INVESTMENT AND FINANCIAL FLOWS (I&FF) ASSESSMENTS

TO ADDRESS CLIMATE CHANGE IN THE SECTORS:

ELECTRICITY, AGRICULTURE AND DRINKING WATER SUPPLY

Executive Summary

Summary

Uzbekistan decided to carry out an assessment of Investment and Financial Flows (I&FF) to reduce emissions and to adapt to climate change in three key sectors of the economy (electricity, agriculture and drinking water supply).

The practical significance why this work was carried out is that no similar assessment had been conducted in Uzbekistan earlier yet. This work is rather a logical continuation of earlier studies conducted in this process, including: a national review of the regulatory framework, a portfolio of projects/programs implemented jointly with international environmental organizations; a mapping of sectoral investment programs and projects, evaluating the effectiveness of the results obtained.

In addition to the above, in order to prepare this report, a team of national experts has been trained in a special training to enhance national capacity in the field of I&FF assessments.

The **goal** of this study is to assess whether, in reality, the investment and financial flows in the economy of Uzbekistan contribute to an effective solution of the problems associated with climate change (challenges). To achieve this, in all three target sectors, based on the need for adaptation measures and measures to reduce emissions of pollutants into the atmosphere, the following ***tasks*** were completed:

- ✓ the boundaries of the sectors were defined. For example, in the social sector, the I&FF assessment focuses on drinking water supply;
- ✓ an analysis of historical investment and financial flows was carried out (the historical period was identified individually in each sector, depending on the availability of complete and reliable data);
- ✓ measures were identified to mitigate the effects of climate change as well as adaptation measures;
- ✓ sectoral scenarios: baseline scenario and adaptation/mitigation scenarios, which all consider climate change were developed;
- ✓ investment and financial flows were identified for the baseline scenarios and the adaptation/mitigation scenarios for the future (2017-2025);
- ✓ a comparative analysis of the measures has been done of the above scenarios;
- ✓ the feasibility (costs) of implementing the proposed activities was assessed.

According to the results of the assessments, the relevant conclusions were drawn that, in the implementation of the baseline scenario under consideration, where climate change is not being addressed, the environmental burden will increase and its negative consequences will not only affect the environmental situation, but will also have a multiplier effect on the socio-economic development of the country.

Based on these considerations, the authors proposed adaptation/mitigation scenarios, which envisage measures to address climate change. In addition, these scenarios take into account factors related to structural changes in the economy, development of industrial and social infrastructure, technological modernization of and physically obsolete facilities and others. The obtained results of the I&FF assessments show that the implementation of activities under the adaptation/mitigation scenarios in the sectors "Electricity" and "Agriculture" will contribute not only to limiting the negative effects of climate change, but also to have a positive impact in all spheres of human life. It should be noted that those activities aimed at adapting to climate change will also contribute to the successful implementation of innovative projects linked to the development of the "green economy".

With regard to the sector “Drinking water supply”, implementation of adaptation measures will not only significantly reduce the adverse effects of climate change, but also address an important social problem in providing the population with quality drinking water.

This research reveals the political consequences, first of all, regarding the issues of improving the legal framework and legislative acts in the field of water resources management in the social sector and the agriculture sector, as well as optimizing the ecological state of the environment in the Republic of Uzbekistan.

The experts also identified the main uncertainties related to the key sectors: Firstly, the lack of an officially approved concept for the development of renewable energy in Uzbekistan for the medium and long term, which would guide actions and predictions for mitigating climate change; second, the lack of a government program to develop a drinking water supply system in Uzbekistan until 2025.

ASSESSMENT OF INVESTMENT AND FINANCIAL FLOWS (I&FF) TO ADDRESS CLIMATE CHANGE IN THE ELECTRICITY SECTOR

Objectives

The assessment of investment and financial flows[1] in the electricity sector of Uzbekistan is designed to identify priority actions to mitigate the effects of climate change and to ensure sustainable development of the electric power industry in Uzbekistan in the future.

The main objective of this process is to identify and describe scenarios for the assessment of investment and financial flows in the electricity sector for the implementation of activities that can be implemented to reduce greenhouse gas emissions.

To achieve this goal, the following tasks have been accomplished in the course of the process:

- defining the boundaries and scope of the sector;
- analysing and assessing investment and financial flows in the energy sector for the historical period (2010-2016);
- determining measures to mitigate the effects of climate change in the energy sector;
- identifying future scenarios for the electricity sector (baseline scenario and mitigation scenario);
- defining investment and financial flows for the baseline scenario and for the mitigation scenario (2017-2025), taking into account the current situation of equipment and technological capabilities of Uzbekistan to mitigate climate change;
- conducting a comparative analysis of the above scenarios to determine the required changes and increases of investment and financial flows;
- evaluating the feasibility (costs) of implementing mitigation measures.

[1] "Investment Flow" (IF) is the capital costs for the construction of new and modernization of existing power plants.
"Financial Flow" (FF) is the current costs associated with program activities for training personnel, the costs of conducting seminars, the dissemination of popular literature, the training of new personnel and the upgrading of skills of previously employed personnel.
"Operating and Maintenance Costs" (O&M) are operating costs, including: raw materials and materials, payment for water, production services, fuel, energy, payroll, social security, environmental fees, and others.

Results

An analysis of the scenarios shows that the implementation of the action plan in the "Electric Power" sector in the mitigation scenario will help limit the negative consequences of climate change in the country.

With the total value of the I&FF shown in the tables (Tables 11-16), taking into account possible investments from other sources, including the funds of foreign financial organizations, the sustainable operation of the electricity sector will:

- meet the country's electricity needs;
- reduce greenhouse gas emissions;
- diversify the structure of electricity production; and
- increase in the share of renewable energy sources.

Table 15. Difference in I&FF between mitigation scenario and baseline scenario (US$ million)

Year	Total flows (IF + FF + O&M)	including:		
		Investment Flows (IF)	Financial Flows (FF)	Operation and Maintenance cost (O&M)
2017	0.00	0.00	0.00	0.00
2018	12.20	10.60	0.33	1.27
2019	42.47	37.60	0.36	4.51
2020	49.11	43.50	0.39	5.22
2021	62.90	56.00	0.63	6.27
2022	173.71	156.50	3.38	13.83
2023	246.04	225.00	3.04	18.00
2024	192.15	174.50	2.74	14.92
2025	75.42	66.50	2.47	6.45
Total:	**854.00**	**770.20**	**13,30**	**70.5**

Source: Authors' calculations

This assessment of investment and financial flows (I&FF), the first ever conducted in the Republic of Uzbekistan in the electricity sector, showed that this sector is vulnerable to the climate change projected up to 2025. This, in turn, determined the need to develop a set of measures aimed at the implementation of energy-saving projects to generate electricity and contribute to mitigating the negative impact of climate change.

Table 16. Difference in I&FF between the mitigation scenario and the baseline scenario for the types of generating capacity (US$ million)

Year	Total flows (IF + FF + O&M)	Thermal power plants	Hydro power plants	Solar power engineering				Wind power engineering			
		Total flows (IF + FF + O&M)	Total flows (IF + FF + O&M)	Total flows (IF + FF + O&M)	Invest-ment Flows (IF)	Finan-cial Flows (FF)	Opera-tion and Mainte-nance cost (O&M)	Total flows (IF + FF + O&M)	Invest-ment Flows (IF)	Finan-cial Flows (FF)	Opera-tion and Mainte-nance cost (O&M)
2017	0.00	0.0	0.0								
2018	12.20	0.0	0.0	12.2	10.6	0.3	1.3		0.0		
2019	42.47	0.0	0.0	42.5	37.6	0.4	4.5		0.0		
2020	49.11	0.0	0.0	49.1	43.5	0.4	5.2	0.0	0.0	0.0	0.0
2021	62.90	0.0	0.0	53.0	47.0	0.3	5.6	9.9	9.0	0.3	0.6
2022	173.71	0.0	0.0	64.7	57.5	0.3	6.9	109.0	99.0	3.1	6.9
2023	246.04	0.0	0.0	50.7	45.0	0.3	5.4	195.4	180.0	2.8	12.6
2024	192.15	0.0	0.0	60.7	54.0	0.3	6.5	131.4	120.5	2.5	8.4
2025	75.42	0.0	0.0	40.5	36.0	0.2	4.3	34.9	30.5	2.2	2.1
Total	**854.00**	**0.0**	**0.0**	**373.4**	**331.2**	**2.5**	**39.7**	**480.6**	**439.0**	**10.8**	**30.7**

Source: Authors' calculations

National specialists of the sector have acquired considerable experience and skills in conducting economic and financial analysis in this sector. International experts from Europe, UNDP (Ms. Olbrisch and others) and other countries have repeatedly conducted seminars and trainings on various issues of financial and economic analysis in Uzbekistan and other countries of the world and, most importantly, handed over to the national experts of Uzbekistan the "Methodological Guide for Assessing Investment and Financial Flows" for addressing to climate change mitigation and adaptation.

We believe that the results of the work prepared by the experts of the electricity sector will provide significant assistance and will be used by the leaders and relevant specialists of the ministries, departments and institutions of Uzbekistan to address issues related to making decisions to mitigate the negative impact of climate change.

The results of this paper have shown that the implementation of mitigation measures will significantly reduce the adverse effects of climate change in the sector. Required I&FF for the mitigation scenario exceed the I&FF compared to the baseline scenario by US$ 854 million due to additional implementation of investments in the field of alternative energy.

In general, the implementation of a set of mitigation measures based on the optimal use of renewable energy will ensure:

- the formation of conditions for the sustainable provision of regions with energy through the introduction of renewable energy sources;
- the reduction of mono-dependence in the energy sector from natural gas, thereby ensuring the country's energy security;

- the creation of a qualitatively new field of energy in the country: an alternative to traditional energy based on hydrocarbons by using renewable energy sources and applying qualitative new technological solutions that promote the development of high-tech industries;
- the active social and economic development of remote areas through guaranteed energy supply to business entities and the social sector;
- raising the technical level of specialists in the regions of construction and operation of renewable energy sources;
- the substitution of hydrocarbons and the restriction of greenhouse gas emissions into the atmosphere.

Political Implications

At the policy level, as part of the implementation of the mitigation scenario, it is necessary:

- to improve legislation and regulatory framework in the field of renewable energy sources;
- to create an organizational management structure and to introduce modern technologies in the field of use of renewable energy sources;
- to implement financial mechanisms to encourage the introduction of renewable energy sources, creating favorable conditions for attracting investments, primarily foreign direct investment;
- to stimulate the market (business) of renewable energy technologies by the state through tax benefits, "green" tariffs and other financial measures;
- to support the implementation of investment projects for the use of renewable energy sources, as well as the production of technological equipment for renewable energy;
- to form a modern database on technologies for the use of renewable energy sources, including both global and national experience in the development of renewable energy sources;
- to create a market of equipment, works and services in the field of the use of renewable energy sources, to strategically allocate the production of equipment for power generation based on renewable energy sources;
- to conduct research and experimental design work with the preparation of a complete set of design and technology documentation in the field of renewable energy use, in relation to the georaphic and climatic conditions of Uzbekistan;
- to stimulate demand among the population through concessional loans for the purchase of energy-efficient housing, subsidies for the installation of energy-efficient equipment and introduction of the use of renewable energy sources.

For the successful implementation of specific areas to expand the use of renewable energy, it is necessary:

- to establish a procedure for the examination of project solutions for renewable energy installations and monitoring its compliance;
- to establish stimulating "green tariffs" for electricity produced from renewable energy sources and purchased by state energy supply organizations, differentiated depending on the type of renewable energy sources and the capacity of facilities for the use of renewable energy sources;
- to provide a guaranteed connection to the unified energy network of installations for the use of renewable energy sources and the compulsory acquisition by the operators of energy supply organizations of the proposed energy produced from renewable energy sources on the basis of "green tariffs".
- to provide research and development works in the creation of energy-efficient equipment for the use of solar, wind and other renewable energy sources;
- to improve normative methodological documentation, legal and organizational basis in the use of local and renewable energy sources;
- to develop standards for the use of local and renewable energy sources, which are harmonized with relevant international standards and regulatory norms.
- to provide initial and refresher trainings, as well as advanced training of personnel in the field of renewable energy, including issues of production, design, construction and operation.
- to conduct awareness raising work in the field of the advantages of renewable energy sources for the consumer and training the population in the field of using renewable energy sources.

Chapter II. ASSESSMENT OF INVESTMENT AND FINANCIAL FLOWS (I&FF) TO ADDRESS CLIMATE CHANGE IN THE AGRICULTURE SECTOR

Objectives

The main goal of this work is to assess and analyze investment and financial flows,[2] to identify priorities for adaptation activities of the agricultural sector in the context of climate change.

To achieve this goal, the following tasks have been accomplished in the course of the work:

- analysis of national efforts to address climate change in the agricultural sector;
- assessment of investment and financial flows in the historical period (2010-2016);
- promoting the integration of climate change considerations into national planning;
- conducting a comparative data analysis of the baseline scenario and adaptation scenario;
- evaluation of the requirements/incentivs for implementing adaptation measures.

Results

An analysis of the above scenarios shows that the implementation of the action plan in the agriculture sector will help limit the negative consequences of climate change in the country. In particular:

1. Optimization of the allocation and improvement of the structure of acreage with a gradual reduction of cotton crops on lands where its yield does not exceed 10 centners per hectar and grain-crops with yields below 20 centners per hectar on a total area of 220.5 thousand hectares and and replacing them by food crops, which will increase the production of fruit and vegetable products

[2] "Investment flows" (IF) are investments in physical assets aimed at improving the land reclamation state (construction and reconstruction of collector drainage networks), as well as modernizing agricultural production.
"Financial flows" (FF) are the programmatic costs associated with training farmers, the costs of conducting training seminars, disseminating knowledge, conducting research in the field of improving land use.
"Operating and Maintenance Costs" (O&M) are operating expenses, which include: salary with deductions, inventory, payment for production services, fuel, energy, payment for insurance services and other current costs.

by 4.056 million tons, and the production of fodder crops by 1,670 thousand tons and the production of oilseeds by 62 thousand tons. This will allow to generate an additional income of over 490 billion soum, instead of losses in the amount of over 270 billion soum due to climate change.[3] Also in terms of employment, instead of climate change induced losses in these areas, there will be an increase in employment of the population by 175,000 people.

2. Step-by-step replacement of existing old orchards and vineyards for intensive ones, as well as creating new intensive orchards and planting of fruits and vegetables on the liberated lands using high-tech agrotechnical measures. At the same time, the measures will allow to increase fruit yields at a minimum of 3-4 times only due to increasing the planted area and the share of high-yield intensive gardens from 5.4% or 14.1 thousand hectares in 2015 to 28.3% or 78 thousand hectares in 2019.

3. According to the results of the planned measures, improvement of the reclamation state of more than 1.4 million hectares of irrigated land is expected, including the reduction of lands with a critical level of groundwater occurrence by 310 thousand hectares (29%), and a reduction of heavily and medium saline lands by 80.2 thousand hectares (11.5%). A deterioration of the condition of about 970 thousand hectares will be prevented.

An increase in soil fertility will ensure an increase in crop yield by an average of 14-17% per year.

4. Increasing the export potential of the agricultural sector. Growth in the production of agricultural products, primarily fruits and vegetables, will create favorable conditions for a greater export orientation of the industry.

The total export volume of fresh and dried fruit and vegetable products is expected to gradually reach 2.1 million tons, or 11.4% in the total fruit and vegetable production. With the unique fruit and vegetable products, it should be aimed to develop markets not only for neighbouring countries, but also for the European Union, as well as for Asian countries like Korea and Japan.

At the same time, the creation of an export system requires a uniform supply of products throughout the calendar year. To this end, it is necessary to gradually create modern so-called ’dry ports‘ with refrigerating capacities for the simultaneous storage of up to 3 million fruit products, as well as to create an entire logistics system, including a procurement system, vehicles (refrigerated trucks and autotractors) and to identify the most efficient transport routes.

All this will increase the export of fruit and vegetable products by 2020 to a total of US$ 5 billion.

[3] According to national experts.

5. As a result of increasing the level of processing of agricultural products, it is expected to achieve:

- An increase in the volume of processing raw fruit, vegetable and grapes from 2,253.2 thousand tons to 3,327.8 thousand tons (147.7% by 2015), an increase in meat processing from 115.9 thousand tons to 275 thousand tons (by 2.4 times), as well as an increase in milk processing from 1058.4 thousand tons to 1795 thousand tons (1.7 times).
- Production of:
    - canned fruits and vegetables: 1 billion 192 million cans (2.1 times by 2015);
    - dried fruits: 256.7 thousand tons (1.7 times);
    - sausage products: 52.8 thousand tons (1.7 times);
    - milk and dairy products: 1 million 36.1 thousand tons (1.9 times);
    - butter: 17 thousand tons (1.8 times);
    - sugar: 610 thousand tons (1.5 times);
    - confectionery products: 98.2 thousand tons (2 times).

These measures will ensure an increase in production of food products per capita compared to 2015 for meat and meat products by 28.9%, in the production of milk and dairy products by 37.3%, fruit and vegetable preserves by 2 times, dried fruits by 58.5%, vegetable oil by 12.4%, sugar by 37%, and confectionery products by 186.8%.

Particular attention is paid to increasing exports of processed fruit and vegetable products. By 2019, the export of processed fruit and vegetable products is to be expected to reach:

- canned fruits and vegetables: 26 thousand tonnes (2.1 times more than 2015);
- fruit juices up: 31.5 thousand tonnes (1.9 times more than 2015);
- dried fruit: 135.2 thousand tonnes (1.7 times more than 2015).

6. Growing income and quality of life of the rural population. The social gap between rural and urban residents is decreasing, and this dynamic is being tracked. The reduction is a result of the measures to increase employment and income of the rural population, to improve the quality of their lives in recent years. Today the average per capita income of the rural population does not differ from that of the urban resident, while in 2005 the gap between them was 1.2 times. As a result of the accelerated development of the service sector in rural areas, the gap between the average per capita urban and rural services has been almost halved over the past seven years (from 4.9 times in 2007 to 2.7 times in 2015).

In general, for 2007-2014, the Giny coefficient, which reflects the differentiation in the level of incomes of different population groups in a country, decreased from 0.32 to 0.29, which corresponds with the average level of the economically developed countries in the world.

The agricultural reforms aim at creating the most favorable conditions for the life of rural residents. By 2020, the income level of rural residents should grow by a factor of 1.7.

At the same time, rural residents will be fully equal in terms of access to services for school and secondary special education, health services, telecommunications, most types of communal and household services, like urban residents, and see significant improvements in transport infrastructure, especially roads.

Political Implications

Over the next five years, no less than 87,000 typical rural houses will be built, which will improve housing conditions and provide comfortable living conditions for 102,000 rural residents.

All new settlements will be provided with social, transport, communal infrastructure, trade and consumer services facilities, as well as new jobs in the newly created industrial and service facilities.

At the same time, as part of the implementation of the mitigation scenario, it is necessary to:

- Improve the legislation and regulatory framework in the field of administrative responsibility aimed at enhancing legal compliance of officials and other persons for mismanagement of lands, violation of the state land cadastre, leading to a decrease in soil fertility and land degradation;
- Introduce amendments and additions to the relevant legislative acts to further improve farm activities, and to effectively use their land areas, including definiting the legal status of multi-disciplinary farms;
- Implement financial mechanisms to encourage the introduction of renewable energies, to create favorable conditions for attracting investments, primarily foreign direct investment;
- Support the implementation of investment projects on resource-saving technologies, and on the production of technological equipment for drip irrigation.

Chapter III. ASSESSMENT OF INVESTMENT AND FINANCIAL FLOWS (I&FF) TO ADDRESS CLIMATE CHANGE IN THE SOCIAL SECTOR IN TEMRS OF DRINKING WATER SUPPLY

Objectives

To achieve this goal, the following tasks have been accomplished in the course of the assessment:

- Determining the boundaries of the sector by drinking water and water supply sources;
- Identifying of adaptation measures in the sector;
- Assessing investment and financial flows of the historical period (2006-2014);
- Identifying scenarios of future sector development (baseline scenario and adaptation scenario);
- Determining investment and financial flows for the baseline scenario and the adaptation scenario (2015-2025);
- Conducting a comparative data analysis of the baseline and adaptation scenarios;
- Evaluating the policies for implementing adaptation measures.

Results

The main result of this work is the first time ever analysis of investment and financial flows in the Republic of Uzbekistan in the sector "Drinking water and natural sources of water supply"; this is one of sectors most vulnerable to climate change, given temperatures are projected to rise nationally up to 2°C by 2025. Climate change, as mentioned above, can lead to unfavorable consequences in the sector, which will eventually contribute to an increase in the levels of anthropogenic pollution of water supply sources, to a deterioration of drinking water quality, to a sharp increase in related morbidity rates, and to a malfunction in the operation of centralized water supply systems.

Under such conditions, the social tension in the Republic is expected to increase significantly. The forecasted situation requires a set of measures as presented in the adaptation scenario (target scenario) that contribute to adapting to climate change in the sector "Drinking water and natural sources of water supply", to address the causes of potential failure in the operation of centralized drinking water supply systems and and to optimize the condition of water supply

sources.

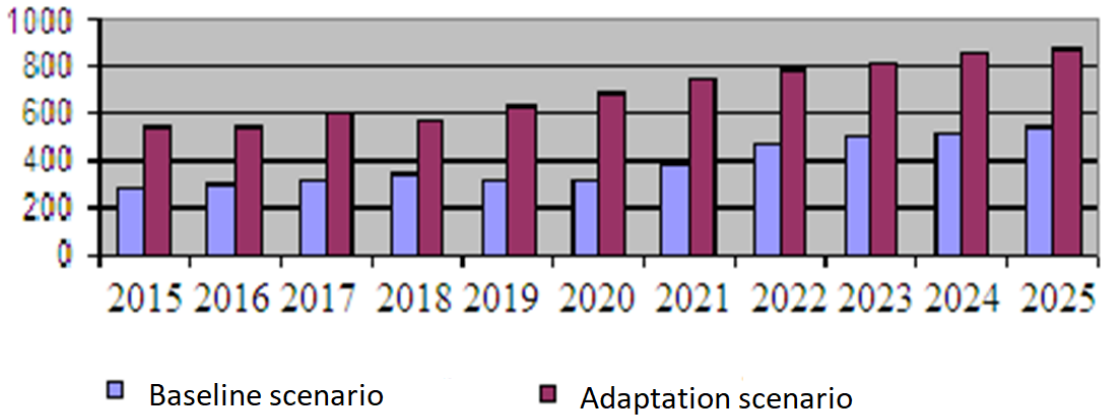
National specialists of the sector have acquired considerable experience and skills in conducting economic and financial analysis in the sector through the I&FF assessment. International experts from UNDP (Mrs. Susanne Olbrisch etc.) and other countries have repeatedly conducted seminars and trainings on a range of aspects of financial and economic analysis in other countries and in Uzbekistan; and - most importantly - handed over to the national experts of Uzbekistan the "Methodological handbook on investment and financial flows assessments to address climate change".

The results of the assessments prepared by the sector specialists on "Drinking water and natural sources of water supply" will provide significant input and will be used by the leaders and relevant stakeholders of ministries, departments and institutions of Uzbekistan in terms of decision-making to address climate change in the water sector.

The results of this assessment show that implementing adaptation measures will significantly reduce the adverse effects of climate change in the sector. I&FF for the adaptation scenario are **75.2-85.3**% higher than in the baseline scenario. So, if in the baseline scenario the total I&FF for the construction, repair and reconstruction of water pipelines amounted to **807.4** million soum, then in the adaptation scenario it was **1,422.5** million soum. For repair, reconstruction and construction of water supply networks, in the baseline scenario **350.0** million soum and in the adaptation scenario **634.6** million soum. For well construction, in the baseline scenario **631.8** million soum and in the adaptation scenario **1,1236** million soum. For the construction of water towers, in the baseline **683.7** million soum and in the adaptation scenario **1230.1** million soum. For the construction and repair of tanks, in the baseline scenario **623.3** million soum and in the adaptation scenario **1,092.2** million soum. For the construction, repair and reconstruction of pumping stations, in the baseline scenario **521.3** million soum and **922.5** million soum. For the construction of chlorination plants, in the baseline scenario **668.7** million soum and in the adaptation scenario **1239.6** million soum. In total for the baseline scenario, I&FF amount to **4 billion 286.2 million** soum, and for the adaptation scenario to **7 billion 665.1 million** soum. In general, the total amount of I&FF for the adaptation scenario exceeds the amount of I&FF of the baseline by **78.8**%.

The dynamics of I&FF for the baseline scenario and the adaptation scenario are shown in the figure (Figure 2). It can be seen from the figure that for the adaptation scenario the amounts of I&FF exceed the amount of I&FF of the baseline scenario.

Figure 2. Dynamics of I&FFs for the baseline scenario and the adaptation scenario (in million soum)



Political Implications

It should be noted that the current legislative framework in the Republic of Uzbekistan allows organizations and institutions to carry out activities in the field of drinking water supply systems and the use of natural water sources. At the same time, projected climate change can lead to a significant deterioration in the functioning of centralized drinking-water supply systems, the quality of drinking water and natural water sources. This makes it necessary to strengthen the regulatory and legal framework and improve legislative acts in the field of water resources management, to provide the population with safe drinking water and to optimize the ecological status of water bodies in the Republic of Uzbekistan.

The implementation of the adaptation scenario requires concrete actions, for example, the adoption of a law in the Republic of Uzbekistan on the transition to paid water use, the adoption of the law on the establishment of a Water User Association, the decision to issue permits for special water use to state sanitary inspectors, etc. First of all, this concerns political decisions on the following issues:

- Construction of inter-district and communal rural water pipelines;
- Use of artesian or deep-seated groundwater, which is well protected against pollution;
- Prohibition of the use of natural water sources for needs not related to drinking water supply;
- Creation of special services for the construction, operation and repair of rural water pipelines;
- Step-by-step introduction of a system of paid water use based on a differentiated tariff policy;
- Improvement of existing regulatory and legal documents in the water sector in accordance with the requirements of international standards;

- Mobilization of foreign sources for financing the construction of interregional water pipelines in rural settlements.

The existing legal basis for water management does not meet modern requirements and needs to be improved. The administrative and territorial system of water resources management leads to inconsistency of management decisions within the framework of a single river basin. There is an inconsistency in the use and protection of water resources (surface, groundwater, return water), a lack of coherence between the different levels of water management, and there is yet no mutual interest between water resources management bodies and water users to increase the productivity of water resources use. All this underscores the need for a gradual and consistent implementation of the principles of Integrated Water Resources Management in the Republic of Uzbekistan.

Experience in introducing Integrated Water Resources Management exists in many countries, and in Uzbekistan this activity is just beginning. In the Republic, it was possible to create a scientific basis for integrated water resources management and some aspects were tested during the pilot project "Integrated Water Resource Management-Fergana". It is advisable for the national Government to review the results of this project and, if necessary, consider the possibility of implementing this mechanism throughout the country. To this end, the Government needs to take a decision to change the management structure of the water management complex.

As noted earlier, in Uzbekistan, sources of water supply are mainly of transboundary nature. Countries in the basins of transboundary rivers are united through water ecosystems. Any change in water use in one country inevitably affects the interests of other countries. The need for a modern, interrelated and coordinated system for managing transboundary water resources is caused by nature itself and requires the creation and development of a mechanism for cooperation on integrated approaches.

As it is known, a tense situation in the management of transboundary water resources in Central Asia has developed in the basins of the Amudarya and Syr Darya rivers. The countries of Central Asia have a fairly large experience of working together to solve problems of interstate water relations, the positive results of which are recognized throughout the world. On 18 February 1992, the heads of the water management departments of Central Asia signed in Almaty the "Agreement between the Central Asian states on cooperation in the joint management of the use and protection of water resources of interstate sources", which was subsequently approved by the heads of state on 26 March 1993 in Kyzylorda. By this agreement, the parties established the Interstate Water Coordination Commission with the executive bodies of the Basin Water Management Organization"Amudarya" and the Basin Water Management Organization"Syrdarya". It should be noted that the Scientific Research Center of the Interstate Water Coordination Commission is located in Uzbekistan in the building of the Scientific Research Institute of Irrigation and Water Problems.

Supervised by Professor VA Dukhovny.

By recognizing the principles of international law, the countries of Central Asia and the founders of the International Fund for Saving the Aral Sea increase their ability to appeal to the UN for assistance to solve various issues, e.g. by possibly of involving international financial institutions and bilateral donors to solve regional water-related environmental problems for a sustainable development of the region.

"The Convention on the Protection and Use of Transboundary Watercourses and International Lakes" (Helsinki, 1992) entered into force on 6 October 1996. It determines that "Transboundary waters are any surface or groundwater that indicates, crosses or is located on the borders between two or more States; where transboundary waters flow directly into the sea, their end is determined in a straight line across the mouth of the rivers between the points of the horizon of the shallow waters of their shores."

The proposal on the accession of all the countries of Central Asia to the above Convention was considered at the Interstate Water Coordination Commission meeting in Almaty, 14-15 June 2002, and a protocol note was made to "Members of the Interstate Water Coordination Commission" to consider making proposals to their governments in due course on the possibility of ratifying the "Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki, 1992)".

The will of Central Asian countries to cooperate to solve the most acute problems of the region was clearly expressed during the development of the Aral Sea Basin Programme.

The program consists of four priority areas to:

- stabilize the ecological situation in the Aral Sea basin;
- restore the crisis zone around the Aral Sea;
- improve the management of international waters in the Aral Sea basin;
- strengthen the capacity of regional bodies to plan and implement the Aral Sea Basin Programme.

The solution of this problem led to the creation of special institutions in the form of the International Fund for Saving the Aral Sea, which includes: their Board, an Interstate Commission for Water Coordination, an Interstate Commission for Sustainable Development and a Scientific Information Center. The activities of the International Fund for Saving the Aral, which is financed by the Central Asian states, were significantly reinforced by external financial assistance through projects of the United Nations Development Program and the Global Environment Facility (GEF).

In addition, each of the Central Asian countries adopted a National Environmental Action Plan.

One of the determining factors of the implementation effectiveness of environmental policy are:

- management and regulation of environmental issues;
- perfection of legislation in the field of environmental protection;
- effectiveness of economic methods and mechanisms for environmental management.

Most important for the countries of the Central Asian region is that the presidents and governments of all five countries support and implement policies that ensure environmental security. In all countries, the National Environmental Action Programs have been developed, the main laws implementing environmental policy have been put in place and are functioning successfully, the economic mechanisms for environmental management are basically similar.

The cooperation of Central Asian countries in the framework of regional programs and institutes allowed to develop certain methods, and cooperation style between countries on managing and using transboundary water resources. These approaches are unique in their own way, as coordination, action planning, adjustment and distribution of water resources on an ongoing basis are carried out within the framework of this cooperation.

However, as the water expert collaboration and the I&FF assessment show, there is a certain inertia and stagnation in the activities of regional and intergovernmental organizations, in particular regarging the improvement of regional water policy and the strengthening of the legislative base. For an effective management of transboundary river basins, a new system of national and regional norms and rules for the use and protection of water resources is required, with clear procedures and economic mechanisms.

Overarching Conclusions

The I&FF assessment of the **electricity sector** to implement measures to reduce greenhouse gas emissions allow to draw the following conclusions:

1. Despite the measures taken in recent years to upgrade the fuel and energy complex, the energy system of Uzbekistan remains vulnerable to energy security.

2. Currently, in the context of growing global climate change impacts, Uzbekistan does not yet actively pursue the diversification of the energy generation structure through introducing renewable energy sources (solar, wind, etc.).

3. A set of measures to mitigate climate change is foreseen, along with the implementation of major investment projects for the expansion, modernization and construction of new thermal generating facilities. These measures include:

- The expansion of the hydropower potential through constructing 42 new and upgrading 32 operating hydroelectric power stations on natural watercourses and water management facilities of the Republic;
- The implementation of advanced demonstration projects of new photovoltaic and wind power plants, which ensure a high efficiency of power generation.

4. An analysis of the mitigation scenario for the development of the electricity sector shows that the implementation of the action plan will help limit the negative consequences of climate change in the country. At the same time, the sustainable operation of the electricity sector will ensure:

- Meeting the country's electricity needs resulting from an increasing demand from enterprises and the population, and taking into account the projected GDP growth of 1.5-2 times by 2025;
- Diversifying the structure of generating capacities by increasing the share of renewable energy sources to 2.5%, which is equivalent to the release of natural gas for the whole assessment period in the volume of 1.32 billion m^3;
- Reducing greenhouse gas emissions compared to the baseline scenario by 2.4 million tons of CO_2.

5. Compared to the baseline scenario, the implementation of the mitigation scenario will require total I&FF of US$ 26.9 billion, including investment flows of US$ 12.2 billion, financial flows of US$ 1.2 billion and operation and maintenance costs of US$ 13.5 billion. At the same time, the total I&FF of alternative types of electricity will be US$ 854.9 million.

6. Implementing a set of mitigation measures for renewable energy sources will ensure:

- Creating conditions for sustainably providing regions with energy through the introduction of renewable energy sources;
- Reducing the mono-dependence of the energy sector from natural gas, and thereby improving the country's energy security;
- Creating a qualitatively new field of energy in the country - using renewable energy sources with a qualitative new technological solution that promotes the development of high-tech industries, as an alternative to the conventional energy based on hydrocarbons;
- Actively socially and economically developing remote areas through guaranteed energy supply to business entities and the social sector;
- Substituting hydrocarbons and restricting the emission of greenhouse gases into the atmosphere;
- Raising the technical level of specialists in the regions regarding the construction and operation of renewable energy sources.

7. The I&FF assessment results can be used for the implementation of the set of measures and corresponding roadmaps, and mitigation projects in the energy sector by: policy-makers and relevant specialists of the joint-stock companies Uzhydromet, "Uzbekenergo" and "Uzbekhydroenergo", the Ministry of Economy and other key line Ministries, departments and institutions of the Republic of Uzbekistan.

8. According to the Intended Nationally Determined Contribution (INDC) for the period up to 2030, Uzbekistan aims to reduce specific greenhouse gas emissions per unit of GDP by 10% by 2030 compared to the level of 2010 through the implementation of:

- Programmes to reduce energy intensity of economic production, to introduce energy-saving technologies in the economic, social and renewable energy sectors **(as reflected in the I&FF assessment);**
- National development concepts and reports (National Communications etc.) **(as included in the I&FF assessment);**
- A set of measures on energy efficiency in the economic and social sectors **(the I&FF assessment envisages the implementation of a set of measures to mitigate climate change, resulting in a fuel consumption reduction from 359.8 g/kWh in 2017 to 283.5 g/kWh by 2025, with a total reduction of greenhouse gas emissions by 11.16 million tonnes of CO_2)**.

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The main results and conclusions of the I&FF assessment in the **agriculture sector**, based on the above analysis, are as follows:

1. It is important to improve the legislative and regulatory framework in the field of administrative responsibility and to better enforce existing regulations

regarding the mismanagement of lands, violation of the state land cadastre, leading to a decrease in soil fertility and soil degradation.

2. It is necessary to introduce changes and additions to the relevant legislative acts to further improve farming activities, to effectively use agricultural areas, including determining the legal status of multi-sector farms.

3. A main point to address is the creation of financial mechanisms promoting the introduction of renewable energy sources, and the creation of favorable conditions for attracting investments, especially foreign direct investment.

4. Support is needed for the implementation of investment projects on the use of resource-saving technologies, and for the production of technological equipment for drip irrigation.

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Finally, the I&FF assessment of the **social sector** focusing on **"Drinking water and natural sources of water supply"** showed that:

1. By 2025 the runoff of natural water supply sources will decrease by an average of 15-20%. The total reduction in river flow will be about 3400 million m^3.

2. Due to the projected increase in temperatures of 1-2°C in Uzbekistan, the quality of drinking water is expected to decrease by 30%, the mineralization of water supply is expected to increase by 25%, while 25% of water supply systems are expected not to meet the requirements of sanitary standards, 40% of water supply networks are expected not to meet the requirements, and 25% of the substance and technical equipment of water pipes is expected to deteriorate.

3. Measures assessed within the sector "Drinking water and natural sources of water supply" include: Construction and repair of water pipes, water supply networks, wells, water towers, tanks, pumping stations, and chlorination plants.

4. It was calculated that the total amount of I&FF for the historical period in the drinking water sector was 499.4 million soum. Out of this, the percentage of I&FF for the construction of water pipelines was 18.5%, for water supply networks was 8.2%, for wells was 14.5%, for water towers was 19%, for tanks was 12%, for pumping stations was 10.2%, and for chlorination plants was 17.6%.

5. The conducted assessment showed that for the baseline scenario the amount of I&FF drinking water sector is **4,286.2 billion soum, and for the adaptation scenario is 7,665.1 billion soum.**

6. It was determined that the I&FF for the adaptation scenario **are higher** compared to the I&FF of the baseline scenario: by 75.2% for the water pipes;

by 81.3% for water supply networks; by 77.8% for wells; by 79.9% for water towers; by 75.2% for tanks; by 76.9% for pumping stations; and by 85.3% for chlorination plants.

7. Calculations showed that the implementation of the planned adaptation scenario in the Republic of Uzbekistan by 2025 **will allow**: to reduce the levels of anthropogenic pollution of natural water sources, to provide the population with safe drinking water, to modernize the systems of centralized drinking water supply, to reduce the cost of fresh water for irrigation of crops, and to use water resources that are not fit for non-drinking purposes for agriculture.

8. The I&FF assessment for the period up to 2025 will be useful for the Ministry of Municipal and Consumer Services, the Ministry of Agriculture and Water Resources, the Committee for Environmental Protection, design institutes, the Irrigation and Water Problems Research Institute, the Republican Center for State Sanitary and Epidemiological Surveillance, to implement measures to protect water bodies and drinking water.