

Kingdom of Morocco



Ministry Delegate to the Minister of Energy,
Mining, Water and the Environment,
in charge of Water

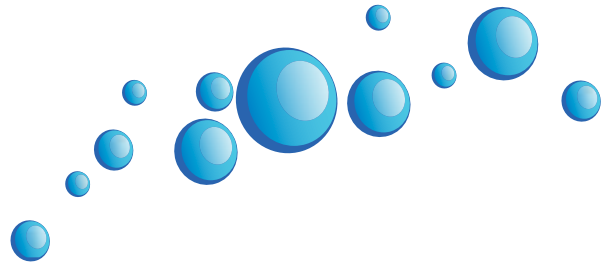


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UN CLIMATE CHANGE CONFERENCE

WATER AND CLIMATE

Blue book





WATER AND CLIMATE
Blue book



Produced by:

- the Ministry Delegate in charge of Water, Kingdom of Morocco;
- the Ministry of Environment, Energy and the Sea, France;
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Abreviations

AF	Adaptation Fund
CMP	Conference of Parties serving as the meeting of the Parties to the Kyoto Protocol
COP	Conference of the Parties of the UN Framework Convention on Climate Change
COP21	21 th Conference of Parties of the UN Framework Convention on Climate Change
COP22	22 th Conference of Parties of the UN Framework Convention on Climate Change
FSCC	Special Climate Change Fund
GCF	Green Climate Fund
GDP	Gross domestic product
GHG	Greenhouse Effect Gases
ICWC	International Conference on Water and Climate
INDCs	Determined Planned Contributions to the National level
IPCC	Intergovernmental Panel on Climate Change
LPAA	Lima Paris Action Agenda
NGO	Non-Governmental Organization
OMD	Millennium Development Goals
PMA	Fund for Least Developed Countries
SDG	Sustainable Development Goals
UN	United Nations
UNEP	United Nations Environment Program
UNCFCC	United Nations Convention Framework for Climate Change





Climate change is a reality, becoming more and more pressing. Scientific studies clearly have shown that the development of economic activities has resulted in an increase in atmospheric temperatures and climate disturbances such as the intensification of extreme climate events.

Climate change has direct impacts on natural resources, ecosystems and societies. In particular, the water sector is among the most affected sectors, as confirmed by the observations and projections of scientific experts.

The impacts of climate change on the water cycle are complex and different for each region of the world, with strong socio-economic and environmental impacts.

The Mediterranean region is one of the poorest region in terms of water, with less than 1,000 m³ / capita / year and it will have even more pressure on water due to several additional factors - the population is growing in the Southern and Eastern area, there is a high trend for development of tourism, industry and irrigation, and it is a place of high impacts from climate change.

In the “water poor” countries of the Mediterranean area, the population should increase from 180 million people today to over 250 million in the next 20 years, with 80 million living with less than 500 m³ / capita / year to 2025.

Although Africa has a low level of greenhouse gas (GHG) emission, it has become a real victim of climate change. The arid and dry subtropical parts of Africa are expected to be the region with the highest impact from climate change by 2100. The continent is already affected by severe aridity and some regions such as Sahel should expect an increase in droughts. Thus, the Africa’s population living under water stress will increase from 47% in 2000 to 65% in 2025.

These effects generally threaten sustainable development, particularly the sustainable development program adopted by the UN in September 2015. It includes a set of global objectives, including access to water and sanitation, integrated and sustainable water management, to end poverty and fight inequality and injustice and to face climate change by 2030.



In Africa, the negative effects of climate change have already reduced GDP level by about 3%, according to current estimates. The 2013 UNEP report confirms that Africa needs US\$ 7 to 15 billion annually, by 2020, in order to face adaptation challenges. The report also states that «even if the world manages to keep global warming below 2°C, the cost of adaptation in Africa will be approximately equal to US \$ 35 billion per year by 2040, and around US \$ 200 billion in 2070».

To keep the rise of the average global temperature below 2°C by 2100 and continue the efforts to limit the increase to 1.5°C, and to adapt the affected societies, communities and sectors to change climate, the 21th Conference of the Parties, held in Paris from November 30, to December 11, 2015, has concluded a comprehensive agreement and built a climate Alliance.

During COP21, water was, for the first time, very present in a climate conference. Several initiatives have actually been launched within the Agenda of Action including: the Paris Agreement on Water and Climate Change Adaptation in river basins, rivers, lakes and aquifers, the Alliance Enterprises for Water and climate and Megacities Coalition for Water and climate change.

The Paris conference had also a strong mobilization of civil society and all stakeholders, in particular as part of the «Climate is water» Initiative.

The Paris Agreement recognizes the importance of adaptation which should be treated similarly to mitigation - including for funding- and consequently, water should be a priority beneficiary for it is a resource largely impacted by climate change and also facing the majority of risks.

These initiatives have raised awareness and mobilized the international water community around the world. Many water-dedicated meetings have taken place since the COP21 in Paris in order to put water at the heart of climate negotiations. The work was continued throughout the year and resulted in a strong mobilization of local governments, businesses and parliamentarians.

In this context, and in order to attribute to water the place it deserves and mobilizing all stakeholders during the various negotiations which integrate the process of the parties, the Ministry Delegate in charge of the water of Morocco, the French Ministry of Environment, Energy and the Sea, and the World Water Council organized the International Conference on Water and Climate on 11-12 July 2016, in Rabat, halfway between the Paris and Marrakech COP.

The discussions were organized into four sessions and a ministerial roundtable was dedicated to Africa with the objective of highlighting the impact of climate change on water in this continent and underlining the necessity of justice through initiatives and programs to setting up in urgency in order to improve water situation, sanitation and food security in Africa. The various conference sessions covered the following topics:



- Session 1: Water Resources Vulnerability to Climate Change;
- Session 2: Place of water in the Implementation of the Paris Agreement and SDG's;
- Session 3: The Alliance of Water-Energy-Food Security-Health-Education;
- Session 4: Water and Financing Mechanisms related to Climate Change;
- Ministerial Roundtable on Africa - Water in Africa: Towards a Climate Justice!

This «blue book», prepared on the basis of documents, discussions and recommendations of the International Conference on Water and Climate in Rabat, aims to raise international awareness on the vulnerability of water in the context of climate change and the urgency of action. It also speaks in favor of merging both agendas of water and climate, in order to ensure a total integration of water in the negotiations on climate change.

The Blue Book also presents concrete actions in the water field to cope with the impact of climate variability, actions which have already been launched or are being implemented, including the initiative «Water for Africa ». It is organized around chapters that highlight the challenges of water, its positioning within the adaptation and mitigation set of actions, and the recommendations to the international water community for a better water resilience to climate change and ensure sustainable development.



Summary



Climate change is an undeniable reality, which affects mainly water resources. The impacts and consequences of this change on the water cycle are related mainly to variations in the average and the geographical distribution of rains, the upsurge in droughts and heavy precipitations. The situation with real socio-economic impact is beginning to significantly affect countries financially, by challenging governments and the international community for the implementation of particular resilience actions in Africa, where 25% of the current population suffers from water stress and the third of it lives in areas that are subject to droughts and which have become vulnerable to its impacts.

Climate change also affects aquatic ecosystems and other sectors related to water including energy, food and health. Hence the need for coherent and integrated policies for these sectors to face the challenges and pressures imposed by climate change.

On the other hand, climate change increases uncertainty in the field of water. It also introduces new constraints and exacerbates those that are already impacting governments and communities in the water field. Only an integrated and sustainable water management can help mankind to meet the challenges related to water availability, changes, extreme weather events (floods and droughts) and the uncertainty of the resource, in order to ensure water security and achieve the Sustainable Development Goals.

Addressing climate change and achieving the SDGs, requires the implementation of structuring actions and achieving significant investments in infrastructure and new technologies in the field of water. To this end, a central place must be given to water in the negotiations of the Parties under the UN Framework Convention on Climate Change.

In fact, during the 21th session of the Conference of Parties (COP) and the 11th session of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP), which took place in Paris in 2015, water was significantly present through a number of initiatives. COP 21 resulted in a historic agreement called «Paris Agreement», to fight climate change and unleash new measures and investments for a resilient and sustainable future.

In this context, and to implement the Agenda of water-climate, the Ministry Delegate for Water of the Kingdom of Morocco, the French Ministry of Environment, Energy and the Sea, and the World Water Council organized the International Conference on Water and Climate Marrakech, on 11-12 July 2016, in Rabat, halfway between COP 21 in Paris and COP 22 in Marrakesh.

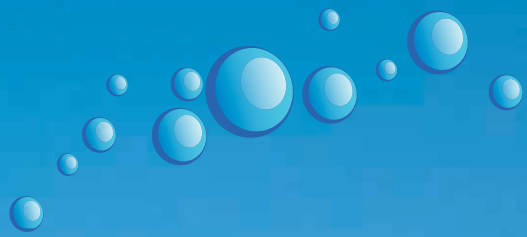


The discussions and exchanges that took place during this conference gave a base to this blue book on water, to present the recommendations to the international water and climate community for better climate change resilience and to ensure sustainable development. The conference was also the occasion to launch the Call of Rabat «Water for Africa» as a new African initiative for water.

The main recommendations will be shared with the international water and climate community, during the COP22 meetings in Marrakech, are summarized as follows:


1. Recognize water as the first victim of climate change;
2. Place water at the heart of Climate Change negotiations;
3. Engage in an Agenda of Action for water;
4. Improve access to finance;
5. Establish mechanisms for monitoring the commitments made in the field of water and climate change;
6. Engage a specific agenda for water and climate change in Africa;
7. Implement the principles of good governance and integrated water management;
8. Improve and share knowledge on water and climate change;
9. Strengthen cooperation and assistance to developing countries;
10. Develop research and capacity building.





**WATER VULNERABILITY
TO CLIMATE CHANGE**





Today, global warming is a certainty. It leads to climate disruption, affecting henceforth the water cycle and water resources in general.

The Intergovernmental Panel on Climate Change (IPCC) stated in the 5th Assessment Report that climate change impacts four particular sectors:

- Water;
- Ecosystems, both freshwater and marine environment;
- Crop yields;
- Health by increasing the risk of waterborne diseases.

Water Vulnerability to Climate Change

The impacts on the water cycle results mainly in variations in the average and geographical distribution of rainfall, the increase of evapotranspiration, the upsurge in droughts and heavy precipitations. These new events, which have also a socio-economic impact are beginning to significantly affect countries financially, urging governments and the international community to implement resilience actions.

The changes are already visible everywhere around the world, in California, Brazil, Sahel, etc. In the region of the Mediterranean, rainfall decrease are already witnessed along with an increase of extreme events exacerbated by climate change. Similarly, global warming has a negative impact on the regularity of river flows, which once were replenished by snowmelt. On the other hand, climate change reduces the self-purifying capacity of rivers, multiplying water pollution problems.

In addition, it is important to remember that water resources are affected by socio-economic development, before climate change.

According to the prediction of the last report of IPCC, water cycle changing trends manifest themselves through:

- **Rising temperatures, since the mid-19th century:** The years 1983 to 2012 were probably the hottest 30 years ever for the Northern Hemisphere since 1400 years. This temperature increase could continue in the future. Higher temperatures will affect the type of precipitations (rain or snow) which could have an impact on runoff. The form of precipitation is extremely important for regions dominated by snow (Sierra Nevada, the Andes and the Himalayas). These regions are highly dependent on snow to meet demand during the dry seasons;
- **The change in the average and the geographic distribution of rainfall with significant disparities at the regional level:** Climate change tends to interfere in the spatial and temporal distribution of precipitation. Thus, some areas are

expected to become wetter, while others will be drier. It is in the Sahel and West Africa that the downward trend in rainfall is the highest but also areas such as the Mediterranean basin, southern Africa and Central America could experience fairly significant precipitation drops;

- **The increase in droughts and heavy rainfall:** Climate change leads to changes in the frequency, intensity, spatial extent, duration and timing of extreme weather events. Extreme weather events represent a serious risk to the population, infrastructure and ecosystems and impact both the quantity and quality of water.

In North America the rainfall intensifies. Projections show that it is very likely that the frequency of heavy rainfall increases with time, especially in high altitudes and tropical regions, as well as in the northern hemisphere and in the winter.

Widespread increases in heavy precipitations events have been observed even in areas where the average annual rainfall decreases.

Observations show that some regions, particularly in Southern Europe and West Africa, experience trends toward longer and more intense droughts since 1950. At the same time, droughts have become less frequent, less intense and shorter in other parts of the world such as North America, Central America and Western Australia.

- **Melting glaciers and decreasing snow:** Glaciers worldwide have declined due to global warming, leading to a significant decline in water storage, and causing thereby an increase in sea level. Moreover, in most regions, snow cover has decreased, particularly during spring and summer periods.

- **The modification of the runoff, river flow and groundwater flow:** The changes in the volumes of annual rainfall and extreme events will impact runoff and recharge rate of groundwater aquifers. The flow can also be affected by the increase in evapotranspiration. A tendency to runoff decrease was observed in the periphery of the Mediterranean Basin and in West Africa.

The decline in the availability of water resources in regions that experience a decreased runoff will result in increased conflicts between different uses of water. These regions, which are already experiencing shortages, will be most heavily impacted, with increasing frequency and intensity of droughts in arid areas and periods of heavy and destructive rainfall. In these areas, populations will fall back on easily accessible water resources, such tapping into non-renewable groundwater reserves, with all the negative consequences that we all know on the sustainable management of this resource.

- **The impact on evapotranspiration and soil moisture:** Climate change can affect evapotranspiration and soil moisture. In some areas, the evapotranspiration rate can be quite high. However, direct measurements of this phenomenon are limited, and therefore, little reliable information on the trends is available.



The change in evaporation and in the volume and timing of precipitation, have an impact on the soil moisture. However, projections on changes in soil moisture are very uncertain. Reductions would be felt in some areas (like subtropical regions, the Mediterranean, and high altitudes) while increases are expected in others (such as East Africa and Central Asia).

• **Rising sea levels:** The continued increase in air temperature resulted in the gradual melting of glaciers, thermal expansion of water and then the rising of sea levels, threatening coastal cities and small islands that are just above or at the sea level. From the mid-19th century, the average sea level rise is above the average of these last two millennia. The global average sea level rose between the 19th and 20th century and still continues. The spatial distribution of change is not uniform.

The other impact of climate change is the increase of water related natural disasters. Globally, the number of disasters per decade caused by inland flooding during the period 1996-2005 has doubled over the period 1950-1980 and economic losses were multiplied by 5. It is expected that the risk of floods will increase particularly in the South, Southeast and East Asia, tropical Africa and South America. If the increase in the frequency and intensity of water-related natural disasters can be attributed largely to climate change, increased losses from these disasters is mainly explained by socio-economic factors which contribute to increased vulnerability: population growth, poverty, insecurity, absence or lack of planning and urban design, informal settlements, construction in flood zones, lack of monitoring and warning systems, etc.

Moreover, vulnerability to pollution and nuisance will increase especially in areas that will experience a decline in flow and/or a higher concentration of runoff over time, mainly because of the decrease in dilution capacity and self-purification of rivers.

With climate change, freshwater ecosystems are particularly threatened. In fact, the increase in water temperatures, the decreasing runoff and the draining of wetlands will result in the extinction of a large number of amphibian's and other aquatic species. The coastal deltas are also particularly sensitive to change, reducing runoff and, construction of dams altering the sediment supply, which result in an increase in coastal erosion.

Furthermore, the increased uncertainty on the development of water resources is in itself the main impact of climate change on the availability of water resources, with consequences that may be important to the management of 'water.

Finally, global warming would increase the domestic water demand, as well as in industry, tourism and irrigation.



The Alliance of «Water-Energy-Food Security-Health-Education» and climate change

Climate change has highlighted the link between water, energy, food security, health and education. It has also raised awareness of the need for coherent and integrated policies in these areas if we want to meet the challenges raised with climate change.

Water-Food Security

Water and food security are linked through irrigation, which consumes most of the water resources mobilized and crops evapotranspiration across the planet. In some parts of the world, agricultural production and therefore food security is only possible through irrigation. In these regions, a significant proportion of agricultural GDP, or almost all of it for some countries, comes from irrigated agriculture.

Not only the agricultural sector consumes about 70% of the mobilized water volume, but we need to produce more food to meet the needs of a continuously growing population and improve its living conditions. According to FAO, we will have to produce 60% more food by 2050. How are we going to do that? Will we use 60% more water, and in this case how shall we manage water competition?

Food production is mainly addressed from the supply side (production, storage, transport, treatment, food processing, retail ...), but from the demand side, the FAO estimates that globally 33% of all food products are wasted and lost. This means that we do not lose only food, but we also lose water, energy and land which have been used to produce these agricultural products.

Climate change impacts the declining availability of water resources in many parts of the world and therefore increases conflicts between different water users. If in some regions, particularly in the northern hemisphere, climate change is expected to have positive impacts on crops due to greater water availability (Canada, Russia), globally, the benefits of climate change on food production will be lower than the costs. Again, the areas that are already the most affected by food insecurity will be most heavily impacted, by increased drought frequency and intensity in arid areas, and with periods of heavy and destructive rain for the crops. The small southern food crops are particularly exposed to these changes because of their greater dependence on the surrounding environment. Massive changes will not allow people to adapt according to traditional methods of integrating climate variability.

Agriculture and food security are thus highly threatened by climate change. Indeed, «The threat due to disruptions in the food systems, generated by drought and rainfall variability» and «endangering the livelihoods of rural population, due to inadequate access to water for irrigation and declining agricultural

productivity», are two of the six major global risks, which are identified by the IPCC (2014) with «high confidence».

Food security will be affected, especially in Africa and the Middle East with heavy consequences on world commodity prices, poverty and economic growth leading to social and political instability. The «Trap» to poverty will increase in vulnerable areas, which will face a sustained migration, while generating conflicts and risks of the integrity of certain States (IPCC, 2014).

Water-Energy

If the link between water and food has always been detected, particularly in the countries around the Mediterranean, North Africa and Asia, awareness of the strong link with the energy is rather recent.

The energy is used to pump, treat, transport and distribute drinking water and to collect and treat wastewater. However, it is much less apparent how much energy depends on water availability. In the energy cycle, water is required to extract the primary energy for fuels refining and to generate hydropower, especially through dams.

Water and energy are inextricably linked. Despite this strong interdependence, both sectors were regulated and managed independently. It was not until the last decade that the importance of the close relationship between water and energy was recognized by many international institutions, including the United Nations and the World Business Council for Sustainable Development. Finally, the Water-Energy link is an essential element in the discussions on the concept of green economy and was one of the objectives of the Rio+20 Conference in 2012.

Unlike sectorial approaches, which are adopted so far in terms of water and energy, integrated approaches optimize and better understand the impacts of climate change, since the solutions in the water sector are linked to those of other sectors. Indeed, several examples can be highlighted, in particular, use of low carbon new technologies, renewable energy, or innovative technologies such as water desalination and wastewater treatment.

It is also very important to draw a parallel between water and energy when we talk about concepts related to adaptation and mitigation. Thus, water is for adaptation what energy is for mitigation. However, the interrelationship between agriculture, energy, cities and environment places water as a connector.

Water-Health-Education

Water is a fundamental element for life and health; the human right to water access is essential to enable a healthy life and human dignity.

Declining flows and increased temperatures under the effect of climate change leading to a deterioration of water quality, has direct consequences on human health.



Moreover, population growth, rising living standards, food production and constantly increasing industrialization, mean that the pressure on water resources is increasing. Pollution and contamination of freshwater resources have resulted in continuing decline in available reserves of good quality.

This pressure, exacerbated by the negative effects of climate change, questions the progress made in developing all these areas, i.e.: access to water, food security, and health.

Alleviating this pressure, feeding people, preserving their health and ensuring a decent life while securing a sustainable water management, is a complicated equation to be solved by the international community. This requires exemplary behavior of citizens and all stakeholders. Education plays a fundamental role to inform, and raise individual and collective awareness for the need to preserve natural resources.

Civil society plays an important role in this interaction between water, health and education and is active in promoting itself through NGOs, human rights and the role of women.

Water and Climate in Africa

Despite its relatively large water resources, Africa is the second driest continent in the world with 3 931 billion m³, or nearly 9% of global freshwater resources.

Geographically, water distribution is sporadic in Africa. If the whole continent has significant water resources, huge disparities exist between different regions of Africa. Northern Africa, the Sahel and parts of Southern Africa and the East, with fewer rainfalls, have limited water resources. Tropical and equatorial regions have abundant water resources. The six most water-rich countries located in Central and West Africa concentrate 54% of the total resources of the continent, while the driest twenty countries hold only 7%.

However, the lack of infrastructure and equipment, combined with the rural nature of the population, are at the origin of water access deficit, even if Africa does not lack water.

A third of Africa's population - 330 million inhabitants, lack access to safe drinking water, and almost half of Africans suffer from health problems related to lack of drinking water. In addition, in sub-Saharan Africa, 40% of the population has no access to safe drinking water.

In terms of sustainable development, Africa is well below the global average for the majority of water-related and sanitation indicators: low renewable resources, low proportion of population with access to water and sanitation, little irrigated cropland and untapped hydroelectric potential.

Some African countries are already using all of their renewable water resources, while others use less than one percent. Currently, over 40% of the African population lives in arid, semi-arid and sub humid regions. The proportion of the African population in water stress in 2000 was 47%.

Furthermore, over 64% of Africa's population is rural (World Bank, 2008), much of which lives on subsistence agriculture. 95% of African farmlands depend on rain-fed agriculture, making much of the population highly dependent on rainfall. For small farms, regular and adequate rains are vital to the livelihoods and food security. In some areas, such as West Africa, where 80 percent of jobs are in agriculture, regular rainfalls are critical to the entire economy. In addition, dwindling rainfalls is of particular concern in arid and semi-arid regions where rainfed agriculture is precarious.

African countries, low emitters of greenhouse gases, and experiencing significant levels of poverty, suffer from the impact of climate change. It will aggravate the already fragile situation for both communities and ecosystems. Consequently, the continent must receive a special treatment.

Climate change is exacerbating the situation of water stress, and threatens the economic development of the African continent. The arid and dry subtropical part of Africa should be the region where climate change will be the largest by 2100. Thus, the regions already affected by severe aridity as the Sahel should expect an increase in drought occurrence. The share of Africa's population that could be facing water stress will rise, from 47% in 2000 to 65% in 2025.

Thus, the global water crisis should take a special dimension in the context of Africa. Between 2010 and 2040, Africa's population is expected to increase by 50%, with a percentage of urban dwellers rising from 44% to 57%, according to the African Water Association (AWA).

The combination of some geographical and economic factors, added to dependence to natural resources, made Africa the most vulnerable continent to climate change. This vulnerability undermines the development of the continent and threatens millions of Africans and their livelihoods.

According to current estimates, the negative effects of climate change already reduced the GDP of Africa by about 3%. The UNEP report published in 2013 confirms that Africa needs 7 to 15 billion USD per year by 2020 to address the challenges of adaptation. The report also states that «even if the world manages to keep global warming below 2°C, the cost of adaptation in Africa will be about 35 billion US dollars annually by 2040 and around 200 billion US dollars in 2070».


Finally, changes in the water sector are also at the origin of migration. Indeed, people who live in a climate of health, food and social insecurity, are looking for living income and seasonal jobs across the continent. Hence, they are forced to migrate and leave an environment with fewer water resources.





**WATER MANAGEMENT AND ACHIEVING
SUSTAINABLE DEVELOPMENT
GOALS IN THE CONTEXT
OF CLIMATE CHANGE**





Integrated and sustainable water management in the context of climate change is since now one of the major challenges in the future. Climate change introduces new constraints and exacerbates those already impacting governments and communities in the water field. These constraints concern water availability, variations and extreme weather events, as uncertainty about the resource will increase.

Water Security and management of water-related risks

By 2050, over 40% of the world population will be subject to severe water stress, and nearly 20% exposed to flooding. From an economic standpoint, assets threatened by floods account for nearly USD 45,000 billion in 2050.

On the other hand, water consumption will increase exponentially in the next 30 years, which will result in a more difficult situation in the future given our current mode of consumption and water use. The increase in demand for water and food would be between 40 to 50% to fuel and feed the additional 2 billion people worldwide.

However, the situation differs across countries: while water demand is expected to decline in the OECD area (1,000 km³ in 2000 to nearly 900 km³ in 2050), it will increase in the BRICS (1,900 km³ in 2000-3200 km³ in 2050) and the rest of the world (700 km³ in 2000-1300 in 2050).

The combination of the impacts of climate change and increasing water demand and the effects of the deterioration in resources quality will threaten the human right to water in sufficient quantity and acceptable quality and therefore the water security in many parts of the globe.

The concept of water security remains innovative, it means providing a sufficient volume of water in acceptable quality to all users and ecosystems, while limiting the risks linked to floods and droughts.

Water security and the water-related risks management involve the provision of reliable and sufficient information on water, strengthening consultation and arbitration in public policies choices related to risks or between different water uses (domestic, agricultural, industrial and energy).

In terms of risk management related to water, arbitration is mainly between the different water users, rather than between different risks that may exist. Thus, the risk levels are assessed according to different standards: quality, floods, and quantitative deficit. For example, as part of risk management of quantitative deficit, there is a prioritization principle for drinking water supply and for other users and ecosystems.



Often, arbitration between public policies related to water risk management is made in favor of preventive measures rather than curative actions. The latter tend to be more costly than the former.

The systematic use of participatory democracy as a form of governance implies the involvement of all stakeholders and ensures social acceptability of water management measures.

Increasing uncertainty about the water cycle requires the provision of reliable and sufficient information to properly assess risks, plan, make informed decisions and ensure proper management of risks related to water.

The complementarity between economic and regulatory instruments, contributes to meet the challenges of an integrated and coordinated management of water by including impacts of both environmental and socio-economic sides.

Finally watersheds are the preferred level of the management of water-related risks and the most appropriate space to achieve sustainable water management.

Achieving sustainable development goals in the context of climate change

Reaching sustainable development goals in the water sector has been mitigated.

While global progress towards these goals varies, 147 countries have reached the target on drinking water, 95 countries have reached the target for sanitation and 77 countries achieved both targets. The disparities between rural and urban areas have been decreasing worldwide, but large gaps persist.

According to the 2015 Report «Millennium Development», it is estimated that 663 million people worldwide still use unimproved water sources in 2015, including unprotected wells, springs and surface water. Nearly half of these people live in sub-Saharan Africa.

The target of the Millennium Development Goals (MDG) in terms of access to improved sanitation services has not yet been achieved globally. In 2015, 2.4 billion people still use unimproved sanitation. In sub-Saharan Africa, the proportion of the population not using improved sanitation in 2015 is still important, representing 70%.

In rural areas, the proportion of the global population without access to improved drinking water has decreased by more than half since 1990, from 38% to 16% in 2015. Currently, 96% of urban populations use improved drinking water sources, against 84% for the rural population. Similarly, four out of five people living in urban areas are connected to the water network, against only one in three in rural areas.

In 2015, almost half of people living in rural areas do not have to access improved sanitation facilities. In fact, access to clean water and improved sanitation remain low for poor and marginalized group of people. Water cycle modifications, which are due to climate change is also part of the problem.

Thus, due to mitigated achievements of the water related Millennium Development Goals in the water field, the international community decided that water should remain an important challenge for development and is highly committed to the subject (water quality, waste water management, preservation of environment...). Hence, these concerns were fully integrated into the definition of Sustainable development Goals (SDGs) of the post-2015 agenda.

In fact, the post-2015 agenda, which include 17 goals and 169 targets, has dedicated the objective number 6 to water under the heading: «Ensuring universal access to water and sanitation and ensure a sustainable management of water resources», with six targets focusing primarily on improving access to drinking water and sanitation services, preservation of water quality and reducing sources of pollution, strengthening of integrated water resources management with the participation of the local population, as well as the rational use of water resources.

Achieving this ambitious agenda is a big responsibility made even greater by the effects of climate change, which requires more efforts to ensure the resource and water supply in a hydrological context with increasing uncertainty.

Nearly a quarter of humanity lives in countries with limited water resources. If current water policies continue, and if the climate model projections proof to be real, then water scarcity will appear in areas that do not suffer so far and will worsen in those where this precious resource is already very rare. Dealing with these challenges to achieve the SDGs, require structuring actions and investments in infrastructure and technology as well as non-structural actions.


Reaching the targets that are set in the SDGs requires necessarily the implementation of resilience to climate change policies.





**WATER IN THE
PARIS AGREEMENT**





The 21st Session of the Conference of Parties (COP) and the 11th session of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP), which took place in Paris from November 30th to December 12th, 2015, have resulted in a historic agreement namely the «Paris Agreement» to fight climate change and establish the measures and investments for a resilient and sustainable future.

The Paris Agreement fixed a target of keeping global temperature increase «well below» 2°C by 2100 compared to pre-industrial levels and to continue efforts to limit the increase to 1,5°C, as requested by the most ambitious countries in terms of the fight against climate change.

During COP21, water issues were present through numerous initiatives launched for the occasion, to extend and strengthen increased ambitions. Within the Agenda for Action, which gathers multi-stakeholder coalitions for transformational potential, three major initiatives were presented:

- The Paris Pact on water and adaptation to climate change in the basins, rivers, lakes and aquifers, including more than 350 signatories of 94 countries (basin organizations, governments, local and national authorities, companies, donors, civil society organizations and international organizations) are committed to taking action to better adapt by improving integrated water resources management. 10 projects have been launched in this framework and other 18 projects have been identified and will be presented at the COP22;
- The Business Alliance for Water and Climate which gathers more than 30 companies, that commit to measuring and reducing their water footprint;
- The Alliance of Megacities on water and climate, which gathers 17 megacities that aim to adopt measures for their cities to face climate change and to put knowledge exchange platform.

On the other hand, civil society was highly mobilized, particularly through the Youth Engagement for Water and Climate Change Adaptation (declaration of youth)

Several international organizations, representing thousands of actors have also been committed to ensure that water is recognized at the political level during COP21, and in the coming editions, by communicating with one voice: Climate Is Water with the objective to see both Water and Climate agendas converging.

These initiatives are continuing including a new call for action launched in the Paris Agreement to stimulate transformational actions at COP22, with a special focus on Water Information Systems (WIS) and the mobilization of the corporate world. The agenda of the action has also been recognized within the climate



negotiations. Current initiatives will be pursued and new initiatives will join the Agenda.

Therefore, this mobilization of the international water community is materialized in the work undertaken to prepare the COP22 and the launch of new initiatives at this COP 22 including «Water for Africa», the International Network of Parliamentarians for Water and the Delta Coalition.

In order to evaluate the place of water in climate change mitigation and adaptation initiatives, it should be noted that more than 80% of INDCs submitted by 160 countries (out of 188) to the UNFCCC addressing adaptation, are measures related to water.

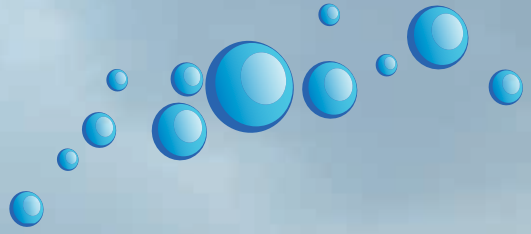
Water security is clearly a development priority for most parties, which have integrated different types of actions related to the protection of water resources in adaptation. The proposed actions are generally intended to: water saving, securing water supply, improving water distribution, and expanding water supply.

The main projects considered by countries for adaptation in the field of water include:


- Water management in an integrated approach to watershed scale, in a decentralized and participatory manner;
- The consideration of constraints related to water in urban planning documents and territory design and when the implementation of heavy water consumer or/and pollutant projects;
- Adequate pricing to encourage and mobilize financial resources for the maintenance of the infrastructure and its sustainability;
- Improving the efficiency of irrigation and water distribution;
- The reuse of water;
- Sea water desalination;
- The increase in surface water storage capacity;
- More effective management of water and soil;
- The management of the risk of flooding of plains subject to natural floods;
- The protection of freshwater ecosystems.

Finally, it is important to notice that the activities or climate change adaptation projects must take into account the vulnerability of the target environment or ecosystem and contribute to improving its resilience.





**WATER AND THE FIGHT
AGAINST CLIMATE CHANGE**



Water has an important role to play in the fight against climate change, by limiting the energy consumption to different levels of the water cycle, or by valuing hydropower potentials (attenuation), but most importantly by integrating the climate dimension in the management of water resources (adaptation).

Climate change exacerbates the existing constraints, complicating water planning, its management and mobilization of water related investments. These environmental changes are remodeling the future of fresh water. Reducing these consequences and ceasing the right opportunities, require the adjustment of the behavior and practices with this scarce resource.

The fight against climate change and in particular the adaptation to those changes require flexibility and visibility in climate projections at the local level for key water parameters, as well as adaptive governance, in order to keep up with the growing demography. In response to these challenges, mobilized countries in facing climate change, seem to be making a lot of progress, based on existing experiences.

In that sense, the African continent presents a large adaptive capacity in the water sector. Historically, the actions which are put into place to face drought and innovation are part of the adaptation measures. It includes both traditional and modern agriculture techniques, as well as water storage and conservation. On the other hand, several initiatives were launched by governments to channel investment to projects around water access and sanitation, the rehabilitation of ecosystems and to develop water related sectors. These efforts should be pursued and multiplied as part of a cooperation framework and in partnerships with the scientific communities.

In fact, it was recognized and confirmed through all the international experiences, that in order to fight climate change in the water sector, it is important to:

Integrate the fight against climate change in water policies

Well thought policies in favor of water can reduce the stress on water systems, by ensuring a good resilience to future changes. The existing water policies are adjusted in order to include explicitly climate change. In fact, having this new pragmatic approach in order to review countries' activities is part of the climate change adaption concept.

Several examples of the integration of climate change in water policies in different countries are focused on the water management plans, which integrated flood, drought and lack of water. Improving the governance of



groundwater is also taking a more important place in the agenda of adaptation, recognizing the need to preserve this strategic resource during periods of drought or water shortage. However, what is considered, or labelled, in practice, as adaptation varies from one country to another.

In Morocco, for example, climate change adaptation measures, have been included in the National Water Strategy, the different water related plans (National Plan for Water, Integrated water management plans for river basins), in order to ensure the sustainable development of the water resources, including improving water related data and knowledge, the economy of water, the development of hydraulic infrastructure, the preservation of natural environment and of sensitive and fragile zones...

The long term planning should be revisited to emphasize the importance of integrated measures which include both water and energy, and the appropriate way to take structural and integrated measures, with large programs which include both water and energy.

At the basin level, as the ideal territory for implementation and action, the water policy should also enable the development of plans for adaptation to climate change integrated into river basin management plans in line with the national strategy.

Setting up a water adaptation governance to face climate change

Institutional fragmentation and different governance is a constraint for some countries, when striving to ensure climate change adaptation governance, in particular in the context where regional and local authorities, as well as river basin authorities, are in charge of water resources management.

Climate change adaptation requires a sound governance, an appropriate organization of responsibilities among institutions and decision levels, which are linked to climate change with the promotion of processes and flexible inter-sectorial coordination as well as a share of expertise between the different territorial levels (national, regional, local...) and integrating civil society.

Efforts made to face climate change are good opportunities to revisit the governance structures. It is possible to face existing challenges at different levels, through policies in multiple domains, and through the various levels of the public administration.

The coordination among climate communities and water policy communities remain equally important for an effective adaptation.

In addition, to the different aspects which are related to the governance at different levels, climate change brings new challenges to the existing water governance practices. In fact, in order to elaborate sustainable development

plans, it is important to implement dynamic and flexible water resources planning with good future perspectives.

Long-term structures are needed to plan adaptation measures that will create deferred costs and benefits in terms of climate impact, which are often difficult to quantify, and impose real challenges for the typical planning of institutions and political cycles.

Give the priority to the efficient use of water

The first measure which should be included in every policy and each development and climate change adaptation plan, refers to the efficient use of available and mobilized resources, through the reduction of water losses, the promotion of economical techniques for water, the generalization of good practices and an appropriate water tariff scheme.

In fact, water tariff would promote efficiency and make it possible to generate good income for the financing of investments in water infrastructure and services. In general, putting the appropriate price to water and services encourage people to spend less, pollute less and invest more in water related services. The variation in precipitation, drought frequency and intensity, and the growing uncertainty regarding future hydrological conditions, triggered by climate change, are calling for efficient water tariff schemes. This approach will reduce inefficiency in terms of water use, will encourage diversification of water production and increase the available financing of high investment requirements.

Water pricing could also be used as a lever to manage water demand. It should not however be solely meant for improving water use efficiency and increasing the sector's self-financing but must also consider the ability of users to pay and also ensure fair access to water for all social groups.

Water pricing must be associated and related to the level and the quality of water service in order to meet users' expectations.

Developing robust water infrastructure

The development of water related infrastructure and the mastering of a robust water system and climate resilient, is an important element and represent a crucial aspect for the fight against climate change.

Large dams play a major role in regulating water disparities inter-annually and between different seasons. They are considered excellent measures for resilience and adaptation to climate change, primarily in the regions with a semi-arid climate and irregular rainfall regime in time and space, such as for African countries.



The development of this water related infrastructure should be made within a larger vision, integrating the management of the demand, the efficiency and the preservation of water related ecosystems and the environment. Moreover, these large reservoirs deserve to be prioritized according to a multi-level analysis at the watershed level (especially in transboundary basins, where profits can be shared between countries).

Finally, these multifunctional structures should be favored, for securing drinking water, irrigation development, protection against floods, but also for the development of the production of hydropower as clean and renewable energy playing an important role in terms of mitigation of climate change.

Improve knowledge, evaluation and management of water related risks

Climate change related water risks are numerous: water shortages, water quality degradation, flood and exchange disturbance between surface and groundwater.

A first step to facing these risks consists in evaluating scientifically those risks (exposure and vulnerability of population, ecosystems and activities) and in understanding its perception.

In particular, it is now urgent to promote the development of climate models per basin (by zoom of IPCC models) to quantify the impact of change on water resources. Such models have certainly still highly uncertain, but significant progress is being made as part of the research, and they provide tools to facilitate decision making.

Knowledge management and risk assessment in the field of water requires the availability of sufficient and reliable data on the entire water cycle including all uses (agricultural, domestic, industrial, energy sector ...) and their impacts on the environment and socio-economic aspects in order to establish viable adaptation scenarios. This is only possible through networks of measurements and representative observatories, coupled to an organization of data sharing between institutions, and interactive information systems to integrate the cross-processing and recovery of data produced by multiple organizations.

The lack of financing this activity is being difficult for a robust planning. It is therefore important to reserve part of the available funds to improve the sources of information and to evaluate water resources and their related risks, and integrate the information aspects in the global funding of infrastructure projects.

Applied research development, capacity building and cooperation

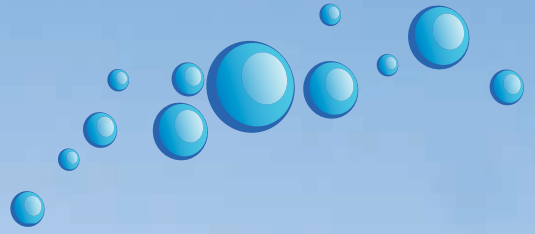
The innovation efforts and the development of technical solutions for the attenuation and adaptation to climate change, have provided the opportunity to set up innovating technological solutions, such as sea water desalination, used water recycling, irrigation and rain water collection and valorization systems.

Some of these technologies are under-used and less accessible in developing countries, primarily for cost reasons. Therefore, research efforts should be focused on the democratization of these solutions and on making them more accessible.

Cooperation and capacity building reinforcement will make it possible to share these technologies with the developing countries, and with the population in need, primarily in Africa, which should be able to attract more interest.

It is also necessary to strengthen the skills of professionals in the water sector, including the creation and strengthening of dedicated training centers. These centers are of course a key element of a good functioning of water and sanitation services and the basin organizations and their optimal use of resources. More broadly, they also contribute to the emergence of a competent engineering, able to develop strong mitigation and adaptation projects of both technical and financial point of view and ensure support to the project management these projects.





FINANCE AND COOPERATION FOR CLIMATE CHANGE RESILIENCE IN THE WATER SECTOR



Climate Finance Development

Climate related finance is one of the four pillars of climate negotiations, and constitute a real challenge for the different negotiating groups and coalitions.

Climate finance was developed to accompany the fight against climate change and to undertake initiatives in line with climate change adaptation and mitigation programs. Thus, several investment funds were established as part of the climate change programs.

The existing financing schemes to support the fight against climate change in developing countries were delivered by a panel of diversified actors (including UNCFCC financial mechanisms, multilateral and bilateral institutions, private funds, etc).

Climate change convention includes a financial support to the Parties, with a priority access to resources for countries with the least capacities and which are the most vulnerable to climate change. Thus, the Parties have designated Green Climate Fund (GCF) as an operational financial mechanism for the Convention (ref. article 11).

The parties have also launched three special funds: Climate Change Special Fund (CCSF), the Fund for less advanced countries (PMA) in line with the Convention, and the Adaptation Fund (AF) as per the Protocol of Kyoto.

Overall, adaptation projects represent a fairly significant part of the funding. Adaptation projects being funded mostly by bilateral institutions.

In those different financial vehicles, one or more compartments are reserved to the water sector. However, the sector should deserve a greater attention. This is why the international mobilization around water comes at a very important moment of the international negotiations around climate change.

Mobilization and access to financing for climate change adaptation in the water sector

If political mobilization and the strength of the technical analysis and innovation to re-orient the global systems towards a more consistent scenario towards a moderate increase in global temperature- which will not exceed two degree Celsius- are necessary to face climate change, they are not sufficient! In fact, the fight against climate change requires the mobilization of appropriate financial resources in order to structure projects with climate change targets.

In the water sector, the need for sophisticated and costly projects has become more and more urgent. It is not sufficient to have access to services and to develop water supply distribution networks. The demand is focused on reliable water infrastructure, with new choices for increased water storage and desalination. There are several decisions, which are not related only to water



engineering, but include other sectors. In addition, decision-making is made in a context with more and more uncertainty: shall we have more or less water?

The financial needs are important, if we take into consideration the needs in terms of adaptation of all water related infrastructure, including water resources management. It is a costly infrastructure; it ranges from dams' storage to flood control, and from water production to waste water sanitation.

In this context of new uncertainties related to climate change, which affects both the relevance of technical choices for major infrastructure, the policy-making process, governance and trade-offs between uses, it becomes increasingly necessary to support developing countries that do not have their own financial resources and help fund and develop knowledge of infrastructure and monitoring of the resource and its uses.

Despite the fact that there is a considerable number of funds which are dedicated to « climate finance », the remaining question is the access to those funds. In fact, despite the existence of funds and institutions, which finance the fight against climate change, some countries find it difficult to access those resources. This is even more real when it comes to financing adaptation projects. The majority of funds has limited access because of the complexity of the process, and cannot be accessed by some countries, as they have to go through financial institutions or regional banks.

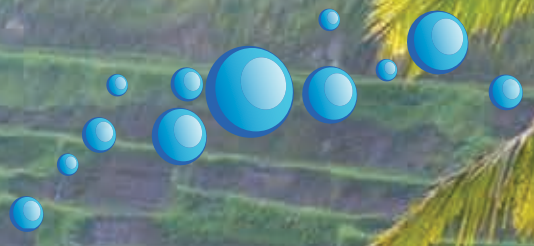
Multilateral development banks dedicate more and more funds to climate. In 2014, according to the fourth report of climate finance by multilateral development banks, the six first multilateral banks for development have mobilized more than 28 billion USD to help countries in development and emerging economies to reduce climate change effect and to adapt to it. But most of these financial instruments are drawn more towards attenuation projects (23 billion USD in 2014) and little towards adaptation (5 billion USD in 2014).

Access to these funds is binding by the technical requirements and the long time spent for processing applications; many countries experiencing difficulties in preparing bankable projects.

The inadequacy of the legal framework, the absence of a national strategy on climate change, the shortage of technical and financial management skills in some countries increases the difficulty for these countries to access financing.

It should also be noted that commercial finance, particularly through national actors, shows an interesting potential and offers funding opportunities for adaptation and resilience projects to climate change. Hence, they should not be overlooked.





RECOMMENDATIONS

1. Recognize water as a primary victim of climate change

Climate change impacts manifest itself more frequently through changes in the water cycle. The water and climate community, including the scientific community should be very aware of it, admitting it and recognizing it as a reality.

Failing to recognize the relationship between water and climate and measure what it implies, is a threat to our future.

2. Place water at the heart of climate change negotiations

The socio-economic impacts of the climate change are starting to weigh financially on the countries. Governments and the international community should therefore thrive for the mobilization of financial resources and the set-up of urgent actions in favor of water.

Thus, the UNCFCC should consider water as a priority in the discussions around both mitigation and adaptation projects, including within the Adaptation Committee. The Marrakech COP22 would then give the same level attention to both attenuation and adaptation. Adaptation has not having so far received the attention that is needed given the important issues it covers, particularly in Africa.

The agendas of water and climate should be merged in order to support financial engagement creating a more resilient society and protected ecosystems, to meet the need for adaptation and climate change as well as to reach sustainable development goals.

Water should also be included as a primary priority in terms of the adaptation part of the proposed national contributions by the Parties.

3. Engage in a water action agenda

In order to send a clear signal to all the stakeholders for the setting up of concrete actions in favor of water, with a mechanism to monitor the different engagements, it becomes urgent to adopt water prioritizing action plan and to create a political momentum, in addition to a call for action in favor of water.

This Agenda of Action for water must consider the initiatives launched during the COP21 and those that will be initiated during the Water Action Day during the COP22.

It is also recommended to launch a call to carry on the initiatives which were launched in Paris and Marrakech and to mobilize non-government bodies, particularly the private sector.

4. Improve access to financing

Beside the mobilization of promised financing on which efforts should be focused, access to these financing should be improved and simplified in order to allow a better access by countries in the developing world . It is also necessary



to strengthen the capacity of contracting authorities in particular in developing countries, for the preparation of projects that meet the criteria of climate funds.

The projects seeking financing, need to be drawn from the NDCs which are proposed by countries.

In summary and in order to translate to actions water related priorities:

- Climate funds (Adaptation Fund, Green Climate Fund) should consider projects that aim to improve the management of water resources and facilitate the adaptation for activities which are tightly linked to water availability and of good quality.
- Support to developing countries, including African countries, to develop bankable projects funded through climate finance is needed.
- The 50%-50% proportion of funds for mitigation and adaptation applied by those funds should also be revised in order to give more importance to adaptation. Water should constitute a priority in the financing mechanisms related to adaptation.
- Financing mechanisms should not cover only infrastructure projects, but also improve the knowledge on water resources and climate change impacts, capacity building, governance, monitoring and assessment of policies.

On the other hand, activities related to climate change in the field, to qualify for these funds, must respect a number of norms and standards that must be stopped in a clear, joint and collaborative manner.

5. Setting up mechanisms for monitoring of the commitments taken in the water sector and climate change

Monitoring the commitments to fight climate change in the field of water as well as the impact of the proposed actions will allow ensuring the achievement of each party commitment, which will lead to raise the ambition in terms of mitigation and adaptation to climate change.

It is strongly recommended to set up monitoring mechanisms of the commitments made in the water sector and to set up a dashboard to monitor the status and control the actions.

6. Engage in a specific water and climate change agenda for Africa

The important potential in terms of adaptation and resilience of Africa, which face important risks related to climate change, needs to be put forward. The international community of water offers a holistic expertise, which could support the different strategies related to climate change in the African continent.

Africa, the main victim of climate change disasters, needs financing and know-how in order to be able to contribute to the adaptation related initiatives. International financial institutions and Green Climate Fund should be mobilized



to help Africa to propose efficient contributions in terms of adaptation, primarily in the water sector, and to set up the appropriate measures regarding this contribution.

Africa needs are specific and require the setting up of special funds. In particular, capacity building for the mobilization of the resources should be a priority and should benefit of a particular attention.

The initiatives and some structures, which are already functioning, including the different trans-boundaries cooperation, where there are a lot of important practices in Africa, should be reinforced and enlarged.

In this regard, it is particularly urgent to elaborate and adopt a priority action plan to reach Sustainable Development Goals in Africa, in line with the initiative « Water for Africa ».

The « Water for Africa » Initiative

The impacts and consequences of climate change on Africa threaten the continent sustainable development in general, and in particular the UN program which was adopted in September 2015, and which include overall world objectives, such as access to water and sanitation, and the integrated and sustainable management of water, in order to end poverty, fight inequalities and injustice, and to face climate change by 2030.

Due to the urgency and the necessity to engage in actions to face climate change in the water sector for Africa, in order to minimize the impact of those changes in terms of access to water, health and food security, and protect aquatic ecosystems and ensure sustainable development, a call to the international community, was launched at the Rabat international water and climate conference.

This call was translated into an initiative entitled «Water for Africa ».

This initiative aims to:

1. Engage a specific agenda for water and climate change in Africa;
2. Develop and adopt a Priority Action Plan for achieving the Sustainable Development Goals related to water in Africa;
3. Facilitate access to finance African projects: climate, classic, PPP;
4. Create a specific fund for Africa.

For the implementation of this initiative several actions and measures to be taken include:

1. capacity building;
2. the development of cooperation and in particular South-South trade;
3. the transfer of technologies and good practices;
4. the establishment of an incubation and monitoring mechanism of projects and commitments.



7. Good water governance and integrated water management

The best way to adapt to climate change is to undertake an integrated water resource management, which should include the management of both supply and demand.

It is also important to raise awareness to users regarding the risks related to decision making in water resources management.

Environment needs, which are most often neglected, should be taken into consideration, in the same line with other needs.

Integrated water resources management is not only a government question. Better governance for water goes also through the implication of association in water resources management and partnerships to raise awareness, and to develop sanitation training to local population. It is a way to contribute to the effective achievement of results and ensure the success of projects related to water conservation and pollution reduction. Government institutions are called for to encourage the implication of associations in their projects, in particular when these projects require the implication of the population. For instance, in Morocco, the new law 36-15 gives a central role to the civil society and to woman in particular, in water management within river basins.

8. Improve and share water and climate change knowledge

Mastering the impact of climate change on water and the planning of adaptation measures to this change, goes through a good knowledge management, through tools and interactive information systems, as well as through planning practices for robust infrastructure and climate resistant.

Adaptation to climate change in the field of water depends on the availability of reliable and sufficient data particularly on the hydrological cycle, the uses of the resource, environmental and socio-economic aspects..., to assess correctly risks.

Unfortunately, these data are available only partially and cannot be reliable in most of the countries of the world. Data should be collected and processed, harmonized and brought in information systems to enable wide use. Since these information systems are lacking in many countries, it is urgent to promote their creation or reinforcement.

To this end, governments need to develop and implement national information systems on water covering the entire water cycle. These systems must be connected to data on everything that impacts the water resources: demography, urban development, land use, industry, agriculture...

Financing water resources' knowledge and information should be supported by politicians, as they could convince financial institutions to do so. However,



financial institutions are invited to be aware of the interest of financing water resource knowledge and related information system.

9. Reinforcing the cooperation and assistance to developing countries

International financial institutions and the Green funds are invited to assist developing countries to propose efficient contributions in terms of adaptation, primarily in the water sector, and to set up the appropriate measures.

Partnership in research and development of innovative solutions in the water sector between research institutions are encouraged between countries.

A particular attention should be given to water management in trans-boundaries basins. Thus, it is expected to assist developing countries when they have shared water to cooperate in order to build the right infrastructure and to set up the structures and management mechanism of these shared resources.

10. Research development and capacity building

Innovation and development of technical and institutional solutions in the water sector become a necessity for the attenuation and adaptation to climate change.

Thus, the international community should devote more financial resources for research and development and training in order to set up the appropriate technologies, which are economically accessible for countries in development, in order to ensure sustainability in their use.

The coupling of renewable energies and the techniques to valuing non-conventional water resources should be considered for research and development as well as for north-south partnerships.

It is necessary to have well developed engineering schemes in order to face climate change and to have a resilient infrastructure, as the infrastructure could sometime suffer from excess water and sometime from less water which requires reliable and sufficient data.



MINISTRY DELEGATE IN CHARGE OF WATER

Avenue Hassan Bencheikroune, Agdal, Rabat
Tél. : 05 37 77 87 11/15/27 • Fax : 05 37 77 86 96

www.water.gov.ma

