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# Study on Programme for Infrastructure Development in Africa (PIDA)

## Phase III

### ➔ PHASE III REPORT TWRM

 **SOFRECO**

in consortium with



# PHASE III REPORT TWRM

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# INTRODUCTION

The objective of the Phase III report is to present a strategic framework, infrastructure development programme, and implementation strategy for PIDA in the TWR sector. The proposals made are based on the challenges and priorities identified in Phase I of the PIDA project. During Phase I and Phase II, a broad consensus has been arrived at through a sustained participatory approach and consultative process with key stakeholders during the inception workshop held in Addis Ababa in July 2010, the field visits achieved in August and September 2010, the Phase I validation workshop held in Libreville in April 2011 as well as the regional consultations held in Nairobi, Libreville, Abuja and Rabat with the RECS in October 2011.

The consultations have focused on:

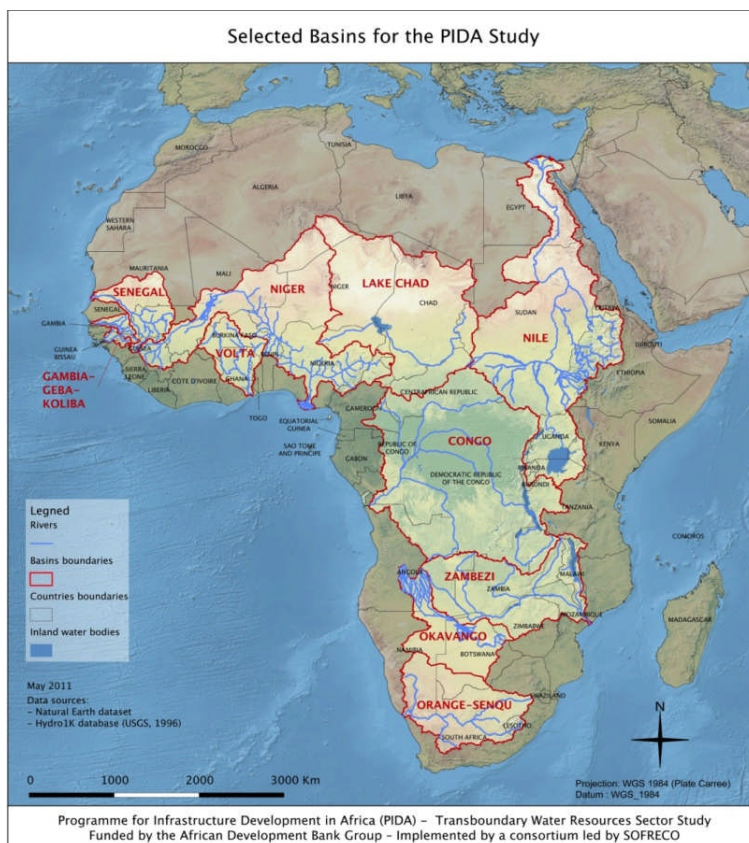
- The development of the overarching principles which should guide policy orientations and decisions on regional integration;
- Agreement with the stakeholders on the major challenges to be considered for the development of regional and continental infrastructure, based on the studies carried out during Phase I and Phase II of the PIDA Study;
- Agreement with the stakeholders on the strategic objectives and required policy and institutional interventions to be implemented in order to meet the identified challenges.
- Agreement on the project selection process and selected projects

Following the presentation of the key findings from Phase I and Phase II, the Phase III report covers three main parts, namely a strategic framework including project selection criteria, a Priority Action Programme (PAP) and a implementation strategy.

The PIDA study focused on ten selected Transboundary Lake and River basins, namely Lake Chad, Congo, Gambia-Geba-Koliba, Niger, Nile, Okavango, Orange-Senqu, Senegal, Volta and Zambezi. The selected basins straddle, partly or completely, most the African countries and account for 51.5% of African land area and 80% of the total area of the African international basins.

In addition to the ten surface water basins, three transboundary aquifers have been selected for inclusion in the PIDA studies and development of the PAP, namely the Nubian Sandstone Aquifer System, the North West Sahara Aquifers System and the lullemeden Aquifer System.

**Figure 1: Selected surface water basins for the PIDA study**



# 1. SUMMARY SECTOR OUTLOOK

## 1.1 Key strategic messages

- Transboundary Water Resources represent 80% of Africa's total freshwater.
- The Renewable Water Resources of the African continent represents only 9 % of the World Water Resources compared to 28% in Asia and these resources are very unevenly distributed.
- About half the African continent faces some sort of water stress or water scarcity and Several countries that were in a situation of vulnerability in 2005 will become water stressed or water scarce in 2040.
- Due to population growth, the demand for food is expected to double between now and 2040.
- As the main water demand driver is food production, a water crisis would mainly be a food crisis.
- The Nile and the Orange basins, and to a lesser extent the Zambezi, the Volta and the Niger basins are the ones facing the biggest challenge. In these basins, the competition between water use sectors and the environment is likely to increase given the growing pressure on freshwater resources.
- Africa has the lowest level of water storage capacity and irrigated agriculture globally. Currently, merely 20% of the potential irrigation area in Africa is exploited. An expansion of approximately 13 million ha would be a realistic target.
- Investment in irrigation expansion in the next 30 years will not be enough to avoid a water and food crisis if significant investments are not made in:
  - increasing the productivity of rainfed agriculture
  - increasing irrigation efficiency
  - intra-African food trade
- The solution to the water crisis thus lies largely outside the water sector
- Due to lack of water, food self-sufficiency will not be possible in many African countries. Food security will strongly depend on intra-African food trade and "virtual water "strategies.
- The annual investment needs in the overall water sector are expected to be around US\$ 49 billion per year. The PIDA investment needs are focused on multi - purpose water storage and hydropower infrastructure with an estimated total annual investment need of US\$ 25 billion.
- Investment in water storage other than for hydropower does not attract private sector finance, but is critical for economic development and should be provided through public investment.
- Investments in water infrastructure are only effective if well integrated into coherent, cross-sectoral development strategies and infrastructure investment programmes.

- The majority of L/RBOs are not focused on infrastructure development projects. Where there is still a significant development potential, the “core business” of the L/RBOs needs to be oriented towards the preparation, implementation and operation of joint infrastructure.
- Policy frameworks are still mostly inadequate in addressing transboundary aquifers and conjunctive use of surface water and groundwater.
- Without stronger regional cooperation for optimal use and management of shared surface and groundwater water resources – based on sharing investments & benefits - the African continent will face highly inefficient water use and rapidly increasing risks of conflicts over water.

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## 1.2 Overview of the current baseline

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With a focus on the ten selected PIDA basins the following sections present a brief summary overview of the current baseline in terms of available water resources at present and existing infrastructure against the background of estimated potential. Enabling factors such as the given policy environment and basin planning frameworks are also presented.

The overview informs the then following sections on future water demand estimation and investment needs, which in turn forms the basis for the defined PIDA TWR vision and objectives and the programme framework.

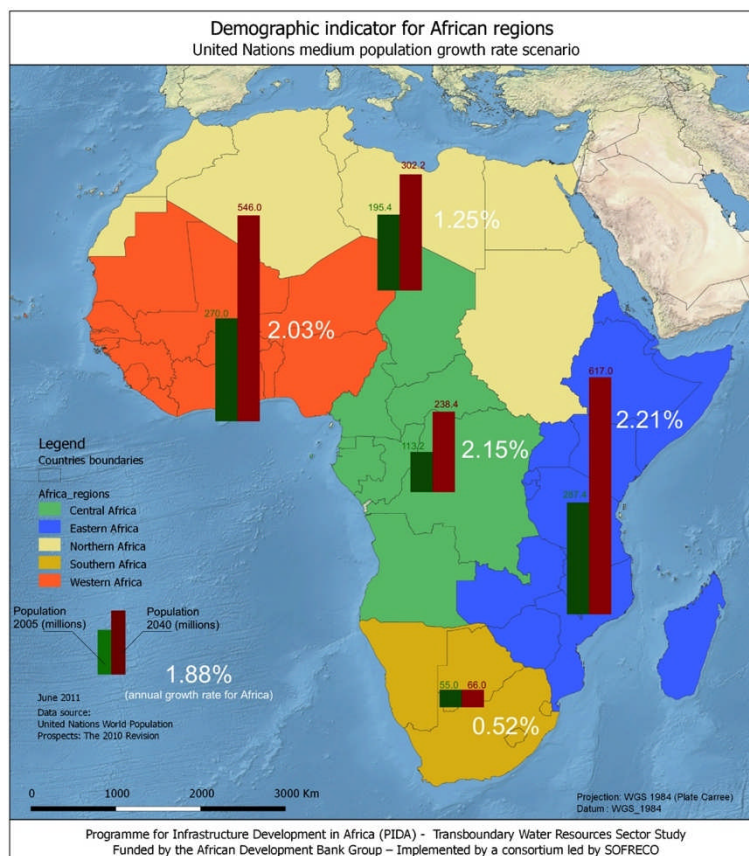
### 1.2.1 Water Demand Drivers

The Outlook 2040 identifies three primary drivers for increased water demands in the agricultural, industrial and domestic sectors, namely

- Population growth
- Food demand and policy objectives
- Gross Domestic Production (GDP) growth

#### ***Population growth***

Africa’s population is expected to almost double between 2010 and 2040, with a percentage of population living in urban areas rising from 44% in 2010 to 57% in 2040.



**Figure 2. Map of demographic indicator for African regions (Data source: United Nations, World Population Prospects: The 2010 Revision, <http://esa.un.org/unpd/wpp/index.htm>).**

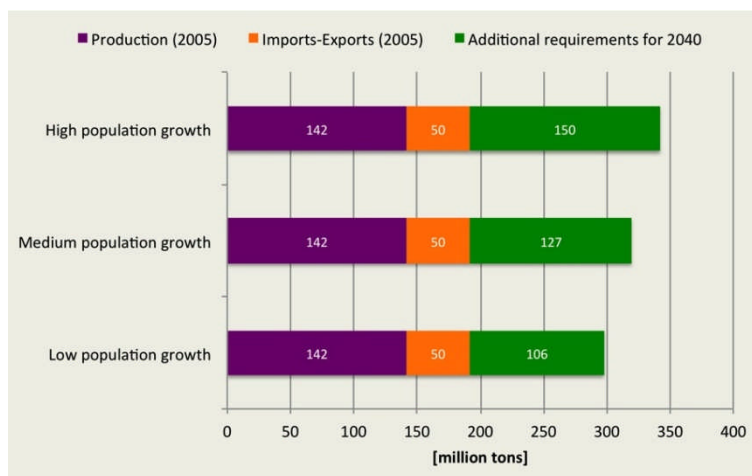
In the period from 2005 (reference year) to 2040 (planning horizon), the African region with the highest annual population growth rate is Eastern Africa (2.21%), followed by Central Africa (2.15%) and Western Africa (2.03%). Southern Africa is expected to experience a slower annual growth rate of 0.52% (see Figure 2). The average annual population growth rate for the whole African continent is estimated to be around 1.88 %.

In the selected PIDA basins, the population increase follows the continental trend with most of the basins expected to experience a population increase of around 100% (Figure 2). The Nile basin will remain the most populated basin in absolute terms, followed by the Niger and Congo river basins. Combined with forecast higher living standards and GDP growth, population growth will be the major driver for future food and water requirement.

### ***Food demand and food policy objectives***

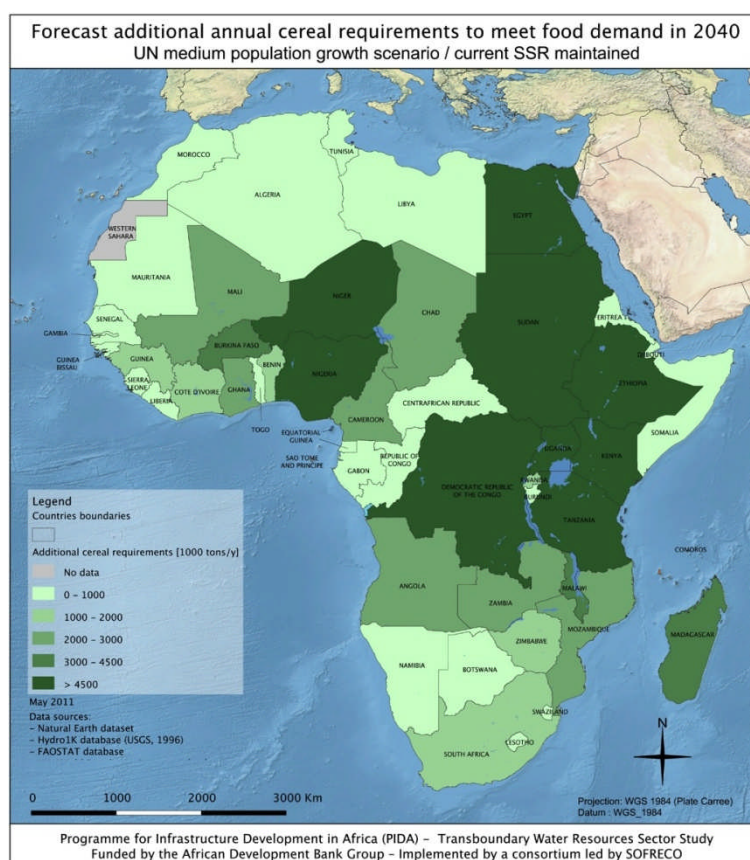
As a consequence of the expected high population increase the demand for food will rise significantly between now and 2040.





**Figure 3. Current cereals consumption and forecast requirements for 2040 in Africa.**

Ensuring increased Food production and improving access to Food will continue to be a key challenge For the African continent. It is Forecast (see Chapter 4 For details) that the increase in total cereal requirements in 2040 in Africa (compared to the current situation) is expected to range between 56% and 78% depending on the scenario considered (Figure 3). In terms of cereals quantities, it represents an increase ranging from 106 to 150 million tons (compared to 192 million tons currently).



**Figure 4. Additional annual cereal requirements to meet food demand by 2040.**

The spatial distribution of these additional food requirements (figure 4) mirrors the overall population growth trend. In terms of the selected PIDA basins, the Nile, Congo and Niger River basins (and the Zambezi to a lesser extend) are the ones facing the biggest challenge.

In order to meet the increased food demand countries will have to make clear food policy choices in order to implement long-term measures that guarantee sufficient access to food of the population in the long-run. Commonly two different food policy choices are considered, food self-sufficiency and food security. The former aims at achieving a 100% self-sufficiency ratio of domestic food production, often requiring significant investments in the agricultural sector in order to keep up with increasing domestic food demand. The latter approach includes option to supplement domestic production with food imports in order to meet domestic production shortfalls. Given the expected population increase it is likely that a combination of investments in irrigated agriculture to increase domestic production and trade-based food security options need to be pursued by most countries in parallel. With some African countries having the potential of becoming large-scale net cereal exporters, regional investment and trade options should be promoted.

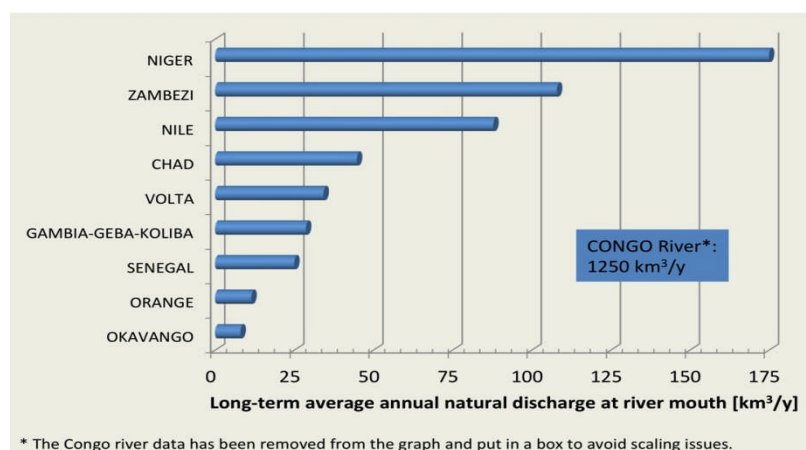
### GDP growth

Detailed macro-economic analyses and forecasts carried out by the PIDA macro-economic expert team expect a relatively high economic growth rate for Africa between now and 2040, estimated to be at 6% per year.

Around 40 countries out of the 53 are expected to exhibit a growth rate higher than 5% per year on average for the period 2008-2040 and 20 African countries are forecast to experience an average growth higher than the continental growth rate of 6%. The forecast high overall GDP growth rate will have significant impacts on industrial water requirements since water is a production factor of nearly all economic goods. Likewise, with increased economic growth energy consumption will rise and increase the water requirements the cooling of thermal power plants. Higher GDP also results in higher living standards with a commensurate increase in water requirement for domestic uses by urban and rural populations.

### 1.2.2 Overview of surface and groundwater resources

The total Internal Renewable Water Resources (IRWR) - the long-term average annual flow of rivers and recharge of aquifers generated from endogenous precipitation - in Africa as a whole are estimated to be 3931 km<sup>3</sup> per year. Africa represents 9.2 percent of the World IRWR, compared to 28% and 29.1% in Asia and South America respectively. The IRWR in Africa is distributed between surface water (3833.63 km<sup>3</sup> per year) and groundwater (1419.28 km<sup>3</sup> per year) with an overlap of 1324.19 km<sup>3</sup> per year.



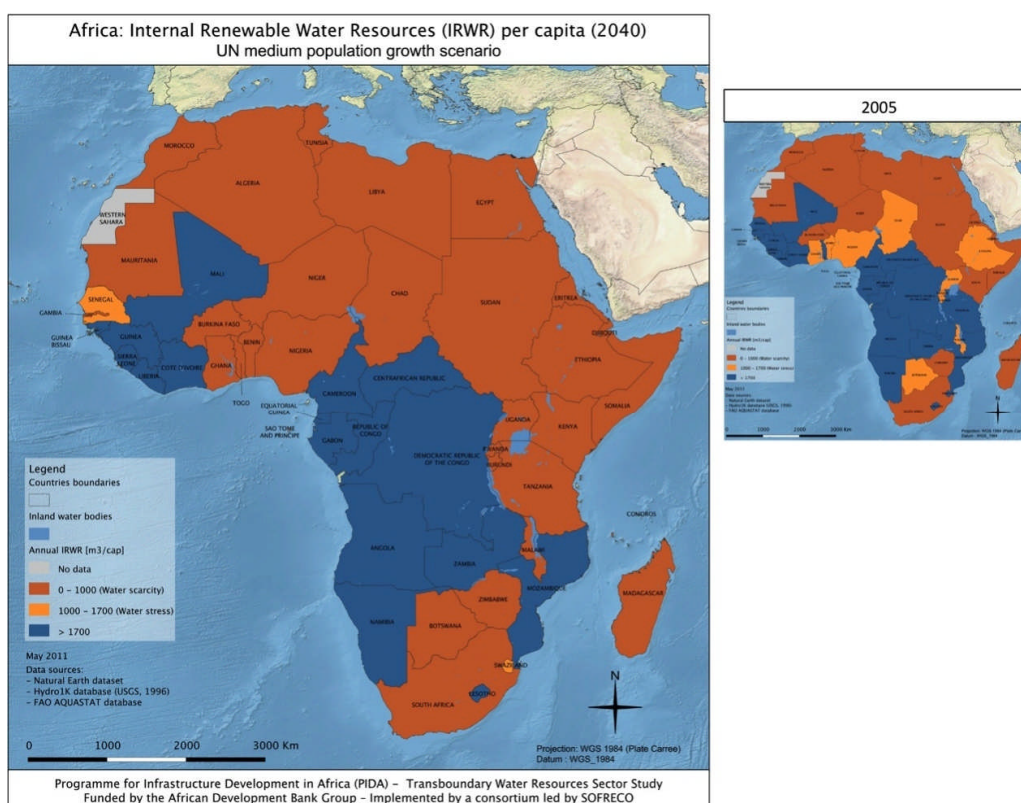
**Figure 5. Long-term average annual natural discharge at river mouth.**

At the lake or river basin scale, the renewable water resources available are defined as the natural discharge of the river (and groundwater flow) that flows into the sea (or inner lake) in natural conditions. In other words, it represents the river discharge before the construction of infrastructure and withdrawals of water. The disparities amongst the selected river basins are significant. The river basin with the highest natural discharge is the Congo, with a long-term average natural flow around 1250 km<sup>3</sup> per year, which represents around seven and 14.5 times the value for the two next biggest basins: the Niger and Zambezi river basins respectively. The aggregated annual natural discharge in the ten selected basins is around 1773 km<sup>3</sup>/y, which represents 46.3 % of total renewable water resources in Africa and around 80% of the renewable water resources in the continent's international basins.

Water resources are unevenly distributed within Africa, due to physical and climatic conditions. Most of the IRWR are located in the central region, mainly in the Congo river basin and the upper (Guinea) and lower (Nigeria) part of the Niger river basin. North Africa is particularly poor in terms of internal renewable water resources, of which most are groundwater resources.

While absolute IRWR figures are of indicative value, the concept of IRWR per capita is of greater relevance for strategic planning as this more accurately depicts the degree of water availability for the various users and uses.

At present about half the African continent faces some sort of water stress or water scarcity. The situation is predicted to become significantly more aggravated in 2040 by when the only regions where the IRWR per capita is considered as sufficient are the Congo River basin and Guinea, Guinea Bissau, Sierra Leone and Liberia. Several countries that were in a situation of vulnerability in 2005 will become water stressed or water scarce in 2040. It is also interesting to notice that the majority of the countries sharing international river basins (except Congo) would have to face severe water scarcity challenges in 2040.

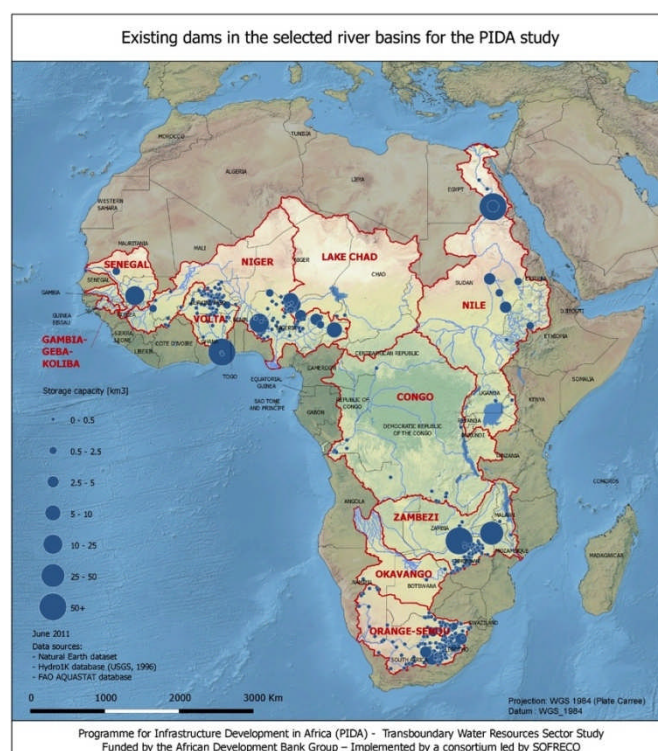


**Figure 6: Map of Internal renewable surface and groundwater resources per capita in Africa. Comparison between the reference year and the situation in 2040 for a medium population growth scenario (Data sources: FAO AQUASTAT database and UN World Population Prospects).**

### 1.2.3 Overview of the existing water infrastructure

#### *Reservoirs and hydropower plants*

Most of the dams in Africa have been built before 1988 with only a few completed in the last two decades (the Lesotho Highlands Water Project (Katse and Mohale dams and associated transfer tunnels) and Tekeze dam (TK-5) in Ethiopia arguably being the most significant ones). While a number of pre-investment studies are ongoing, at present only a few projects are at the stage of detailed design.



**Figure 7. Map of the existing dams in the selected basins. Points are proportional to the total storage capacity of the dam.**

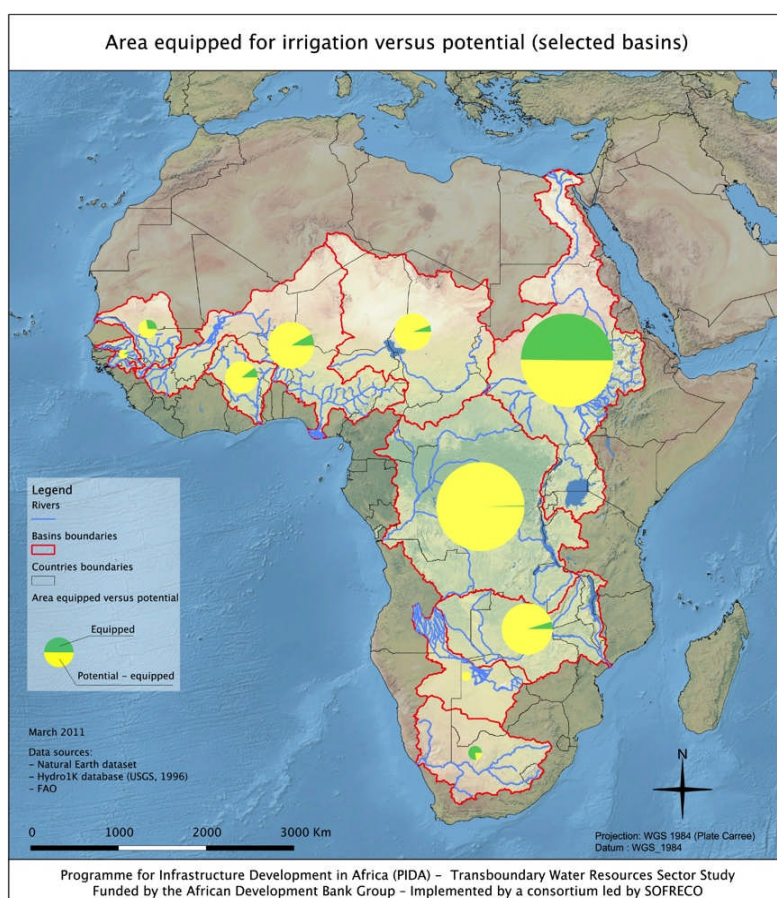
Whereas multi-purpose dams are increasingly being conceptualized, most of Africa's dam infrastructure in the past has been built with hydropower generation as a primary purpose (followed by irrigation water supply). Nonetheless, at present, only 8.4% of the total estimated hydropower potential in the ten PIDA basins are exploited with the total installed capacity at around 15 756 MW. Of this more than 60% are located in the Nile and Zambezi river basins with 5407 MW (34.31%) and 4904 MW (31.15%) installed capacity respectively and a further 27% of installed capacity is found in the Niger (2068 MW or 13.12%) and Volta river basins (1511 MW or 9.59%). Thus, a total of 84% of currently installed capacity is concentrated in these four river basins. Despite these basins having the highest installed capacity (in terms of absolute capacity), the bulk of the estimated (and currently unexploited) potential is also located in these basins, with only a small percentage of estimated potential in the remaining PIDA target basins. While hydropower projects in other basins are possible, the future increase in the utilization of the existing (continental scale) hydropower potential would have to target these four basins primarily.

Similar to the situation described for installed hydropower capacity, the bulk of the currently existing storage capacity is concentrated in only a few basins. Of the total storage capacity in the PIDA basins of 669 billion m<sup>3</sup>, 66% are in the Kariba, Cabora Bassa (both Zambezi basin), Akosombo (Volta basin) and High Aswan dams (Nile basin) as illustrated in figure 7. Despite the

comparatively low storage capacity in absolute terms (given the relatively small total annual run-off) the Orange-Senqu River basin is noteworthy in that it is one of the most developed river basins in the world, with several large dams and the world's largest international inter-basin-transfer.

### ***Irrigated areas***

In the selected PIDA basins the area equipped for irrigation at present stand at around 6.2 million hectares, which represents around 20% of the estimated potential in these basins. At the continental scale the irrigation potential in Africa has been estimated by FAO<sup>1</sup> at more than 42.5 million ha amongst which 30.6 million ha are located in the selected basins for the PIDA study. Almost one third of this potential is located in only two humid countries: Democratic Republic of the Congo and Angola.



**Figure 8. Area equipped for Irrigation versus potential**

Critically, the biggest challenge for the expansion of agricultural production in Africa (both irrigation and rain fed) is the low efficiency of production. Thus, in addition to increasing the area under production, significant investments need to be made in improving production efficiency if food production targets for 2040 are to be met.

### ***Rivers and lakes transport infrastructure***

The main regional inland waterways in Africa are limited to five rivers, the Nile, the Congo, the Niger, the Senegal and the lower Zambezi Rivers, and three lakes, Lake Victoria, Lake Tanganyika and Lake Malawi. Currently, river and lake transport serve essentially only the people living

<sup>1</sup> The FAO, the irrigation potential is an estimation of land suitable for irrigation the irrigation potential can therefore be overestimated in some basins depending on the availability of other factors.

directly along rivers while river and lake based long haul traffic has practically completely disappeared. The main reason is that the rivers and lakes are not maintained appropriately maintained for navigation and transport purposes, for example dredging is not carried out, the navigation systems are not correctly maintained and the fleets are old and in very poor conditions.

#### 1.2.4 Overview of the existing governance frameworks

The review of governance frameworks<sup>2</sup> (policy, legal, institutional) for Transboundary Water Resources Management (TWRM) assessed three distinct levels – the continental level with an emphasis on the policy framework provided by the African Union (AU), the regional level with a focus on the role of Regional Economic Communities (RECs) and at shared river basin level with emphasis on the role of international organisations (L/RBOs).

With regards to **policies** it was found that there is a high degree of commonality between policy objectives across the continent and water is recognized throughout as a key driver for achieving economic growth and improved social conditions. However, the policy frameworks are still mostly inadequate in addressing the management of transboundary aquifers as well as the issue of conjunctive use of surface water and groundwater.

In terms of the **legal framework** there are numerous bilateral and multilateral basin-specific agreements but regionally agreed rules for TWRM in the form of regional (framework) agreements only emerging. At present only the SADC region has adopted a regional framework agreement (Revised SADC Protocol on Shared Watercourses). However, other RECs are in the process of developing and adopting similar regional legal frameworks and already have strong and functioning institutional mechanism for cooperation over shared water resources (e.g. Water Charters and basin agreements).

At present the difference between regions does not lie in the policy framework, but in the vastly differing strengths of the institutional mechanisms for implementing the expressed policy objectives.

The majority of L/RBOs are not focused on infrastructure development projects. Instead they have an advisory mandate with the emphasis being more on determining an overall management system for the basin that balances socio-economic development needs with the need for protecting the basin's biodiversity and the significant environmental services the basin provides to its population. Only very few L/RBOs have a mandate for infrastructure management and operation. Against this background, it is recommended that:

- In the basins where there is a significant development potential, the “core business” of the L/RBOs needs to be oriented towards the preparation, implementation and operation of joint infrastructure in order to be in line with the African Water Vision 2025.
- The identification of concrete joint investment opportunities with significant socio-economic benefit for the people of the basins will generate the necessary political and social motivation for developing strong cooperation agreements and institutions.
- The operation of jointly owned infrastructure should generate additional financial resources to develop the capacity of the organizations.

The governance framework for the management of transboundary aquifers is comparatively less developed. However, efforts to strengthen the management architecture for shared groundwater are increasingly made. At present groundwater is considered only to a very limited extend in continental or regional **policies** and designated policies for the management and development of shared groundwater do not exist. Likewise, regional **legal frameworks** for the management of

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<sup>2</sup> In this context governance frameworks encompasses the inter-related framework of policies, laws (domestic legislation and international agreements) and institutional mechanisms within which the management of water resources takes place.

shared aquifers do not exist on the continent, with the exception of the Revised SADC Water Protocol on Shared Watercourses.

In terms of the institutional framework, at the **continental level** AMCOW has established a Africa Groundwater Commission. Its main objective is to generate ongoing political buy-in and support in a roll-out of the AMCOW Brazzaville decisions towards the vision of **“An Africa where groundwater resources are valued and utilized sustainably by empowered stakeholders.”** At the **regional level** the SADC, ECOWAS, IGAD have been involved in the development or the management of transboundary aquifers.

At **shared aquifer system level** – analogous to lake/ river basin for surface water –only three cooperative structures for the management of transboundary aquifers exist and are at various stages of their development. Additional structures are currently being set up for some aquifer systems in southern and West Africa. A key gap is the current lack of management arrangements for the conjunctive use of transboundary surface and groundwater resources.

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### 1.3 Summary of forecast water requirements

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An estimation of the future water demand by 2040, though subject to a number of uncertainties and therefore somewhat crude, provides an indication of the degree of TWR development that the regions (basins) and the continent as a whole will have to address. Such estimate serves as a basis for the formulation of realistic long-term objectives, to be targeted by policies and programmes at the continental and basin level in order to effectively balance infrastructure development with future demands within the given limits of infrastructure development potential.

Estimates of future water demands have been developed through an extensive modeling exercise carried out during PIDA Phase I<sup>3</sup>. These estimates were developed for a total of 12 development scenarios, using “low”, “medium” and “high” population growth scenarios as well as well as four different irrigation development scenarios, namely

- **Status quo:** the current situation in the irrigation sector remains unchanged at the 2040 horizon (in terms of irrigated area, irrigation system efficiency, irrigation technologies, crop water requirements etc.)
- **Business as usual:** the growth rate of irrigated area during the last 30 years (from 1978 to 2008) will remain constant until 2040. Other parameters (crop yields, irrigation system efficiency, technology, etc.) remain unchanged.
- **Accelerated irrigation expansion:** identical to the second in all respects, except that it assumes that the growth rate of irrigation area experienced during the last 30 years (from 1978 to 2008) is doubled in the forthcoming 30 years until 2040 (thus assuming political choices oriented towards accelerated irrigation expansion).
- **Full irrigation:** it is assumed that irrigation expansion will be the only source of food to bridge the gap between the food requirement and the current situation. This unrealistic assumption is of analytical interest, rather than for practical application. This scenario will provide an estimated upper bound on projected water requirement for agriculture. In this scenario it is also assumed that the current crop yields will remain unchanged in the future.

In combining the above factors and scenarios the 12 scenarios were modeled and analyzed as follows.

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<sup>3</sup> For a full description of the methodology and results see “Outlook 2040” report.

**Table 1: Scenario overview**

	Exogenous factors	
	Population Growth	Irrigation development policy
Scenario 1	Low	Status-quo (lower bound)
Scenario 2	Medium	Status-quo (lower bound)
Scenario 3	High	Status-quo (lower bound)
Scenario 4	Low	Business as usual
Scenario 5	Medium	Business as usual
Scenario 6	High	Business as usual
Scenario 7	Low	Accelerated Irrigation expansion
Scenario 8	Medium	Accelerated Irrigation expansion
Scenario 9	High	Accelerated Irrigation expansion
Scenario 10	Low	Full irrigation (upper bound)
Scenario 11	Medium	Full irrigation (upper bound)
Scenario 12	High	Full irrigation (upper bound)

### 1.3.1 Analysis of gross water requirements

In 2005, the volume of water withdrawn from the river systems across Africa was about 265 km<sup>3</sup> (or billion m<sup>3</sup>) per year amongst which 66 km<sup>3</sup> per year lost by evaporation losses from man-made reservoirs, 9 km<sup>3</sup>/y for industrial uses, 21 km<sup>3</sup> per year for domestic uses and 170 km<sup>3</sup> for the agricultural sector.

It is estimated that by 2040, the gross water requirement - the volume of water that must be withdrawn from the river system for domestic, industrial and agricultural uses - for

- **domestic uses** will range between **135-161 km<sup>3</sup>** per year, depending of the population growth rate scenario. In other words, the impact of the future population growth rate on the gross water requirements can be as high as 20%. According to the estimated future annual GDP growth rate of 6%
- **industrial** gross water requirements will total around **35 km<sup>3</sup>** per year.
- **evaporation losses from man-made reservoirs** will be a total of around **77 km<sup>3</sup>** per year, more than twice the gross water requirement for industrial uses.

For the **agricultural** sector, the water withdrawals in 2040 will vary depending on a series of economical, technical, climatic and political choices and factors that are difficult (if not impossible) to estimate. However, modeling the four scenarios (for irrigated agriculture development) described above provides a good indication of the expected order of magnitude of the future withdrawals for the irrigation sector:

**Status-quo scenario:** If the current situation in the irrigation sector remains unchanged at the 2040 horizon (in terms of irrigated area, irrigation system efficiency, irrigation technologies, crop water requirements etc.), the withdrawals will remain unchanged. In this status-quo situation, the gross water requirements for irrigation will be around **170 km<sup>3</sup>** per year in 2040.

**Business as usual scenario:** If the irrigated area growth rate of the last 30 years (from 1978 to 2008), estimated to be around 0.15 million ha per year, remains constant until 2040, the irrigated area will increase by around 35% in 2040. This represents an additional annual irrigation

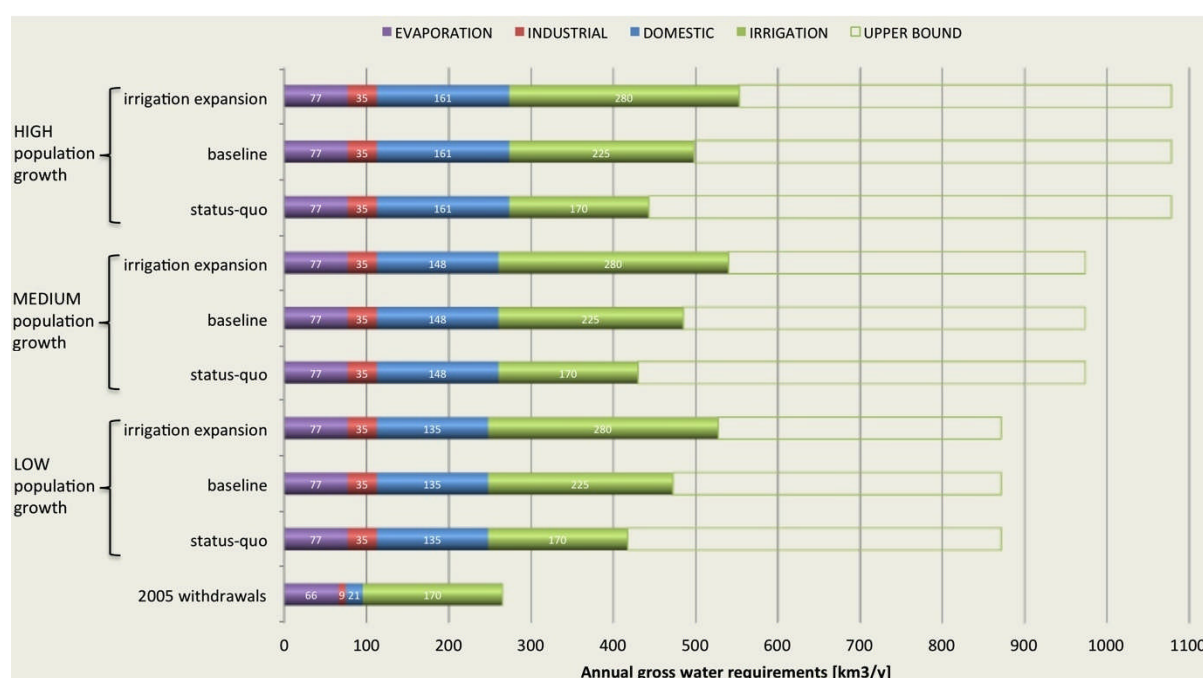


withdrawal of **55 km<sup>3</sup>** per year in 2040. In this scenario, the total withdrawals for the irrigation sector would be **225 km<sup>3</sup>** per year (170 km<sup>3</sup> + 55 km<sup>3</sup>).

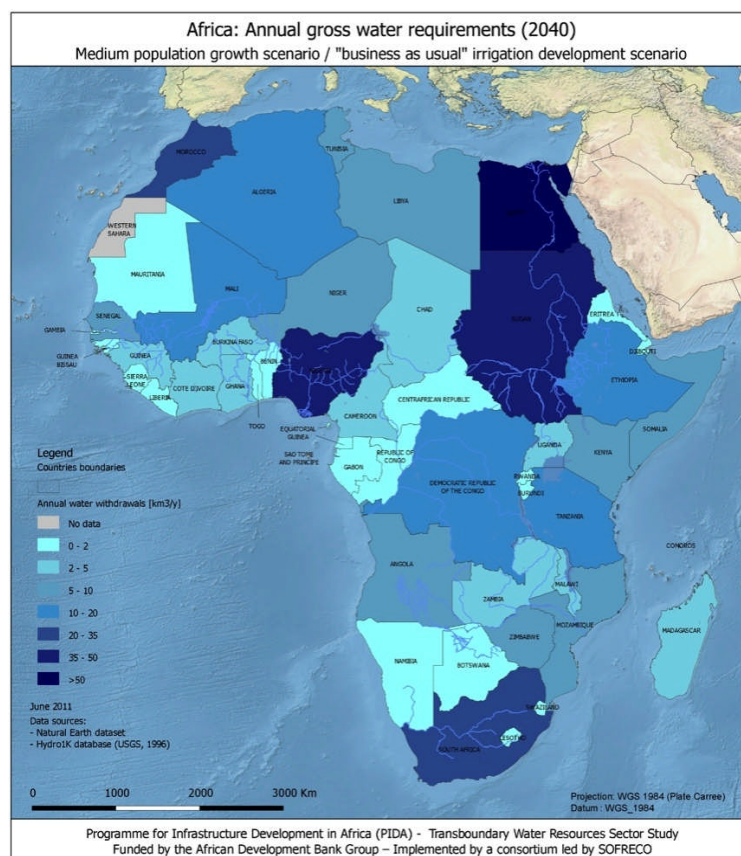
**Accelerated irrigation expansion scenario:** a doubling of the growth rate for the expansion of irrigation areas over the next three decades (compared to the previous 30 years from 1978 to 2008) would lead to continental gross water requirements for the irrigation sector of around **280 km<sup>3</sup>** per year.

**Upper bound scenario:** In the theoretical upper bound scenario where it is assumed that irrigation expansion will be the only source of food to bridge the gap between the food requirement and the current situation the estimated additional withdrawals for the irrigation sector range from **400 km<sup>3</sup> - 580 km<sup>3</sup>**.

In the case of three first irrigation scenarios (status-quo, business as usual and irrigation expansion) it is worth mentioning that the gap between the food production and the demand will be met by either rain fed agriculture or international imports. The importance and potential development of rain fed agriculture will be highlighted in the section addressing the choices and options to meet the future challenge in Africa.



**Figure 9. Projections of annual gross water requirements in Africa in 2040 as compared to current withdrawals in 2005.**



**Figure 10. Forecasted annual gross water requirement (2040).**

A breakdown of estimated gross water requirements for the selected PIDA basins is provided in Table 2 below

		LAKE CHAD	CONGO	GAMBIA-GEBA-KOLIBA	NIGER	NILE	OKA VANGO	ORANGE	SENEGAL	VOLTA	ZAMBEZI
<b>RENEWABLE RESOURCES</b>		44.00	1250.00	28.70	174.99	87.90	8.00	11.44	25.00	34.25	108.00
	2005 withdrawals	4.49	1.66	0.45	10.69	118.75	0.19	4.82	2.31	3.65	16.99
<b>"Low" population growth</b>	status-quo	11.49	14.27	0.97	25.91	144.11	0.63	6.91	2.94	7.32	21.39
	business as usual	12.51	14.97	1.11	31.63	165.99	0.70	7.49	3.71	8.05	24.34
	irrigation expansion	13.53	15.68	1.26	37.34	187.88	0.76	8.07	4.48	8.78	27.30
<b>"Medium" population growth</b>	status-quo	12.09	15.37	1.02	27.24	146.67	0.66	7.09	3.02	7.65	21.88
	business as usual	13.11	16.08	1.16	32.95	168.56	0.73	7.66	3.78	8.38	24.83
	irrigation expansion	14.13	16.78	1.30	38.67	190.44	0.79	8.24	4.55	9.11	27.79
<b>"High" population growth</b>	status-quo	12.71	16.51	1.07	28.60	149.31	0.70	7.27	3.09	7.99	22.38
	business as usual	13.73	17.21	1.21	34.31	171.19	0.76	7.85	3.86	8.72	25.34
	irrigation expansion	14.74	17.91	1.35	40.03	193.08	0.82	8.42	4.62	9.45	28.30



## 1.4 Main findings on infrastructure gaps

### 1.4.1 Hydropower infrastructure gap

Africa has 15% of the world's population but accounts for only 3% of the world's primary energy consumption (renewable energy and waste excluded) and 5-6% of world's final energy consumption (renewable energy and waste included). Electricity consumption per capita is 1/6 of world overall average. Access rates, particularly in Sub-Saharan Africa, are amongst the lowest in the world with only 1/5 of the population having access to electricity. For the reference period until 2040 power demand for Africa as a whole is projected to increase considerably by a factor of four (410%) with an average energy demand growth rate of 5.5% p.a over the entire period.

The planning model of the PIDA energy sector team estimates that, in addition to the currently installed 15 756 MW, a further 72 563 MW will be commissioned (in the selected basins) in the period until 2040 amongst which an estimated 64.71% will be in the Congo basin, 18.47% in the Nile basin and 13.41% in the Zambezi basin (Table 3). In terms of determining the hydro-power infrastructure gap, two types of gaps can be distinguished, namely

the **theoretical gap**, defined as the difference between the current developed (and under construction) hydropower generation capacity and the estimated (theoretical) potential. The theoretical gap is estimated to be 179 744 MM.

the **planning gap**, defined as the difference between the current developed (and under construction) hydropower generation capacity and the planned installed capacity in 2040, given the commissioning calendar established by the planning model of the PIDA energy sector. The planning gap is estimated to be 72 563 MW (39.5 % of the theoretical gap).

**Table 3. Operational, under construction and planned hydropower in the selected basins<sup>4</sup>**

BASIN	Installed capacity [MW]			Potential
	Operational	Under Construction	Planned	
LAKE CHAD	0	0	75	
CONGO	840	0	46957	123600
GAMBIA-GEBA-KOLIBA	0	0	120	4000
NIGER	2068	0	1054	6000
NILE	5407	185	13404	45000
OKAVANGO	0	0	0	400
ORANGE-SENQU	625	0	77	
SENEGAL	216	0	609	2000
VOLTA	1511	0	538	2500
ZAMBEZI	4904	0	9729	12000
<b>TOTAL PIDA BASINS</b>	<b>15571</b>	<b>185</b>	<b>72563</b>	<b>195500</b>

<sup>4</sup> Although efforts have been made to ensure consistency of data use across PIDA sectors, some figures presented in the table may differ from the ones used in the Energy Outlook due to different spatial scales of analysis (RECs for the energy, transboundary river basins for TWR).

## 1.4.2 Irrigation infrastructure gap

Currently, merely 20% of the potential irrigation area in Africa is exploited. During the last decade (from 1998 to 2008), the annual growth rate of area equipped for irrigation in Africa was only half of the one observed in the World (0.62% compared to 1.10%). In terms of irrigated area, this represents an annual increase of 81 030 ha per year in Africa while it was 3 178 300 ha per year in the World.

The modelling carried out during Phase I of PIDA and presented in the Outlook 2040 report, estimates the irrigation gap as shown below in table 4 which (for the medium population growth scenario) would require an increase of 12.85 million ha compared to 2008 to a total of 26.3 million ha.

**Table 4 .Irrigation infrastructure gap.**

Irrigation development policy	Year	Irrigated cereal production* [million tons]	Cereal demand [million tons]	Gap to be filled by rain fed and net imports [million tons]
Assesement	2005	34.18	191.89	157.71
Business as usual <sup>5</sup> + 10% of crop yield increase	2040	66.96	319.34	252.38
Accelerated irrigation expansion <sup>6</sup> + 10% of crop yield increase	2040	79.58	319.34	239.76

## 1.5 Summary of key challenges and options

Africa has a highly untapped (transboundary) water resources potential and it is well recognized that water resources development can play a key role in economic development and poverty reduction in Africa. While the varied climatic and ecological zones in Africa provide great potential for food and energy production the continent suffers from underutilization of its water resources potential. The key challenges and a number of possible response options (within and outside the scope of PIDA) are described below.

### 1.5.1 Key challenges

The African Water Vision 2025, the continent's over-arching policy instrument for water, identifies a number of key issues facing the African water sector, thereby differentiating between resource-side issues, demand-side issues and compounding issues. While these issues remain relevant today not all of them can be directly addressed by the PIDA programme with its clear focus on investments and infrastructure development. In the context of PIDA four main categories of challenges have been identified (and described in detail in the Outlook 2040 report) to which the programme can respond, directly or indirectly.

<sup>5</sup> Business as usual scenario assumes that the irrigated area growth rate of the last 30 years (from 1978 to 2008), would remain constant until 2040.

<sup>6</sup> Accelerated irrigation expansion scenario assumes that the irrigated area growth rate of the last 30 years (from 1978 to 2008) is multiplied by a factor two until 2040.

- Inadequate amount of available water resources in some basins in light of forecast demand
- Inadequate governance frameworks
- Inefficient existing infrastructure
- Inadequate levels of infrastructure development

### 1.5.2 Response options

In order to address these four key challenges a number of response options have been identified, categorised into the two broad options of “governance responses” and “investment responses”. A tabular overview of challenges and corresponding responses is provided below <sup>7</sup> and in discussed in more detail in Chapter 2 dealing with the Strategic Framework.

**Table 5. Overview of challenges in the TWR sector and corresponding responses.**

Challenge	Governance responses	Investment responses
Inadequate amount of available water resources in some basins in light of forecast demand	<ul style="list-style-type: none"> <li>▪ Demand management</li> <li>▪ Finding the right balance between rain fed and irrigated agriculture</li> <li>▪ Regional integration, sector integration and trade strategies</li> <li>▪ Benefit sharing</li> <li>▪ Strengthening TWRM governance frameworks</li> </ul>	<ul style="list-style-type: none"> <li>▪ Reducing water losses and increasing the efficiency and productivity of existing irrigation and rain fed systems</li> <li>▪ Coordinated planning and operation of infrastructure</li> <li>▪ Conjunctive use of surface and groundwater</li> <li>▪ Increase multi-purpose water storage</li> <li>▪ Irrigation expansion</li> <li>▪ Inter-basin water transfers</li> </ul>
Inadequate governance frameworks	<ul style="list-style-type: none"> <li>▪ Strengthening TWRM governance frameworks</li> </ul>	<ul style="list-style-type: none"> <li>▪</li> </ul>
Inefficient existing infrastructure	<ul style="list-style-type: none"> <li>▪ Strengthening TWRM governance frameworks</li> <li>▪ Benefit sharing</li> </ul>	<ul style="list-style-type: none"> <li>▪ Reducing water losses and increasing the efficiency and productivity of existing irrigation and rain fed systems</li> <li>▪ Coordinated planning and operation of infrastructure</li> <li>▪ Conjunctive use of surface and groundwater</li> </ul>
Inadequate levels of infrastructure development	<ul style="list-style-type: none"> <li>▪ Strengthening TWRM governance frameworks</li> <li>▪ Benefit sharing</li> </ul>	<ul style="list-style-type: none"> <li>▪ Increase multi-purpose water storage</li> <li>▪ Irrigation expansion</li> <li>▪ Inter-basin water transfers</li> </ul>

<sup>7</sup> A detailed discussion of the response option is provided in chapter 6 of the Outlook 2040 report

## 1.6 Summary of investment needs

In 2000, the estimated annual investment needs in the water resources sector in Africa for reaching the African Water Vision goals had been estimated at around 20 billion US\$ per year. Amongst these 20 billion US\$, 12 billions US\$ were devoted to basic needs (i.e. domestic water supply) and sanitation and hygiene. These figures have now been updated in the Africa Regional Paper for the 5<sup>th</sup> World Water Forum (2009), which estimates annual investment needs of 50 billion US\$ in the water sector.

The paper estimates an annual investment need of \$US 12 billion to meet the **basic water supply and sanitation** services in Africa overall. In addition, it is estimated that additional \$US 5 billion will be necessary to upgrade wastewater infrastructure to ensure adequate water quality standards. The annual investment need for **hydro-power infrastructure** is estimated at \$US 20 billion with an additional need of \$US 5 billion for storage projects where hydropower generation is not a feasible option within multi-purpose planning.

According to the AICD, 1 million ha of land currently under irrigation in Sub-Saharan Africa needs rehabilitation, at a cost of US\$1900 per hectare, excluding storage costs. On this basis, the investment needs for **rehabilitation of existing schemes** in SSA would be \$US 1.9 billion. This would include investment in applied research and ambitious agricultural extension programmes aiming at more efficient on-farm irrigation technologies and irrigation management approaches (demand management). The investment need for **irrigation expansion** at continental scale would be in the range of \$US 74.53 billion, over the next 30 years or approximately \$US 2.5 billion per year.

By combining the estimations of the Africa Regional Paper for the 5<sup>th</sup> World Water Forum (2009) and cross checking with various sources, Table 6 gives an indicative summary overview of investment needs.

**Table 6. Indicative Investment Requirements in the Water Sector**

Investment category	\$US billion/year
Irrigation rehabilitation	<0.01
Irrigation expansion and O&M costs	5
Drinking water and sanitation	12
Desalination	1
Urban waste water	5
Multipurpose water storage	5
Hydropower-driven infrastructure	20
<b>Total</b>	<b>48</b>

Domestic water supply and sanitation as well as desalination is outside the immediate scope of PIDA. Likewise, irrigation scheme infrastructure is virtually always national infrastructure and therefore also outside the scope of the PIDA TWR component with its focus on transformational projects of regional character. The investment needs relevant in the context of the PIDA TWR programme are thus focused on multi-purpose water storage and hydro-power infrastructure with an estimated total annual investment need of US\$ 25 billion.

Investment category	\$US billion/year
Multipurpose water storage	5
Hydropower-driven infrastructure	20
<b>Total</b>	<b>25</b>

Of these US\$ 25 billion some does not meet the PIDA criteria for regional investments (see chapter 2 of this report) while others are not in one of the ten selected PIDA target basins. The part which would be considered a regional investment need in the scope of the PIDA programme is therefore considerably less. A more detailed overview of investment needs for the TWR PAP is presented in Chapter 4 of this report together with the financing mechanism for each project.

## 1.7 Trends and challenges in water infrastructure finance

The traditional source of development aid for the water sector in Africa has been official development assistance (ODA) of the members of the Development Aid Committee. In 2009, Africa received ODA of US\$47bn or just over a third of world ODA<sup>8</sup>. An analysis in the SSA water and sanitation, agricultural water and hydro sub-sectors postulates that although the immediate impacts of the financial crisis on spending are limited, there may be a longer-term effect<sup>9</sup>.

Recent years have seen strong growth in the African financing activities of “emerging partners” with China being by far the largest<sup>10</sup>. Most of this investment was in hydropower.

The global financial crisis had relatively limited impact on private capital flows to Africa although a modest decline occurred in 2009<sup>11</sup>. In terms of infrastructure the portion went mainly into the telecom, energy and transport sectors with only very nominal amounts to the water sector.

### 1.7.1 Generic sources of infrastructure finance

In Africa, governments are currently the primary funders of infrastructure – both for physical projects and operations and maintenance of assets<sup>12</sup>. To finance capital infrastructure projects in the water sector, governments have relied largely on aid. This has been forthcoming in the water supply and sanitation sub-sector but not in the water resources sub-sector (except hydro-electricity). An interesting contrary development is Ethiopia’s Grand Millennium Dam that is aiming to finance Euro3.3bn through local bonds. To this end, the central bank of Ethiopia has issued bonds to raise funds and the Ethiopian government has appealed to all Ethiopians to buy the bonds<sup>13</sup>.

<sup>8</sup> OECD (2011) Development Aid at a Glance: Statistics by Region: 2. Africa

<sup>9</sup> Joyce, J., Granit, J., Frot, E., Hall, D., Haarmeyer, D., Lindström, A. (2010) The Impact of the Global Financial Crisis on Financial Flows to the Water Sector in Sub-Saharan Africa. Report 28. SIWI.

<sup>10</sup> World Bank: Building Bridges: China’s Growing Role as Infrastructure Financier for Sub-Saharan Africa. Trends and Policy Options. No.5. 2008.

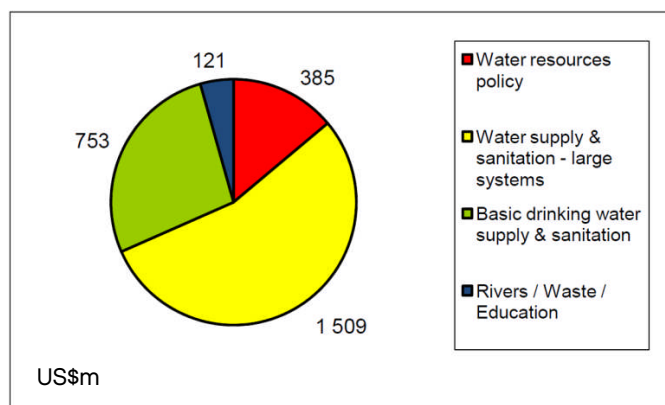
<sup>11</sup> UN Secretary General. (2010) Follow-up to and implementation of the Monterrey Consensus and the Doha Declaration on Financing for Development. Report No A/65/293 of 12 August 2010

<sup>12</sup> United Nations Office of the Special Advisor on Africa and the NEPAD-OECD Africa Investment Initiative (2010) Infrastructure in Africa. Policy Brief No 2.

<sup>13</sup> <http://grandmillenniumdam.net> accessed on 24 August 2011.



The split of ODA in the water sector is shown in Figure 11. **Note that no ODA was disbursed for large water resource infrastructure.** The US\$ 385 million for water resources policy represents about 14 percent of the water sector and 0.6 per cent of all ODA to Africa.



**Figure 11: ODA commitments to water by sub-sector 2009/14**

Much of the ODA is channelled through, in parallel with and aligned to the approaches of the multi-lateral **development financing institutions (MFIs)** (also International Financing Institutions (IFIs)) such as the African Development Bank, the World Bank and the European Investment Bank. Some is very concessional such as the IDA in the World Bank. The MFIs pay as much attention to economic justification as they do to financial. However, they cannot over extend the trade-off between the two. Throughout the world, in the case of irrigation projects, the financial tariff flows from irrigators seldom cover the operation and maintenance costs, never mind the financing cost of the off-farm infrastructure. Consequently, irrigation projects cannot access much MFI financing and never without sovereign guarantees.

More recently the concept of “**blending**” has been promoted with the establishment in 2007 of the EU-Africa Infrastructure Trust Fund. The Trust Fund, managed by the EIB is the EU’s main financial instrument for funding and implementing infrastructure projects in Africa with a regional dimension<sup>15</sup>. The portfolio includes several hydro-electricity projects and one water supply project but no water resource projects.

The “**emerging partners**” (China, India) have financed a number of African infrastructure projects, much of it through export credit arrangements. The sectors where China has been most active are in hydro-electricity<sup>16</sup>.

The **private sector** has increasingly financed several types of infrastructure in Africa. However, the water sector presents a number of unique features, first clarified by the Camdessus Panel<sup>17</sup>, that make private sector financing of the sector problematical (hydro-electric infrastructure excepted). Africa has few effective national financial markets so that indirect private investment in water infrastructure, through mechanisms such as institutional or project bonds, forms of “mezzanine” financing and others, is all but impossible.

What remains is project financing. At the core of project financing are two often ignored principles that open the chasm between supply and demand for private sector financing in the water sector. The first is that there has to be a revenue stream that is sufficient to cover all the financial demands of the project including a premium for the investors. The second is the risk principle which requires that risks should be borne by the institution or organisation that is best placed to control or manage the

<sup>14</sup> OECD (2011) *Development Aid at a Glance: Statistics by Region: 2. Africa*

<sup>15</sup> EU-Africa Infrastructure Trust Fund. *Annual Report 2010*

<sup>16</sup> World Bank: *Building Bridges: China’s Growing Role as Infrastructure Financier for Sub-Saharan Africa*. Trends and Policy Options. No.5. 2008

<sup>17</sup> Winpenny J. (2003) *Financing Water for All*. Report of the World Panel on Financing Water Infrastructure. Chaired by Michel Camdessus. World Water Council, Global Water Partnership.

risk. In Africa, these two principles all but eliminate the risk appetite of private investors for irrigation and water supply and sanitation projects. Consequently, over the last decade virtually no private investment has been made in these sectors<sup>18</sup>.

However, new approaches to risk reallocation have already spawned experiments with private sector involvement in waste treatment, water distribution, irrigation design and operation, and water services provision, but this falls outside the scope of PIDA.

A potential special source of partial financing for hydro projects is the **Clean Development Mechanism** (“carbon credits”) established in terms of the Kyoto Protocol. However, there have been objections from some civil society groups that hydro projects were afforded eligibility at all. There are other procedure- and rules-related difficulties.

Several of the MFIs (eg the Multilateral Investment Guarantee Agency (MIGA) in the World Bank Group) offer **guarantees** in various forms as additional financial products, generally to attract more risk adverse private investors.

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<sup>18</sup> Vivien Foster and Cecilia Briceño-Garmendia (Editors) (2010) *Africa's Infrastructure: A Time for Transformation*. World Bank. p80

## 2. STRATEGIC FRAMEWORK

### 2.1 Vision for the sector

The shared water vision for Africa has been defined in the Africa Water Vision 2025 as:

"An Africa where there is an equitable and sustainable use and management of water resources for poverty alleviation, socioeconomic development, regional cooperation, and the environment."

Guided by this vision the overarching goal for the PIDA in the TWR sector has been defined as

#### PIDA Goal in the TWR Sector

To develop transboundary water infrastructure projects and strengthen transboundary management frameworks for regional integration and ensuring water security for socio-economic development of the African continent while protecting the environment and mitigating and adapting to the impacts of climate variability and change.

### 2.2 Strategic Objectives

Guided the African Water Vision 20205 and the PIDA Goal in the TWR Sector, four strategic objectives for the PIDA TWR programme have been defined. In order to ensure a coherent strategic planning and subsequent implementation framework, the PIDA TWR Objectives are based on and closely aligned with the Framework for Action of the African Water Vision and the African Water Facility Operational Strategy.

African Water Vision Framework for Action	AWF Operational Strategy
1. Strengthening governance of water resources	1. Strengthening water governance
3. Meeting urgent water needs	2. Investments to meet water needs
4. Strengthening the financial base for the desired water future	3. Strengthening the financial base
2. Improving water wisdom	4. Improving water knowledge

Likewise, the four intervention categories described under 1.5.2 are also aligned with the four strategic objectives. The strategic objectives are:

### PIDA Objectives in the TWR sector

- Objective 1:** Strengthening the institutional basis for efficient transboundary cooperation on shared water resources.
- Objective 2:** Developing transboundary water infrastructure to meet the increasing water demands while protecting people and the environment.
- Objective 3:** Strengthening the financial base for transboundary water resources development and management.
- Objective 4:** Improving water knowledge on transboundary water basins and shared aquifers.

## 2.3 Guiding principles

The PIDA programme is driven by the common desire of African states for enhancing the livelihoods and ensuring the wellbeing of their people. In pursuing to contribute to these objectives the PIDA programme in the TWR sector is guided by the following principles.

- The **well-being of the people** in the basins and the continent as a whole – in economic, health, social and cultural terms – and the improvements of their livelihoods is recognised as a primary objective of African states.
- The principle of **sustainable development** shall be applied such that there is a prudent and rational utilization of living resources and the preservation of the rights of future generations to a viable environment.
- The development and utilisation of transboundary water resources shall be determined by the underlying principles of **equitable and reasonable utilisation** of shared watercourses and the duty to **prevent significant harm**.
- The principle of **cooperation and good neighbourliness** shall be applied in that no state shall allow its territory to be used for acts contrary to the rights of other states.
- The concept of **integrated water resource management (IWRM)** shall be recognized, which is a process which, using the lake/ river basin as the management unit, promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems’.
- The principle of **anticipatory action** shall be applied, such that contingency planning, environmental impact assessment and strategic impact assessment shall be undertaken in the future development of the basins.
- The principle of **public participation, transparency and accountability** shall be applied, such that all stakeholders, including communities, individuals and concerned organizations shall be given the opportunity to participate, at the appropriate level, in decision-making and management processes that affect the development of the basins.

## 2.4 Strategies to meet the objectives and expected outcomes

### 2.4.1 Strategic options

The PIDA TWR Strategic Objectives are focused on facilitating investments in physical water infrastructure as well as strengthening, and where necessary creating, the enabling environment for infrastructure investments to be effective and efficient. As described in Section 1.5.2 above, this requires investment responses as well as governance responses and typically a combination of both.

This is of great relevance in the context of the strategic framework and PAP for two reasons:

- Whereas the focus of PIDA is on promoting and facilitating direct investment projects (hard projects), some so-called “soft” interventions, i.e. governance interventions, can be directly supported by PIDA where they contribute to creating the necessary enabling environment for effective and efficient investments.
- Some governance responses cannot be directly facilitated or supported through PIDA but are nevertheless essential in order to address the identified key challenges. In these cases policy-makers and strategic planners need to be aware that PIDA interventions need to be complemented with governance responses outside the immediate scope of PIDA.

The PAP presented in Section 3 therefore, in addition to describing an implementation and financing mechanism for each priority project, highlights also key interventions outside the scope of PIDA, which are beneficial, if not essential, for the success of the respective project. Below, a number of strategic options for addressing the identified challenges in the TWR sector are presented in a generic format.

#### ***Investment responses:***

- Maximising efficiency gains: increasing the efficiency of existing infrastructure
  - Finding a right balance between rain fed and irrigated agriculture
  - Reducing water losses and increasing the efficiency of existing irrigation systems
  - Coordinated planning and operation of infrastructure at basin or sub-basin scale
  - Conjunctive use of surface and groundwater
- Building of new infrastructure
  - To increase multipurpose water storage to deal with climate variability and adapt to climate change while minimizing negative impacts on the environment
  - To increase area under irrigation knowing that only 20% of the irrigation potential is currently exploited
  - To increase energy production
  - To increase the water yield of stressed transboundary rivers
  - To meet the growing demand for water supply and sanitation

#### ***Governance responses***

- Finding the appropriate balance between supply and demand policies
  - Developing and implementing water demand/ water efficiency plans
  - Streamlining water availability issues into national and regional economic planning
- Strengthening transboundary water management frameworks

- Developing strong regional legal frameworks
- Develop basin agreements based on regional legal frameworks
- Developing and strengthening the existing institutional infrastructure
- Creating new basin organizations
- Strengthening the institutional cooperation and coordination between L/RBOs and national implementation agencies
- Strengthening regional and national policy frameworks
- Strengthening the information and knowledge base

Despite the options outlined in generic format above, it is critical to note that many countries on the continent are unlikely to be able to meet their future food and energy demands through domestic production, even if the water resources potential is fully exploited. At the same time it is likely to be difficult in practice to meet all identified investment needs. The biggest potential for increasing the effectiveness and efficiency of water infrastructure investments arguably lies in better harnessing the benefits of regional integration and trade. It is therefore essential that investments in water infrastructure are accompanied by innovative policy choices and the strengthening of regional integration and trade regimes. A number of possible macro-level policy options, ranging from regional to basin-scale, are presented below.

- **Virtual water trade strategies:** virtual water refers to the quantity of water used in the production of a product. As the final product (e.g. wheat) does not contain that water anymore it is called “virtual” water. Virtual water trade essentially means that water scarce countries can potentially mitigate the local scarcity of water by importing large amounts of virtual water instead of building new water supply infrastructure. In other words, water scarce countries could for example primarily import grain (which requires significant amounts of water during production) for local use instead of producing it locally. Through the export of food stuffs on the other hand, water rich countries could make use of their water abundance by becoming large-scale exporters of water intensive goods, primarily agricultural goods. For some water-rich developing countries, export oriented agriculture could be a driver of economic growth and substantially contribute to poverty reduction. While such virtual water trade is de facto already practised by some countries, including African countries, its implementation on a regional scale within Africa is only starting to be considered. In this context it is noted that the Nile Basin Initiative (NBI) has recently commissioned a study exploring the possibility of a virtual water trade strategy for Nile basin states.
- **Trade facilitation:** any trade-based solutions, whether virtual water trade or other strategies, require significant improvements in trade regimes and supporting infrastructure, mainly transport. Effectively using the full potential of regional markets in Africa could prove to be a major growth factor if certain trade impeding factors were to be removed. Despite the establishment of Free-Trade Areas (for example the launch of a regional trade bloc comprised of the members of SADC, EAC and COMESA in June 2011), the elimination of tariff and non-tariff barrier has in practice been neglected. Likewise, with transport costs being a major factor, the existing regional initiatives to build a functioning and cost-effective regional transport network need to be continued and intensified in order to make trade-based solutions a viable policy option for African regions.

- Integrated sector planning:** Whereas the importance to transport networks has been illustrated above, the same is true for the link between investments in water infrastructure and energy. On the one hand water, through the generation of hydro-power, can be substantial component of the overall energy generation capacity. On the other hand, investments in irrigated agriculture are highly dependent on the availability of (cheap) energy. The availability of energy (for the pumping of water) is essential for future expansion of irrigation and energy costs are a significant cost factor in irrigated agriculture. While energy costs for irrigation are highly site-specific and a continental forecast of additional energy needs associated with the described irrigation scenarios is not possible, it is clear that there is a strong inter-dependence between energy availability and the possibility of irrigation expansion. It is thus clear that investments in water infrastructure need to be well integrated into coordinated, cross-sectoral investment and infrastructure plans (primarily transport and energy) in order to achieve the desired outcomes.

## 2.4.2 Expected outcomes

The expected outcomes of the PIDA in the TWR sector are manifold. Some while materialize in the short term while others will only be achieved in the long run. A generic list of expected key outcomes is provided below together with the (primary) corresponding PIDA objective. However, as previously stated it needs to be understood that PIDA is merely a key contributor to achieving these outcomes, but that they cannot be achieved without commensurate macro-level (governance) responses outside the immediate scope of the PIDA programme, such as for example improved regional trade integration.

Water security <sup>19</sup> is ensured to meet the water and energy demands and enable the socio-economic development of the regions of the African continent	Objective 2
Transboundary water resources are equitably allocated among basin countries and among competing water uses	Objective 1
The benefits arising from shared water resources development are equitably shared	Objective 1 Objective 2
The impacts of climate variability and change are mitigated and effective adaptation mechanisms in place	Objective 1 Objective 2
Regional cooperation is enhanced at various levels by deploying the principles of integrated water resource management (IWRM)	Objective 1
Governmental support to transboundary water resources management is ensured and the African Ministers' Council on Water (AMCOW) fully supports the outputs of the program	Objective 1
There is sustainable access to safe and adequate water supply and sanitation to meet the basic needs of all	Objective 2
Water for sustaining ecosystems and biodiversity is adequate in quantity and quality	Objective 2

<sup>19</sup> Water security involves the sustainable use and protection of water systems (surface water and groundwater), the protection against water related hazards (floods and droughts), the sustainable development of water resources and the safeguarding of (access to) water functions and services for humans and the environment.

Institutions that deal with transboundary water resources have been created or strengthened to create an enabling environment for effective and integrated management of water in transboundary water basins and shared aquifers	Objective 1
Water basins serve as a basis for regional cooperation and development, and are treated as natural assets for all within such basins	Objective 1
There is an adequate number of motivated and highly skilled water professionals	Objective 3
There is an effective and financially sustainable system for data collection, assessment and dissemination for national and trans-boundary water basins	Objective 4
There is political will, public awareness and commitment among all for sustainable transboundary water resources management, including the mainstreaming of gender issues and youth concerns and the use of participatory approaches	Objective 1

## 2.5 TWR Selection and Prioritization Criteria: from the Strategic Framework to the PIDA TWR PAP

The point of departure for the selection of PIDA projects is that the projects need to deal with transboundary, or cross-border infrastructure. This is defined for the 4 sectors as an **“infrastructure of common interest that renders services across national frontiers with high cooperation content for its implementation”**.

### 2.5.1 Types of interventions considered

For the PIDA TWR sector, in line with the other three PIDA sectors, four categories of projects are considered:

- **Facilitation projects:** Establishing policy, regulatory and institutional frameworks to create a suitable environment for investment and efficient operations
- **Capacity building projects:** Launching initiatives to empower the implementing institutions to perform their mandates
- **Studies:** Preparing future projects
- **Investment projects:** Investing in physical and capital projects

In order to qualify for PIDA selection, any project falling under the first three categories (also referred to as “soft” projects) needs to show a clear link to an investment project (also referred to as “hard” project) or the development of an investment programme. Thus, general capacity building projects or studies that are carried out independently from specific investment project or programme are not considered.

In line with agreed project nomenclature the projects described in subsequent sections of this report as well as in the project fiches will be categorised from N1-N4 as illustrated in the below table.



**Table: Project types**

<b>Facilitation projects</b>	<b>N1:</b> Institutional projects: initiatives establishing policy, regulatory and institutional frameworks to create a suitable environment for investment and efficient operations.
<b>Capacity Building projects</b>	<b>N2:</b> Capacity building projects: initiatives to empower the implementing institutions to perform their mandates with regards to infrastructure development and management.
<b>Studies</b>	<b>N3:</b> Pre-investment studies aiming at identifying investment opportunities and preparation of investment projects and programmes. A distinction is made between two types of pre-investment studies:
	<b>N3-I:</b> investment opportunity studies and preparation of investment plans and programs at basin or sub-basin levels.
	<b>N3-II:</b> Feasibility study, Environmental Impact Assessment, detailed design of infrastructure projects and resources mobilization for projects which have been identified within the scope of agreed investment plans.
<b>Investment projects</b>	<b>N4:</b> Investments in regional hydraulic infrastructure for which the detailed studies are available.

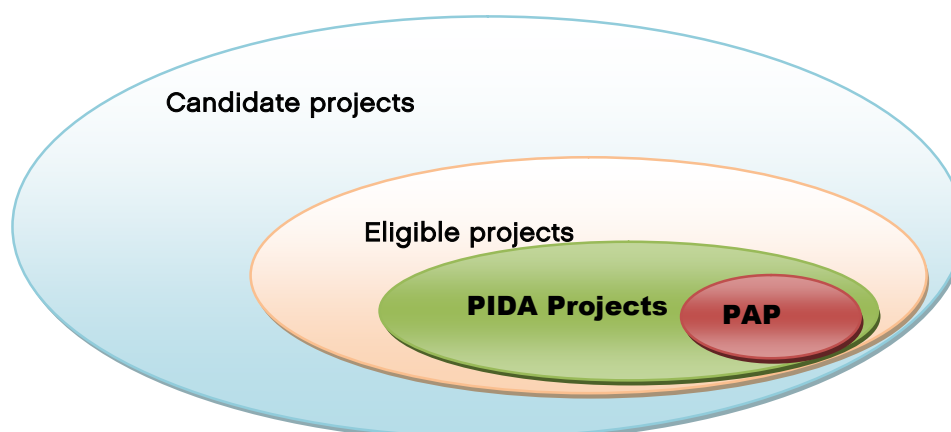
## 2.5.2 Guiding principles

The definition of criteria for prioritizing both transboundary basins and investment programs/projects within those basins are essential, as they will help to focus efforts on a realistic core of projects, and to build consensus among the stakeholders (including financing partners) around that core. Technical and political processes need to go hand in hand for arriving at agreement on a set of prioritized TWR projects, based on sound technical and consensus-based proposals.

The screening process applied to TWR projects for their integration in the PIDA program proceeds in two steps:

- The identification of eligible projects meeting the regional integration criteria;
- The selection from eligible projects of those that maximise TWR sector specific PIDA criteria (as described below).

The selection process is illustrated by the diagram below.



Projects are first selected at individual basin level (i.e. within each basin), and secondly at a continental/programme level (across basins) with the objective of achieving a balance in the PIDA project list and the PAP between different regions. Due to their different nature, facilitation projects,

capacity building projects and studies follow a different selection procedure than the investment projects with a more detailed assessment methodology applied to the latter ones.

The application of criteria for pre-qualification and prioritization is based on existing data relating to identified projects or projects under study, using action plans, master plans and investment programmes, feasibility studies, project studies, environmental and social impacts assessments and other available documents (see bibliography) obtained from a variety of institutions such as national agencies, transboundary basin organisations or regional organisations.

The criteria are summarised in order to be adaptable to the various contexts specific to each structure, taking into account the different degrees to which available studies and data have advanced. The choice of criteria is based on the need to compare developments through multi-criteria analysis.

The assessment is based on quantitative criteria (measurable indicators) as well as qualitative criteria (i.e expert analysis). Quantitative criteria are used to the extent possible in order to limit subjective elements as much as possible.

This section describes the eligibility and selection criteria whereas the methodology for their application is described in further section.

### **2.5.3 Eligibility Criteria**

As a first step a project (both soft and hard) needs to meet the basic eligibility criteria before being entered into the selection and prioritization process. This eligibility test is required for consistency with the overall PIDA programme and the sector strategic framework and is comprised of three criteria:

- The project (hard or soft) involves two or more countries with shared activities
- Endorsement by one regional organization (TBO or other institution)
- The project is aligned with at least one of the PIDA TWR strategic objectives:
  - Objective 1: Strengthening the institutional basis
  - Objective 2: Developing transboundary water infrastructure
  - Objective 3: Strengthening the financial base
  - Objective 4: Improving water knowledge

#### ***Selection / Prioritization Criteria***

Depending on the nature of the project (soft or hard) different selection criteria apply.

#### ***Selection criteria for the soft/facilitation projects***

The selection will be based only on two aspects:

- Fit of the project with the sector strategic objectives;
- Capacity and willingness of the regional organization to conduct the relevant project / study in time.

#### ***Selection criteria groups for the hard/investment projects***

The selection criteria for hard projects are categorised into five thematic groups, comprehensively covering the aspects pertinent for successful project development and implementation.

Criteria group	Aspects covered
1. Economic and financing	This criteria group measures the economic and financial feasibility and viability of the project, the funding availability and the PPP attractiveness.
2. Environment and Social	This criteria group measures the impact of the project on the environment (and climate change), and how the project is designed to mitigate the environmental impact. This criteria group measures also how the project is likely to interact with its social environment in terms of benefiting population, project affected persons, poverty reduction, and standard of living. The majority of these aspects are quantifiable.
3. Institutional and policy assessment	This criteria group is related to the aspects of ownership, robustness of the planning, implementation and operating provisions, and to regulation, harmonisation aspects. Some of these aspects are based on expert analysis.
4. Synergies among PIDA sectors	The synergy is measured by the contribution of the project to improve the infrastructure network in one or more other PIDA sectors. This aspect is quantifiable.
5. Technical criteria	In the different sectors there is a set of technical indicators usually taken into consideration. They target often physical or non physical standards.

**Table: Criteria groups**

### ***Criteria for the (hard) Investment projects***

Within each of the criteria groups described above a number of specific criteria has been developed and is listed in the synthesis table below. Each criterion is measured using defined indicators that are applied using the specific characteristics of the works, as well as on other data available from studies.

**Erreur ! Source du renvoi introuvable.** The criteria for investment projects are universal for all types of projects, except *5. Technical criteria* which apply only to large dams.

The following types of indicators are used:

- quantifiable (number), with a formula and unit. As a number, it can be Growing or Descending
- binary (Yes / No)
- qualitative (weak / average / strong)

*A rationale, definition and formula have been developed for each criterion and are shown below.*

**Table7: Definition of criteria**

Criteria group	Criteria	Rationale / Definition	Indicator Formula	Indicator type / Unit	Growing/ Descending
1. Economic and Financing	<i>1. Economic and Financing</i>	Performance indicator concern hydro-electricity.  Investment cost: infrastructure only, without mitigation plan cost. Maintenance costs are supposed to be proportional to investment cost	Project cost (M\$) <sup>20</sup> versus annual energy generation (GWh) versus	M\$/GWh	Descending
2. Environment and Social	<i>2.a Water depletion</i>	Measures the water losses within the large basin. Large consumptive use projects are likely to generate environmental and social effects.	annual evaporation (mm/year) * water surface area (km <sup>2</sup> )	m <sup>3</sup> /year	Descending
	<i>2.b Downstream impacts</i>	Captures the extent to which downstream river discharges will be affected by the project. Indicator measures the hydrologic regime change (and then other impacts)	storage capacity / transferred discharge (km <sup>3</sup> ) versus average annual discharge (km <sup>3</sup> )	%	Descending
	<i>2.c Upstream impacts</i>	An infrastructure can modify land use within the reservoir and can lead to human settlements and destroy environmental sectors of interest	water surface area	km <sup>2</sup>	Descending
3. Institutional and policy assessment	<i>3. Joint project</i>	Describes the level of internationality	position between countries <sup>21</sup>	weak/ average/ strong	
		Any investment project has to be	priority project in	weak/ average/	

<sup>20</sup> Cost updated in 2010

<sup>21</sup> In an ascendant sequence of interest:

Weak: Projects located on an international river and in one single country, without any other country downstream

Average: Projects located on an international river and in one single country, with at least one country downstream

Strong: So-called international projects, i.e. situated across a river forming the border between two States (be it the structure itself or the reservoir)

Criteria group	Criteria	Rationale / Definition	Indicator Formula	Indicator type / Unit	Growing/ Descending
		considered in the broader Framework of an integrated investment strategy and program	the basin wide strategy <sup>22</sup>	strong	
4. Synergies among PIDA sectors	4.a <i>Multipurpose</i>	Water projects often have multiple objectives/uses. Priority should be given to projects having multiple and diversified uses <sup>23</sup> . Primary uses are: hydropower, irrigation, environment (low-flow support), navigation	number of primary uses	1 to 4	Growing
	4.b <i>PIDA sectors</i>	Synergy with other PIDA sectors: <ul style="list-style-type: none"> <li>- A hydropower plant integrated into a regional power pool is likely to promote cooperation and leads to benefit sharing arrangements.</li> <li>- How easy it is to distribute agricultural products.</li> </ul>	Power plant connected (less than 200 km From a grid power line) to a regional (e.g. power pool) grid, existing or programmed	Yes / No	
			distance to a regional transport corridor	km	Descending
5. Technical criteria	<i>Structure safety Factor</i>	To take into account the risks for goods and people because of a river works creation, a security criterion is taken into account <sup>24</sup> .	height <sup>2</sup> * capacity		Descending

<sup>22</sup> If no basin strategy, all projects are average

<sup>23</sup> For example, a hydropower project could also yield substantial benefits in terms of irrigation, navigation, etc. Investments will be geared towards those that generate multipurpose benefits

<sup>24</sup> It is based on a formula used for the risk classification of dams

## 2.5.4 Methodology for criteria application

### *TWR projects eligibility*

The eligibility test is a simple matter of “Yes” or “No”. If the candidate project does not meet either of the three eligibility criteria it cannot be included for selection to the PIDA programme and is excluded at this stage. All projects are subjected to the eligibility test and those that pass will then be assessed against the described selection criteria. The two lists (soft/facilitation and hard/investment) of selected projects are provided in the annex.

### *Selection of TWR soft/facilitation projects*

As described in section 2.4 the selection of soft projects is based on two aspects:

- Fit of the project with the sector strategic objectives:
  - Objective 1: Strengthening the institutional basis
  - Objective 2: Developing transboundary water infrastructure
  - Objective 3: Strengthening the financial base
  - Objective 4: Improving water knowledge
- Capacity and willingness of the regional organization to conduct the relevant project / study in time (strong if the organization has already conducted such a project with success).

This is assessed through expert analysis using the criteria “weak”, “average” and “strong”. If the answer to one of the criteria is weak, then the project cannot be included in the PAP.

Applying the criteria to the list of soft/facilitation projects gives results presented in annex (prioritized soft/facilitation projects).

### *Selection of TWR hard/investment projects*

A criterion may include several indicators which determine the score given to such criterion. The various types of indicators include:

- Numerical indicators (calculated based on structure’s specifications);
- Logical indicators (“yes / no”);
- Level indicators (for example “weak, average, strong”).

The described indicators are calculated if they are defined by technical characteristics. The main technical baseline data, obtained from available technical reports, covers the following aspects:

<b>Characteristics of site location</b>
- Project number (text)
- Project (text)
- Basin (text)
- Country (text)
- River (text)
<b>Hydrological characteristics of the site</b>
- River basin area (km <sup>2</sup> )
- Annual discharge (hm <sup>3</sup> /year)
<b>Characteristics of the project</b>
- Type of infrastructure (dam, derivation, transfer, extension)
- Dam height (m)
- Water surface area (km <sup>2</sup> )
- Storage capacity or transferred discharge per year (hm <sup>3</sup> )

<b>Functions of the dam</b>	
-	Dam main purpose (hydroelectricity, agriculture/irrigation, environment/low flow support, navigation)
-	Installed capacity (MW)
-	Guaranteed energy generation (GWh)
<b>Economic</b>	
-	Investment Cost (M\$)
-	Cost reference year

Others indicators have been determined using expert analysis. When a criterion consists of only one indicator, the mark of the sub-criterion is the same as the main indicator's one. When a criterion is made of two indicators, the mark of the criterion is given by the expert.

For multi-criteria analysis and projects ranking, the total score of each project is calculated by multiplying the value score for the criteria by the weight given to each specific criterion, and then adding all those weight scores together.

The following methodology is applied for the analysis:

- Each criterion is scored 0 (lowest performance, last position) to 4 (highest performance, first position) i.e. 5 progressive scoring degrees;
- A weight is given to each criterion, the total weights per group according to the table below;
- A score is calculated for each project;
- Projects are ranked by order of position in each basin;
- A set of priority projects (first position projects in each basin), are taken from previous rankings.

Weighting for the 5 major prioritization groups is shown below:

**Table 8: Criteria weighting**

Criteria group	Weight
1. Economic and Financing	30
2. Environment and Social	20
3. Institutional and policy assessment	20
4. Synergies among PIDA sectors	10
5. Technical criteria	20
TOTAL	100

The analysis is the same for all basins but results are given within each basin.

The multi criteria analysis follows the following procedural flow chart:

**Erreur ! Source du renvoi introuvable.** An example of scoring is provided below for the Chollet dam project.

**Table 8: Example of criteria notation**

Criteria	Indicator	Project Number	C1 Cholle
		Indicator note	Criteria note
1. Economic	(project cost) versus (annual energy generation)	1	1
2.a Water depletion	(annual evaporation) * (water surface area)	2	2
2.b Downstream impacts	(storage capacity) versus (average annual discharge)	3	
2.c Upstream impacts	water surface area	2	
3. Joint project	position between countries	Strong	3
	priority project in the basin wide strategy	Average	
4.a Multipurpose	number of primary uses (1 to 4)	1	1,5
4.b PIDA sectors	power plant connected to a regional grid	Average	
	distance to a regional transport corridor	2	
5. Technical criteria	height <sup>2</sup> * capacity	1	1

Applying the criteria to the list of eligible hard/investment projects gives the ranking presented in Annex 1.



## 3. TWR INFRASTRUCTURE DEVELOPMENT PROGRAMME

### 3.1 List of TWR selected projects

The TWR infrastructure development programme consists of a pipeline of regional projects composed of a balanced combination of hard and soft interventions/studies over the short, medium, and long-term horizons, which are consistent with the strategic framework and TWR objectives. The hard/investment projects have been scored and ranked applying the described selection/ prioritisation criteria (see full list of scored projects in Annex 1). The selection of hard/investment projects is based on the score achieved by the project when applying the selection criteria. After the scoring and ranking three priority hard projects were selected for each of the selected PIDA target basins (except for the basins where no, or fewer than three, hard projects were available for consideration. Soft projects were selected using expert analysis.

The selected PIDA projects are:

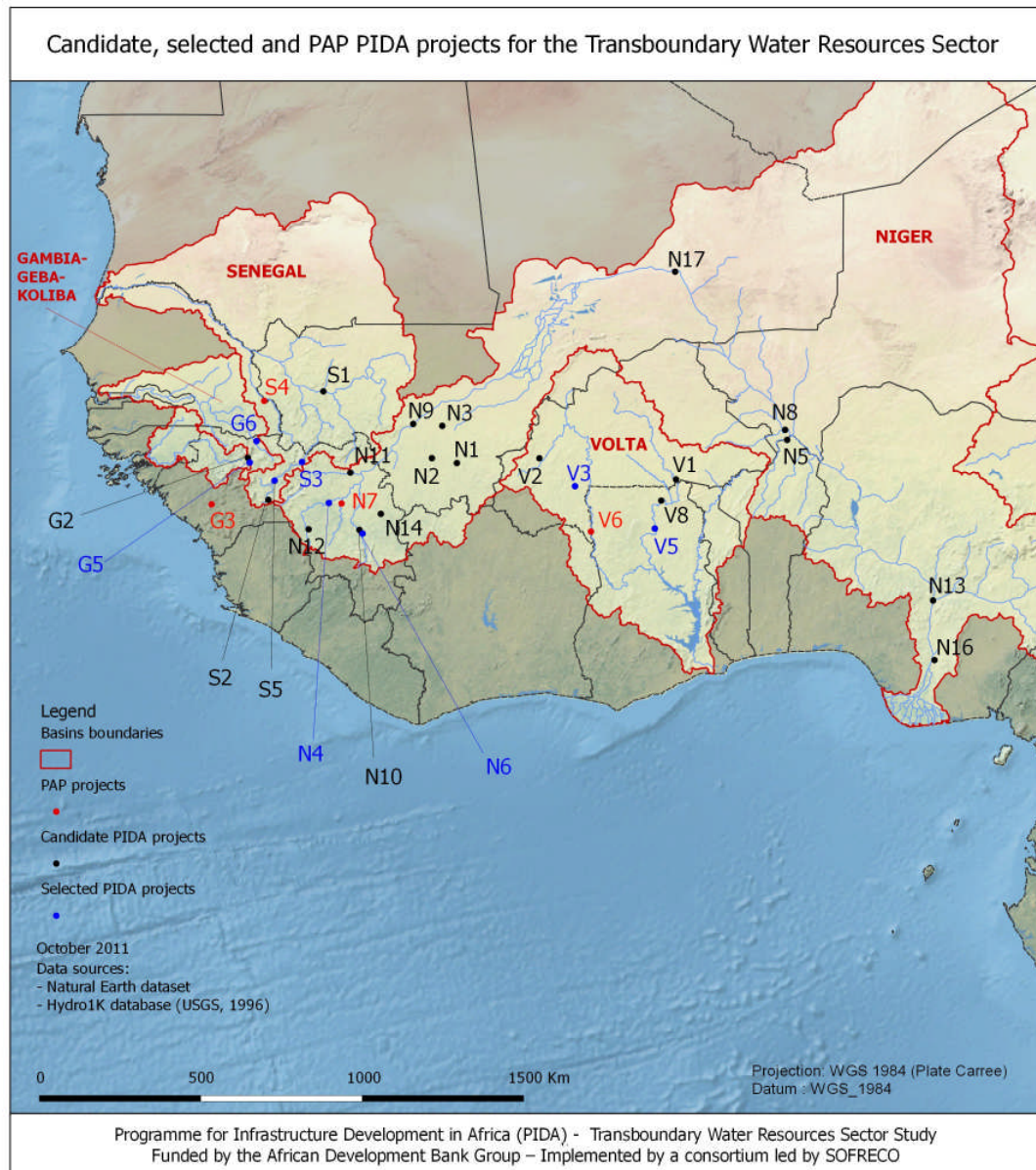
Number	Project	Score/4	Project Type
<b>Congo River Basin</b>			
C5	Ruzizi III	2,95	Investment project
C4	Palambo	2,62	Investment project
C6	Waine Rukula	2,60	Investment project
<b>Gambia-Geba-Koliba River Basin</b>			
G3	Kaleta	2,37	Investment project
G6	Sambangalou	1,40	Investment project
G5	Kouya	1,30	Investment project
<b>Lake Chad Basin</b>			
LC 1	Capacity building of the LCBC for basin wide IWRM management	n/a (soft project)	Capacity Building
<b>Niger River Basin</b>			
N6	Farankonedou	2,58	Investment project
N7	Fomi	2,20	Investment project
N4	Diaraguela	1,75	Investment project
<b>Nile River Basin</b>			

Number	Project	Score/4	Project Type
L8	Rusumo Falls	2,92	Investment project
L4	Kakono	2,87	Investment project
L1	Beko Abo	2,12	Investment project
<b>Okavango River Basin</b>			
Ok1	Multi-sectoral Investment Opportunity Analysis	n/a (soft project)	Studies
Ok2	Development of IWRM Master Plan	n/a (soft project)	Studies
Ok 3	Development of Flood Forecasting and Early Warning System	n/a (soft project)	Studies
<b>Orange-Senqu River Basin</b>			
O1	Lesotho HWP Phase II		Investment project
O2	Lower Orange		Investment project
<b>Senegal River Basin</b>			
S4	Gourbassy	1,80	Investment project
S5	Koukoutamba	1,98	Investment project
S3	Boureya	1,93	Investment project
<b>Volta River Basin</b>			
V3	Bougouriba	1,52	Investment project
V6	Noumbiel		Investment project
V7	Ouessa		Investment project
	Volta Master Plan Development	n/a	Studies
<b>Zambezi River Basin</b>			
Z7	Kafue Gorge Lower	2,75	Investment project
Z1	Batoka Gorge	2,55	Investment project
Z12	Mphanda Nkuwa	2,45	Investment project
<b>Nubian Sandstone Aquifer System</b>			
NSAS	Capacity Development for the Management of the	n/a (soft project)	Capacity Building Project

Number	Project	Score/4	Project Type
	aquifer susyem		
<b>North-West Saharan Aquifer System</b>			
NWSAS	Pre-feasibility studies aimed for better usage of the aquifer system	n/a (soft project)	Studies
<b>Iullemeden Aquifer System</b>			
IAS	Pre-feasibility studies aimed for better usage of the aquifer system	n/a (soft project)	Studies
<b>Continental</b>			
Co	Capacity Building in Investment Project Preparation	Studies	All RBOs and RECs

A below series of regional maps provides an overview of the PIDA candidate projects that were considered and scored (hard projects only), selected PIDA projects as well as the projects selected for the PAP 2012-2020.

**Overview of candidate, selected and PAP projects: West Africa**



### Overview of candidate, selected and PAP projects: Central and East Africa



### Overview of candidate, selected PAP projects: Southern Africa



## 3.2 TWR Priority Action Plan

The first TWR Priority Action Plan (PAP) comprises priority projects to be undertaken in the period 2012-2020, showing the link with the strategic objectives. It includes:

- Hydraulic infrastructure projects ready to go (N4 type), for which the detailed design has been completed, the Environmental Impact Assessment/mitigation plans available and the social and institutional aspects adequately dealt with;
- Identified hydraulic infrastructure projects which need complementary studies – feasibility or detailed design and Environmental Impact Assessment (N3-II);
- Short-term soft projects (N1, N2 and N3-I) to facilitate projects, build institutional and technical capacity, elaborate master plans.

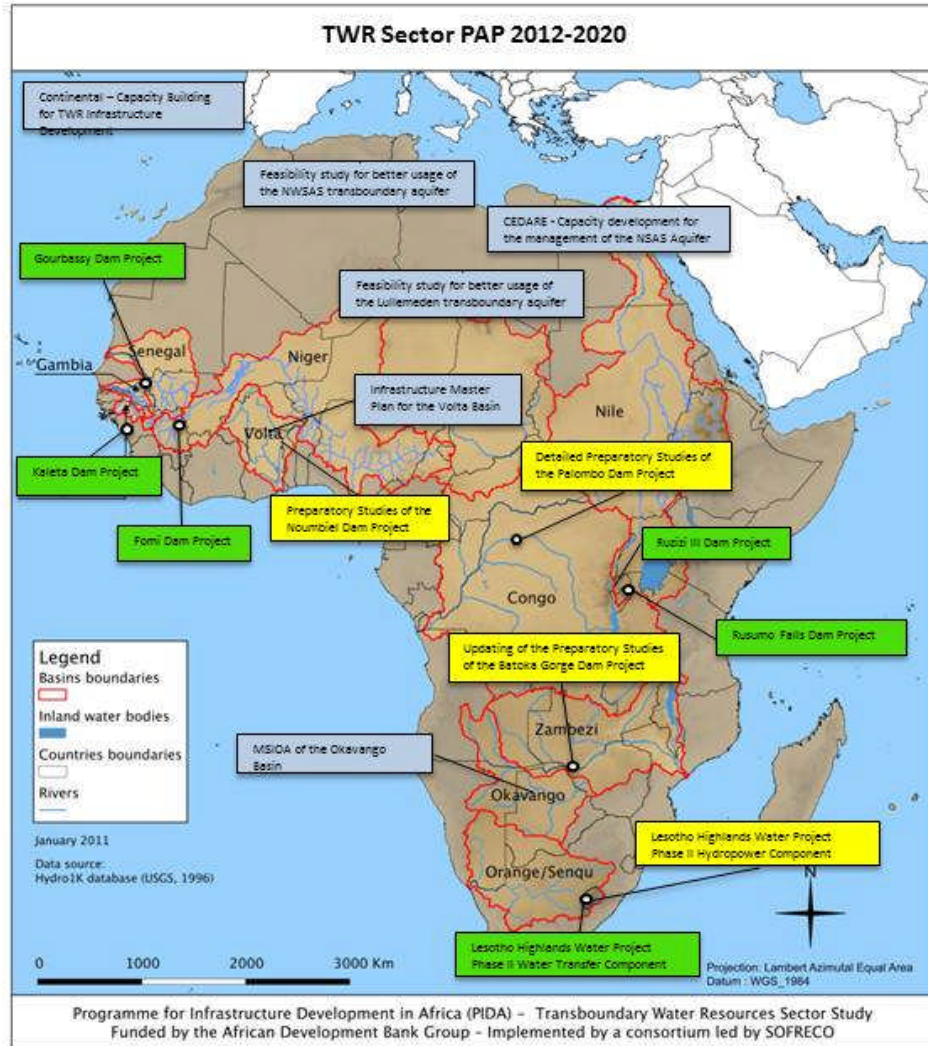
The below table provides an overview of the priority projects selected for the PAP as well as their estimated costs followed by a map showing the location of the selected PAP projects. In section 4.3 a brief description of each project is provided, including rationale for selection, implementation mechanism, financing mechanism and key challenges to be addressed. A brief project summary sheet for each project is provided in Annex.

PAP 2012 - 2020				
Number	Project	Project Type	REC	Estimated costs in million US\$
<b>Congo River Basin</b>				
C5	Ruzizi III	N4	ECCAS/ Tripartite	400
C4	Palambo	N3-II	ECCAS/ CENSAD	14 <sup>25</sup>
<b>Gambia-Geba-Koliba River Basin</b>				
G3	Kaleta	N4	ECOWAS	179
<b>Niger River Basin</b>				
N7	Fomi	N4	ECOWAS	384
<b>Nile River Basin</b>				
L8	Rusumo Falls	N4	IGAD/ Tripartite	360
<b>Okavango River Basin</b>				
Ok1	Multi-sectoral Investment Opportunity Analysis	Studies/ N3-1	SADC	1
<b>Orange-Senqu River Basin</b>				
O1	Lesotho HWP Phase II - water transfer component	Investment/ N4	SADC	1,100

	Lesotho HWP Phase II - hydropower component	Studies/ N3-II	SADC	99 <sup>26</sup>
<b>Senegal River Basin</b>				
S2	Gourbassy	N4	ECOWAS	
<b>Volta River Basin</b>				
V6	Noumbiel	Studies/ N3-II	ECOWAS	
V	Volta Basin Master Plan	Studies/ N3-I	ECOWAS	3
<b>Zambezi River Basin</b>				
Z1	Batoka Gorge	Studies/ N3-II	SADC	225
<b>Nubian Sandstone Aquifer System</b>				
NSAS	Capacity Development For the Management of the aquifer system	Capacity Building/ N2	IGAD/ Tripartite	5
<b>North-West Saharan Aquifer System</b>				
NWSAS	Pre-Feasibility studies aimed for better usage of the aquifer system	Studies/ N3-1 & N3-2	ECOWAS/ UMA	2.5
<b>Iullemeden Aquifer System</b>				
IAS	Pre-Feasibility studies aimed for better usage of the aquifer system	Studies/ N3-1 & N3-2	ECOWAS	2,5
<b>Continental</b>				
Co	Capacity Building in Investment Project Preparation	Capacity Building – N2	All RBOs and RECs	3



**Overview of PAP projects by region and project type:**



N4 project

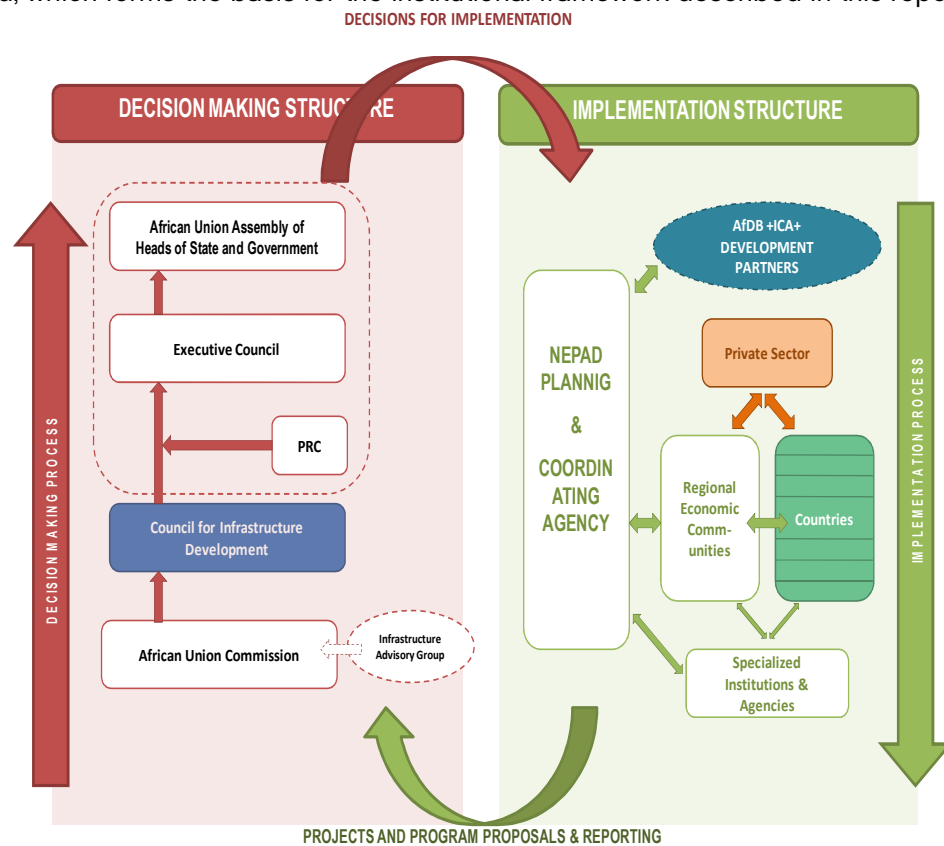
N3-II project

N3-I and N2 project

# 4. IMPLEMENTATION STRATEGY AND PROCESSES OF THE TWR PAP

## 4.1 Institutional roles and arrangements for financing

The implementation of the PIDA programme, including its TWR component, needs to take place through a variety of organisations within a multi-tiered, integrated institutional framework. The IAIDA<sup>27</sup> report commissioned by the Department of Infrastructure and Energy of the African Union Commission proposes an institutional structure through which the overall PIDA programme will be implemented, which forms the basis for the institutional framework described in this report.



Source: IAIDA report

The IAIDA report elaborates a decision-making structure and an implementation structure for the PIDA programme at continental level. While the IAIDA report makes some reference to project implementation it is primarily focused on programme level implementation, e.g. the review and update of the programme, selection of projects according to identified criteria and coordination between the relevant role-players at different levels. Given the elaborate description of the programme level implementation mechanism in the IAIDA report this is referred to and this chapter is focused on project level implementation and describes the role of actors at continental, regional, basin, and national level in more detail with specific respect to the implementation and financing of water resource infrastructure projects.

#### **4.1.1 Role of continental institutions**

In the framework illustrated above the NPCA is at the heart of the PIDA implementation mechanisms and, guided by the 'Decision Making Structure', builds the nexus between programme level management and project level implementation.

According to the IAIDA report, the NPCA is responsible for the pre-selection of future projects by applying selection criteria, and checking coherence with the agreed upon PIDA criteria. The report further states that in this regard, NPCA sets appropriate process to coordinate with all existing organs such as RECs, Countries, Development Partners and Specialized Institutions (which includes L/RBOs) and Agencies to receive their support in the compilation of projects. This coordination function is critical to the success of PIDA as it is through this mechanism that the programme is regularly updated in a dynamic process and its implementation monitored and supported. It is therefore essential that appropriate coordination structures between the NPCA and the other relevant role-players are established and maintained in this regard and proposals in this regard are made in the subsequent section of this report. Likewise, the REC validation meetings strongly propose the establishment of a knowledge exchange mechanism between regions facilitated through the NPCA for the sharing of experiences and best practice in infrastructure project planning, preparation and implementation.

The role of AMCOW in promoting projects has to be strengthened as well as its synergy with the African Ministerial Conference on Environment (AMCEN). The key role that TWR Infrastructure can play in mitigating the impacts of climate variability and change (UN Climate Change Fund) and in enforcing the green economy (African Green Fund) have to be highlighted. At the level of the AUC, coordination with the management of the Climate Change Programme should be developed (joint secretariat of center).

From a project preparation perspective it is important to note the key role of existing facilities such as the African Water Facility (AWF), hosted by the AfDB, as well as the NEPAD Infrastructure Project Preparation Facility (IPPF). The latter has been specifically established to facilitate the preparation of African infrastructure project while the former, with its strong donor base, has gained extensive experience in capacity development projects in the water sector and is increasingly shifting its focus to infrastructure project preparation. The effective use of these available facilities is critical to overcome the most common bottleneck for TWR infrastructure projects, i.e. the preparation of "bankable" projects. The creation of a TWR Unit in the AWF should be considered.

#### **4.1.2 Role of RECs**

The role of Regional Economic Communities is not in the practical implementation of individual infrastructure projects. Instead, the role of RECs is to create an optimum enabling environment for maximising the benefits from TWR infrastructure investments. As emphasised in this report, though not project specific, regional integration in trade, customs facilitation, transport etc. is essential to achieve this and forms a core responsibility of RECs.

Furthermore, it is the role of RECs to coordinate regional infrastructure planning and the identification and promotion of regional investments (as also highlighted in the IAIDA report). In the TWR sector, with its high potential for joint or cooperative projects it is critical that regional infrastructure development initiatives are well aligned and coordinated across different basins in order to ensure optimal use of TWR resources in a given region. Likewise, coordination between planned infrastructure investments in TWR needs to be coordinated with infrastructure development in other fields, notably energy and transport and the REC are the critical joint to ensure such alignment.

At the same time, given their regional mandate, the RECs are in a position to assist their Member States with the early promotion of infrastructure projects and in soliciting finance. A regionally and inter-sector harmonised infrastructure development plan promoted by the REC should add additional political weight to specific projects contained therein and assist in promoting such projects to potential financiers.

In order to maintain close cooperation and coordination with the PIDA programme it is recommended that each REC establishes a PIDA focal point entrusted with liaising with the NPCA at continental level. Where a REC has a designated water and/or infrastructure secretariat it is recommended that these become the designated PIDA focal points.

### 4.1.3 Role of RBOs

As described in the Outlook 2040 report there are several forms of river or lake basin organisations with varying mandate. Basin-wide L/RBOs all have the mandate for conducting basin studies and basin-wide planning. Thus all RBOs play an important role in project identification and selection and will have to coordinate closely with the respective REC for integrated regional planning and with the NPCA in terms of project selection for the PIDA programme. It is therefore recommended that each RBO establishes a PIDA focal point within their structures for liaison with the NPCA.

On the other hand, the mandate of L/RBOs to raise finance and implement projects varies considerably:

- A committee established between states for the purpose of consultations has no legal or financial capacity to raise financing.
- A Commission established by international treaty for the purpose of advising the parties has no inherent authority to raise financing or even to administer funds.
- A Commission established by international treaty for the purpose of advising the parties with separate legal personality in each of the states has no inherent authority to raise financing for capital projects but may do so if the Parties agree.
- A Commission established by international treaty with separate legal personality in each of the states and the specific mandate to raise financing and implement capital projects has the authority do so through the decisions of its governance structure (an example is OMVS).
- A public or private sector special purpose vehicle (SPV) set up with legal personality in each state for the specific purpose of raising finance and implementing a transboundary water project must derive its authority from the express terms of an international treaty between the participating states along with further contractual arrangements. An example is the bilateral Komati Basin Water Authority established for the implementation of the Komati Development project between South Africa and Swaziland.
- An organisation or authority set up with legal personality by one state in its own jurisdiction, in accordance with an international treaty with other states, has authority to raise finance and implement capital projects within that jurisdiction through the decisions of its governance structure. An example is the Lesotho Highlands Development Authority (LHDA) established to implement the Lesotho component of the Lesotho Highlands Water Project.
- The below table provides an overview of the basin organisations for the selected PIDA basins – or organisations of regional significance as far as the selected aquifers are concerned - and their mandate with respect to infrastructure development. It is clear that only a small majority of RBOs have a specific infrastructure development mandate whereas in all other basins alternative institutional approaches need to be developed.

Basin	Organization	Mandate for implementing large hydraulic infrastructure	REC
Congo River	CICOS	only project examination	ECCAS
Gambia-Geba-Koliba Rivers	OMVG	yes	ECOWAS
Lake Chad	LCBC	only knowledge and information exchange	ECCAS
Niger River	NBA	yes	ECOWAS
Nile River	NBI	no	EAC
Okavango River	OKACOM	Only investigations	SADC
Orange-Senqu River	ORASECOM	only investigations and studies	SADC
Senegal River	OMVS	yes	ECOWAS
Volta River	VBA	yes	ECOWAS
Zambezi River	ZAMCOM	no	SADC
Nubian Sandstone Aquifer System	CEDARE	n/a	UAM
North West Sahara Aquifer System	OSS	n/a	UAM
Iullemeden Aquifer	OSS	n/a	UAM

Against this background, the role of RBOs needs to be carefully distinguished and their role be defined on a project-by-project basis.

For basins where organizations still do not exist, the creation of L/RBOs needs strong support from AU, AMCOW and REC in order to increase the political motivation of governments. Technical support can be provided by ANBO. As for the case above, concrete joint investment opportunities can be studied according to a specific agreement between interested countries or on the basis of a general and comprehensive cooperation agreement between basin countries. Capacity building projects, data collection and knowledge generation activities, transboundary master plan elaboration including environmental diagnostic studies and investment programme can be developed at the same time.

Where RBOs exist (now the majority of basins) their role in infrastructure development differs considerably depending on their mandate. For basins where organizations have the mandate for implementing large hydraulic infrastructure, the proposed approach for the short term is to give priority to physical investments implemented by the L/RBO (N3-II and N4 projects) to consequently ensure more substantial financial support to these projects. Additional measures may be required to secure successful implementation, effective benefit sharing between countries and mitigation measures. Mostly specific studies on optimal implementation mechanisms for each concerned common infrastructure are recommended.

For (the majority) of basins where RBOs do not have the mandate for implementing large hydraulic infrastructure, other approaches have to be taken. One option is to facilitate a change in mandate of the RBO towards infrastructure development with direct and tangible economic return for the people of the basins where this change is desired by the RBO Member States.

At the same time it needs to be realised that a change of mandate for an RBO would often require a change of treaty, which, even if desired, is a time-consuming process. Likewise, many (if not most) RBOs in their internal governance structure and equipment with (human and financial) resources are not capacitated for project preparation and infrastructure development. Their organisational set-up and capacity has been geared towards overall basin assessment, planning and management in line with their primary mandate of advising the Member States. These functions remain relevant and need to be maintained. Re-focusing the mandate of the RBO entirely towards infrastructure development

puts continued carrying out of these functions at risk without necessarily increasing the efficiency and effectiveness of infrastructure project preparation and implementation.

It is recommended that instead additional support is provided for strengthening the critical joint between basin planning and early project identification (a primary task of RBOs) and project preparation and implementation through designated Special Purpose Vehicles (SPVs). The latter, in their various forms, are often better equipped for the specialised tasks of project preparation, including the raising of finance. It appears to be essential that the organisational linkages between RBOs and SPVs are clearly defined in each basin (for each project). The RECs can provide valuable political support to RBOs and Member States in the process of promoting a project early after its identification towards creating an adequate SPV for implementation.

In determining the institutional arrangements for transboundary water resources infrastructure projects it is important to closely examine whether the establishment agreement authorises the commission or organisation to raise finance and implement capital projects. In some cases, a new international treaty may be required with the full procedure for the ratification of international treaties and this can be expected to be a protracted affair. In other jurisdictions the law allows a head of state or minister to authorise a state's participation in an international organisation.

Most financing institutions particularly from the private sector will seek to manage the risks of lending to a multi-national project by requiring guarantees from the governments. Where the setup is for limited recourse project financing through an SPV, the financial institution will seek to manage risk by protecting the income stream by cession, guarantees or insurance. It would be important to confirm that the states, their functionaries and the organisations are authorised to accept such indirect liabilities.

#### **4.1.4 Role of national governments**

Both L/RBOs and RECs are comprised of sovereign Member States and express the agreed priorities of their collective members. Thus, national governments are key actors in the project selection and prioritisation of TWR projects through the basin-planning work carried out by L/RBOs and the regional strategic infrastructure planning undertaken at REC level.

In terms of infrastructure project implementation national governments take on different roles, varying greatly from project to project. Commonly governments create the entities responsible for project implementation (be that RBOs or any form of SPVs) and are an integral part of the governing structures of such entities, thus involved in project oversight and monitoring.

In terms of project finance national governments have taken on the role of (partial) financiers as well as guarantors for credits.

#### **4.1.5 Role of private sector**

The involvement of the private sector is largely that of project finance once projects have been selected and prioritised. Given the financial volume required for the implementation of the PIDA TWR PAP it is critical that efforts are made to maximise private sector finance. However, the challenge of limited (to non-existent) PPP and private sector interest in financing non-hydropower TWR infrastructure has been highlighted and discussed under item 1.7.

#### **4.1.6 Role of Civil Society**

Civil society participation in the preparation and implementation of projects has been identified as a PIDA principle. This applies to physical investments specifically, but also to soft studies and action plans.

All investment project in the PAP are prepared in accordance with internationally accepted standards for environmental and social assessment, of which stakeholder participation is a mandatory

component. Costs for the stakeholder participation activities during project preparation are factored into the financing plans outlined for each project in section 4.3.

#### 4.1.7 Summary of key institutional roles

While the exact role for project implementation for each actor varies considerably and needs to be determined on a case-by case basis, the main roles described are summarised in generic form in the table below.

Organisational level	Role in project implementation
Continental organisations	<ul style="list-style-type: none"> <li>▪ Coordination of PIDA programme (project evaluation, programme update)</li> <li>▪ Project selection</li> <li>▪ Financing of project preparation (through special funds)</li> <li>▪ Project promotion (to investors)</li> <li>▪ Resource mobilisation</li> </ul>
RECs	<ul style="list-style-type: none"> <li>▪ Integrated, inter-sectoral regional planning</li> <li>▪ Project selection</li> <li>▪ Project promotion (to investors)</li> <li>▪ Resource mobilisation</li> <li>▪ Facilitating improved enabling environment (e.g. regional trade integration etc.)</li> </ul>
L/RBOs	<ul style="list-style-type: none"> <li>▪ Project identification and selection</li> <li>▪ Project promotion (to investors)</li> <li>▪ Resource mobilisation</li> <li>▪ Project implementation (directly or in conjunction with SPVs)</li> </ul>
National Governments	<ul style="list-style-type: none"> <li>▪ Project selection</li> <li>▪ Project promotion (to investors)</li> <li>▪ Resource mobilisation</li> <li>▪ Financing</li> </ul>
Private Sector	<ul style="list-style-type: none"> <li>▪ Financing</li> </ul>
Civil Society	<ul style="list-style-type: none"> <li>▪ Consultation</li> <li>▪ Inputs to project planning during EIA and SIA process</li> </ul>

## 4.2 Implementation of the PAP

### 4.2.1 Structure of PAP

The PIDA TWR programme is structured as a long-term infrastructure development programme consisting of three programme cycles, the 2012-2020 PAP, the 2020-2030 mid-term programme and the 2030-2040 long-term programme.

Large-scale TWR infrastructure projects, even in optimal circumstances, require a long planning and preparation period before they are ready for construction with ten or more years being common. The preparatory work that needs to be carried out includes pre-feasibility studies, feasibility studies, EIA and SIA, technical design, economic and financing studies, determination and establishment of institutional mechanism for project implementation. A number of the projects contained in the 2012-

2020 PAP have completed or are far advanced with that preparatory work and are included in the PAP as N4 (investment) projects. It is expected that these projects will either complete or at least commence construction during the 2012-2020 period. Each project will include a Capacity Building component.

Other projects still require most or all of the preparatory work to be done. The primary purpose for these projects in the PAP is therefore to bring these projects from the planning to construction-ready stage. Therefore they are included in the PAP as N3-II type projects (project specific studies) and it is expected that the preparatory work will be completed by 2020, meaning that the projects have reached N4 stage. For the replenishment of the programme these projects are then pipelined for the mid-term cycle (2020-2030) as N4 projects with construction expected to take place during that time period.

An example of the rolling-plan nature of the PIDA programme is presented in the table below, using the PIDA TWR projects selected for the Congo River basin as an example (see section 4.2.2 for the review and update mechanism).

PAP 2012 - 2020			Mid-term cycle 2020 - 2030			Long-term cycle 2030 - 2040		
Number	Project	Project Type	Number	Project	Project Type	Number	Project	Project Type
Congo River Basin			Congo River Basin			Congo River Basin		
C5	Ruzizi III	N4						
C4	Palambo	N3-II	C4	Palambo	N4			
			C6	Waine Rukula	N3-II	C6	Waine Rukula	N4

#### 4.2.2 PIDA programme review and update mechanism

The implementation of the PAP will be monitored through the structures described in the IAIDA report. Likewise, a periodic review of the PIDA programme as a whole and the replenishment and update of the programme will be effected through these mechanisms.

The projects included in the PAP 2012-2020 have been selected and prioritised (and validated through extensive consultation with regional and continental stakeholders) for fast-tracked implementation.

The other projects contained in the PIDA list represent a basket of pre-selected projects that meet the agreed PIDA TWR criteria and will be the starting point for the selection of projects for programme replenishment. In light of the above and given the long timeframe of the PIDA programme (2012-2040) it is clear that it is not cast in stone and needs to be a dynamic and flexible programme as priorities can change over time. Any potential new projects need to be tested against the agreed criteria through the above-mentioned project selection and prioritisation mechanisms and be included in the programme if they meet the agreed criteria.



## 4.3 Project specific finance and implementation mechanisms

### CONGO RIVER BASIN – RUZIZI III DAM

#### Rationale for PAP selection

- Ruzizi III is the highest scoring project in the Congo River basin. Ruzizi III involves the construction of a new sub-regional hydroelectric plant in the Ruzizi River, a natural border between DRC and Rwanda upstream the river flow, and DRC and Burundi downstream. This plant is expected to generate 143 MW of power by 2013 and will play a critical role to reduce the energy shortage of the 3 countries of the Great Lakes region. Total Project Cost for the construction of Ruzizi III is estimated at 300 million Euro (EUR 378 million, with high-voltage transmission links to supply electricity to three neighbouring countries).

#### State of preparation:

- The project studies are promoted by "Électricité des Grands Lacs" (EGL), a regional organisation responsible for the elaboration of the strategy of energy development in the Great Lakes region.
- The EU mobilised the financing needed to carry out of the first phase of the technical studies in 2007. The ITF Grant is used to finance additional and complementary studies for the preparation of this project, mainly focusing on the economic and financial viability of the project and its institutional arrangements, including the management of the water flow and interactions with the existing plants. The studies will also review the interconnection of South Kivu and North Kivu and their interface with the CEPGL interconnected network.
- A second phase of project preparation will consist of further studies to bring the existing ESIA, which provides a good baseline for complementary studies, to a bankable format.
- The Republic of Burundi, the Democratic Republic of the Congo and the Republic of Rwanda are actively working to set up an International Convention on the management of the water resources of Lake Kivu and the Ruzizi River. This Convention, based on the principle of benefit-sharing among the three States, clearly defines the conditions for the long-term development of the valley's hydropower potential. It also establishes environmental safeguards and guarantees the rights of the populations.
- A Basin Authority, whose statuses are also under finalization by the three States, will be set up to implement and enforce the Convention.

#### Implementation and Financing Mechanism:

- The project will be financed with a 70% debt : 30% equity ratio. National power utilities shall not participate in the equity. States may take part as minority shareholders (less than 30%), while private investors are expected to hold a large majority of the shares. International Financing Institutions may also participate in the equity.
- International Financing Institutions are supporting EGL the three States to foster the development of Ruzizi III. Ongoing studies are financed by the European Union and the European Investment Bank. The World Bank, the African Development Bank, as well as numerous bilateral development organizations, have expressed their interest: KfW (Germany), AFD (France), FMO (the Netherlands), CTB (Belgium), DBSA (South Africa), ADA (Austria), etc.
- The project is developed under a Public Private Partnership (PPP) model where the project company will operate the power plant as an Independent Power Producer. The PPP structure was retained as being the most efficient way to rapidly mobilize financial resources, and to ensure the sustainability of the operation in the long run. The Ministers for Energy of the three States have given EGL a specific mandate to implement the Ruzizi III HPP under a PPP structure, through a delegation of authority co-signed by the three Ministers.
- On the basis of the strength of the balance sheet , their track record with the development of large hydro projet, and their experience as operators of large power plants, consortia were selected. The four short listed developer/investors are: IPS/Sithe Global (USA); SN Power Africa (Norway); GMR Infra Ltd (India); and IMPSA/CopperBelt (Argentina/Zambia). All the preselected consortia present a net worth of about USD 1 billion or higher and have experience in developing/financing more than 3,000 MW of hydro capacity. The next step in the preparation of Ruzizi III is the preparation of the selection of the preferred investors amongst the short listed consortia, through a transparent consultation organized by EGL.

## CONGO RIVER BASIN – PALAMBO DAM

### Rationale for PAP selection

- Palambo project, localised 64 km upstream of Bangui, capital of Central Africa, will produce low flow support for inland navigation between Bangui and the two other capital cities, Kinshasa (DRC) and Brazzaville (Republic of Congo). The navigation conditions have been degraded since the decreasing of flow since 1970, due to climate change impacts and socio-economic conditions. Palambo will also produce energy for Bangui (CAR) and DRC.

### State of preparation:

- A pre-feasibility study has been produced for the Palambo project in 1990 by the 3 countries (DRC, Central Africa and Congo with European funding). The project is classified N3-II, as feasibility study must be revised and detailed study carried out. Environmental impact assessment has not been studied yet. The CICOS Council of Ministers has validated in 2010 the Terms of Reference for a Palambo dam feasibility study. CEMAC is also involved in the Palambo project.

### Implementation and Financing Mechanism:

- The project, with an installed capacity of 30MW is estimated to cost US\$155m.
- If separated effectively from the rest of the project, the hydropower component could probably attract private sector financing. This would not be the case for the navigation component. A PPP is proposed but the financial capacity of the electricity organisations that must back up the essential off-take agreement, is in question.
- All feasibility studies need to be completed. A study into the financing and establishment of a special purpose vehicle in order to attract private sector financing for the hydropower component is required. The study would need to establish the extent to which the two purposes of the dam should be financed differently.
- As navigation is usually regarded as an economic good, this portion of the project would probably need to be financed by the governments directly or with development aid.

### Challenges to be addressed:

- While the project was initially investigated by three states, it is now under the auspices of the CICOS.
- The CICOS established by four riparian states does not have the legal mandate to implement an investment project (only projects examination) and an empowering agreement or the creation of a project specific entity will be required.
- The project has two purposes namely hydro-electricity and flow regulation for navigation. The former will have financial flows from energy sales while the latter will have none and rely on economic merit for its implementation. Such a multi-purpose project introduces complexity both in financing and in the operating procedures.
- At present feasibility studies into the technical, environmental, social and economic aspects of the project are nearing completion but financing proposals have not yet been prepared.
- The Palambo project, with another configuration, is also part of Water transfer project from Ubangi river to Lake Chad.

## GAMBIA-GEBA-KOLIBA RIVER BASIN - KALETA DAM

### Rationale for PAP selection

- The Kaleta dam project is selected for the TWR PAP. This project is not localised in Gambia River basin but it is implemented by OMVG, together with the Sambangalou project.
- Kaleta project, localised in Guinea, consists of the installation of a hydroelectric power generating station with a yearly guaranteed energy generation of 259 GWh.

### State of preparation:

- Detailed Project and Environmental and Social Impact Assessment have been produced in 2006 by OMVG for both Kaleta and Sambangalou projects, together with the interconnecting transmission line.

### Implementation and Financing Mechanism:

- The studies for the project have been driven by the Gambia River Basin Development Organization (OMVG) established in 1978 by international treaty between Gambia, Guinea, Guinea-Bissau and Senegal. As the project is likely to attract investors a special purpose vehicle is indicated but this will have to be clarified.
- AfDB completed an appraisal report on 30 May 2011 and this is scheduled to serve at the Board on 30 November 2011. The project cost is about US\$179m (2006). The implementing agency is listed as OMVG. There are no further details of co-financiers.

<b>NIGER RIVER BASIN - FOMI DAM</b>	
<b>Rationale for PAP selection</b>	
<ul style="list-style-type: none"> <li>▪ The best SCORING project in Niger River basin is Farankonedou dam. However, although mentioned in The NBA Sustainable Development Action Plan (SDAP), Farankonedou project is not one of the three main projects written in the SDAP, which are Fomi dam, Taoussa dam and Kandadji dam. Instead, Farankonedou dam is proposed in Fomi Environmental and Social Impact Assessment as a complementary installation to Fomi dam.</li> <li>▪ The second highest scoring project in Niger River basin is Fomi dam. This project is located in Guinea and is expected to be very beneficial to Mali, especially for the extension of Niger Office irrigation schemes. Fomi dam project is selected for TWR PAP.</li> <li>▪ The objective of Fomi project is mainly to increase the low-flow of the Niger River in Guinea and Mali. It will also permit to develop agriculture and hydropower production.</li> </ul>	
<b>State of preparation:</b>	
<ul style="list-style-type: none"> <li>▪ Environmental and Social Impact Assessments of Fomi dam project have been produced by NBA in 2010. A feasibility study has been carried out in 1999 and needs to be updated. Fomi project is classified N3-II, as detailed study is just beginning with NBA (World Bank funding).</li> </ul>	
<b>Implementation and Financing Mechanism:</b>	
<ul style="list-style-type: none"> <li>▪ The Fomi Dam cost is about US\$384m (2008).</li> <li>▪ The dam proposal includes a hydro-power station with an installed capacity of 102MW. This component presents a possible income stream that would attract investors to an SPV.</li> <li>▪ However for the other functions of the dam being livestock watering, environment, agriculture, fishing and navigation, this is not the case. The governments supported by ODA would have to finance these components. A multi-purpose financial model would introduce considerable complexity.</li> <li>▪ AfDB is reported as having expressed an interest in (co-) financing the project. World Bank and European Commission have funded the studies.</li> <li>▪ If the provider of the off-take agreement is financially weak, the project will need to be supported with guarantees.</li> <li>▪ The role of NBA needs to be clarified and it should be considered mandating it as the SPV for the dam.</li> <li>▪ Efforts need to be made to mobilise the interest in the project of providers of guarantee instruments.</li> </ul>	
<b>Challenges to be addressed</b>	
<ul style="list-style-type: none"> <li>▪ The Niger Basin Authority (NBA) established by the nine riparian states has the legal mandate to implement an investment project. The studies used the mechanism of designating the Guinean Ministry as the executive agency. This model is unlikely to be suitable for implementing the dam and certainly not for its later operation. Application of the mandate of NBA for example through the creation of a Fomi Management society based on the OMVS model (SOGEM and SOGED) seems necessary, or alternatively the establishment of a project-based authority.</li> <li>▪ The preparation studies are incomplete but are underway and financed by the World Bank. A study for institutional and financial arrangements still needs to be completed.</li> <li>▪ A PPP is proposed but the financial capacity of the electricity organisations that must back up the essential off-take agreement, is in question.</li> <li>▪ The project is multi-purpose but with only energy having a significant income stream. There is potential for confusing economic and social purposes and the aligned financial sources.</li> </ul>	

## NILE RIVER BASIN - RUSOMO FALLS DAM

### Rationale for PAP selection

- The Rusumo Falls hydropower project is the highest scoring project in the Nile River basin. This project is located at the border between Rwanda and Tanzania, close to Burundi on the Kagera river.
- The Strategic Social and Environmental Assessment (SSEA) intended to produce strategic level guidance to decision making in the power sector at the regional and national levels for the NELSAP Region, notes that Kakono and Rusumo falls projects are joined. The SSEA ranks Rusumo Falls as a priority project in the NELSAP area.

### State of preparation:

- A technical feasibility study has been carried out in 1987 and needs to be updated. Transmission studies have been carried out in 1995.

### Implementation and Financing Mechanism:

The NELSAP: Regional Rusumo Falls Hydroelectric and Multipurpose Project is in appraisal at the World Bank with an estimated Board Date of March 2012<sup>28</sup>. AfDB is proposed as a co-financier.

The tentative financing proposal is:

SOURCE	US\$millions
IDA	135
AfDB	90
Burundi	10
Rwanda	10
Tanzania	10
Other possible (project sponsor, IFC, commercial banks)	105
<b>TOTAL</b>	<b>360</b>

Note: The "other" above is proposed to be guaranteed by IDA PRG and/or MIGA

- All three countries qualify for concessional funding from IDA.
- The feasibility studies indicate that the power demand of Burundi, Rwanda and Northwest Tanzania is high and is expected to increase rapidly. In addition to three state utilities, mining companies have indicated preliminary interest in purchasing additional power from the Rusumo project. These credible power demands in the region would help secure the financial viability of the project and invite more competitive funding from project financiers and commercial banks.
- With regard to multipurpose aspect of the project, around US\$ 32 million has been allocated for environmental and social mitigation, resettlement and local area development programs based on the results of preliminary ESIA. The economic return of multipurpose benefits has not yet been calculated but will be integrated during project preparation.
- While the outcome of the World Bank appraisal is awaited it seems sensible in the meantime to continue negotiating around the institutional arrangements.

### Challenges to be addressed

- There is no separate institution proposed for the project and it appears that financing will be offered jointly to the three governments. Each country has nominated its electricity SOE as joint implementing agents. Such an arrangement appears less than optimal especially in view of the fact that the project will have to reconcile the needs of the multi-purpose users.

## OKAVANGO RIVER BASIN - MULTI-SECTORAL INVESTMENT OPPORTUNITY ANALYSIS

### Rationale for PAP selection

- Under the auspices of the Permanent Okavango River Basin Water Commission (OKACOM) the basin states Angola, Botswana and Namibia have recently concluded the development of a Strategic Action Programme (SAP) for the basin. The SAP is based on in-depth scientific-technical studies carried out through a GEF funded Transboundary Diagnostic Analysis (TDA).
- The SAP is the central basin-wide strategic planning framework for the Okavango basin and the proposed Multi-Sectoral Investment Opportunity Analysis (MSIOA) is the key SAP component dealing with investment planning.
- Based on the preliminary economic assessments carried out as part of the TDA, the objective of the study is to provide guidance to the basin states in supporting investments in the Okavango River Basin through a multi-sectoral economic analysis of growth focused development options and investment potential from both a basin and country perspective.

Specifically, the analysis will:

- Identify growth focused potential investment options and make an initial assessment of the economic, hydrological, social and environmental implications of options.
- Assess the benefits of cooperative and joint investments over unilateral development for the riparian countries individually and the region as a whole.
- Assess the economic, hydrological, environmental and social inter-relations between existing and proposed activities and investments from a basin perspective.

### State of preparation:

- The MSIOA is included in the Okavango basin SAP and currently in the conceptualisation stage. A detailed project concept note, funding proposal and ToR need to be developed.

### Implementation and Financing Mechanism:

- OKACOM, through its organs, is mandated to oversee, monitor and coordinate the overall implementation of the SAP.
- The estimated costs for the study are in the range of US\$ 1-1.5 million and it is recommended that grant finance is sought for financing the study. The recently established CIWA (Cooperation in International Waters in Africa) Multi Donor Trust Fund administered by the Water Resources Management Unit of the Africa Region of the World Bank appears to be suitable funding source and it is proposed that the basin states, through OKACOM, approach the fund to initiate project preparation.

### Challenges to be addressed

- While the SAP has been approved by OKACOM it is not yet formally signed by the relevant Ministers of the three basin states as it is presently going through the national approval processes in the three basin states. The internal processes are however expected to be completed soon and Ministerial signing is expected to take place in 2011. With that the SAP will be the formal basis for the strategic planning activities of OKACOM.

## ORANGE-SENQU RIVER BASIN - LESOTHO HIGHLANDS WATER PROJECT PHASE II

### Rationale for PAP selection

- Overseen by the Lesotho Highlands Water Commission (LHWC) the Lesotho Highlands Water Project Phase II consists of two separate components – a) the construction of Polihali Dam and transfer to tunnel to Katse dam (which was built during Phase I of the project), and b) the Kobong pump storage scheme hydro-electricity scheme.
- The project is of strategic importance to the two countries in that it provides significant royalty payments to Lesotho (from SA) for the water transfer and ensures the water security of South Africa's most important economic region (Gauteng province) centred around Johannesburg and the capital city Pretoria.

### State of preparation:

- The preparation for the water transfer component is well advanced. The issuing of design and construction tenders is scheduled for July 2012 – January 2015. Construction of the supporting infrastructure is scheduled to start from February 2014 and of construction of the dam and transfer tunnel from January 2016.
- The feasibility study for the proposed pumped storage scheme will only be completed in 2012 (financed by the Sweden) and further detailed studies are only expected to start from January 2013.

### Implementation and Financing Mechanism:

- In terms of the Treaty signed between the two governments, the Lesotho Highlands Development Authority (LHDA) is a parastatal set up on the Lesotho side and charged with the implementation operations and maintenance of the project within Lesotho whereas on the RSA side, the Trans-Caledon Tunnel Authority (TCTA) is mandated to do the same for that part of the project taking place on the RSA territory. On 11 August 2011, the governments of Lesotho and South Africa signed the agreement to proceed with the Lesotho Highlands Water Project Phase II. It needs to be noted that Phase II is geographically entirely located in Lesotho, however, the South African TCTA assumes responsibility for the storage and water transfer component of the project, whereas the LHDA assumes responsibility for implementing the pump storage component of the project.
- In terms of the LHWP Treaty between South Africa and Lesotho, South Africa assumes responsibility for the costs relating to the water transfer, and as such provides the guarantees required in support of funding for this component. Similarly Lesotho assumes responsibility for the costs of implementing the pumped storage scheme and raises the guarantees to support the secured financing facilities.
- The estimated costs of the two project components are (at Dec 2010):
 

Water Project	US\$1.1bn
Pumped Storage and transmission line	US\$1.1bn
<b>TOTAL</b>	<b>US\$2.2bn</b>
- For the water component, South Africa will probably follow the financing model used in Phase I B, i.e. the major part will be raised by its water project financing parastatal, TCTA, on the capital and money markets and the balance as loans from international development financing institutions such as the World Bank, EIB and DBSA.
- Lesotho's financing of the pumped storage project presents more of a challenge bearing

in mind Lesotho's financial situation and size relative to the financial resources needed. If the income stream can be proven and the special institutional arrangements for peaking power can be resolved, private sector financing is indicated.

**Challenges to be addressed:**

- The Project follows the successful implementation of Phases I A and I B, except that the proposed 1200MW pumped storage component presents a new dimension.
- Support Lesotho in advancing preparation for the pumped storage component, particularly in relation to financing.
- Investigate the use of guarantees by international institutions such as Miga for the pumped storage component.



<b>SENEGAL RIVER BASIN - GOURBASSY DAM</b>	
<b>Rationale for PAP selection</b>	
	<ul style="list-style-type: none"><li>▪ The selection of this project has been proposed by Organisation pour la Mise en Valeur du Fleuve Senegal (OMVS) during the regional Phase II workshop.</li></ul>
<b>State of preparation:</b>	
	<ul style="list-style-type: none"><li>▪ A feasibility study of Goubassy project is ongoing with OMVS. It is part of an integrated management program that includes feasibility studies of five multipurpose hydroelectric projects (credit of US\$110 million from the World Bank's International Development Association).</li></ul>
<b>Implementation and Financing Mechanism:</b>	
	<ul style="list-style-type: none"><li>▪ Goubassy project would be implemented by OMVS through the creation of a management society, on the same model than the existing SOGEM and SOGED.</li></ul>
<b>Challenges to be addressed:</b>	
	<ul style="list-style-type: none"><li>▪ Information on the state of project preparation and envisaged institutional and financing approaches could not be obtained.</li></ul>

<b>VOLTA RIVER BASIN - NOUMBIEL DAM</b>	
<b>Rationale for PAP selection</b>	
<ul style="list-style-type: none"> <li>▪ Nounbiel (Kourbi) dam is a very “integrative” project as it is localized on Mouhoun river on the border between Ghana and Burkina Faso.</li> <li>▪ It consists in a hydroelectric and agricultural dam with an installed power of 62 MW, an annual productible of 203 GWh and an irrigated perimeter of 7800 hectares</li> </ul>	
<b>State of preparation:</b>	
<ul style="list-style-type: none"> <li>▪ The main characteristics of Nounbiel dam project have been defined in 1987.</li> <li>▪ Feasibility study needs to be completed. If positive, it must be followed by detailed studies and environmental impact assessment.</li> </ul>	
<b>Implementation and Financing Mechanism:</b>	
<ul style="list-style-type: none"> <li>▪ The project was estimated to cost FCFA106bn in 1987.</li> <li>▪ If separated effectively from the rest of the project, the hydropower component could probably attract private sector financing.</li> <li>▪ A study into the financing and establishment of a special purpose vehicle in order to attract private sector financing for the hydropower component is required. The study would need to establish the extent to which the different purposes of the dam should be financed differently.</li> </ul>	
<b>Challenges to be addressed:</b>	
<ul style="list-style-type: none"> <li>▪ The Volta Basin Authority (VBA) does not have the legal mandate to implement an investment project (only investigations and studies) and an empowering agreement or the creation of a project specific entity will be required.</li> <li>▪ VBA which is a relatively “young” institution still does not have a Basin Master Plan nor an Investment program.</li> </ul>	

## VOLTA RIVER BASIN - DEVELOPMENT OF BASIN MASTER PLAN

### Rationale for PAP selection

- Until recently development of the Volta River basin has been largely the result of national or bilateral initiatives. A basin-wide management and investment plan does not yet exist. With the recent establishment of the Volta Basin Authority (VBA) the cooperative platform for multi-lateral, basin-wide coordination, planning and management has been established. In order to ensure optimal water resources use and maximising the investment potential of the basin, a basin-wide water resources management master plan is required and has been identified as a priority by the VBA and its Member States.

### State of preparation:

- The project is currently in the conceptualisation stage. A detailed project concept note, funding proposal and ToR need to be developed.

### Implementation and Financing Mechanism:

- The Volta Basin Authority (VBA), through its organs, is mandated to oversee, monitor and coordinate the development of the Volta Basin Master Plan.
- The estimated costs for the study are estimated to be in the range of US\$ 3 million and it is recommended that grant finance is sought for financing the study. The recently established CIWA (Cooperation in International Waters in Africa) Multi Donor Trust Fund administered by the Water Resources Management Unit of the Africa Region of the World Bank appears to be suitable funding source and it is proposed that the basin states through VBA approach the fund to initiate project preparation. Alternatively, the support of bilateral donor agencies can be sought.

## NUBIAN SANDSTONE AQUIFER SYSTEM - IMPLEMENTATION OF REGIONAL STRATEGY FOR THE UTILISATION OF THE AQUIFER SYSTEM

### Rationale for PAP selection

- The Nubian Sandstone Aquifer System is one of the three selected PIDA aquifers. The proposed project is Phase III of a Regional Programme for the Development of Nubian Sandstone Aquifer System and builds coherently on the Phase I and Phase II projects that have created the knowledge and institutional base for the proposed project activities.

### State of preparation:

A detailed project proposal and budget has been developed. The proposed four components of the project are:

- Developing a standard mechanism for monitoring the development of the Aquifer
- Capacity building of professionals in the four countries in field investigations and monitoring of groundwater
- Creating a legislative framework for attaining principles of cooperation and equitable utilization
- Developing a framework for the implementation of the regional strategy for utilization of the NSAS

### Implementation and Financing Mechanism:

- It is proposed that the project will be implemented by the Centre for Environment and Development for the Arab Region and Europe (CEDARE). The project is conceptualised for implementation over a 3-year period with estimated project cost of US\$ 4.2 – 5 million.
- It is recommended that grant finance is sought for financing the project. The recently established CIWA (Cooperation in International Waters in Africa) Multi Donor Trust Fund administered by the Water Resources Management Unit of the Africa Region of the World Bank appears to be suitable funding source.
- Phase I and II of the programme were funded by the International Fund for Agriculture Development (IFAD) and the Islamic Development Bank (IDB). It is proposed that these two agencies are also approached for soliciting the required project funds.

## NORTH-WEST SAHARA AQUIFER SYSTEM - PRE-FEASIBILITY STUDIES FOR IMPROVED USE OF THE AQUIFER SYSTEM

### Rationale for PAP selection

- The North West Saharan Aquifer System (NWSAS) is one of the three selected PIDA aquifers. The proposed project builds coherently on previous GEF supported studies and aims at further developing the knowledge base about the aquifer and address some of the key management challenges identified through the previous studies.

### State of preparation:

The project is in the conceptualisation stage and is currently envisaged to consist of the following elements:

- Following a review of the findings of the previous GEF supported project and of the scope of the new proposed project, establish and confirm the areas where future production from the aquifer would be hydrogeologically viable, with reasonable well field yields, for planning horizons of 30 to 50 years into the future.
- Conduct a consultation process under the Joint Mechanism to agree the next steps.
- Drawing on the mathematical model simulation results, conduct land capability assessment in areas promising from the aquifer yield point of view, where some agricultural activities from the coastal areas may be transferred, though the socio economics implications would need to be carefully assessed as part of this element.
- A better form of economic development in these new areas, with good aquifer potential, would be to seek alternate investments, such as high tech industry, benefiting from the very cost effective solar energy that might be deployed.
- If the model results show promising areas for aquifer development and the socio economic benefits appear to be reasonable, conduct a programme of exploratory drilling in the region.
- With the results available proceed to a pre-feasibility study of the alternative ways to benefit from the resources of the transboundary aquifer.

### Implementation and Financing Mechanism:

- As the project is in the early conceptualisation stage. The amount of required finance is currently estimated to be US\$ 2.5m. . A full project concept and preliminary budget needs to be developed, which can be used as a basis for approaching potential financiers.
- As the project is a pre-feasibility study private sector finance cannot be expected. It is proposed to seek grant financing.
- It is proposed that the project will be coordinated by the Sahara and Sahel Observatory (Observatoire du Sahara et du Sahel – OSS)

## IULLEMEDEN AQUIFER SYSTEM - PRE-FEASIBILITY STUDIES FOR IMPROVED USE OF THE AQUIFER SYSTEM

### Rationale for PAP selection

- The Iullemeden Aquifer System (IAS) is one of the three selected PIDA aquifers. The proposed project builds coherently on previous GEF supported studies and aims at further developing the knowledge base about the aquifer and address some of the key management challenges identified through the previous studies.

### State of preparation:

The project is in the conceptualisation stage and is currently envisaged to consist of the following elements:

- Review and analysis of the proposed surface water projects for the river Niger, in particular those in the vicinity of the Aquifer System, to evaluate the potential of artificial recharge being included in them.
- After consultation under the Joint Mechanism, conduct a prefeasibility study of the flood plains of the Niger and its tributaries, to assess the potential for developing a managed aquifer recharge scheme using the flood waters.
- Evaluate the alternative designs and their limitations and provide a range of possibilities that might be applied.
- Conduct socio economic studies of the areas where the well construction intensity is large to evaluate the costs of overdraft on ground water resources and evaluate the potential of developing new ground water sources in the underutilised parts of the aquifer.
- Based on the outcomes of the pre feasibility proceed to more detailed designs if the benefits exceed the costs.

### Implementation and Financing Mechanism:

- As the project is in the early conceptualisation stage. The amount of required finance is currently estimated at US\$ 2.5m. . A full project concept and preliminary budget needs to be developed, which can be used as a basis for approaching potential financiers.
- As the project is a pre-feasibility study private sector finance cannot be expected. It is proposed to seek grant financing.
- It is proposed that the project will be coordinated by the Sahara and Sahel Observatory (Observatoire du Sahara et du Sahel – OSS)

## CONTINENTAL – CAPACITY BUILDING IN INVESTMENT PROJECT PREPARATION

### Rationale for PAP selection

- Limited capacity of L/RBOs, RECs and other relevant organisations in investment project preparation was identified in the consultations as a major constraint for accelerated infrastructure investment on the continent. The regional validation meetings strongly proposed the development of a continental capacity building project to strengthen the capacity of L/RBOs and RECs in aspects related to project preparation and implementation.

### State of preparation:

- The project is in the conceptualisation stage. A detailed project concept note, funding proposal and ToR need to be developed. In developing the project proposal it can be drawn from the existing Sustainable Water Infrastructure Development (SWID) capacity building initiative of UNEP and GIZ.

### Implementation and Financing Mechanism:

- The estimated costs for the study are in the range of US\$ 3 million and it is recommended that grant finance is sought for financing the study