

IULLEMEDEN and TAOUDENI/TANEZROUFT SYSTEMES AQUIFERES: Integrated and concerted management of water resources and their liaison with the Niger River (GICRESAIT)

**Strategic alignment and regional engagement**

*Include the project's presence in the ERC master plans and/or, if they exist, the Memorandums of Understanding between countries*

**Source in national master plan**

Include the reference/name of the national master plan in which the project is included

**Source in the REC master plan**

Include the reference/name of the regional master plan in which the project is included

**Brief description of the project**

*Provide a brief history and context of the project*

**Logic of the PAP (Priority Action Plan) selection:**

Project history:

The GICRESAIT Project "Integrated and concerted management of water resources of the lullemeden-Taoudéni Aquifer System and their liaison with the Niger River" is one of three aquifer systems selected under PIDA. It corresponds to Programme 9 of the PIDA Priority Action Plan (2012-2020) for the "Cross-Border Water Resources" sector. Seven countries are affected: Algeria, Benin, Burkina Faso, Mali, Mauritania, Niger and Nigeria.

This proposal, which was not acted upon during the PIDA-PAP1 phase (2012-2020), was introduced in the PIDA-PAP2 phase due to the achievements achieved since 2012. Indeed, this project proposed at PIDA-PAP2 is based on the consistency of the results and evidence from previous studies (2004-2009) concerning the lullemeden Aquifer System (Mali, Niger and Nigeria), then extended to the Taoudéni/Tanezrouft Aquifer System (2010-2017) with four other countries (Algeria, Benin, Burkina Faso and Mauritania) due to the hydrogeological continuity of the same aquifers in the two Aquifer Systems (lullemeden and Taoudéni/Tanezrouft).

The proposed project thus concerns a single hydrogeological complex "lullemeden-Taoudéni/Tanezrouft" spread over nearly 2.5 million<sup>km<sup>2</sup></sup>. This hydrogeological complex is traversed by the Niger River for nearly 2500 km with which close hydraulic relations exist (OSS, 2017). The project aims to deepen knowledge about the potential of the aquifer in order to define a better policy of its recovery.

Project background:

This area contains potential for groundwater and under-exploited agricultural land while people suffer from food and water insecurity and are the first victims of the recurrent impacts of climate change.

Renewable groundwater resources are in the order of 19 billion m<sup>3/year</sup> including 11 billion m<sup>3/year</sup> in the Taoudéni/Tanezrouft basin and 8 billion m<sup>3/year</sup> in the lullemeden basin. Areas with high groundwater

potential have been identified. In addition, upstream, the Niger River feeds aquifers with more than 1.5 billion  $m^3/year$  in the Taoudéni-Tanezrouft basin (SAT). Downstream, in the lullemeden basin, the Niger River receives 3.3 billion  $m^3/year$  of groundwater.

In addition, groundwater withdrawals (all uses combined) from lullemeden-Taoudéni/Tanezrouft aquifers have been estimated at about 350 million  $m^3$  each year (less than 2% of renewable potential) mainly for the water needs of populations and livestock. Water needs for agriculture (18 billion  $m^3/year$ )<sup>1</sup> are, for the most part, covered by surface water.

However, these resources will be increasingly threatened by increased water demand and the impacts of climate variability and change, the degradation of their quality due to pollution from various sources. Recent initiatives in the region provide for socio-economic activities that consume groundwater anywhere and at any time of the year. These include:

- The Harmonized Global Strategy (SGH) of the Pan-African Agency of the Great Green Wall (APGMV) (Senegal, Mauritania, Mali, Burkina Faso, Niger, Nigeria, Chad, Sudan, Ethiopia, Eritrea, Djibouti) which aims to accelerate the adaptation and resilience of the Populations and Local Communities of sahelian soils by transforming the arid areas of the Sahel into the Rural Poles of Production and Sustainable Development;
- CILSS's PARIIS (Regional Support Project for the Sahel Irrigation Initiative) involving six countries (Burkina Faso, Mali, Mauritania, Niger, Senegal and Chad) which aims to significantly increase irrigation investment from 400,000 ha today to 1000,000 ha by 2020 (2030) with irrigation types: Contractual Irrigation under Public and Private Partnerships (PPP); Large irrigation conducted in state programs; Small village and community irrigations; Small individual irrigations; Improvements to the rain system (natural irrigation).

Food insecurity could increase especially in deprived areas, if agricultural practices are maintained without a real transformation of agriculture and the sustainable use of the potential for renewable water resources. However, this agricultural sector employs nearly 70% of Africa's population (AfDB, 2010) and contributes between 25% and 34% on average to GDP. In West Africa, the sector provides about 80% of the food needs for nearly 300 million people. It is the main activity of about 60% of the population and also engages on average 60% of the working population (CEA et al., 2014).

Finally, the management of these water resources is often inefficient.

## **Project objective and justification**

*Include the overall and specific objectives of the project*

*General Objectives:* The project aims to help meet the water needs of urban and rural populations, in particular, by promoting sustainable agricultural development, through strengthening people's resilience to climate extremes so that they can better adapt to global change. The project will also help these people fight poverty by ensuring food security, social stability and reducing migration, putting the issue of water at the top of regional political agendas (African Union Agenda 2063, the AfDB's top 5 priorities to support inclusive growth and the transition to green growth,, ECOWAS and UMA sectoral strategies) and international (SDG 2030, Nationally Determined Contributions (CDN) from the Paris Climate Agreement).

*Specific objectives/state of preparation:*

The project is at the conceptualization stage and is currently being considered to consist of:

- To examine and analyze the proposed projects for the surface waters of the Niger River, to assess the potential of artificial recharge planned in these projects.
- Perform simulations using a mathematical model, taking into account the impacts of climate change on water resources.

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<sup>1</sup> FAO. 2015. [AQUASTAT database](#). United Nations Food and Agriculture Organization (FAO)

- Conduct a pre-feasibility study on the floodplains of the Niger River and its tributaries, in order to assess its potential by developing a recharge scheme of the Lullemeden-Taoudéni/Tanezrouft Aquifer System using overflow waters.
- Assess alternatives (e.g. in relation to the large dam project and/or water transfers) and their limitations and provide a range of possibilities that could be applied.
- Conduct socio-economic studies of areas with high concentrations of operating water points to assess overdraft costs on water resources, and assess the development potential of new groundwater sources (high-potential areas identified in 2017) in under-exploited areas of the aquifer.
- Based on the results of prefeasibility, make more detailed designs if the benefits outweigh the costs.

### ***Justification***

The study area is confronted with increasingly recurrent climatic extremes (floods, drought) with significant impacts on the riparian society (loss of life, economic damage, environmental degradation). In addition, the increased demand for water for various uses is leading to an increasing demand on the waters of the Niger River and the construction of groundwater catchment works.

The project is a pre-feasibility study that will be devoted to field investigations with the aim of increasing the resilience of populations in this arid and semi-arid region of Lullemeden and Taoudéni/Tanezrouft, and proposing structuring projects (intra/inter-basin water transfer, infrastructure in relation to large dam projects) that will be studied in detail.

These feasibility studies include the identification and characterization of all plains and flood zones, the application and adaptation of proven methods of controlled recharge of aquifers to increase drinking water supply capacity especially during dry seasons of high water demand, the management of increasingly recurrent climatic extremes (floods, drought) that are experienced each year by the populations living along the giCRES , socio-economic and environmental investigations, and the management of sometimes conflicting demands on groundwater resources (using management tools such as water management and allocation models).

Socio-economic investigations will be conducted in areas with high concentrations of operating water points to assess overdraft costs on water resources, and to assess the development potential of new groundwater sources in under-exploited aquifers. Indeed, the joint management of the surface waters of the Niger River and the groundwater of the Lullemeden and Taoudéni-Tanezrouft aquifers, in order to be sustainable, must be based on a thorough socio-economic analysis based on an individual database describing the actual behaviour of the user of the resource. This analysis should focus on an appropriate assessment of the actual mobilization costs as well as the actual valuation of the resource used.

Although the underground resource is not currently being used intensively, it is established that it is expected to experience increasing pressure as a result of the combination of at least two important factors:

- The already anticipated climate change that will reduce natural recharge in a fairly severe way and further disrupt the economic life of these already fragile regions.
- The rapid growth in water demand as a result of the economic, demographic and urban development that the region will experience in the years to come.

In order to meet these threatening challenges, proper control of this demand would require the use of both technical resource conservation and economic instruments to achieve optimal allocation of water mobilized between alternative uses.

In order for economic instruments to lead to a sustainable management of the resource increasingly in demand by increasing pumping, it is essential to launch studies as soon as possible to enable a detailed knowledge of the real costs of mobilization.

### **Location/Site**

Make it clear where a static infrastructure is located or where a linear infrastructure is going

The site concerns the lullemeden-Taoudéni/Tanezrouft aquifer basin involving national portions of the seven countries sharing the Aquifer system (Algeria, Benin, Burkina Faso, Mali, Mauritania, Niger and Nigeria. For example, there are highly populated areas, areas with high potential for groundwater.

### **Image/map files**

It is possible to download a map of the project to indicate its location. There are two options.

- A. Favorite option: download a file ". kmz."
- B. Prepare a "screen print"

### **Size/capacity**

Include the capacity of the project (if energy: MW, if transport: Km, if Water: m<sup>3</sup>, if ICT: Tbps))

The capacity of the project is expressed in m<sup>3</sup>.

The project concerns the lullemeden Taoudéni/Tanezrouft Aquifer System, whose reserve is estimated at 15000 billion m<sup>3</sup> with usable resources of 19 billion m<sup>3/year</sup>. This is therefore a huge potential for the development of the economic activities of the region.

### **Existing or planned projects related to the proposed project**

*Please indicate whether the proposed project is parallel to another existing or planned infrastructure in all four areas of PIDA or whether it serves an existing or planned infrastructure*

Aims to provide an indication that the project is geographically aligned or serves an infrastructure project in another area of PIDA

Please specify whether "parallel infrastructure" exists/is operational or is in the process of planning

Please note that the term "parallelly aligned" applies to cases where geographic overlap with another PIDA infrastructure (existing or planned) is less than 50%

Two major groundwater initiatives currently underway are:

- Implementation of the Harmonized Global Strategy (GHS) of the Pan-African Agency of the Great Green Wall (APGMV) (Senegal, Mauritania, Mali, Burkina Faso, Niger, Nigeria, Chad, Sudan, Ethiopia, Eritrea, Djibouti) which aims to accelerate the adaptation and resilience of the Populations and Local Communities of sahelian soils by transforming the arid areas of the Sahel into the Rural Poles of Production and Sustainable Development;
- CILSS's PARIIS (Regional Support Project for the Sahel Irrigation Initiative) involving six countries (Burkina Faso, Mali, Mauritania, Niger, Senegal and Chad) which aims to significantly increase irrigation investment from 400,000 ha today to 1000,000 ha by 2020 (2030).

While these two initiatives are not included in the PIDA initiative, they are worth considering.

### **Please provide more details for your choice above :**

Letters of endorsement (in 2008) of countries and the Niger Basin Authority (ABN) to join the GICRESAIT initiative;  
Abuja Declaration for the creation and establishment of a consultation mechanism (consultation framework);

### **Project technical specification**

*Technology associated with the project (e.g. solar, wind, smart lines, etc.)*

Technology used. Example: for energy projects: solar, hydraulic, wind,. For transmission lines, à two-lane highway, 3-lane highway, etc.

Solar and wind energy will be used for the development of climate-smart agriculture, and for access to safe drinking water for the most deprived rural populations(The rate of access to drinking water for the urban

population exceeds 80%. In rural areas, it varies on average between 50 and 80%, with the exception of Algeria 98%).

### **Innovation, / "smart" features of the project**

Here, indicate what are the characteristics of the proposed project that are innovative. Innovation can include deployed technology, business and revenue models, financing mechanism, inclusive implementation and climate resilience.

- Action to increase water potential/water availability by artificial recharge from flood waters;
- Climate-resilient Intelligent Agriculture (Pilot): Development of water-efficient irrigation techniques for climate-resilient agriculture
- The development of remote sensing to inventory floodplains;
- Evaluation of groundwater resources for agricultural water, follow-up of land/land use and inventory of floodplains with Remote Sensing;
- Strengthening the capacity of technical structures through training sessions on adaptation to climate change.
- Metrics of Adaptation to Climate Change.

### **Market size**

*Information on beneficiary populations and/or expected demand for proposed infrastructure*

If possible, provide information on the number of people affected by the project and/or the expected demand for the use of the infrastructure

- 30 million people live in this space.

### **Project funding (USD)**

Include the estimated COST of the project. This cost should focus solely on CAPEX, the funds needed to build the infrastructure project.

If no studies are available, the EM and/or RECS may use relevant reference points for the project and the sector. (e.g. a unit cost per MW for power plants, or a unit cost per KM for roads and highways)

PAP/PIDA has provided funding of US\$10 million to complete the project's pre-feasibility study. It is in the initial conceptualization stage.

A concept of a complete project and a preliminary budget need to be developed, which can be used as a basis for approaching potential financial partners (leverage).

As the project is a pre-feasibility study, private sector funding cannot be provided. It is proposed to seek a grant.

### **Public procurement action for women;**

*Include the number and content of gender actions for the proposed project. These are actions that could increase women's opportunities to participate in the infrastructure value chain (e.g., preferential contracting of women-owned SMEs or companies certified as subcontractors).*

Because of the uniqueness of women's issues in infrastructure, the gender criterion was the subject of political agreement at the Specialized Technical Committee (STC) at the second regular session of the African Union (AU) in 2019. This also led to the creation of the African Network for Women in

Infrastructure (ANWIn), which led the definition of the criteria as an aspiration to ensure women's participation in infrastructure development.

The project includes:

- better participation of women in productive social and economic activities and the schooling of children, especially girls, thanks to the time recovered from the drudgery of water;
- job creation and increased income for farmers (in particular), through the development of agricultural land (Smart Agriculture).

### **Last known milestone**

*Include the number and content of gender actions for the proposed project. These are actions that could increase women's opportunities to participate in the infrastructure value chain (e.g., preferential contracting of women-owned SMEs or companies certified as subcontractors).*

Refers to the project stage:

S1: project definition and planning

S2A: Prefeasibility study

S2B: feasibility study

S3A: Project structuring

S3B: Financial close

More information on project steps can be found in the IIDA Virtual Information Centre (VPIC) project dashboard [at: https://www.au-pida.org/projet-stages-and-key-milstones/](https://www.au-pida.org/projet-stages-and-key-milstones/)

S2A: Prefeasibility study