to hydropower generation in the upstream countries and agricultural production in the downstream countries. There is a clear trade-off, as demand for energy in upstream countries peaks in winter time while downstream irrigated agriculture require water releases in summer time. These demands and dependencies could be reduced: for energy through an increased diversification of energy sources and improved energy efficiency, and for water through furthering the on-going transformation of agriculture involving improved water use efficiency, crop switching and land reform, among others. Water quality issues, driven by untreated wastewater discharges and inadequate agricultural practices, are also relevant given their human health and environmental impacts.

Reduced cooperation has left riparian countries more exposed to external shocks. In Soviet times, the basin resources were to a significant extent managed in an integrated way as to address development priorities, with compensation mechanisms facilitating the acceptance of the planner's decisions. Since 1991, cooperation between countries has decreased, despite the establishment of agreements and a number of basin governance institutions at the Aral Sea level. Opportunities to seize cooperative solutions have been missed, in particular on energy exchanges and water discharges, leading the countries to act independently and without coordination to ensure economic growth and resource security. This

has not only caused transboundary tensions, but also increased the exposure of each country to external shocks.

Transboundary cooperation in the management of the basin resources can generate large economic benefits but a lack of trust is a serious bottle-neck. Cooperative solutions are available and could generate massive economic benefits, by reducing input costs, increasing the value of agricultural production, promoting exports of energy carriers, enhancing the sustainability of economic activities, reducing the costs of droughts and power cuts, and promoting cross border investments and the development of regional markets for goods, services and labour. Improved cooperation in managing the basin resources can also generate a number of social and environmental benefits – including poverty reduction, employment generation, health benefits, improved status of riverine ecosystems – as well as geopolitical benefits.

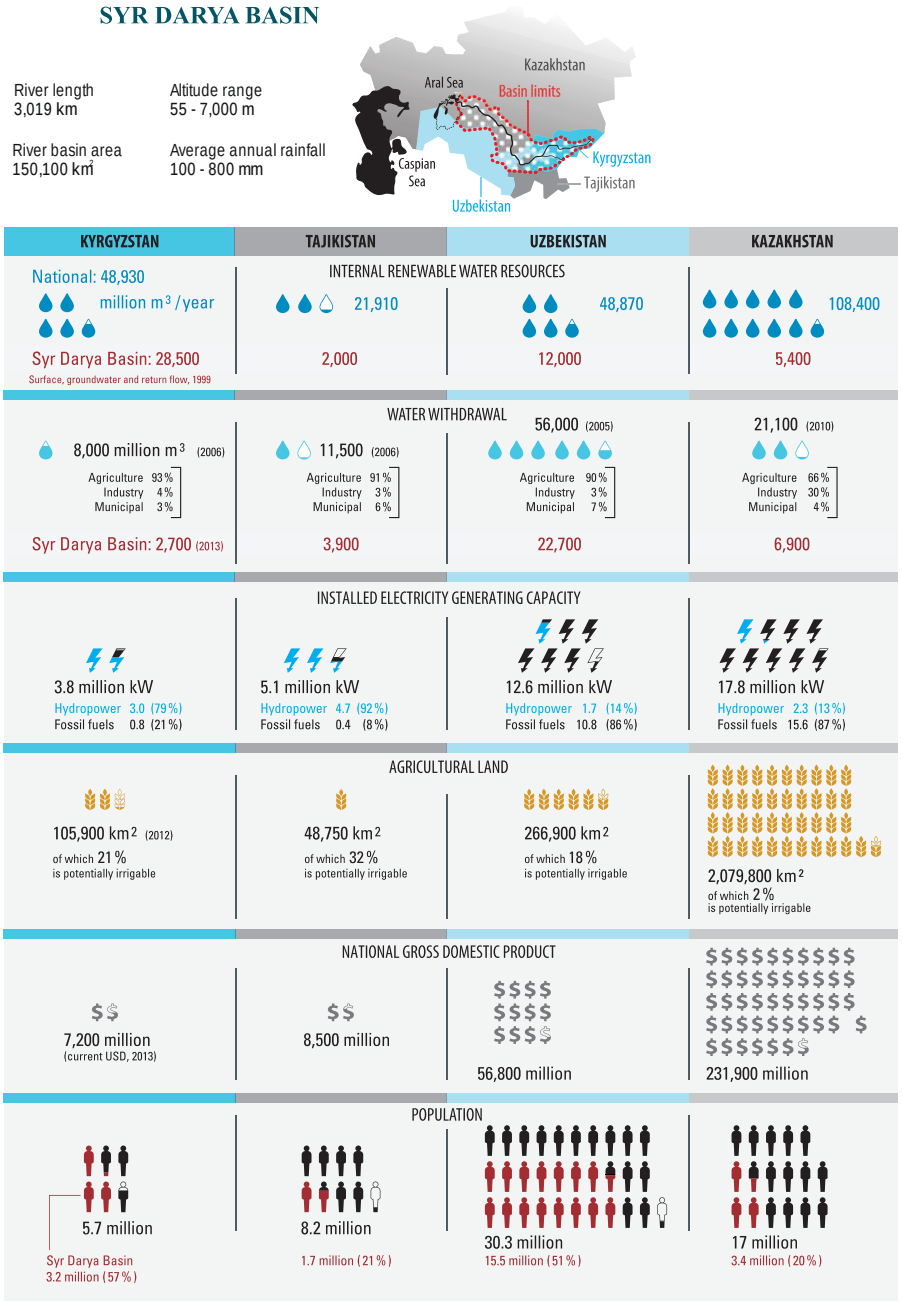
Realising the potential benefits of improved management of the basin resources demands an ambitious programme of action. Such a programme would encompass: (i) energy diversification in upstream countries to reduce dependency on hydropower in winter time and crop diversification; (ii) modernisation of energy and water infrastructure to minimise system losses; (iii) policy packages to increase energy and water efficiency (including pricing reforms, public awareness campaigns, and introduction of energy efficiency standards); (v) agricultural extension programmes to support crop shifting and adoption of sustainable resource management practices; and (iv) the development of regional energy and agricultural markets. Planning and implementation of such measures would also require institutional reforms and capacity development, both at national and basin level, to facilitate basin-wide integrated resource planning. The new Aral Sea Basin Programme (ASBP-4), which is under discussion and will be in the form of action plan for 2018–2025 to alleviate the environmental and socio-economic consequences of the Aral Sea disaster and to facilitate progress towards integrated water resources management (IWRM) and sustainable development in the Aral Sea basin, actually envisages addressing a number topics relevant to the nexus. Improving the efficiency of the responsible institutions operating in the area of water and related resources in Central Asia (ICSD, ICWC and IFAS) requires harmonization, better coordination and the improvement of their relations.

The riparian countries are already taking various initiatives that go in the direction of the identified solutions, both technical and in the field of legislation and policy. Furthermore, at the level of national strategic documents (for example the Presidential Degree on Kazakhstan's Transition to Green Economy (2014), the National Sustainable Development Strategy of the Kyrgyz Republic for 2013-2017, the Strategy of actions on five priority directions of development of the Republic of Uzbekistan in 2017-2021), the importance of efficiency and sustainability in managing (nexus) resources — water, arable land, energy and/or environmental services — is recognized, in some cases with explicit, set targets. However, unless concerted action is taken, the efforts risk not reaching the desired level of impact.

Improved coordination, between the riparian countries but also between sectors at the national level, is necessary to that end. Improved transboundary relations as well as consistency in national policies (making a business case for energy efficiency and renewable energies, providing incentives for rational water use etc.) would improve investor confidence, which is important for mobilizing resources, in particular for major projects.

Moving forward will require progressive trust-building to gain high-level political backing. The Syrdarya basin is an example of river basin where there are evident trade-offs across sectors, resulting in inefficient use of resources, environmental degradation and tension between riparian countries. Transboundary cooperation would benefit from an improved understanding of the different sectoral needs and how these needs can be reconciled. A number of efforts to enhance resource management, based on integrated approaches and the promotion of multi-sectoral cooperation, have already been proposed in the basin. But presently the riparian countries find themselves in a vicious cycle, in which solutions based on self-sufficiency lead to negative effects on co-riparian , additional loss of trust and decreasing opportunities for the development of cooperation. Uncoordinated national policies risk pushing countries further away from each other and undermining opportunities to optimize resource use and maximize benefits. Transboundary relations and confidence in cooperation could and should be developed step by step, paying attention to actions that, while benefitting national economic development, also decrease pressures on shared natural resources, increase efficiency of sectors and strengthen economic ties between the countries.

This scoping level nexus assessment only provides an overview of the importance of the basin's resources, the inter-sectoral linkages, potential solutions and untapped benefits. Further analytical, stakeholder engagement and planning work is needed to identify precise governance reforms, policy measures and investment opportunities to address the challenges and seize the opportunities.



Sources: Scientific-Information Center of the Interstate Commission for Water Coordination of Central Asia (SIC ICWC), 2013 ; FAO ; US EIA ; World Bank, 2015.

Figure 5. Main Indicators of the Syrdarya River Basin

THE SPECIAL CASE STUDY:
UPDATE AND DEVELOP NATIONAL WATER POLICY IN LINE WITH SDGS, PARIS DECLARATION AND LONG TERM DEVELOPMENT POLICY OF MONGOLIA

This activity was initiated by the Mongolian government and supported by Asia Water Council with involvement of GWP CACENA.

Objectives of the case Study

Evaluate the current water management practices of Mongolia and recommend implementation plan to raise up the efficiency based on WEF nexus approach:

- Evaluate and make recommendation to the Mongolian water management plan based on the National Water Program until 2030, linking with the international development agendas (SDGs and Paris Declaration).
- Assessment of current status of Water, Energy, and Food Sector in Mongolia
- Feasibility of the proposed water program reflecting the changing environment
- Suggestion of efficient management for Water, Energy and Food
- Understand the legal, regulatory and institutional framework related to water policy and development planning of Mongolia

Actors involved

Prof. Shahbaz Khan, Director and Representative, UNESCO Jakarta Regional Science Bureau for Asia and the Pacific

Dr. Vadim Sokolov, Regional Coordinator, Global Water Partnership Central Asia and Caucasus, Uzbekistan

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Dr. Sangyoung PARK, Principal Researcher, K-water Institute

Dr. Eul Reae LEE, Head Researcher, K-water Institute

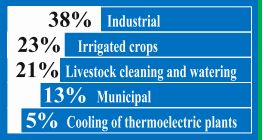
The action proposal was submitted by the Mongolian government and approved by the BoC of AWC at the 1st general assembly, Bali, in March 2016. The title of action is 'Update and develop national water policy in line with SDGs, Paris declaration and long term development policy of Mongolia'.

As an outcome of this activity, a mission trip to Mongolia was conducted, 21-25 June 2016. The agenda of mission covered the kick-off workshop, field visit for groundwater monitoring site and bi-lateral meeting with the water authority of Mongolia. The mission led by Prof. Jang and was supported by the AWC secretariat. The Mongolian counterpart, Ministry of environment, green development and tourism of Mongolia, actively involved in the mission and contributed on the kick-off workshop, field trip and expert consultation meeting. The output and outcome of Mongolian mission presented at the 2nd BoC of AWC, 13th July, Singapore and also discussed at the special session.

Mongolia UN-Water Country Brief

		year
Total population (UN Population Division)	**2.8** million inhabitants	2012
Total area	**1.56** million km^2	2012
Population density	**1.8** inhabitants/km^2	2012
Human Development Index (UNDP) (between 0 and 1; 1 is highest)	**0.675**	2012
Country rank (total 187 countries; 1 is highest)	**108**	
Gender Inequality Index (0 is equality between women and men; 1 is least equality)	**0.328**	
Water, sanitation and hygiene-related deaths as % of total deaths (WHO)	**3.5** %	2004
Long-term average precipitation (CRU CL2.0)	**241** mm/year	
Long-term average actual renewable water resources (FAO AQUASTAT)	**34 800** million m^3/year	
Actual renewable water resources per capita (FAO AQUASTAT)	**12 429** m3/inhabitant	2012
% of total actual renewable freshwater resources withdrawn (MDG Water Indicator) (FAO AQUASTAT)	**1.6** %	2009
Groundwater withdrawal as % of total freshwater withdrawal (FAO AQUASTAT)	**82** %	2005
Total area equipped for irrigation (FAOFAOSTAT)	**84 300** ha	2009
% of area equipped for irrigation actually irrigated (Ministry of Food, Agriculture and Light Industry)	**57** %	2012
Increase in number of dried up streams, lakes and springs since 2003 (Mongolia Ministry of Nature, Environment and Tourism)	**30** %	2007
Ramsar sites (Ramsar) - number -total area	**11** sities **1.4** million hectares	2013

Water withdrawals by sector (total 550 million m^3 in 2009)



MAJOR FINDINGS

The basis of collaboration was made through the MoU between Mongolian Ministry of Environment and Green Development (MEGD) and K-water in December 2015. The Mongolian water resources is managed by 29 sub-catchments. The concept of catchment was introduced in 2004 and basin authority was established in 2012 and the concept of Integrated Water Resources Management (IWRM) has been applied since 2013. The Mongolian water policy is relatively well organized however, it is needed to update reflecting the international trend such as climate changes. The water supply system is very old and the service area is limited. The water policy is closely related the national security of Mongolia and the update and renewal process should take multi-dimensional approach with careful consideration.

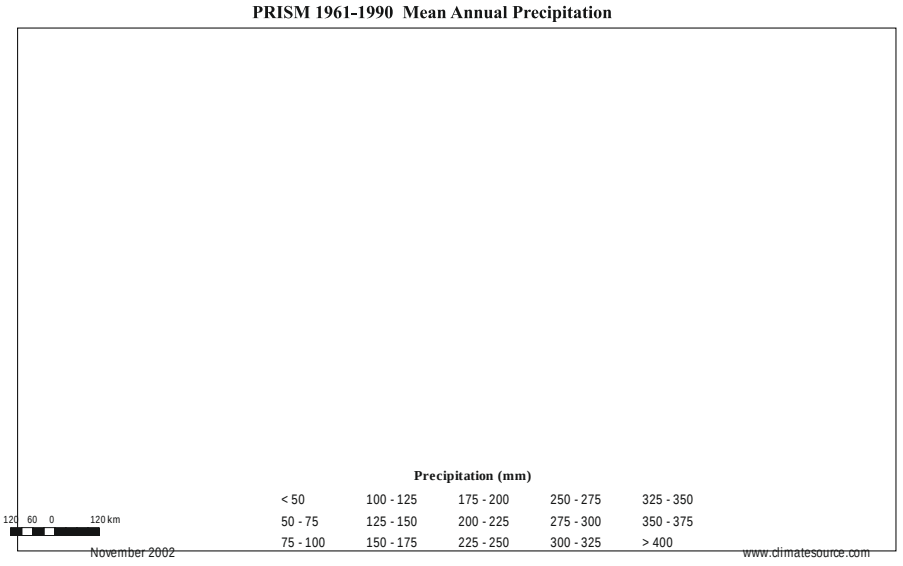


Figure 6. The Precipitation map of Mongolia

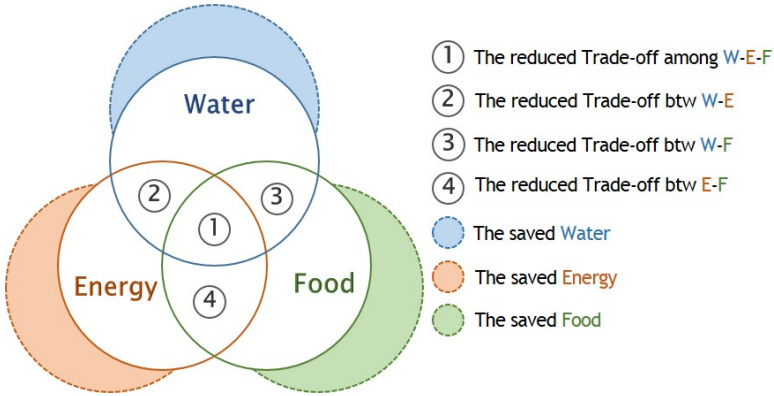
The Expert group proposed Driving force, Pressure, Status, Impact, Response methodology (DPSI) to explore the current status and the impact of policy intervention, which calls for collection and pre-processing of water rerated parameters and build up database.

DPSI	Social Aspect	Economic Aspect	Environmental Aspect
Driving Force	• Population density • Population growth rate • Migration rate • Population Distribution • Number of house • Economic activity Pop	• GDP per capita • Production rates • Unemployment rate • Governmental Investment in environmental sector • Economic growth rate	• Water resources per capita • Forest area per capita • Number of reservoirs or wells • Regulated Area including ecosystem, water resources, national park etc. preservation
Pressure	• Urbanization rate • Increasing mining area	• Number of Factory • Land use change • Amount of Water demand	• Deforestation rate • Waste Water discharge • Solid waste amount • Annual rainfall
State	• Water supply rate	• Pasture watering	• Amount of groundwater with drawal • River environmental flow • Water quality Status • Achievement of ambient water quality standard • Irrigation rate • Flooding/ Drought frequency • Temperature change rate • Temporal water quality change
Impact	• Death rate under 5 years • Water shortage Decrease of water resoirce	• Population and damage area due to the limited water supply	• Number of environmental accident • Disease caused by water quality

Figure 7. The DPSI methodology suggested for Mongolia

THE LESSONS LEARNED FROM CASE STUDIES

Water-Energy-Food-Ecosystems Nexus could be innovative concepts and tough trade-offs will increasingly be needed between energy, climate, food and water in terms of resource allocation, planning and long term sustainable growth that accommodates those at the bottom of the economic pyramid. Climate change, environment, economy, and policy/regulation also play an important role for the nexus as external factors.



Those activities could address water related problems in each regional country while achieving global SDGs and all other goals. The results of the case studies could serve as an example and be duplicated in other countries by GWP CACENA.

ECO-SYSTEMS AS NEXUS DIMENTION

Over a long period of time, humankind considered itself as all-powerful and able to bend nature to its will. However, instead of a slogan: "We cannot wait for favors from the Nature …" has come the understanding that "a human being has got nature not as a gift from his ancestors, but borrows it from his descendants." Such a concept adopted in the water sector, first of all, implies the recognition of rivers, lakes and other water bodies as "water consumers" along with other economic entities, and without specific ecological water flows they can lose their natural essence. Today, the priorities of water management organizations, openly speaking, are aimed at current momentary needs of mitigating the consequences of floods and droughts as well as the satisfaction of daily wants. It is easy to see that even people living in the vicinity of the epicenter of environmental disaster in the Aral Sea region in the end of 1980s and suffering from decline in fishery and loss of the river delta, nevertheless have preferred to take away the water from their sea for increasing the rice production in Karakalpakstan and Kyzyl-Orda Province in Kazakhstan. After independence, some shifts in rising of ecological awareness of society affected by this crisis took place; however, as a whole, the conservation and especially recovering of the disturbed environment are staying in "backyard" of the water policy and, in some extent, are being an obvious attempt to follow the fashion. A water culture level of the country, region, zone, and even water management administration is defined by the observance of nature protection regulations in current practice. This concerns such directions of activity as: (i) maintaining the minimum ecological flows in natural streams supporting their eco-systems and capability for self-purification, (ii) sanitary water-releases for dilution of harmful ingredients, and finally (iii) satisfaction of water requirements of deltas and estuaries. At the same time, this approach should be applied not only to large rivers and water bodies, but also to small streams, water sources and affected entities.

Environmental aspects of NEXUS as a tool specify activities and awareness in two directions: to prevent harmful events related to water resources, and to meet water requirements of eco-systems. From the ecological point of view, the main features of water are its high mobility and ability to dissolve different chemical components of the natural complex. A key condition providing the sustainable natural and anthropogenic cycles is to minimize the negative impacts of interacting sources of water and territories in use, as well as the interaction of surface and ground water.

In respect to providing the environment sustainability over the drainage basin, it is possible to propose an approach under which such principle and interrelated conservation factors as water quality in its sources and accumulation of pollutants over areas under economic use are taken as sustainability criteria. In other words, the criteria of well-being in the drainage basin are represented as follows:

- A pollution level of the area under economic use and affected eco-systems should not exceed the permissible concentrations, and trends of accumulation of toxic pollutants are to be negative, i.e. gradual reducing of pollution over the concerned area is in progress;
- Concentration of contaminants in water sources over all zones of the drainage basin, from headwaters to its mouth, shall not exceed the maximum permissible concentrations for all water users utilizing water from these water sources; and
- Anthropogenic pressure on eco-systems over the catchment area should not exceed the optimal limits that ensure maintaining of their biodiversity and bio-productivity.

Another important issue is the observance over the CACENA region of ecological requirements to water resources, when we keep in mind the requirements of eco-systems to water supply as the basis of sustainability of flora and fauna, as well as of esthetic characteristics of natural complexes. It is important not only to preserve natural flora and fauna of small and large rivers, but also to keep their natural attractiveness for people. Undoubtedly, many natural streams have lost their original status: rivers Zarafshan, Murgab, and Tejen have lost their links with the Amu Darya, and in a similar manner, rivers Chu, Talas, and Assa have lost their links with the Syr Darya River. However, our task is to stop this grievous process.

It is clear that Nexus approach shall provide the real observance of ecological requirements to water as a key task of hydro-ecological management. A number of the provisions that need to be considered in the practice of water resources management may be formulated from the positions of ecosystem-defined approach.

1) In compliance with the IWRM principles, water, land, and other resources within a catchment area should be considered *as components of joint use, management, conservation, and development*. Responsibility and duties should be distributed among water users at national, sectoral, local and “bottom” level in such a way that the regulation of water demand and use would provide sustainable preservation and/or development of the natural potential as well as preventing its reduction. Based on those considerations, all water resources within the basin have to be considered in their interaction with economic activities, taking into account some limitations in use of

water, land, and other resources, and reclamation measures in order to ensure sustainable development.

2) On the basis of the legislation, regulations, and international agreements, the Government assumes the responsibility, with the assistance of its conservancy agencies, water management organizations and public mobilization, to monitor ecological and sanitary flows and the norms on preserving natural streams that were discussed above.

3) Step by step inclusion of the environmental component into IWRM in the form of the participation of conservancy agencies in decision making at all levels of the water management hierarchy as equal partners should be accompanied by the introduction of hydro-ecological management, as a top stage of IWRM. This type of management is formed by means of priority-driven consideration and observance of environmental requirements, assessment of ecological service and transforming the Basin Water Council into the Basin Council of Natural Complexes that should consider maintaining the sustainability of ecosystems as its primary task. In the BWOs "Amudarya" and "Syrdarya", the initial phase of such an approach should be the inclusion of the Delta Water Users Association as the most important and full member into the Basin Council for defending the interests of natural complex.

4) Water resources management has to base on the rigid principle of *ecologically permissible water abstraction* (EPWA) to prevent the possibility of irrevocable water consumption. When this level is exceeded (such a situation took place in the past), countries-consumers shall make their contribution into the international basin fund as a payment for excessive use of natural resources and implement mitigation measures. For example, in the Aral Sea basin, this recommended level of total water abstraction from water sources is about 78 km3 against the present water abstraction of 106 km3, and 123 km3 in the past (1990)! If each water consumer that exceeds the ecologically permissible water abstraction will make its contribution into the fund of ecological safeguarding of the basin, then opportunities for usage of these funds to improve environmental conditions within the basin as a whole will arise.

5) For the purpose of preserving rivers and water bodies as natural ecosystems, drawdown of water of reservoirs and river flows *should not be less in summer and more in winter than mean annual runoff (that is specified based on long-term flow rate measurements)* in respective seasons. The observance of this rule can prevent transformation of rivers into runoff ditches. Water requirements of ecosystems in deltas and estuaries and flow-through and closed water bodies should be specified taking into consideration their bio-productivity and sustainability based on monitoring data along with taking into account requirements of countries that are using water resources.

6) Environment aspects should be included into IWRM plans at the level of basin, sub-basin, and region. Those activities include: (i) rehabilitation of disturbed natural landscapes due to water erosion, waterlogging, and deforestation; (ii) putting in order of such matters as excessive abstraction and use of local water sources; and (iii) inventory of sources and spread zones of pollutants, and their control and localization.

It is clear that at present, water requirements of ecosystems cannot further be met according to "a residual principle" (delivering of residuary water after satisfaction of the economic needs). Meeting of water requirements of ecosystems should be one of priority activities within Nexus actions.

ACTIONS AND MEASURES AS A WAY FORWARD

Based on those lessons, GWP CACENA will work together with countries (National stakeholders) towards SDGs achievement. The policy guidelines could be approached from the following perspectives:

• Governance, institutional and legal framework and the enforcement inter-sectoral nexus at regional, national, sub-national levels through community empowerment,
• Science and technologies for the acceleration of the nexus policies' implementations and the monitoring process towards SDGs
• Financial and economic instruments to ensure diversification of economic revenue for investing nexus

As a part of regional process GWP CACENA organized in 2017 a gap assessment of the Paris Agreement implementation and movement towards SDGs by CACENA countries to synthesize the results of that was done in the CACENA region and to answer the following questions:

1. Are there gaps between what is set out in the National Adaptation Plans (NAPs) and Nationally Determined Contributions (NDCs) and what is needed to enhance water security and climate resilient development? Are these gaps addressed elsewhere?
2. Are there gaps between what is set out in the NDCs and NAPs and the enabling activities related to capacity, knowledge, governance and financing needed in order to achieve them?

The main outcomes of the gap assessment are:

• Poor understanding of climate risk and its factors – hazard, exposure and vulnerability. No GWP knowledge sharing on this
• Few climate impact assessments and no vulnerability assessment
• No quantitative NAP targets
• No links to SDGs 6, 13 and 17
• Science-policy gap: GWP should speak on risk reduction instead of "achieving security"
• No GWP role as a neutral platform

The most significant and relevant issues for the countries of the region to date include the establishment of an efficient system of rapid response and adaptation of different sectors to the negative challenges related to changes in climatic conditions in CACENA. The most vulnerable sectors for the regional countries are the rural population that suffers from floods, landslides and mudflows, and agricultural production that suffers from water scarcity and high temperatures during vegetation period.

Within the framework of these issues GWP CACENA is going to discuss during the ordinary session to be held at the 8th World Water Forum the following:

- How to assist countries in the development of water adaptive to risks systems;
- The way to catalyze adaptation processes through policy dialogues;
- Encourage and assist in raising the awareness and knowledge of the population, politicians and experts on all matters of climate change and its negative impact, as well as mitigation or adaptation methods and approaches.

The Session Description: title "Water-Food-Energy-Ecosystems Nexus as a Tool towards SDGs in the CACENA Countries"

The main goal of the CACENA Sub-Regional Session is to inform the world water society about implementation framework towards water targets under the SDGs, which is conducting by all nine CACENA countries under umbrella of the Global Water Partnership network using Nexus approach as a practical tool. Water is the key to the world's ability to meet SDGs, which will change to better conditions of life for humankind. Whether it is food security, poverty reduction, economic growth, energy production or human health – water is the nexus. There will be discussed ways to improve the inter-resource linkages by the step-by-step inventory build-up in the flow of each sector/resource and the nexus mechanism through which the efficiency and synergy could be achieved.

The Session will present proper policy guidelines for National Governments promoting Nexus in a different CACENA country-specific environment through analysis of its effects at National and Sub-regional levels. GWP CACENA will present its strategy how to work together with countries (National stakeholders) towards SDGs achievement. The policy guidelines could be approached from the following perspectives:

- Governance, institutional and legal framework and the enforcement inter-sectoral nexus at regional, national, sub-national levels through community empowerment

- Science and technologies for the acceleration of the nexus policies' implementations and the monitoring process towards SDGs

- Financial and economic instruments to ensure diversification of economic revenue for investing nexus

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This publication was prepared as report about Sub-regional process of Caucasus and Central Asia towards the 8th World Water Forum. The main goal of this paper is to warm up discussion during the special side event at the Forum and follow-up actions under the umbrella of the Asia-Pacific Water Forum.

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