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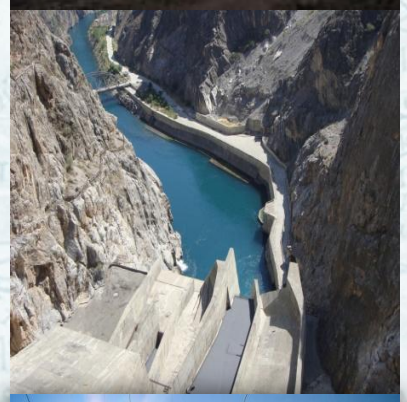
Strengthening Analysis for Integrated Water Resources Management in Central Asia: A Road Map for Action

ANNEXES

Final


Central Asia Energy-Water Development Program (CAEWDP)
Europe and Central Asia
The World Bank

In partnership with:
United Nations (Economic Commission for Europe); and
Swiss Cooperation

September 2013

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Annex 1: Phase 1A-Summary of Preliminary Findings from the Reconnaissance Mission with National Energy and Water Stakeholder
Executive Summary
(September, 2010)

Introduction. The overall aim of the ESCC Pillar 3 energy-water linkages[i] is to build regional energy and water security[ii] through enhanced regional cooperation and strategic investment. This initiative[iii] in the Central Asia Region (Afghanistan, Kyrgyzstan, Kazakhstan Tajikistan, Turkmenistan, Uzbekistan) has the aim of strengthening regional cooperation in energy and water resources development and management.[iv] The conceptual approach is to develop a decision support system (DSS) to understand the energy-water linkages. The DSS combines the relevant physical, infrastructure, economic, social and environmental data and suitable analytical tools including models,[v] and supports a multilevel dialogue process among key policy makers and technical specialists in the region, both at the national and regional levels. The DSS[vi] would be based on a transboundary approach that reflects the unique basin hydrology of the region, the large existing and potential water storage capacity in the region, the uneven distribution of energy resources and agriculture potential across the region and their demand and supply characteristics, and the development needs of all the sectors that must utilize in a sustainable manner the water resources of the region.

A World Bank reconnaissance mission visited Central Asia[vii] from August 21 to September 21 with the objective to meet with national energy and water technical specialists and begin formulating the technical and institutional baseline for an energy and water analytical and modeling framework for Pillar 3. Meetings were held with individual national design and institutions and in some cases ministerial counterparts.[viii] A consistent and open approach for discussion was maintained with each counterpart. The preliminary outcomes from the discussions are summarized below.

Overall objectives and direction of energy water linkages Though the countries responded to the program proposals with tempered optimism, they uniformly welcomed the initiative, and recognized that despite the numerous "initiatives" and "models" that have taken place in and for the region, none addressed the critical question of energy and water together at a broader transboundary scale. The countries agreed with goal to develop an independent, more transparent and technically acceptable integrated energy-water model as the core analytical framework on which to base a dialogue on acceptable options to resolve current and future problems. There are numerous difficulties and issues from counterparts' perspective as explained individually and in detail to the Bank mission. Nevertheless, they suggested that the effort had to be made, and suggested the World Bank facilitate the process.

ESCC's Pillar 3 analytical and modeling approach. All national counterparts emphasized the need to build a comprehensive and transparent analytical tool and database (the basis for a DSS) upon which the countries can technically agree. The DSS should enable a clear exposition of the facts and alternatives, linkages, and tradeoffs; it should be seen to reasonably representative of the physical and economic relationships and linkages, and it should foster a high level of technical acceptance.While details of the modeling systems that might be used were not discussed at these meetings, the discussions about developing and using models indicated that a basin model that represents all the relevant energy and water linkages can and should be developed. While some advocated using models already developed, others agreed that there is significant modeling experience to build on should it be decided to build a new model. In principle, data for the model is available, but accessibility varies. However, the lack of confidence in and acceptance of some data and the numerous past efforts to model the basins was apparent. The Bank mission emphasized any approach towards defining the regional transboundary model architecture and output variables will involve national technical and political level engagement and ownership.

Institutional approach and capacities. From the country discussions it became increasing apparent that the joint regional institutional framework, policies and rules of the former Soviet period, adopted immediately after independence for water and energy management, are breaking down in some important collaborative and technical aspects; there appears to be a widespread view that the current institutional arrangements should be reformed and strengthened, and made more transparent and effective. The World Bank observed challenges institutionally, as to: who might implement the proposed initiative in each country, lack of clarity of individual institutional mandates, current institutional operations and expectations. A specific institutional framework has not been defined for this effort. The Bank's approach during this reconnaissance mission was to listen to national counterparts discuss current structures, and possible future structures for bilateral and transboundary collaboration. It became evident that for any analytical and modeling effort to be effective, requires that the approach be economic and robust, and new institutional arrangements will be needed to create the confidence of all parties that the proposed solution will be effective and avoid unintended consequences.

Specific issues. Some specific issues identified by national counterparts:

- The rise of national aspirations and development needs, the emergence of new and distinctive political cultures, as well as the drive for energy and water self-sufficiency has led to the breakdown of regional water and energy mechanisms borrowed from Soviet times. These difficulties have promoted an increasingly inward looking rather than regional and transboundary perspective. Bilateral agreements are not respected; rules are not followed between upstream and downstream riparians, and between downstream riparians.
- Though water allocation issues are in the forefront of tensions, there was greater concern expressed about extreme conditions and debilitating risks from floods, increased volatility from releases, recurring drought, and the increased frequency of these events (i.e. most recently the drought of 2008 and the summer floods in 2010).
- The balance between water allocation priorities for agriculture and energy appears to be shifting, but without the means to analyze options that would ease this shift and ensure benefits and support growth in each of the region's countries. Moreover, while considerable attention has been focused on the need to meet present and future energy demand growth, other important changes that have implications for these tradeoffs are taking place: for example, transformations are taking place in the important agriculture sector that will lead to changes in cropping systems and possibly water demand and water supply reliability requirements.
- Development and effective management of storage in the upper basin appears to be an option that might resolve problems of jointly managing energy and water – and joint management would appear to be essential – where and when to build, the size and characteristics, how to operate, and who should control the management of the storage are open but vital questions; currently, there no agreement on the location and no basis to explore possible agreements, size or operating modalities for this needed storage among the downstream and upstream countries, as well as between downstream riparians.
- National stakeholders noted that numerous models[ix] "initiatives" and "models" have been undertaken in and for the region however, none addressed the critical question of energy and water together at a broader transboundary scale. Though these models have degrees of limited accessibility, platforms are not transparent, and data is not accessible and not comprehensive. However, the national stakeholders requested any effort, if possible, should consider appropriate and relevant models.
- There were considerable discussions on data sharing among countries and the need for transparency and verification of information.
- In defining and evaluating priorities, trade-offs and options, it is imperative that the widest range of practical and pragmatic options be analyzed even though they are not presently favored by all countries.

- The World Bank consistently heard that modeling and analytics are required to have a sound economic basis and be commercially viable. No country can afford uneconomic choices that do not promote growth and contribute to the solution of national development issues and priorities in the context of regional resources**;** options should address core aspirations and needs in each of the basin countries, and yield significant benefits to each country rather than benefits to some at the expense of others (without fair compensation).

Next Steps. National level workshops with energy and water technical specialists and policy-makers are proposed to take place in January 2010, to continue the discussions on energy water linkage, followed by regional workshop in early 2011.

Endnotes

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[i] The intense interest in what is called the Region's "energy-water nexus" stems in part from the degree to which peak demand for water for irrigation (in the summer season) is out of synch with the peak demand for energy (in the winter months), and the uneven distribution of storage and energy generation potential (mainly in the upper basin particularly Tajikistan and Kyrgyzstan) and irrigated agriculture (mainly in the lower basin on the arid plains in Uzbekistan, Turkmenistan and Kazakhstan) and the dilemmas this causes for the development and operation of necessary water storages to support both of these economically vital water uses.

[ii] In the context of ESCC Pillar 3 the the World Bank Central Asia Energy Water Development Program (CAEWDP), references to the "region" or "regional approach" are referring to the Aral Sea Basin, which includes the Amu Darya and Syr Darya basins, and to a basin approach, that encompasses both of these basins. The present extent of the Central Asia (CA) regional electricity grid and the load sources are also limited to these two basins with the exception of exports (central Afghanistan and Iran) and parts of northern Kazakhstan). Note that the closed Zarafshan basin, which lies between the Amu and Syr Darya rivers in Uzbekistan and Tajikistan, and northern Afghanistan are a part of the "region" and the Amu Darya basin.

[iii] ESCC Pillar 3 water energy linkages is consistent with World Bank's CAEWDP Component 3 energy water linkages.

[iv] Pillar 3 had its genesis in the priority actions identified and adopted at the Central Asia Regional Economic Cooperation (CAREC) Energy Sector Coordination Committee (ESCC) workshop in Almaty in September 2009 in which ESCC and donor members, and representatives of the Executive Committee of the International Fund for the Aral Sea (EC-IFAS) and the Scientific Information Center of the Interstate Water Coordination Center (SIC-ICWC), participated

[v] There have been efforts to comprehensively model the region's water supply and demand system in the past, but these have not generally been accepted and trusted and hence have not provided the analytical platform needed to move the dialogue on regional cooperation forward. Whether by greater transparency, verification and testing of results or other mechanisms, this problem must be overcome.

[vi] The DSS is a critical element in the approach because it serves two key purposes among others: first, to illuminate the value and tradeoffs among a wide range of strategic options including infrastructure investment; and second to inform the dialogue towards a mechanism by which the countries of the region can sustain energy and water security and economic growth. Moreover, such a DSS is an essential tool for determining vulnerabilities and risks associated with global warming (changes in temperature and precipitation) and to evaluating alternative adaptation options.

[vii] The reconnaissance mission met with water and energy sector counterparts in: Bishkek, Kyrgyzstan; Astana and Almaty Kazakhstan; Dushanbe Tajikistan, Tashkent, Uzbekistan; and Ashgabat, Turkmenistan. One of the Bank's consultants has extensive experience in Afghanistan and currently participated in completing a DSS system for Afghanistan water sector.

[viii] Institutions included planning, design and research institutions for water and energy, national Hydromets, and water basin organizations (BVO) in some cases at the policy level Water and/or Energy Ministers, and Prime Ministers.

[ix] To include and not limited to: National level GAMMS-based planning models, GEF Aral Basin (locked model), USAID TWEP-NASPI model, Syr Darya BVO, and EurAsEC water allocation and energy models of the Syr-Darya and Amu-Darya River Basin to name a few.

Annex 2: Energy Water Linkages CAREC ESCC Workshop Summary

Energy-Water Linkages

Analytical Foundations : Action Items
Notes from the Workshop
September 4, 2009
Almaty, Kazakhstan

Introduction

A workshop with representatives of EC-IFAS, SIC-ICWC, donors and the World Bank was held in Almaty on September 4, 2009. The purpose of the workshop was to identify priority actions to enhance understanding and analysis of energy and water issues. The workshop followed two previous sessions that laid the basis for needs and applications.

The first of the two sessions was the meeting of the Energy Sector Coordinating Committee of CAREC, held on September 2,2009 . In that meeting the Committee approved a Central Asia Energy Action Plan. The action plan included a component on energy-water linkages, the objective of which is: To strengthen cooperation by integrating energy and water analysis. The three deliverables under this objective are: (a) strengthen Central Asian institutions to lead the dialogue and analysis on rational use of energy-water resources; (b) enhance integrated energy-water models, analytical tools and shared databases that enable assessment of options and impacts across both sectors; and (c) identify consensus projects to improve energy-water rational and effective use (e.g. irrigation and hydro-power rehabilitation and efficiency improvements).

On September 3, water and energy professionals joined in a knowledge sharing session on the analytical foundations of energy-water linkages. The session included presentations from international and regional experts, and concluded with discussion on three topics: data and data sharing, modeling and analysis, and analysis for dialogue.

This note documents the discussion on September 4, 2009, namely a discussion among representatives of EC-IFAS, SIC-ICWC, donors and the World Bank to identify priority actions to enhance understanding and analysis of energy and water issues.

The note follows the structure of the agenda: Data and Data Sharing; Dialogue; Modeling; and Donors. It focuses on action items identified in the session.

These action items will provide input to a work program for the ESCC energy action plan, IFAS ASBP3 and the World Bank's Central Asia Energy-Water Development Program. Additional input will be provided by international experts and regional modelers and analysts, with review by the ESCC, IFAS and World Bank.

Implementation of the work program will be rooted in regional institutions. It is expected that IFAS will take a leading role, collaborating *with energy and other institutions to ensure technical credibility and inclusive dialogue.*

Actions
GENERAL

- Undertake overview of current situation
- Use/Needs analysis (water and energy)
- Water productivity (energy, irrigation)
- Quality assurance on existing data (on water needs/uses (e.g., are irrigation norms up to date?)
- Use of own water resources (beyond Amy Darya and Syr Darya)
- Include indirect effects
- Incorporate Afghanistan in analytical efforts
- Establish institutional arrangements
- Include in models and analysis
- Reach agreement between TAJ and AFH on hydromet data collection and sharing of responsibility
- Establish International Panel of Advisors to assist in technical developments
- Establish coordination group within IFAS (responsible to Board) to oversee analytical work (experts to build, another to test)
- Develop strategy to better incorporate energy in IFAS and in analytical foundation

Actions
DATA AND DATA SHARING

Undertake regional hydromet project

- Expand surface climatology data
- *Strengthen data collection program (enhancement to Regional Hydromet project)*
- Explore opportunities to combine macro satellite data with local data for regional spatial scale analysis, ensuring resulting data provides adequate resolution for decision-makers
- Reliability of streamflow data
- Water quality
- Additional SCADA instrumentation on the Amu Darya
- Glacier monitoring
- Monthly irrigation
- Planning zones data
- Flood plain mapping

Improve data sharing

- Develop standard data sharing sheet and methodology to assess projects

Actions
MODELING

Review basic model

- Assess relative usefulness of RiverTwin, GAMS, ASBmm-EC-IFAS models

Establish regional specialist working groups (including energy)
Develop additional modules (see over)
Enhance transparency

- Increase awareness and understanding of existing models among IFAS agencies (e.g., SIC presentation to EC-IFAS)
- Consider establishing open models for building awareness
- Increase training in regional offices

Additional modules/Model enhancements

- Climate change impact on demand and supply/flow
- Environmental demand/needs
- Socio-economics (and commercial)
- Needs of Aral Sea communities (e.g. potable water)
- Energy
- Safety of hydro facilities (including dams)
- Water savings including irrigation options and hydropower options; Assessment of losses
- Sedimentation
- Groundwater
- Dynamic balance of water
- Water quality (surface and underground)
- Multiple year regulation

Actions
DIALOGUE

- Users
- Range from experts + public + media to the IFAS management board to Heads of State
- Input to analysis
- Discuss analysis at IFAS Management Board:
- Are output variables the important ones for decision-makers?
- Are available models/analysis trusted and adequately understood by national and regional experts?
- Allow for input from interested parties, including perspectives on trade-offs
- Establish a coordination group of IFAS board to oversee analytical work (experts to build, another to test)
- Transparency
- Consider open models for building awareness
- Training in regional offices
- Link with other working groups
- Decision tools
- Explore application of decision tools to communicate analytical results and facilitate dialogue on trade-offs and synergies

Actions
DONORS

- Seek support through donor conference and consultation
- Match donor resources with plan
- Divide short and long term investments
- Use analysis to set investment priorities (but don't prevent early wins)

Annex 3: SWOT Analysis of the Regional Technical and Institutional Capacity

SWOT Analysis of the Institutional Capacity			
Strengths	1. IFAS has a renewed mandate from all five presidents 2. It is an established institution with a recognized forum for dialogue and research 3. A good understanding of the water and energy issues and the geopolitical problems within the two sectors 4. IFAS & SIC-ICWC cooperate but operate as independent organizations 5. SIC-ICWC has sophisticated technical capability	Weaknesses	1. IFAS has a weak implementation history 2. limited progress on regional cooperation on water resources management 3. conflict within the IFAS / SIC-ICWC structure 4. poor project management under ASBP 1 thus questionable value of continuing the ASBP in the current, changing water management climate, with shift away from the Aral Sea itself 5. role of IFAS as the organization leading ASBP 3 is perhaps no longer valid, thus attracting funding for ASBP 3 is more unlikely 6. currently, there appears to be no viable alternative to the overall IFAS / SIC-ICWC structure 7. IFAS is a political forum for the presidents however, the long-term goal must be to depoliticize the management of water 8. perceptions that some of the regional institutions have certain interests or biases 9. information regarding operating plans and water releases from reservoirs not always shared in a timely manner 10. significant tensions exist among some of the parties engaged in the decision-making and operations processes
Threats	1. there is a need for strong leadership in regional cooperation and water management, IFAS's mandate needs to be revisited 2. discontinuing IFAS would require discussion and agreement at the presidential level to do so, it is now a question of redefining the role of IFAS for at least the short-term future while focusing on strengthening its capacity in the interim 3. Failure to coordinate could lead to investments based on local interests that would eventually preclude a coordinated regional approach;some project investments may prove wasteful and unnecessary in a system that could one day be better coordinated	Opportunities	1. Importance to agree on a set of guiding principles, conventions, treaties and agreements, and develop set of policy and/or technical mechanisms to improve water management 2. imperative that the region have an organization which would be able to carry out analysis for what is best from a regional perspective 3. the regional-game is such that cooperation is needed and will bring significant gains, while staying out of the process can be potentially costly 4. Investing in capacity building for water resources planning and project development should be a priority and close the evident capacity gap between the countries and within the regional institutions 5. capacity building approach should ideally be "learning-by-doing" 6. A two-phase approach (a) initially, workshops at a high-level would be optimal, (b) followed by technical teams from each country that would mostly gather data and document practices. 7. Diffuse the influence of the two or three regional institutions by developing and strengthen "centers of excellence" in each country; a "hub-and-spoke" arrangement could also be considered.

SWOT Analysis of the Technical Capacity			
Strengths	▪ The technical capability of SIC-ICWC and represents a very significant and impressive capability their modeling capacity is quite sophisticated but that they have the "mentality and culture" exists to actually do the work. ▪ The national technical teams are competent and knowledgeable, with a good understanding of the problems, with good analytical technical, and, modeling capabilities, with an understand the issues of data acquisition, and of data sharing.	Weaknesses	▪ There are data needs and maintenance needs for collection platforms and gauging stations. ▪ There is insufficient openness and transparency for sharing information and data. ▪ There is considerable work to do, especially if the data/modeling nexus is to achieve stated objectives of the energy-water analytics.
Threats	▪ Misperceptions on data and modeling and management operations are a threat to cooperation in the region. ▪ Currently irrigation seasons do not coincide with peak energy demand Immediate energy demands and low inflows have led to poor use if the hydroelectric resources – ▪ The greatest threat is if these sectors cannot be brought together to work towards adapting to the realities the region faces. ▪ There appears to be no sound framework and mechanisms for carrying out trade-off analysis for energy and water. ▪ Certain parties do not have confidence in the extant models and analysis.	Opportunities	▪ There is an opportunity to design a coordinated systems-approach to optimally allocate water resources and benefit each party, investments should be opened and accessible, and to begin to build the trust and confidence needed. ▪ The overall modeling activities could be upgraded, through several activities; and the models could be made more transparent and inclusive, bringing other groups into the fold, and being more clear about what is actually in the models being applied. ▪ The technical community should focus of technical work in the short-term should not be "problem-solving," but building common technical platforms. ▪ Gaming models can be very useful in such situations, because they provide a gaming platform without any built scenarios, and therefore are as neutral as possible. Building a gaming platform also often serves as a reason for parties to engage in validating its underlying database, which is an important objective of the ongoing process. ▪ A more rigorous, Aral Sea basin-wide, model could be established, with careful inclusion of data from multiple sources, including satellites. The output would be an improved evaluation of what water is where, for what purpose; it also seems too early to engage in development of simulation models of new infrastructure. However, simulation models of existing facilities could be developed in gaming mode and may prove useful.

Annex 4: Summary Report on the Series of National Consultations

(Executive Summary)
Understanding energy-water linkages in Central Asia:
Designing effective analytical tools
February 22 - March 26, 2011

Introduction and progress on energy water linkages

The World Bank's Central Asia Energy Water Development Program (CAEWDP) aims to build regional energy and water security in the Aral Sea Basin (the Amu and Syr Darya Basins [1]) through enhanced transnational/transboundary cooperation and strategic investments. CAEWDP focuses on three sectors: energy development; water productivity; and energy-water linkages. It complements Pillar 3 of Energy Action Plan of the Energy Sector Coordinating Committee (ESCC) of the Central Asia Economic Cooperation (CAREC). The objective of the energy-water linkages component is to improve the understanding of the linkages between water and energy at the national and regional levels.

As part of the energy-water linkages activities, in September 2009 and 2010 the World Bank held national discussions in Kazakhstan, Kyrgyz Republic, Tajikistan and Uzbekistan with energy and water specialists about the problems associated with the linkages between energy and water management in the basin and the need and potential for the development of a regional or basin-wide transparent analytical tool, such as a decision support system (DSS that would support an informed dialogue to secure energy and water benefits, for all countries in the basin.

A DSS is an analytical tool, based on mathematical computer-based models, which are supported by an information system, to help define one or more management options for integrated water and energy resources management. The model architecture of a DSS has three fundamental elements: (i) the data, a knowledge base and information system; (ii) the tools, a set of analytical tools and mathematical models with which the data can be analyzed; and (iii) the user, an output-user interface to display the results in a form that informs and supports decision making. Through a transparent multi-sectoral engagement, an energy-water DSS (EWDSS) for the Amu Darya and Syr Darya basins is proposed to reflect individual country energy water issues as well as a broader regional context.

A World Bank reconnaissance and scoping mission visited Central Asia[2] from August 21 to September 21, 2010 with the objectives of meeting individually with national technical energy and water technical specialists to begin assessing the technical and institutional baseline for an energy and water analytical framework. Meetings were held with individual national technical institutions and in some cases ministerial counterparts. While recognizing the challenges and history, the countries informally endorsed the concept and encouraged the World Bank to support and facilitate the process of developing an analytical basin-wide DSS. The specialists emphasized the importance of direct national level engagement so that any DSS that is developed reflects the priorities and issues of each country.

[1] The Aral Sea Basin comprises all or parts of six countries – Afghanistan, Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan.
[2] Kazakhstan, Kyrgyz Republic, Tajikistan and Uzbekistan

The preliminary results of the scoping mission were reported at the ESCC workshop held in Bishkek on September 22-24, 2010. Among the key findings from the scoping mission was the need to directly involve a wide range of national experts in the design of the model architecture of a DSS; this engagement requires ownership to ensure the national characteristic and priorities are taken into consideration. All national counterparts emphasized the need to build a comprehensive and transparent analytical tool to enable a clear exposition of the facts and alternatives, linkages, and tradeoffs upon which the countries can technically agree. Past efforts to model the Central Asia water system have been attempted, but existing models have not found common agreement or widespread use. The proposed approach, of national engagement in formulating a DSS through multi-sectoral national discussions in each country, was endorsed by the ESCC representatives at the Bishkek meeting, then later presented and approved at the CAREC Senior Officials Meeting (31 October, 2011) and later at the 9th Ministerial Conference of CAREC (2 November, 2010).

Energy-water linkages national discussions

The energy-water national discussions, in workshop format, were held 22 February – 26 March 2011, in Kazakhstan, Kyrgyz Republic and Tajikistan, and a one-day consultation was held in Afghanistan. Discussions will be held in Turkmenistan and Uzbekistan at the disposition of each Government. The number of participants ranged from 19 in Kazakhstan to 29 in Tajikistan, 37 in Kyrgyz Republic and 40 in Afghanistan. The aim of these discussions was to bring together a multi-sectoral group of national technical experts. The participants included senior officials from the energy and water ministries as well as the technical institutes associated with these ministries, other concerned ministries and agencies, independent research institutes, academia and the Academy of Sciences, and NGOs. The discussions included both young and senior professionals from diverse disciplines. The objectives of the national discussions, in the context of the key parameters of a DSS, were to (i) identify and discuss, national priorities for water and energy in terms of key issues and identify criteria for the model architecture, and (ii) to review and discuss several case studies of DSS application to different planning problems. An additional day was designated for hands-on training on a hypothetical DSS developed by the World Bank Institute (*Basin IT)*. It is important to note that these discussions were informal discussions with national technical energy and water experts, NGOs and civil society, and in no way reflected the official position of the Governments.

National consultation agenda

The typical two-day consultation agenda is shown in Annex A. There were three key sessions: Session 1 provides essential background on CAEWDP and ESCC Energy Action Plan and discusses the objectives and structure of the sessions; Sessions 2, deals with priority energy and water issues; and Session 5, focused on identifying criteria to define priority issues. The format of the key sessions included a brief introduction, small sub-group discussions (the participants were generally divided into three groups) followed by a plenary discussion. Supporting sessions included: Session 3 presented the World Bank Institute's BASIN IT, on a demonstration DSS designed as a training tool to better understand trade-offs in water resources management; Session 4 reviewed the results of a survey of existing energy and water models in the region, and reviewed two case studies of DSS application in Afghanistan and Canada. The consultation concluded with a discussion of possible institutional interfaces, and a session of possible next steps based on a proposal by the World Bank team.

Main outcomes of the national discussions

The outcomes from the national discussions were insightful and true to the individual national concerns and issues. There there was a remarkable common thread of issues and concerns related to water and energy, as there were unique differences among the countries. A synthesis of the small-group and plenary discussions is presented in the Table 1 below. Table 1highlights these key outcomes in terms of the national priority issues and criteria, the indicators to measure these issues. Annex B includes the corresponding complete table of issues, criteria and metrics developed by the small-groups at each of the national discussions.

Despite the unique differences among the countries, there is a surprisingly high level of agreement among the countries about what issues are important and the criteria by which objectives are defined and alternatives are measured. The emphasis shifts slightly from country to country; for example while both Kyrgyz Republic and Tajikistan are concerned about the availability of winter energy and both are also concerned about total energy production, Tajikistan is also focused on exports. Afghanistan's concerns are typical of a country in which the electricity system is totally inadequate and every aspect has to be improved including achieving production levels sufficient to achieve self-sufficiency.

All the countries prioritize food security and achieving higher agricultural production and productivity, and priorities in domestic and industrial water supply are also very similar. Priority concern for the environment is present in all countries but it takes on a different dimension depending on the overriding issues. In Kazakhstan it is sustaining the restoration of the Northern Aral Sea; in Kyrgyz Republic it is protecting its waterways and reservoirs from accidental outflows from toxic tailings ponds; and in Tajikistan it is monitoring and protecting the glaciers that are the main source of water for the region.

There is also another set of issues (the last two rows of the table below) that on the surface seem distinct with each country, but would likely be found to be more common among the countries after more detailed discussion. For example, Afghanistan's focus on employment (jobs), poverty reduction and GDP and economic growth would no doubt be considered a high priority in several other countries of the region as the possible linkages between these development indicators and water and energy development are more clearly articulated.

It is recognized that these outcomes from these national discussions are partial and a high priority is put on expanding the outcomes to include perspectives from Turkmenistan and Uzbekistan. These two countries are critical downstream riparian and are likely to express needs and priorities within their own national context.

Table 1: Preliminary Identification and Comparison of National Issues, Objectives and Criteria Support Developing a DSS for the Amu and Syr Darya

It is important to note that these discussions were informal discussions with national technical energy and water experts, NGOs and civil society, and in no way reflects the official position of the government

Kazakhstan	Kyrgyz Republic	Tajikistan	Afghanistan	Turkmenistan	Uzbekistan
Restoration of northern Aral Sea • Maintenance of water levels, • Maintenance of water quality	Water quality risks	Ecosystems • Glaciers • Deforestation • Natural reserves	Environment	Discussions will be held at a later date	Discussions will be held at a later date
	Energy • Production • Distribution (especially in winter)	Energy • Exports • Winter energy security • Security of hydro facilities	Energy • Production • Reliability • Access • Self-sufficiency & security		
Domestic Water Supply • Safe • Available • Access	Domestic Water Supply • Safe • Available • Access	Domestic Water Supply • Compliance with sanitary norms • Quality & access • MDGs	Domestic water supply and sanitation • Improved access and coverage • Safe supply • Improved sanitation		
Agriculture • Food security • Agriculture production • Fisheries • Farm-household income	Agriculture • Food security, • Agricultural productivity and production • Expansion of irrigated agriculture • Soil quality	Food security • Rehabilitation and upgrading of irrigation systems • Conserving and improving land quality	Agriculture & husbandry • Food security • Production • Reduced agriculture imports • Livestock • Fisheries		
Mgmt. of energy and water in a well functioning legal framework	Flooding and water logging	Other • Climate change • Water tourism • Joint monitoring of water resources	Economic Growth • Poverty reduction • Household income • Employment • GDP growth • Stability		
Water security • Improved agriculture water use and efficiency	Cost and revenues for operation and maintenance of water infrastructure		Security • Social • Economic		

From the discussion on future engagement, national participants acknowledged that a national technical team, specialists in modeling and appropriate energy, water, agriculture and environment sectors, should be formed. In all countries, the participants stipulated that any technical working group requires the involvement and support of senior government officials. Each country acknowledged the value of a regional entity, such as the proposed Modeling and Decision Support Technical Sub-Committee, with the purpose to advise on and recommend refinements to energy-water DSS. However, it was agreed that the specifics on such a sub-committee would be discussed further as the national advisory groups were formulated and secured. The World Bank team acknowledged the national participants stipulations and confirmed future engagement in this activity would continue to inform the senior national government officials.

Other key messages from the discussions

The countries generally reiterated their key message from the August-September, 2010 scoping meetings; namely that a new effort is needed to understand water and energy in the basins, and the need to develop transparent analytical tool, a DSS for the basins was also very important and they welcomed the proposed initiative. The DSS, in design and accessibility, should enable the countries to obtain a greater understanding of energy-water linkages and it should be used to support a new dialogue among the countries. The participants voiced the same caveat as before; that despite many past efforts common ground has so far eluded them and dialogue has not been successful, but they suggested that if the World Bank were provide the leadership for this effort they would support it. But they noted that although past efforts to develop models of the Aral Sea Basin (the Syr Darya and Amu Darya basins) were technically successful in many respects, however, the all important political process must underpin and support the process to develop and effectively use such models. Several countries noted the importance of building confidence and trust among the countries and in the technical analytical work and resulting models. They proposed that one way of doing this would be to launch joint monitoring of water flows in key locations; another is to address the issues concerning timely data sharing and collaboration in strengthening hydro-met services and data quality, particularly stream flow forecasting; and a third proposal was to have additional training and workshops on the principles of DSS.

There was considerable interest among technical participants in the development of a regional DSS and a belief that such an effort could be successful, there is a definite need and the timing is right. They noted several efforts completed in 2002 and 2003 and the ongoing Swiss supported effort to SIC-ICWC; and World suggested that these models would provide a good starting point and basis for developing a new updated and upgraded DSS, and that those programs provide some important lessons that would help the Bank initiative to be successful.

While the DSS case studies were greatly appreciated, it was pointed out that the direct transfer of models used elsewhere has rarely been successful in the Central Asia region. Any CAEWDP DSS needs to be developed in the region jointly by national technical specialists (using to the maximum practical extent existing models and DSS) and it needs to reflect the unique characteristics of the natural hydrologic and geographic systems, the development history and status of the region, traditional water use practices, and the challenges the countries face in the coming years.

The participants in each consultation stressed the importance of the political dimension of water and energy management in the Central Asia region. While it is necessary to take considerable care to get the technical aspect correct, it is even more important to ensure that political decisions makers agree to the overall process and are kept informed of progress. One problem is that political attention to water issues often waxes and wanes according to the abundance of water. The highly variable hydrology of the region suggests those droughts are frequent, so that even if period of abundance one should be looking ahead to what might happen if a severe drought should occur. This situation is very typical of those for which a DSS is most suitable and most important.

Differing or unique issues

Recognizing the commonalities is valuable, but the CAEWDP cannot ignore or discount the very major difference among the countries concerning the primary objective of water and energy management in the region. In the Soviet era it was possible to impose a single overriding objective on the region to maximize the downstream development of irrigated agriculture in the vegetative season. All infrastructures was built and operated to sustain this objective with other objectives such as energy production being secondary. Since independence in 1992, the Central Asia has become five independent sovereign states with different political systems and social and economic aspirations and goals. In this new context, priorities among varying Key issues shift to satisfy individual national demands in ways that make it difficult to meet the water regimes required by other riparians whose priorities are different. This is particularly true in the context of upstream and downstream riparian interests and priorities. Proposed energy water linkages discussions with Turkmenistan and Uzbekistan, the two downstream riparian countries are currently pending, would individually benefit these countries in identifying their national issues and priorities, as seen by the discussions with the other countries to date, and would be an indelible value to the individual downstream riparians and the basin as a whole.

It is important to highlight some unique attributes from the discussions. In **Kazakhstan** a DSS was piloted for the *Nura-Ishim* basin, indicating that DSS efforts have been initiated in the region. The Committee of Water Resources, has within its institution the Center for Water Resources Analysis for Kazakhstan, established to provide a focal point for future water resources modeling in Kazakhstan. In the **Kyrgyz Republic** discussions, there was considerable engagement from the environmental and social NGO community. Civil society's engagement in the process provided a welcomed perspective of the impact of existing practices have on the community and the benefits improved resource management could have on community livelihoods. All national discussions included young professional staff, in **Tajikistan** however, the participation of the young professionals were fully supported by senior Government officials, resulting in a large cadre of young energy and water professional who participated in the discussions, the government. At the request of the Central Asia countries it is vital to engage Afghanistan in this process, as a key upstream riparian where Panj and Vaksh rivers join to form the Amu Darya; **Afghanistan** too expressed the need to be an equal player. There was an expressed willingness by the Water Ministry to begin bilateral cooperation of water monitoring with neighboring riparians.

World Bank Observations

The World Bank is extremely grateful and thanks all participants and supporting organizations for their time, wisdom, sincerity, and forthrightness. The World Bank offers the following observations based on the discussions across all four discussions.

1. The World Bank agrees with the conclusion, consistently expressed, that there is a need for a commonly agreed upon, transparent and rigorous analytical foundation for energy and water, and that such a DSS is an appropriate tool needed for informed dialogue on managing energy and water resources in CA.

2. The World Bank emphasizes that the need for commonly agreed analysis of energy and water issues will accelerate as: (i) climate change imposes more hydrologic variability; (ii) population and economic growth put additional stress on water use; and (iii) individual countries seek to invest in water infrastructure to address national goals. Furthermore, while current events draw attention to specific transnational/transboundary difficulties, discussions revealed that cross-border management issues are spread throughout CA. In short, the importance of understanding the limits and opportunities in the energy-water system – and consequence for economic security -- will grow.

3. There exists a strong technical basis for an updated energy-water decision support system:

    - The discussions, discussions and associated investigations revealed a number of existing models on which to build or adapt the proposed DSS. Some of these models were originally constructed to assess the entire region; but national efforts may also provide helpful components.

    - The commonality of issues and concerns, as reflected in the criteria, provide a basic structure for a DSS that will ensure each country's aspirations are reflected, and can be analyzed, while establishing a regional network of concerns.

4. There is an important opportunity to secure and update human resources for energy-water analysis:

    - First, a strong cadre of senior experienced technical specialists can contribute on-the-ground experience and insights on past modeling efforts; equally important, the discussions revealed a younger cadre of interested professionals. Work on a DSS could bring these groups together and ensure wisdom of past years is effectively integrated into a technological future.

    - Secondly, the discussions brought together professionals who work on similar issues but had had little opportunity to share perspectives and knowledge providing a valued opportunity to discuss. Common to many countries specialists working in either energy or water issues, this collaboration is an important product of the DSS task, with national as well as regional benefits.

5. The lack of discussions in Uzbekistan and Turkmenistan presents a gap. Although considerable understanding of the scope and criteria for an energy-water DSS can be gained from previous modeling and data efforts, and discussions, additional effort is needed to engage the two downstream riparians.

6. Additional discussions with senior government officials and policy makers in each country are also needed to determine their needs and interest in strengthening the analytical basis for informed policy-making and regional dialogue. These needs and interests will guide the existing strong technical base and dispel existing fears that good analytics will "gather dusk on the shelf".

Next Steps

(1) At the request of the Government, the Bank will support a series of workshops in Afghanistan to help the country become better prepared for transboundary dialogue with its Central Asia neighbors.

(2) The World Bank looks forward to engaging in consultations in Uzbekistan and Turkmenistan at the disposition of the individual Governments.

(3) The World Bank will continue an in-depth evaluation of existing basin models in preparation for a regional workshop.

(4) The World Bank will facilitate a regional workshop to complete the Phase 1 energy-water linkages program. The workshop is tentatively scheduled for early September 2011 and would bring together national technical teams from the six countries to explore options for developing a framework for the regional DSS then discussed at the national level with a technical specialists and senior government officials.

CAEWDP Phase I National Discussions

Typical Two-Day Agenda

Time	Program	Purpose
DAY 1: Introduction and Framework		
10:00 11:30	**Session 1:** Introduction to national discussions, participants and agenda	• Present activities leading up to the national discussions • Outline objectives of national discussions • Introduction of participants; review of agenda
Coffee/tea		
12:00 13:00	**Session 2:** National energy and water issues discussion (Part 1)	• Participants discuss what, in their view, are the key present and future (longer term, say 20 years) issues for water and energy management
Catered lunch		
13:45 15:00	**Session 2:** National energy and water issues discussion (Part 2**)**	• Continuation of Session 2
Coffee/tea		
15:00 17:00	**Session 3:**World Bank BASIN IT	• Discuss hypothetical basin demonstration model illustrating elements of a decision support system • Identify challenges to analyzing energy and water issues
17:00 18:00	**Session 4a:** A quick review of the Kabul River Basin DSS	
DAY 2: Towards a Decision Support System &Future Engagement		
10:00 10:30	**Session 4:** Overview of national model inventory	• Presentation of the findings from national model inventory undertaken in January 2011 by World Bank consultant
11:00 11:30	**Session 4b:** Water use planning in Western Canada **Session 4c:** Kabul River Basin DSS	• Two cases studies of how a DSS was applied for either water resources (Canada) or investment planning (Kabul Basin)
Coffee/tea		
12:00 13:30	**Session 5**: Towards a energy water decision support system	• Discussion on criteria and performance measures (output variables), system features; and policy options for a decision support system
Catered lunch		
15:00 16:00	**Session 6**: User interface	• Examples of user interface • Who are the national users?
17:00 18:00	**Session 7:** Future engagement	• What did we hear? • How are we going to proceed at the national and regional levels?
	Wrap Up	

Kazakhstan Key Issues, Criteria and Metrics

It is important to note that these discussions were informal discussions with national technical energy and water experts, NGOs and civil society, and in no way reflects the official position of the Government

Key Issues	Criteria	Metric
Restoration of northern Aral Sea and Syr Darya Delta	• Water flow into delta • Water level of sea • Water quality - average salinity of sea • Delta ecosystem condition: ✓ Delta forest extent and health ✓ Fluctuation of delta lakes • Aral Sea regional population	• m^3/s (varies monthly) • elevation (meters above sea level) • g/l • Area (ha) • Tree and fauna composition index • Area (ha) • Population change (migration)
Drinking Water Supply – safe, available, access	• Chemical and biological standards • Volume of water available	• mg/l and others • m^3/day
Rural livelihoods	• Household income • Livelihood security and diversity • Socio-economic indicators: incidence of water borne disease	• Tenge/month, year • Livelihood vulnerability index • . . .
Agriculture - food security, agriculture production, fisheries, livestock	• Agric productivity • Food security • Fisheries ✓ Fish harvest ✓ Value of fish harvest ✓ Specie composition • Livestock ✓ Pasture condition ✓ Value added ✓ Winter feed availability	• tons/ha • Reduction in food vulnerable population (%) in critical rayons • tons/month, year • Tenge • Index • Index • Tenge • Tons/ 100 head equivalent
Water security – improved agriculture water use and efficiency	• Water productivity • Water use efficiency	• Tenge/MCM • %

Kyrgyz Republic Key Issues, Criteria, and Metrics

It is important to note that these discussions were informal discussions with national technical energy and water experts, NGOs and civil society, and in no way reflects the official position of the Government

Key Issues	Criteria	Metric
Water quality risks	• Compliance with GOST (Government Standards) • Vulnerability	• Maximum Permissible Concentration (MPC) • Index; number of people
Energy production and distribution	• Consumer demand • Generation • Profitability • Reliability • Damage due to construction of energy facilities (loss of land, flooding)	• Kwh • Mw • Net revenues • #number of outages/year; percent of demand unserved • Kyrgyz Som (KGS)
Flooding and water logging	• Extent and depth • Depth of groundwater level • Area of shallow groundwater • People affected • Material damages	• Area (km^2); risk maps • Meters • Km^2 • #number of people • KGS
Drinking water supply – safe, available, access	• Compliance with GOST - Government Std. • Consumption per capita • Amount of consumption relative to production • Accessibility	• % from Maximum Permissible Concentration (MPC) • m^3/day • % • % of population
Food security	• Gross agricultural production • Social: improved standard of living • Environmental: ensured environmentally clean product	• Kg/person • KGS • Quality of product/ton
Agriculture – agriculture productivity and production, and expansion of irrigated agriculture	• increased area of irrigated lands and improved performance • Maximize productivity of irrigated areas under specified volumes of water • Minimum discharge (seepage) of irrigation water to groundwater • Utilization of modern or advanced technology for irrigated agriculture • Minimum use of water per unit of produce • Social: Access to water • Water supply reliability	• Area (ha); yield (tons/ha) • Output (tons, net value added) per m^3 or MCM • m^3/ha; MCM • KGS (technology supported by science) • m^3/ton or ha • m^3/ha • % of time supply equals or exceeds requirements
Maintenance and operation of infrastructure and facilities	• Environmental & economic: area of river run-off (area of glaciers) • Social: Resettlement, compensation fees due to flooding of fertile lands from construction of new facilities	• km^2 • KGS/capita

Tajikistan Key Issues, Criteria and Metrics

It is important to note that these discussions were informal discussions with national technical energy and water experts, NGOs and civil society, and in no way reflects the official position of the Government

Key Issues	Criteria	Metric
Energy • Exports • Winter energy security • Security of hydro facilities	• Production; • Volume of exported energy; • Access for all category of consumers • Availability of electivity • Affordable electricity; • Reliable supply of electivity	• Billion KWh (GWh) • Billion KWh (GWh); Value in million TJS • % of population with access to electricity • Capacity as % of peak demand; • Average TJS/KWh • Number of outages per (day, week, month) by season;
Food security	• Availability of food staples • Rehabilitation and upgrading of irrigation systems	• Cost of consumer basket of food • Ha
Land quality	• Status of productivity of land	• ha
Drinking water	• Compliance with sanitary norms- GOST (state standardization system) • Quality & access • MDGs	• Standard measure (typically mg/l) • l/person/day • % of population with access to safe water supply
Ecosystems • Glaciers • Deforestation • Natural reserves (including wetlands)	• Changes in glacier; • Forest area; • Forest specie composition; • Condition, maintenance, preservation	• Area (km^2), Size(km^3); Melt flow (m^3/s); • Ha or km^2; • Index; • Area (ha or km^2); metrics designed according to the character and features of the area.
Other • Climate change • Water tourism • Joint monitoring of water resources	• Temperature and rainfall trends; • Snow depth and water content trends • Number of tourists and touristic routes (tours)	• Change in mean temperature (ºC; %); rainfall volume (mm; %); change in glacial melt (m^3/s, MCM) • m; ml/m • Persons\month, season or year, number of tours

Afghanistan Key Issues, Criteria, and Metrics

It is important to note that these discussions were informal discussions with national technical energy and water experts, NGOs and civil society, and in no way reflects the official position of the Government

Key Issues	Criteria	Metric
Standard of living & rural livelihood	• Poverty reduction • Household income	• Percent of population below poverty line (%) • Increased net farm-household income (Afs/yr)
Economic Growth	• Employment • GDP growth • Stability	• Number of Jobs created (directly and indirectly (?) from water energy investments) • Total net economic benefit (from water and energy investment) (Afs/yr) • Growth of agriculture GDP (%) • Agri-business expansion (# of SMEs in rural areas, annual turn-over in Afs/yr))
Domestic water supply and sanitation	• Improved access and coverage • Safe supply • Improved sanitation	• Percent of population with access to safe water supply • Protection of groundwater recharge zones • Percent of households with access to improved sanitation facilities
Energy	• Production • Reliability • Access (coverage of distribution system) • Self-sufficiency • Security	• KWh produced (annually, winter season) • Reduction in outages (#, % of time) • Percent of population with access to affordable electricity • National production capacity exceeds national electricity demand (with adequate reserves) • Index (to be developed)
Agriculture & husbandry	• Food security • Production • Reduced agriculture imports • Livestock • Fisheries	• Reduction in # of districts with WFP IPC rating of moderate or greater risk • Increase in volume of production of selected crop groups (tons/year; spatial variations) • Increase in value added of agriculture production (Afs/yr) • Change in food import volume (tons or Afs) • Improved watershed and pasture lands (ha, yield) • Annual fish catch (tons by survey)

Annex 5: Summary of the Hydrology of the Aral Sea Basin: First-Generation Demonstration Model based on Open and Public Source Data

River Systems Research Group School of Oceanography University of Washington (Executive Summary - May 10, 2012)

As part of the World Bank's Central Asia Energy Water Development Program (CAEWDP), a first generation "demonstration" computer/information system model was developed, based solely on public domain platforms. The model would simulate and visualize water and water-energy linkages in the Amu Darya and Syr Darya river systems, with a purpose to provoke a dialogue and discussion with regional and national technical stakeholders. The model and its data sources and output variables would constitute the computational engine of an evolving Decision Support System (DSS). The modeling effort work draws on the emergence of a new generation of Earth System Science, based on the rapidly evolving capabilities for addressing global change issues through the use of satellites, new generations of dynamic, open and publically accessible computer models, and a thinking and practice of integrated systems. To keep track of the multiple information layers involved, and to provide the foundation for the DSS, a Dynamic Information Framework for the Aral Basin (AralDIF) was initiated, using recent advances in cyberinformatics.

The core hydrology model (the computation engine of the DSS) is provided by the Variable Infiltration Capacity (VIC) model, a semi-distributed grid-based mesoscale to macroscale hydrologic model which represents explicitly the effects of vegetation, topography, and soils on the exchange of moisture and solar energy between land and atmosphere. To represent reservoirs, a submodel based on an optimization algorithm was coupled to VIC output. The submodel can handle both hydropower and irrigation, but the application here focused initially only on hydropower. Multiple types of information were acquired (primarily from global datasets based on satellite and climate model products) to support the model, including static data on basin properties (topography, soils, vegetation), dynamic climate forcing data, observed discharge, locations and properties of dams, and satellite data on changes in total water storage in the basins. Again, a very important condition for this work is that these data be derived only from public-domain data.

Following calibration and validation of VIC at stations in the Amu Darya and Syr Darya basins, a time series of historical daily flows was computed (and animated). From the daily values, average seasonal flux patterns (1950-2006) were computed, and then the basins' annual mean was computed, and partitioned by country. Results were consistent with literature values. Reservoir modeling showed how dams affect flow patterns. Climate scenarios from GCMs were analyzed, showing how precipitation, ET, and runoff might evolve. Results from the models were then compiled into an analysis of the changes in total water storage in the two basins, comparing results from the VIC modeling to results from the GRACE satellite. Overall results were incorporated into the prototype AralDIF.

Though still a prototype model with preliminary results, the utilization of multi-source publically available datasets digested through the VIC modeling environment produced a considerably enhanced view of how the water resources of the Aral basin are partitioned. It is fair to conclude that the power of publically-available data and the capabilities to analyze such data provides not only fundamental new understanding of the complexities of the Aral basin, but new tools and systems of considerable power, in support of decisions on the water and energy resources of the region. More broadly, the value and key aspects to the AralDIF is that the synthesis of various public domain models are geospatially-explicit, meaning that they recognize the spatial heterogeneity of the watershed; they are scalable, not bound to explicit boundaries, in that that the can address the entire Aral Sea basin, or can be used at the national-level and sub-basin level. They are developed from public domain platforms, and are developed and supported through public funds, with no distribution restrictions, copyrights or patents apply.

Annex 6: Comparative Model Analysis – Executive Summary

Central Asia's Aral Sea basin consists of two major rivers, the Amu Darya and Syr Darya, both of which increasingly are subject to water stress. This increased pressure affects energy-water linkages play a central role in the future in terms of economic development, poverty alleviation, food security, public expenditures and cooperative relations. The World Bank initiated the "Central Asia Energy and Water Development Program," a comprehensive multi-phase and multi-sectoral long-term technical assistance program, designed to strengthen mutually beneficial regional cooperation to build energy and water security in all countries of Central Asia. The program's energy-water linkages component, which is also part of the *Energy Action Plan* of the Energy Sector Coordinating Committee of CAREC[3], aims to better inform water resources management and build a base for dialogue among the countries sharing the basin through enhanced analytics and decision support.

During the past 20 years, considerable effort has been dedicated to constructing models and analysis of basin-level water allocation; however, few models are used and even fewer are accepted across all countries. Taking into account the request from national technical counterparts to build on existing analytical tools/models (rather than build a new model), a comparative analysis was undertaken of key existing water-resource models prepared for Central Asia. The objective of the comparative analysis is to build awareness of these existing models and distill their features – model structure, similarities and differences – to assist specialists in identifying the most effective and highest priority developments for strengthening analysis for integrated water resources management at the national and regional levels.

From an inventory of existing national and basin models, nine models were selected for the comparative analysis. To broaden the scope of the analysis, a series of general public-domain models, not specific to Central Asia but commonly used for water modeling, were included as well (as the tenth model). Each model was described against a set of 18 descriptors, with the purpose to view the individual features of the models through discrete lenses. In order to capture key features of these models and to present a succinct review, the outcomes from the individual model reviews were transposed to a "Synthesis Matrix" after which the models were described against eight of the 18 descriptors. The analysis of the individual model reviews together with the Synthesis Matrix exhibited a series of trends and characteristics -- common features, model strengths and range of opportunities for expansion -- while also identifying model limitations. In short, the analysis explores the databases and modeling tools used to address the inherent complex systems with many interdependent components in the river basins.

The review does not recommend a single model, rather seeks to identify choices and options. Furthermore, it is also important to consider the regional coordination/dialogue needed on common cross-country interests, specifically: flood forecasting and early-warning systems, flood management and prevention, climate change, and adequate environmental flows. By stimulating discussion on the most relevant features of existing models and on the ways which existing models, as well as their modules/features, can be used for establishing a strategic framework for an integrated water-resources, the review will help define common modeling and analytical needs to support Central Asian countries strengthen water resources management.

[3] Central Asia Regional Economic Cooperation program

Annex 7: Executive Summary from Knowledge-Exchange " Strengthening Analysis for Integrated and Adaptive Water Resources Management in Central Asia"

(July 4-6, 2012)

Challenge of water resources management. The six countries of Central Asia depend on the water resources of the Syr Darya and Amu Darya river basins, the two basins of the Aral Sea, and the stock of infrastructure built around these resources. Challenges from growing demands on limited resources, population pressures, and impacts from a changing climate, place increasing importance on effective and efficient resource management as these countries pursue sovereign development priorities and aspire for both water and energy security Effective resource management requires a modern knowledge base that takes full advantage of existing systems and capacity in the region, while maximizing the appropriate application of emerging technologies and analytical tools, including open source platforms and models that transform data into accessible information.

Workshop to exchange knowledge. The World Bank and its partners, Swiss Development Corporation (SDC) and UN Economic Commission for Europe (UNECE), hosted a knowledge-exchange workshop, "Strengthening Analysis for Integrated and Adaptive Water Resources Management in Central Asia", July 4-6, 2012 in Almaty, Kazakhstan. The workshop builds on two years of national engagement and consultations with Central Asia riparians, which assessed the challenges and opportunities to improve the quality and transparency of analysis and decisions for water resource management. These consultations indicated that the data systems are neither transparent nor reliable, and data sharing is difficult. Technical counterparts recognize that recent advances and innovations in water resource management both in the Basin and internationally can improve the understanding and management of resources and so support an informed dialogue to secure energy and water benefits, for all countries in the two basins.

Workshop objective and outcome. The objective of the workshop was to build on individual national level efforts and, through a multi-national and multi-sectoral format, define a way forward for strengthening analysis for integrated and adaptive water resources management in Central Asia. The 34 national delegates from all six countries of Central Asia, with support from 40 international experts and development partners, were diverse in sectoral expertise, gender, and included technical representatives and policymakers. The key workshop outcome is the delegates' intent to approach the challenges of water resource management differently. Structured within a preliminary road map, with actions and activities to strengthen analysis for integrated water resources management in a decision support system, this approach takes into consideration national sovereign issues, while tackling the issues of common basin-wide concern.

Workshop agenda - data, modeling, analysis, institutions, and capacity building. The workshop agenda had four main themes: data, modeling (and analysis), institutions and capacity building. The national delegates explored current approaches and emerging analytical tools, including a range of available data and information sources, modeling platforms, the importance of the information interface and opportunities available to further develop individual and national capacity. The data and information management session demonstrated the value of standardized, internationally accepted exchange standards while integrating open source 'top-down' with locally-sourced 'bottom-up' data. The modeling session reviewed the level of effort undertaken in the two basins, and presented the outcomes from national consultations and the comparative model review of existing models for the basins. It demonstrated opportunities emerging from new modeling technologies and software, including applications in transboundary river basins. An overview of the current institutional structure in Central Asia provided recommendations for a more effective legal framework and transparent institutions to build cross-border trust regarding data exchange. The national delegates provided their personal priorities (through questionnaires) and discussed common needs capacity development in the context of integrated water resources management.

Appropriate tools for the two basins. Feedback from the modelers-roundtable on existing models in the Basin confirmed that not just one model is adequate for addressing the complexity of water issues: a; instead of talking about "the model", a modeling framework or system of models is preferable. A regional system of models, from which it is possible to "drill down" to sub-catchment and local scales, could be developed for informed decision making across a range of issues to improve outcomes and livelihoods for individuals. The delegates expressed an interest in familiarizing themselves with existing models and model approaches. They confirmed there are a few newer models that are worth exploring in more detail (e.g. ASBmm, BEAM, AralDIF) but they also acknowledged it is important to keep an open mind and explore different modeling opportunities and agreed that the knowledge base and modeling tools, developed by the Aral riparians and development partners over the years could be supplemented/complemented by new technologies, and approaches.

Strategic approach to address common concerns. The participants discussed key priorities of common concern across the basins that would benefits from focused analysis. These included storage management; need for water use efficiency and conservation technologies; sustainability of water ecosystems; rehabilitation and restoration of water infrastructure; balancing hydropower and irrigation; increased flood risks and drought management and other risks from a changing climate. Focusing on these common concerns can catalyze the development of the appropriate analytical tools that building national perspectives and support operational decision-making.

Pulling it all together - a road map to strengthen analysis for water management. A synthesis of key messages of the workshop discussions indicates concurrence on a need to do things differently, articulated by a set of agreed principles and priority activities. Eight fundamental principles emerged from workshop discussions and agreed upon by the delegates:

Principles of Proposed Roadmap	
Cooperation	1. Balance of regional and national ownership in all six countries 2. Emphasis on national and regional consultation
Knowledge outputs	3. Basin modeling addresses regional and national priorities and constraints 4. Presentation of information/outputs in a user-friendly accessible format
Open Source	5. Emphasis on open source data, information products and models placed in the public domain 6. "Top down" and "bottom up" data appropriately integrated
Capacity and Institutions	7. Existing human and technical resource combined with emerging technology 8. Institutional and financial sustainability

The principles guide a three-year (2013-2015) "road map" of priority actions and activities at both regional and national levels. National level activities will be discussed with each country. The workshop focused on a regional roadmap covering:

1) *Improving data and information management and exchange*: Augment the continuing hydromet modernization projects, by constructing a web-based data portal, improving data flows (e.g., elimination of g breakpoints), digitizing and modernizing data storage, and integrating "top-down and bottom-up" data;

2) *Building a system of models*: At the basin level, familiarize technical and policy specialists with different models and sectoral modules to identify a range of modeling approaches and, if appropriate, jointly prepare a Terms of Reference to upgrade or build effective models systems for basin analysis. In addition, the focus on developing tools to address immediate, common, operational issues including flooding and disaster risk management, water conservation and preservation, and water quality and, with a longer term perspective, climate change;

3) *Strengthening capacity*: Expand technical awareness and capacity for data and information management systems and modeling, as well as specific issues of water conservation, climate change and disaster risk management through seminars, workshops, institutional exchanges and individualized training; and build a professional cadre, and

4) *Enhancing governance and the coordination process:* IFAS offers an existing organization that could provide a base for analysis if support for IFAS reforms aligned with the principles articulate in the workshop, supplemented by the opportunity to engage beyond government staff to establish regional knowledge hubs.

Ownership and consultations. The delegates underscored that their participation in the regional workshop had the support of policy makers; however, they noted that opinions at political decision-making level should be acknowledged/included in the early technical stages to inform and foster ownership of the way forward. The delegates underscored the importance for each of them to share workshop outcomes and seek the concurrence of decision makers within their country. The role of civil society was noted.

IFAS role. Delegates agreed that IFAS could play a key role, possibly with EC IFAS as coordinator of the roadmap development and implementation as elements of the work program complement and are compatible with the ASBP3. Continued work on the institutional and legal strengthening of IFAS would support this role.

Feedback from participants: At the closing session of the workshop, participants were asked several questions to evaluate the workshop. A strong majority of participants felt the workshop was very useful and offered new insights and knowledge. Of particular note, more than 80 percent were optimistic about working with their riparian neighbors' in future on water resources management issues and there was a request to further development the roadmap.

Next steps for the road map. The road map is proposed to be a three-year window (2012-2015) on a basin-wide program. Delegates agreed that the preliminary roadmap was a reasonable starting point but that it needs further development, with early actions and national consultations beginning in the fall 2012 The delegations greatly appreciated the efforts of the World Bank, SDC and UNECE and the donor community for their support in promoting and maintaining a dialogue on integrated water resources management in the countries of the Aral Sea basin.

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Annex 8: List of Stakeholders from Central Asia Governments, Institutions and Organizations Engaged in National and Regional Dialogue

September 2009 – July 2012

Annex 8 is a list of stakeholders Central Asia government, institutions, and organizations who engaged in the national and regional dialogue on integrated water resources management throughout the diagnostic phase. The list is a compilation of well over 200 national and regional participants at the various IWRM knowledge and capacity strengthening events.

September 4, 2009 CAREC ESCC Water Energy Linkages Workshop

EC IFAS (Executive Committee of the International Fund for Saving the Aral Sea)

1. Mr. Saghit Ibatullin- chairman of the EC IFAS
2. Mr. Demessin Nurmaganbetov, Deputy Chairman of the EC IFAS
3. Mr. Murat Bekniyazov- special representative, member of the EC IFAS from Republic of Kazakhstan
4. Mr. Marat Narbayev- special representative, member of the EC IFAS from Republic of Kazakhstan
5. Mr. Khayrullo Ibodzoda - special representative, member of the EC IFAS from Republic of Tajikistan
6. Mr. Mavlon Kazakov-special representative, member of the EC IFAS from Republic of Tajikistan
7. Mr. Kurbangeldy Ballyev - special representative, member of the EC IFAS from Turkmenistan
8. Mr. Normukhammad Sheraliyev- special representative, member of the EC IFAS from Republic of Uzbekistan

Regional Center for Hydrology

9. Ms. Svetlana Shyvareva, Director, Department for Methods of Prognosis and Ecological Research, KazHydromet
10. Ms. Valentina Popova, Lead Scientific Specialist, KazHydromet
11. Mr. Khamidulla Shamsiev, Head, Coordinating Dispatch Center of CA (NGO)

Scientific Information Center of International Commission on Water Coordination (SIC ICWC)

12. Mr. Viktor Dukhovniy, Head, Scientific Information Center of International Commission on Water Coordination (SIC ICWC)
13. Mr. Anatoliy Sorokin, Sr. Specialist, Scientific Information Center of International Commission on Water Coordination (SIC ICWC)

September 2010 – Regional Reconnaissance

	Name	Affiliation	Coordinates	Notes
KAZAKHSTAN				
1.	Saghit Ibatulin	Chairman, Executive Committee, International Fund for Saving the Aral Sea	+7.727.387.34.31 +7.701.313.95.50	(Regional) Almaty
2.	Ballyev Kurbaneldy	Representative of the Turkmenistan, Executive Committee, International Fund for Saving the Aral Sea	+7.727.387.34.31 +7.701.787.69.66	(Regional) Almaty (facilitating the modeling efforts)
3.	Anton Krutonov	Consultant for IFAS-3ASBP		(Regional) Almaty
4.	M. Kalinin	Consultant for IFAS – 3ASBP	+7 701 951 3700 kamu@tut.by	(Regional) Almaty (modeling specialist, potential candidate to review EC-IFAS modeling inventory TOR and coordinate)
5.	Leonid Dmitriev	KAZGIPROBVODHOZ Production Cooperative	+ 7 727 279 16 10 + 7 727 279 35 22 kazgipro@mail.ru	Almaty (recommended by Committee for Water Resources)
6.	Baurzhan Jaxaliyev (Dzhaksaliyev)	Director, Department of Management of Electric Power Assets JSC "National Welfare Fund "Samruk-Kazyna	+7.7172.790563 B.DZhaksaliyev@s-k.kz	Astana
7.	Murat Beisenov	Deputy Chairman Committee for Water Resources under the Ministry of Agriculture		Astana
8.	Ms. Azia Shamshieva	Chief Expert, Division for Usage Regulation and Protection of Water Resources Committee for Water Resources under the Ministry of Agriculture		Astana
9.	Zhakyp Bokenbayev	Director, Department for Coal Development and Electricity Ministry of Industry and New Technologies		Astana
10.	Askan.Smailov	Head, Division for Power Industry Development; Ministry of Industry and New Technologies		Astana
11.	Bolot Tyakbayev,	Expert, Division for Power Industry Development Ministry of Industry and New Technologies		Astana
12.	Ms. Anargul Kalelova	Deputy Chairman, Kazgidromet		Astana
13.	Berel Baiagambetov	Director, Hydrology Department Kazgidromet		Astana
14.	Dinara Kussianova,	Director of Ecology Department		Astana
KYRGYZSTAN				
15.	Akylbelk Tiumenbaev	Chief, Dept of Perspective Development and Innovation, Ministry of Energy (MOE)	akyltymon@mail.ru +996.312.561295	
16.	Baratali Koshmatov	Chairman, State Committee for Water Resources (CWR)	baratali52@mail.ru +996.312.549095	
17.	M. Omorov	Kyrgyz Permanent Representative		Based in Bishkek rather

	Name	Affiliation	Coordinates	Notes
		to IFAS (EC-IFAS)		than Almaty at EC-IFAS
18.	Zaryldyk Itibaev	Director, Kyrgyz Hydromet Service		(interesting historic records)
19.	Kubanychbek Ismailov	Deputy General Director, JSC National Electric Grid of Kyrgyzstan Director, PIU for Emergency Recovery Operation		Energy Emergency Operation
20.	Samat Aldeev	Head of Foreign Affairs Electric Power Plants and PIU		Energy Emergency Operation-safeguards contact
21.	Darman Alibaev	Director, WB Water Management Improvement Project PIU		
22.	Shamil Diykambaev	Director, Kyrgyz Science Technical Center of Energetics, Ministry of Energy (MOE)	+996.312.510349	
23.	Makov Oleg Steponovich	PTKI (Vodoprovoravtomtic (main design institute under ICWC, for measurements))	996-312-54-11-50	*Recommended by SANARI in Tashkent
24.	Ashok Raut	SMEC Team Leader, Water Management Improvement Project	Ashok.Raut@smec.com +996-312-549074 +996-559-110026 (mobile)	Contractor for WB project
25.	Dyuchen Mamatkonov	Director of Institute of Water Problems and Hydroelectric Power – National Science Academy of Kyrgy Republic	iwp@istc.kg +996 312 32 39 28, +996 312 32 37 27	- approximately 15 additional staff attended and articulated their research speciality (high altitude glacial lakes, economics of water, modeling climate change, not all names were obtained)
26.	Satylkanov Rysbek	Chairman of the Renewable Energy Association	r.satylkanove@gmail.com +996312 32 37 35 +996 550 992911	Attended meeting with the National Science Academy
TAJIKISTAN				
27.	Sulton Rahimov	First Deputy Minister, Ministry of Melioration and Water Resources (MMRW)	Sulton30@mail.ru +992.37.235.9914	Met with full team (CO will provide translated list)
28.	Akram Suleimanov	Deputy Minister, Ministry of Energy and Industry	s.akram@mail.ru +992.37.221.3798	Met also with three others (CO will provide a translated list)
29.	Nabiev. Ozorovich	Director, Tajikgiprovodhoz, Ministry of Land Reclamation and Water Resources	nabievtj@mail.ru tajikgiprovodhoz@mail.ru +992.37.236.6679 +992.907.71.67.47 (mobile)	
30.	Mahmad Safarov	Director, State Administration for Hydrometeorology (Hydromet)	mahmad@meteo.tj office@meteo.tj +992.37.221.5191	
31.	N.A. Ozorovich	Director, Ministry of Land Reclamation and Water Resources (TAJIGIPROVODHOZ)	nabievtj@mail.ru +992.37. 236.66.79 +992.907. 71.67.47 (mobile)	Met with full team (CO will provide translated list)
32.	Palatov Yarhashevych	General Director, Hydrometric and Melioration Design Institute		
33.	Valamat Gafarouich	Staff, Department of Energy, Ministry of Energy and Industry		
34.	Kholnazarov Dustovich	Head of Electroenergy Dept. Ministry of Energy and Industry		

	Name	Affiliation	Coordinates	Notes
35.	Goibov Sohibovich	Assistant Head of Electroenergy Dept. Ministry of Energy and Industry		
36.	Greogy Petrov	Hydropower Specialist, The Academy of Sciences of the Republic of Tajikistan	geomar@bk.ru +992.918.62.05.36	Recommended by KAZ, KYG, UZB specialists
37.	Yarash Pulatov	Director, NPO-TajikNIGiM (Scientific Research Institute of Hydraulic Engineering and Melioration)		Recommended by SANIRI in Tashkent
TURKMENISTAN				
38.	Lenni Montiel	Resident Coordinator, United Nations in Turkmenistan	+993 12 35 02 25/42 52 50 (office) +993 66 30 12 32 Lenni.montiel @ undp.org	
39.	Amb. Miroslav Jenca	Special Representative of the Secretary General Head of the Regional Center UN Regional Center for Preventive Diplomacy for Central Asia	+993 12 48 16 12 jenca@un.org	
40.	Armands Pupols	Political Affairs Officer UNRCCA	+993 12 48 16 12 (office) +993 66 30 44 92 (mobile) pupols@un.org	
UZBEKISTAN				
41.	Sakhib Saifnazarov	Assistant to Deputy Minister, Ministry of Economy Head of Economic Modernization and Industry Development	+998 71 232 64 57 Ssaifnazarov@mineconomy.uz	
42.	Sergey Myagkov,	Deputy Director General NIGMI, Hydrometservice under Cabinet of Ministers	+998 71 235 83 29 nigmi@albaatros.uz sergik1961@yahoo.com	
43.	Sergey Klimov	Head, Hydrometeorological data provision unit		
44.	Aida Kocheva	Specialist, Protocol Unit, Hydrometservice		
45.	Umid Abdullaev	Director, Uzgipromeliovodkhoz (UZGIP)		@roundtable
46.	Ms. Gulchrkhra. Khasankhanova	Chief, Department of Irrigation and Land Reclamation (DILR) UZGIP	g.khasankhanova@mail.ru	
47.	Andrey Savitskiy	Chief Computer Specialist, DILR, UZGIP	andresavit@yandex.ru andre_savit@yahoo.com	Gams modeling
48.	Stanislav Rudnev	Chief, Advanced Engineering Department, UZGIP	Rudnev.uzgip@yahoo.com	
49.	Shavkat Rakhimov	General Director Scientific Research Institute of Irrigation (SANIIRI)	+998 71 265 18 53 saniiri@mail.ru	@roundtable
50.	Ismail Begimov	(modeling) , Scientific Research Institute of Irrigation (SANIIRI)	begimov@icwc-aral.uz	Gams modeling
51.	Umar Karimov	Chief Dispatcher, United Power System of Central Asia; Central Dispatch Center (CDC)	+10 998 71 233 59 88 karimov@udc.uz	
52.	Dr. V. Dukhovniy	Head, Scientific Information Center (SIC), Interstate Commission on Water Coordination (ICWC)	dukh@icwc-aral.uz www.cawater-info.net +998.71.265.9295	
53.	A. Sorokin	Expert in Water Management, Scientific Information Center (SIC), Interstate Commission on Water	sorant@mail.ru sda@icwc-aral.uz +998.71.265.2557	modeling

	Name	Affiliation	Coordinates	Notes
		Coordination (ICWC)		
54.	Marat Najimov	Director, UzSuvloyikha		@Roundtable
55.	Yulian Gasanov,	Senior Consultant, UzSuvloyikha		@Roundtable
56.	V. Glavatskiy	Chief Engineer, Uzdavsuvloyiha;		@Roundtable Feasibility & economic studies
57.	Sergey Jigarev	Head, Gidroproekt		@Roundtable
58.	M. Beylinson	Unit Head, Department of Water-Energy Projections, Economic, Environmental and Social Issues (Gidroproekt)		@Roundtable
59.	A. Morozov	Chief Specialist, JSC Department of Water-Energy Projections, Economic, Environmental and Social Issues (Gidroproekt)		@roundtable
60.	M. Khamidov,	Head of BVO "Sirdarya		

Spring 2011 – National Consultations

Afghanistan National Consultations - List of Participants
March 15, 2011

#	Name	Position	Organization
1.	H.E. Sahibi	Advisor	President Office
2.	H.E. Mr. Shojuadin Ziaie	Deputy (Water)	MoEW
3.	H.E. Mr. Ghulam Faruq Qazizadah	Deputy (Energy)	MoEW
4.	H.E. Mr. Najib Yamin	DDG	NEPA
5.	Abdul Wahab Arian	Head of Borders	MoFA
6.	Madame Zia Gul Saljuki	Director of Planning	MoEW
7.	Sultan Mahmood Mahmoodi		MoEW
8.	Naseer Ahmad Fayez	Director of Irrigation	MAIL
9.	Abdul Hashim Hekmat	Head of Department	MoEW
10.	Dr.Gul Afghan Saleh	Projects Manager (Water)	USAID
11.	Fazel haq		MoEW
12.	Mohammad Naim Eqrar	Dean of Faculty	Kabul University
13.	Dr. Mohammad Hassan Hamid	Professor	KBL Polytechnic University
14.	Dr. Mohammad Qasim Sedeqy	Professor	KBL Polytechnic University
15.	Abdul Saeed Amiri		
16.	Mohd Ebrahim Barekzai	Deputy Head of Border	MoFA
17.	Sayed Sharif Shobair	NPC/CE	FAO
18.	Azad Mohammadi		
19.	Mohammad Hashem	Head of Planning for CASA-1000	MoEW
20.	Shah Mohammad	Head of Development Project	MoEW
21.	Sayed Raskhudin		
22.	Mohammad Halim Alim	Head of Energy and Water	Water Rights
23.	Chris Knoecki	Team Leader/ AWARD	MoEW
24.	Eng. Mohammad Tamim	Project Member	MoEW
25.	Akhter Nikzad	Reporter	MoEW
26.	Lute Obaidy	ITA	MoEW
27.	Ab. Wali Matmal	Economic Dept.	MoFA
28.	Asad Yousuf	Deputy of DGEH	MoM
29.	Ainudin Ehsan	PPU	MoEW
30.	Ahmad Walid H	Deputy Team Leader	FSP

Afghanistan National Consultations - List of Participants March 15, 2011			
#	Name	Position	Organization
31.	Danny Dualy	Pro. Specialist	MEW Award
32.	Eng. M. Zarif	Director of PPU	MEW PPU
33.	Sayed Karim	Eng. PPU	MEW PPU
34.	Eng. Rauof	Member of PPU	MEW PPU
35.	Eng. Homa	Member of PPU	MEW PPU
36.	Eng. Malalai	Member of PPU	MEW PPU
37.	Anuddin	Member of PPU	MEW PPU
38.	M. Naim	DD PPU	MEW PPU
39.	Eng. Naqibullah Sorat	Member of PPU	MEW PPU
40.	Mohammad Kabir Jaji		MOJ
41.	All of the IT IT		MEW
42.	All Team of Media		MEW
43.	Lufullah	WPPU Eng	MEW WPPU
44.	M.Nasim	WPPU Eng	MEW WPPU
45.	M.Hakim	WPPU Eng	MEW WPPU
46.	Abudullah	WPPU Eng	MEW WPPU

Kazakhstan National Consultations February 23-24, 2011			
#	Name, Surname	Position	Ministry/Organization
Goverment, ASTANA			
1.	Ms. Azia Shamshieva	Chief Expert	Division for Usage Regulation and Protection of Water Resources, Committee for Water Resources under the Ministry of Agriculture
2.	Mr. Daniyar Sagadiyev	Expert	Division for Usage Regulation and Protection of Water Resources, Committee for Water Resources under the Ministry of Industry and New Technologies
3.	Mr. Anuar Omarov	Expert	Department of Power and Coal Industries Development, Water Resource Committee, Ministry of Industry and New Technologies
4.	Mr. Syrym Nurgaliev	Project Coordinator	Climate Change Coordination Center
ALMATY International organizations, Research Academies & Institutes			
5.	Ms. Alina R. Vagapova	Expert	Water Resources Department, Water Industry Research Institute
6.	Mr. Alexander Ivanovich Tverdovsky	Senior Engineer	KAZGIPROBVODHOZ Production Cooperative
7.	Mr. Alexander Yefimenko	Senior Engineer	KAZGIPROBVODHOZ Production Cooperative
8.	Mr. Vitaly Medvedev	Senior Engineer, Water Resources Specialist	KAZGIPROBVODHOZ Production Cooperative
9.	Dr. Martin Lindenlaub	Project Manager / CIM integrated expert Water Initiatives Support Program	The Regional Environmental Centre for Central Asia (CAREC)
10.	Mr. Vladimir Panichkin	Head of Modeling of Hydrodynamical and Geological	Institute of Hydrogeology and Hydrophysics

		Processes, Laboratory	
11.	Mr. Igor Malkovsky	Deputy Director	Institute of Geography
12.	Ms. Lidiya Toleubayeva	Head of the Natural Systems and Water Problems Laboratory	Institute of Geography
13.	Mr. Kairzhan Karzhaubayev	Head of Department	Institute of Geography
14.	Mr. Zhambul Yessimseitov	Leading Engineer	Institute of Geography
15.	Mr. Igor Severskiy	Chairman	Kazakh National IHP Committee, Scientific head of laboratory of glaciology, honorary director of Kazakhstan's Institute of Geography
16.	Ms. Gulsum Kakimzhanova	Board Chair	Association for Development of Civil Society in Kazakhstan
17.	Mr. Alexander G. Kuchin	Lead Hydrogeologist	KazHYDEC
18.	Mr. Amangeldy Dzhumagulov	Candidate of Technical Science, Lead Specialist	Kazakh Agency of Applied Ecology
19.	Mr. Igor Shenberger,	Consultant	UNDP Project

Kyrgyz Republic National Workshop - List of Participants March 1-2, 2011		
#	**Name**	**Position/Organization**
1.	Avtandil Kalmambetov	First Deputy Minister of Energy
2.	Elmar Dyikanov	Chief Specialist, Water Energy Regulation Department, Ministry of Energy of the Kyrgyz Republic
3.	Almaz Stamaliev	Head, Department of Long-Term Development and Innovations, Ministry of Energy
4.	Aigul Tynalieva	Chief Specialist, Water Conservation Systems Operation Unit, State Committee of Water Resources and Amelioration
5.	Gulnura Atakulova	Chief Specialist, Water Use Planning and Control Unit, State Committee of Water Resources and Amelioration
6.	Nargiza Osmonova	Chief Specialist, Water Resources Protection Monitoring Unit, State Committee of Water Resources and Amelioration
7.	Albina Torusova	Leading Specialist, Water Use Planning and Control Unit, State Committee of Water Resources and Amelioration
8.	Esen Jusumatov	Deputy Chairman, State Committee of Water Resources and Amelioration
9.	Chyngyz Uzakbaev	Deputy Chairman, State Committee of Water Resources
10.	Gulfiya Shabaeva	Ministry of Natural Resources of the Kyrgyz Republic
11.	Emil Kudanaliev	Head, Supervisory Service, National Electric Grid of Kyrgyzstan (NESK)
12.	Kubanychbek Djeyentaev	Leading Engineer, Power Plants JSC
13.	Tatyana Solovieva	Chief Specialist, Hydrology Unit, KyrgyzHydromet
14.	Olga Kalashnikova	Head, Hydrometeorological Forecasts, KyrgyzHydromet
15.	Baratali Koshmatov	PIU WMIP Acting Director
16.	Damira Sydykova	Water Management Specialist, PIU WMIP
17.	Shamil Dikambaev	Director, Kyrgyz Research Center "Energy"
18.	Kubanychbek Kulov	Director, Kyrgyz Irrigation Institute

Kyrgyz Republic National Workshop - List of Participants March 1-2, 2011		
#	**Name**	**Position/Organization**
19.	Rafael Litvak	Kyrgyz Irrigation Institute
20.	Alik Bekenov	KyrgygzGiproVodKhoz
21.	Gennadi Tolstikhin	Kyrgyz hydrogeology expedition, Candidate of Science
22.	Duishen Mamatkanov	Director, Institute of Water Problems
23.	Ermek Sharsheyev	Head of Laboratory, Institute of Water Problems
24.	Valery Kuzmechenok	Head of Laboratory, Institute of Water Problems
25.	Gulnara Shalpykova	Research Officer, Institute of Water Problems
26.	Ryskul Usubaliev	Research Officer, Unit 2 "Climate and Water", Central Asian Institute of Applied Geosciences (CAIAG)
27.	Oleg Pechenuk	NGO "Independent Ecological Expertise"
28.	Ilya Domoshov	Ecological Movement "BIOM"
29.	Nurzat Abdyrasulova	Civic Environmental Foundation "UNISON"
30.	Adyljan Djumabaev	PIU DHMP Director
31.	Azamat Toktokunov	M&E Specialist, PIU DHMP
32.	Farida Abdyldaeva	Programme Coordinator on Transparency, "Citizens against Corruption"
33.	Askar Sydykov	"Citizens against Corruption"
34.	Maya Eralieva	NGO Forum on ADB
35.	Anara Dautalieva	NGO "Taza Tabigat"
36.	Zulfia Marat	"Human Rights Bureau"
37.	Kalkash Batyrkanov	Former Minister of Water Resources, Retired

Tajikistan National Workshop - List of Participants March 9-10, 2011		
#	**Name**	**Organization**
1.	Mr. Sulton Rakhimov	Ministry of Melioration and Water Resources Management
2.	Mr. Akram Suleimanov	Ministry of Energy and Industry
3.	Mr. Timur Valamat-zade	Ministry of Energy and Industry
4.	Mr. Kadriddin Mirzoev	Ministry of Energy and Industry
5.	Mr. Rashid Gulov	OJSHC Barki Tojik
6.	Mr. Farrukh Djumaev	OJSHC Barki Tojik
7.	Mr. Hamidjan Arifov	OJSHC Barki Tojik
8.	Mr. Kholnazarov	OJSHC Barki Tojik
9.	Ms. Rafika Musaeva	Power Engineering Specialists Association
10.	Mr. Karimjon Abdualimov	Tajikhydrometservice
11.	Mr. Yarash Pulatov	Hydraulic engineering and Melioration Institute (TajikNIIGIM)
12.	Mr. Murod Amindjanov	Hydraulic engineering and Melioration Institute (TajikNIIGIM)
13.	Mr. Aziz Pirandozov	"Tojikobloihakashi"
14.	Mr. Karimov Rakhmatullo	Center of Irrigation systems rehabilitation
15.	Ms. Dilorom Saidova	Norwegian Center
16.	Mr. Furkat Kadirov	Norwegian Center
17.	Mr. Zafar Usmanov	Mathematics Institute
18.	Mr. Sobir Navruzov	Mathematics Institute
19.	Mr. Hayot Isoev	Hydraulic engineering and Melioration Institute (TajikNIIGIM)
20.	Mr. Qutbiddin Olimov	Hydraulic engineering and Melioration Institute (TajikNIIGIM)
21.	Mr. Georgiy Petrov	Academy of Science of RT
22.	Mr. Zainalobudin Kobuliev	Institute of Water Problems, Hydroenergetic and Ecology
23.	Mr. Bakhtier Rakhimov	"Youth Ecological Center"

24.	Mr. Sukhrob Nuriddinov	“Youth of the 21 century”
25.	Mr. Bobisho Azizov	Agriculture and land using Department
26.	Mr. Ilhom Rajabov	Climate Change and Ozone Center
27.	Mr. Kahramon Bakoev	Sociological and Research Center "Zerkalo"
28.	Mr. Ruslan Sadykov	Swiss Cooperation Office (SDC)
29.	Mr. Phillipe Floch	ADB

June, 2012 Pre-Workshop National Consultations

Pre-workshop consultations took place in June 2012 in all six countries: a) in Afghanistan by Kabul-based World Bank staff and workshop participants, b) in Kazakhstan, a meetingwith Vice Minister (Agriculture) Mr. Tolbayev; iii) in Kyrgyz Republic, Bank staff and the Director Water Resource Committee, Mr. Tashtanaliev and Deputy Director Uzambaev; iv) in Tajikistan with Vice Minister (Water) Mr. Rahimen and World Bank staff; v) inTurkmenistan, an informal roundtable discussion with non-government water and environment specialists; and vi) Uzbekistan with three of six designated workshop participants and World Bank staff.

July 4-6, 2012 Knowledge-Exchange Workshop: Strengthening Analysis for Integrated and Adaptive Water Resources Management, Almaty Republic of Kazakhstan

COUNTRY DELEGATIONS			
	Name	**Title**	**Organization**
AFGHANISTAN			
1.	Mr. Ahmad Tawfiq Kohistani	Power Department Engineer, Water and Power Engineering Company of Afghanistan(WAPECA)	Ministry of Energy and Water (MEW)
2.	Mr. Azizullah Omar	Deputy and Acting General Director of Economic Affairs	Ministry of Foreign Affairs (MoFA)
3.	Mr. Hayat Khan Shams	Head of Irrigation Department Directorate of Research Institute	Ministry of Agriculture , Irrigation & Livestock (MAIL)
4.	Mr. Mazeedullah Shirzad	Head of Renewable Energy Department	National Environmental Protection Agency (NEPA)
5.	Mr. Sayed Rasekhudin	Water Resources Planning Unit Director, General Planning and Donor Coordination Department	Ministry of Energy and Water (MEW)
6.	Mr. Shir Mohammad Noori	Head of Surface Water Unit, Water Right Department, G. Directorate of Water Resources Management	Ministry of Energy and Water (MEW)
KAZAKHSTAN			
7.	Mr. Anatoly Ryabtsev	Advisor to Chairman	Water Resources Committee
8.	Mr. Bolat Kabykenovich Bekniaz	Director General	Scientific Production Association "Eurasian Center of Water"
9.	Mr. Kairat Meirembekov	Acting Director	Natural Resources Department, Ministry of Agriculture
10.	Mr. Orazkhan Karlykhanov	Head, Water Management Department	Water Management Research Institute
11.	Mr. Zhumakhan Nurseitov	Head Deputy	Aral Syrdarya Basin and Water Resources Department
12.	Ms. Lidiya Nikiforova	Head, Hydro Forecast Department	KazHydromet

COUNTRY DELEGATIONS			
	Name	**Title**	**Organization**
13.	Ms. Rystai Tuleubayeva	Head, Planning and Analyses Division,	Strategic Planning and Monitoring Department, Ministry of Environment Protection
14.	Ms. Saule Tanatbayeva	Lead Expert, Water Resources Committee	Water Resources Committee, Ministry of Agriculture
KYRGYZSTAN			
	Name	**Title**	**Organization**
15.	Mr. Kanat Imanaliev	2nd Secretary, International Economic Cooperation Department	Ministry of Foreign Affairs
16.	Ms. Anna Arkhangelskaya	Specialist, Power Generation and Transmission Unit	Ministry of Energy and Industry
17.	Ms. Asel Raimkulova	Chief Specialist, Department of State Expertise	State Agency for Environment and Forestry under the Government
18.	Ms. Ekaterina Sakhvaeva	Head, Information and Analytics Unit	Department of Water Resources under the Ministry of Agriculture
19.	Ms. Gulmira Satymkulova	Water Resources Specialist	Department of Water Resources under the Ministry of Agriculture
20.	Ms. Yulia Antonovich	Chief Meteorological Specialist, State Fund of Hydro Meteorological Data Unit	KyrgyzHydromet
TAJIKISTAN			
21.	Mr. Alikhon Karimov	Director of Science and Research	Committee for Water Resources Protection
22.	Mr. Azim Khisoriev	Head of State Agency for Hydromeliorative Expedition	Ministry of Melioration and Water Resources
23.	Mr. Rakhmonkul Rakhmatilloev	National Consultant	PCU M&E Consultant for "Fergana Valley Water resources management"
24.	Mr. Timur Valamat-Zade	Senior Specialist of Energy Department	Ministry of Energy
25.	Ms. Tojinisso Nosyrova	Focal Point for Sustainable Land Management PPCR, Head of Agriculture Department	Ministry of Agriculture
TURKMENISTAN			
26.	Mr. Taganmurad Muhammedov	Head	Department of technical control Ministry of Agriculture of Turkmenistan
27.	Mr. Shageldy Atayev	Lead specialist	Ministry of Water Resources Turkmenmeliоratiya Institute 3-d department
28.	Mr. Toyly Nazarov	Lead engineer	Ministry of Water Resources Turkmengiprovodhoz Institute 1-st department
29.	Mr. Batyr Mammedov	Senior staff scientist	Ministry of Nature protection National institute of forestry
30.	Mr. Myrat Orazmammedov	Deputy Head	Gidrometeorologiya National Committee under Cabinet of Ministers of Turkmenistan
UZBEKISTAN			
31.	Mr. Avaz Khudayberdiev	Head	Group on Strengthening Relations with International Public Organizations and Movements
32.	Mr. Saidirasul Sanginov	Deputy Chairman	Ecological Movement of Uzbekistan

COUNTRY DELEGATIONS			
	Name	**Title**	**Organization**
33.	Mr. Zhasurbek Abdullayev	Deputy Head, Department of Monitoring of the Quality of Design and Estimate Documentation and Projects Implementation	Ministry of Agriculture and Water Resources
34.	Mr. Zokir Ishpulatov	Head, National Information Department of the Central Technologic and Monitoring Division	Ministry of Agriculture and Water Resources
35.	Ms. Guljamal Nurmuhammedova	Director	Analytical agency "Ynanch-Vepa" (Turkmenistan)
REGIONAL INSTITUTIONS			
36.	Mr. Anatoly Sorikin	Director	SIC-ICWC
37.	Assel Kenzheakhmetova	EC IFAS specialist	EC IFAS-USAID Project "Economic analysis of water resources use
38.	Mr. Saghit Ibatullin	Chairman	EC - IFAS
39.	Mr. Vadim Sokolov	Deputy Director	SIC-ICWC
40.	Mrs. Svetlana Shivareva	Executive Director	Regional Hydrology Center