Towards the 6th World Water Forum — Cooperative Actions for Water Security

International Conference

12-13 May 2011
Tashkent, Uzbekistan

Climate Change and Conserving Environmental Capacity

Concept Note on Thematic Priority

Regional Process Commission:
Central Asia Cross-Continental Process

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Concept Note

Introduction

This Concept Note was prepared within the framework of the Process development framework "From targets to solutions" adopted by WWC and the International Forum Committee. The Concept Note sets up successive steps for development of the proposals on solution of urgent water problems towards the 6th World Water Forum.

The proposed topic corresponds to the key priorities of the WWF6 thematic framework “Climate change and conserving environmental capacity” and is associated with corresponding topic of the Europe Regional process. In the last decades, the global climate change and its effect on natural-resources capacity are among major environmental problems on a global scale. It goes beyond a poorly scientific issue to become a cross-cutting one, which covers all key (environmental, economic, social) aspects of sustainable development in the Central Asian countries.

Future challenges

The intense climate warming is observed all over the Central Asia. Climate change poses a great risk to the regional development, first of all in the key areas, such as water resources, agriculture, and population health, particularly bearing in mind the substantial population growth. Thus, the rise of average annual air temperature by less than 1^0C over the last century has led to more than one third shrinkage of glaciers in Central Asia. For the Aral Sea basin countries facing the growing water deficit, the issues related to changes in climate and water resources are of importance in view of economic development and provision of countries’ vital needs in the future.

The Aral Sea disaster is a sharp evidence of the fatal effects of ill-judged economic activity on the environment. The catastrophic decrease in the volume of the Aral Sea due to reduction of flow in the Amudarya and Syrdarya rivers through irrigation withdrawals is an obvious negative example of economic development at expense of the natural environment. Thus, the Aral Sea volume decreased 13 times, while it area – more than 7 times. The water level lowered to 26 meters, and the coast receded by hundreds of kilometers. Water salinity in some spots of the sea reaches almost 280 g/l. Most researchers noted that exactly that reduction of inflow, deterioration of water quality, and lowering of the sea-level have become the main causes of the Prearalie disaster. All this, in turn, has an effect on regional climate change. ***At present, almost the whole area of Uzbekistan is subject to excessive heat load.***

Consequences of the environmental disaster affected millions of people living in the Aral Sea basin. Given the global climate change, all processes and phenomena in this region are doubled and appear harsher, quicker, and in a more complicated manner.

Seasonal droughts became more intense and prolonged. The Aral Sea disaster made the climate more continental by increasing aridity and heat in summer. The days with the temperature of more than 40°C doubled in Prearalie and increased 1.5 on average in the rest of Uzbekistan.

Today, the Aral Sea basin is facing a complex set of environmental-climatic, socio-economic, and demographic challenges that call for the prevention of further growth of negative changes and the adaptation of Prearale's nature-resource capacity to the increasing climate change impacts.

The change in operation regimes of the interstate reservoir hydroschemes and the lack of monitoring by BWO have caused system-based water shortage in the Amudarya lower reaches.

The relatively high salinity of flow in the Amudarya lower reaches and prevalence of sodium and chorine salts have led to more than 10% increase of annual costs in crop growing, while long (10 years and more) use of highly saline river water (more than 1.0 g/l) in areas of poorly developed drainage has caused salinization of the soil and deterioration of its productivity. Therefore, about half of the area at 460 thousand ha of irrigated land is not used in Karakalpakstan.

Following indepence, the Government of the Republc of Uzbekistan pays close attention to the problems arising from the Aral Sea disaster. The large-scale programs aimed to mitigate the disaster were developed and are implemented. The budget is allocated, funds and efforts of international organizations and foreign investors are attracted as fas as possible for these purposes.

A number of Government decrees related to environmental and social improvement in Prearalie was adopted and aimed to mitigate the negative effects of the Aral Sea disaster, improve livelihoods, protect fauna and flora in Prearalie, combat irrigated soil salinization, and improve water quality in the Amudarya river.

The project on disposal of drainage water from South Karakalpakstan as implemented through international loans (IBRD and IDA), costing 74.5 $US, will allow improving soil conditions on more than 100 thousand of agricultural area, protecting and improving wetlands, archeological monuments, and the nature reserve « Baday tugai ».

A range of projects to mitigate consequences of the shrinkage of the Aral Sea are implemented within the framework of the Aral Sea Basin Program (ASBP) through IFAS. The GEF's grant financed the development of hydrotechnical infrastructure and the restoration of Sudochie lake. The first stage of the project "Development of Local Water Bodies in the Amudarya Delta" was completed with the construction of 5 outlet works, 45 km closure embankment, and artificial regulared lakes (70 thousand ha of the water surface and 810 Mm^3 of the total volume). Currently the second stage is implemented to increase the lake area to 230 thousand ha.

In the recent decade, in order to prevent salt and dust transfer from the exposed sea-bed, the national forestry divisions implemented afforestation on more than 134 thousand ha with the support of foreign investors, including 11.0 thousand ha through

the funds of IFAS. Hundreds of thousands artificial plantatios of saxaul, saltwort, and kandim (Calligonum) fixed the sand.

Since 2005, a project has been implemented to develop the strategy of tugai forest conservation, strengthen the system of protection in the Amudarya delta, and conserve biodiversity. The fauna inventory is been kept. 36 photoelectric systems were installed in outruns located within settlements and replaced oil stoves and gasoline engines.

The Karakalpak branch of the Uzbekistan's Akadamy of Science carries out a number of research on the development of technologies for prevention of desertification, localisation of its negative consequences, and search for ways to conserve biodiversity in South Prearalie. For example, the aquaculture technology that creates sustainable supply of fish in fishery is studied. The application of this technolgoy after completion of the IFAS project "Development of Local Water Bodies in the Amudarya Delta" will allow increasing the fish catch up to 6 thousand tons per year in the near future.

High vulnerability of aquatic ecosystems is already evidents in low-water and dry years that can be viewed as analogs of the future climate warming and aridization.

Further on, the climate warming process will lead to intensive evaporation and will cause an increase in number and depths of crop irrigation, recharge irrigation, and leaching irrigation. Under conditions of water shortage, it is necessary to evaluate additional inputs of irrigation water and irrigation regime for a new climate. Moreover, water demand by irrigated farming will grow since food security will have to be ensured for fast growing population. Therefore, in the mid-term, serious conflicts of interests will occur in distribution of water among irrigated farming and other economic sectors and on local level, especially in context of climate warming.

The problems of water deficit will become more and more critical in the Aral Sea basin. Due to climate change, available water resources are projected to decrease. A substantial decrease in water resources can be expected by 2050. However, water demand is already growing now and does not match available water. The expected increase in use of water for vital needs of growing population and for economy will put additional load on river flows, global climate, and water cycle.

The deficit of water resources, especially in low-water years calls for the revision of water use principles and the implementation of mitigation measures. River water becomes more the key limiting factor of food production, which is equivalent or even more important than land resources deficit. The water supply problem may aggravate, and in context of expected decrease of available water, the situation in the Amudarya lower reaches might become more complicated.

Today the Central Asian countries are facing a need to find the ways to mitigate and, if possible, prevent problems related to shortage of water, change in river regime, pollution and depletion of water sources. ***The improvement of water use efficiency, water conservation, and water demand management, based on equitable distribution, tradeoffs between upstream and downstream, between needs of water consumers and ecosystems, and the development and***

implementation of climate-resistant policy are of vital importance for the Aral Sea Basin 's states.

Efforts on compatting desertification and protecting biodiversity will cal for mutidisciplinary approach and coordinated actions in many associated spheres. The all-round quantitative and qualitative changes in natural surface water in the area of flow use due to its regulation and pollution have caused anthropogenic metamorphosis or degradation of most aquatic and associated terrestrial ecosystems. The ongoing climate change combined with anthropogenic stress lead to additional negative trends in aquatic ecosystems, breach of their fragile ecological balance, and reduction or loss of the ecosystem's biospheric and social functions.

While recognizing the value and priority of reliable hydrometeorological data for the assessment of climatic characteristics and a need to expand the region's hydrological observational networks in both spatial and temporal terms, first of all, it is necessary to have an independent assessment of the conditions of these networks. The reviews by the World Bank and the Global Facility for Disaster Reduction and Recovery (GFDRR) under the initiative «Improving Weather, Climate and Hydrological Services Delivery in Central Asia (Kyrgyz Republic, Republic of Tajikistan and Turkmenistan) have shown that ***the current conditions of hydrometeorological services in the three countries under review do not meet modern requirements. These substandard conditions have led to a continual decline in the efficacy of services provided to their governments and to their economic sectors and entities, as well as a deterioration in their ability to fulfill international and regional obligations, including those under the WMO Global Observing System.***

From Target to Solutions

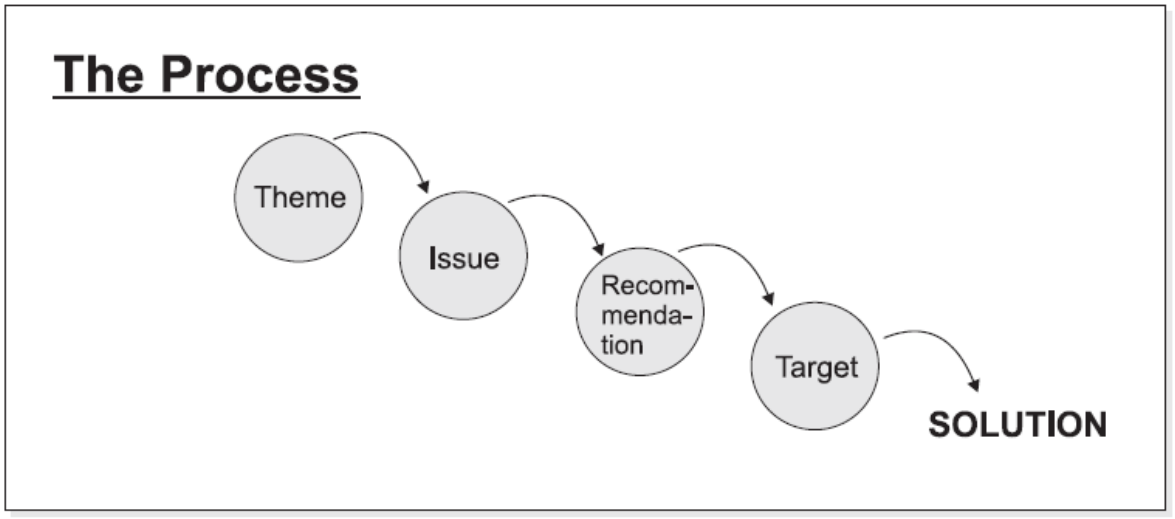
According to the methodological recommendations of the International Forum Committee, a regional process should follow the selected theme and develop towards the targets, with output to final recommendations specific for each region and, moreover, specific for each country. This Conceptual Note does not claim to be exhaustive for all the countries, and it is expected that members of the working group concerned with this theme will elaborate it taking into account the specific peculiarities of their countries (Fig. 1). Moreover, stakeholders will be involved at each stage of proposal development on considered solution during the preparatory process.

The topic under consideration: **The long-term probable climate changes in Central Asia and identification of adaptation measures as recommendations on prevention or mitigation of climate change effects and conservation of environmental capacity.**

This thematic priority is proposed to deal with in the following order:

- Climate projections of the future climatic situation and probable scenarios of its development as the heart of the problem.

- Recommendations on the selection of possible solutions, according to projected scenarios of development, in order to achieve an ultimate objective – establishment of a sustainable mechanism for adaptation to climate change
- Approach to development of national strategies on adaptation to climate change.



Schematic representation of the process involved in the development of "solutions" for the World Water Forum 6 (redrawn from the presentation of Prof. B. Braga at the Stockholm world water week, 8 September, 2010).

Fig. 1.

Projections of long-term climate changes

The results of modeling of long-term climate changes based on climate scenarios indicate to growing variability of air temperature and rainfall against reference period throughout the area and to increased probability of occurrence of extreme droughts and heatwaves and probable continuation of cold snaps in the region.

The scenarios show the substantial rise of air temperature in the republics, especially in winter. The rise of minimum air temperatures is estimated to be more intense than that of maximum ones.

It was concluded that rainfall would probably increase, mainly through winter period (December-February), and similarly the daily rainfall maximum and days with heavy rainfall would rise. This would cause higher risk of extreme floods and mudflows.

Some increase of air humidity as expected in the scenarios corresponds to the currently observed upward humidity trends in the region.

Assessment of river flow in the Aral Sea basin on the basis of climate change scenarios showed the following:

- By 2030, under climate scenarios A2 and B2, there would be no considerable water changes in Syrdarya and Amudarya river basins.
- Under scenario A2, the climate changes probably would result by 2050 in reduction of flow in Syrdarya and Amudarya rivers. The flow would decrease by 2-5% of the current base norm in the Syrdarya basin and by 10-15% in the Amudarya basin.
- Under scenario B2, rainfall would increase by 5 and 15% and more by 2030 and 2050, respectively. This could lead to maintenance of the current flow and event is increase in some river basins. However, a downward flow trend (less than 10%) is expected in the Amudarya basin by 2050.
- Increase of aridization of flow formation zone in mountains is expected in the long-term. Under scenario A2, flow would decrease by 20% in the Amudarya basin and by 15% in the Syrdarya basin.

According to modeling estimations, the average yield losses only through intensification of evaporation will be from 4% by 2030 to 10% by 2050 for cotton and from 2% by 2030 to 4% by 2050. Moreover, the maximum crop yield losses may amount to 14% for most crops in the extreme years.
The average and maximum irrigation norms will need to be increased additionally to compensate crop yield losses resulted from intensive evaporation within Amudarya and Syrdarya basins under scenarios A2 and B2.

Under the above-mentioned scenarios of climate changes, the water shortage will aggravate and water quality will deteriorate. This will have a negative effect on biodiversity and ecosystems, including aquatic ones.

Tree of Targets

The concept of regional program is given in form of a tree of targets, including five main priority targets (Fig. 2):

- Measures for development of hydrometeorological and climate monitoring
- Measures to support development of economic sectors-users of water resources
- Measures for mitigation of negative effect of water vulnerability on economic sectors
- Measures for improvement of aquatic ecosystems and environment conservation
- Measures to improve efficient response of decision-making

Road Map

Target: **Measures for development of hydrometeorological and climate monitoring**

- Technical design of the modernized system of hydrometeorological information collection, checking, and communication ;
- Improvement of the system of hydrometeorological and climate monitoring to provide timely warnings of extreme and hazardous weather events and to manage water resources;
- Institutional strengthening and capacity building of NHMS

Partners:

- National hydrometeorological services
- Donor agencies.
- Research and scientific-production institutes

Target: **Measures to support development of economic sectors-users of water resources**

- reorganization and reorientation of sector development strategies aiming at efficient use of available resources;
- large-scale application of water-conservation technologies in water using industries, agriculture, and public utilities;
- improvement of irrigation and drainage systems in order to reduce water inputs per unit production;
- shifting to use of high saline irrigation water;
- orientation to expansion of irrigated land fund, primarily, through development of fallow land (intrafarm development);
- increase of mechanisation and automation of water distribution in river basins and irrigation districts;
- shifting to a waste-free system of water use;
- potential augmentation of water resources through the use of non-conventional sources (rainwater collection, active influence on clouds) while keeping ecological balance;
- shifting to a flexible system of optimal agricultural production volume planning.

Partners:

- Ministries of economy
- Ministries of agriculture and water resources
- State committees and ministries for nature conservation
- National hydrometeorological services
- Donor agencies.
- Research and scientific-production institutes

Target: **Measures for mitigation of negative effect of water vulnerability on economic sectors**

- stricter discipline of water use;
- improvement of irrigation systems in order to reduce non-production water losses (reduction of percolation, improvement of energy-efficiency of pump equiment, automation of water distribution control), implementation of intergrated water resources management, and application of water-conservation technologies;
- re-use of drainage water;
- shifting to a waste-free system of water use;
- improvement of agricultural production planning system;
- rehabilitation of eroded and saline land, including leaching of salinized soil and removel of toxic soluble salts;
- rehabilitation of highly-degraded pastures and implmentation of rational pasture use methods;
- mitigation of wind erosion effects, implementation of afforestation by plantating bushes and trees;
- improvement of plant protection using biological and chemical methods;
- development and application of new varieties of drought-tolerant and high-yielding crops at present and for the future;
- increase of areas under crops with shorter growing season and with winter growing season;
- diversification of crops using less water.

Partners:

- Ministries of economy
- Ministries of agriculture and water resources
- State committees and ministries for nature conservation
- National hydrometeorological services

- Ministries of emergency
- Donor agencies.
- Research and scientific-production institutes

Target: **Measures for improvement of aquatic ecosystems and environment conservation.**

- Reaching agreement among the riparian states on setting of minimum but obligatory volumes of water releases for in-stream and environmental needs in order to sustain ecosystems restored in the delta.
- Resumption of practices of long-term water regulation in transboundaty watercourses of the Aral Sea basin.
- Performance of systematic environmental monitoring, projection of environmental development and elaboration of concrete measures to prevent degradation.
- Supply of National Hydrometeorological services and BWOs with up-to-date equipment for measurement and monitoring of water resources and monitoring of changes in natural environment and sanitary-epidemiological conditions.
- Improvement of the system of water regime and quality management in delta ecosystems, including regulation of water-exchange between lake systems and flowage that ensure high self-cleaning capacity of lakes.
- Creation of favorable water-heat regime in fish and other living organism habitats, regulation of populations.
- Chemical and biological methods of wastewater treatment.
- Implementation of additional reclamation, afforestation, and agronomic measures to ensure environmental safety.
- Establishment of sanitary protection zones near surface water sources and in places of groundwater abstraction.
- Strict limiting of economic activities in stronger water deficit areas and shifting of such activities to other areas.
- Scientificially-grounded nature-ecological zoning for development of main agricultural sectors.
- Obligatory and independent ecological expertise of new water-use projects.

Climate change and conserving environmental capacity

Measures for development of hydrometeorological and climate monitoring	Measures to support development of economic sectors-users of water resources	Measures for mitigation of negative effect of water vulnerability on economic sectors	Measures for improvement of aquatic ecosystems and environment conservation	Measures to improve efficient response of decision-making
• Technical design of the modernized system of hydrometeorological information collection, checking, and communication ; • Improvement of the system of hydrometeorological and climate monitoring to provide timely warnings of extreme and hazardous weather events and to manage water resources; • Institutional strengthening and capacity building of NHMS	• reorganization and reorientation of sector development strategies aiming at efficient use of available resources; • large-scale application of water-conservation technologies in water using industries, agriculture, and public utilities; • improvement of irrigation and drainage systems in order to reduce water inputs per unit production; • shifting to use of high saline irrigation water; • orientation to expansion of irrigated land fund, primarily, through development of fallow land (intrafarm development); • increase of mechanisation and automation of water distribution in river basins	• stricter discipline of water use; • improvement of irrigation systems in order to reduce non-production water losses (reduction of percolation, improvement of energy-efficiency of pump equiment, automation of water distribution control), implementation of intergrated water resources management, and application of water-conservation technologies; • re-use of drainage water; • shifting to a waste-free system of water use; • improvement of agricultural production planning system; • rehabilitation of eroded and saline land, including leaching of salinized soil and removel of toxic soluble salts;	• Reaching agreement among the riparian states on setting of minimum but obligatory volumes of water releases for in-stream and environmental needs in order to sustain ecosystems restored in the delta. • Resumption of practices of long-term water regulation in transboundaty watercourses of the Aral Sea basin. • Performance of systematic environmental monitoring, projection of environmental development and elaboration of concrete measures to prevent degradation. • Supply of National Hydrometeorological services and BWOs with up-to-date equipment for measurement and monitoring of water	• Improvement of legislative acts and conclusion of interstate agreements regulating water relations, taking into account future water changes ; • Strengthening of material-technical and legal bases of national hydrometeorological services; • Impromenet of timeliness and accuracy of hydrological forecasting; • Development of models and scientifically-grounded recommendations allowing correct and quick assessment of situations arising in water generation and use; • Preparation of respective services for immediate fulfilment of potential decisions;

Measures for development of hydrometeorological and climate monitoring	Measures to support development of economic sectors-users of water resources	Measures for mitigation of negative effect of water vulnerability on economic sectors	Measures for improvement of aquatic ecosystems and environment conservation	Measures to improve efficient response of decision-making
	and irrigation districts; • shifting to a waste-free system of water use; • potential augmentation of water resources through the use of non-conventional sources (rainwater collection, active influence on clouds) while keeping ecological balance; • shifting to a flexible system of optimal agricultural production volume planning	• rehabilitation of highly-degraded pastures and implmentation of rational pasture use methods; • mitigation of wind erosion effects, implementation of afforestation by plantating bushes and trees; • improvement of plant protection using biological and chemical methods; • development and application of new varieties of drought-tolerant and high-yielding crops at present and for the future; • increase of areas under crops with shorter growing season and with winter growing season; • diversification of crops using less water	resources and monitoring of changes in natural environment and sanitary-epidemiological conditions. • Improvement of the system of water regime and quality management in delta ecosystems, including regulation of water-exchange between lake systems and flowage that ensure high self-cleaning capacity of lakes. • Creation of favorable water-heat regime in fish and other living organism habitats, regulation of populations. • Chemical and biological methods of wastewater treatment. • Implementation of additional reclamation, afforestation, and agronomic measures to ensure environmental safety. • Establishment of sanitary protection zones near surface water	• Estimation of surface water resources and statistical characteristics of river flow under changed conditions in order to develop Master plans of multipurpose water use and design hydraulic structures; • Modernization of flow measurement system and development of water monitoring (national and transboundary); improvement of hydrometeorological monitoring in order to measure and forecast water resources and their future changesm taking into account climate change; • Improvement of knowledge and skills on sustainable water management; • Development of hydrological forecasting system; • Development of hydrological drought

Measures for development of hydrometeorological and climate monitoring	Measures to support development of economic sectors-users of water resources	Measures for mitigation of negative effect of water vulnerability on economic sectors	Measures for improvement of aquatic ecosystems and environment conservation	Measures to improve efficient response of decision-making
			sources and in places of groundwater abstraction. • Strict limiting of economic activities in stronger water deficit areas and shifting of such activities to other areas. • Scientificially-grounded nature-ecological zoning for development of main agricultural sectors. • Obligatory and independent ecological expertise of new water-use projects.	early warning system • Development of the system of monitoring over hazardous hydrological events • Development of agreed mechanisms of integrated water use in the Aral Sea basin for different flow probabilities.

Figure. 2. Tree of targets on adaptation to climate change in order to conserve environmental capacity

Partners:

- State committees and ministries for nature conservation
- IFAS
- Ministries of agriculture and water resources
- BWOs
- National hydrometeorological services
- UNESCO, UNEP, UNDP
- Non-governmental organizations
- Donor agencies.

Target: **Measures to improve efficient response of decision-making**

- Improvement of legislative acts and conclusion of interstate agreements regulating water relations, taking into account future water changes ;
- Strengthening of material-technical and legal bases of national hydrometeorological services;
- Impromenet of timeliness and accuracy of hydrological forecasting;
- Development of models and scientifically-grounded recommendations allowing correct and quick assessment of situations arising in water generation and use;
- Preparation of respective services for immediate fulfilment of potential decisions;
- Estimation of surface water resources and statistical characteristics of river flow under changed conditions in order to develop Master plans of multipurpose water use and design hydraulic structures;
- Modernization of flow measurement system and development of water monitoring (national and transboundary); improvement of hydrometeorological monitoring in order to measure and forecast water resources and their future changesm taking into account climate change;
- Improvement of knowledge and skills on sustainable water management;
- Development of hydrological forecasting system;
- Development of hydrological drought early warning system
- Development of the system of monitoring over hazardous hydrological events
- Development of agreed mechanisms of integrated water use in the Aral Sea basin for different flow probabilities.

Partners:

- Ministries of justice
- Ministries of economy

- Ministries of agriculture and water resources
- Ministries of emergency
- State committees and ministries for nature conservation
- National hydrometeorological services
- UNESCO, UNEP, UNDP
- Non-governmental organizations

Main provisions focused on political process

Sustainable development of any country is based on three pillars such as **economic growth, social protection, and environmental safety safety.** To this end, state policies should ensure implementation of necessary measures in this direction.

While recognizing the need to consider the climate change issues in developing national development strategies and plans, it is necessary to integrate such issues of climate change and adaptation to it in these strategies and plans.

As far as adaptation to climate change is concerned, the following measures should be underlined:

- Development and strengthening of monitoring, forecasting, and management,
- Implementation of control system,
- Institutional improvement, development of interdeparmental cooperation
- Development of legal mechanisms
- Sectoral measures

Integration of this set of measures into national development strategies and policy, as well as sustainable development of social-economic and institutional-legal infrastructure will foster the climate-resistant policy and ensure economic growth and adequate degree of social protection and environmental safety.