ECOWAS COMMISSION
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# ECOWAS REGIONAL INFRASTRUCTURE MASTER PLAN

## 2020 - 2045

## Final Report

*March 2022*

SOFRECO

SEQUOIA
EMERGING MARKETS FINANCE LLC

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# ACKNOWLEDGEMENTS

This report was undertaken by a team of experts of a consulting consortium led by SOFRECO (France) and including Sequoia Emerging Markets Finance LLC (USA) over the period January 2016-October 2021. The main members of the team were the following: Theo Audigier (Project Director), Ananda Covindassamy (Team Leader), Henri Beaussant (Energy), Daniel Ekwalla Bouma (Transport), Michel Soulie (Water), Mike Jensen (ICT) and James Bond (Finance), with contribution from a number of other experts.

This Master Plan follows a detailed diagnostic of the current state of infrastructures in the ECOWAS region ("Diagnostic Report") and an in-depth analysis of future infrastructure needs up to the year 2045 based on projections and existing regional and national development plans and strategies ("Outlook 2040 Report").

The main goal of this Master Plan is to determine the priority integrative projects of regional strategic importance for the West African Economic Community up to the year 2045 in each sector, with a view to planning their implementation in a coordinated and perfectly synergetic manner.

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All data without specific references are the responsibility of the consultants.

# CONTEXT

The Economic Community of West African States (ECOWAS) is a regional institution with 15 Member States in West Africa (of which three landlocked and one island) with a population of over 300 million with an annual economic growth rate of around 6%. The ECOWAS Commission is one of the eight Regional Economic Communities supporting the African Union to coordinate the implementation of continental and regional integration and development programmes in the West Africa region.

The objective of ECOWAS is "*to promote cooperation and integration, leading to the establishment of an economic union in West Africa in order to raise the living standards of its peoples, and to maintain and enhance economic stability, foster relations among Member States and contribute to the progress and development of the African Continent*". This will be achieved through a free trade area and customs union to create a common market.

Following the transformation from the ECOWAS Secretariat into a Commission, ECOWAS embarked on a policy paradigm shift with market integration becoming the guiding principle to regional development. The Commission, development partners and Member States therefore pursued various infrastructure development programmes and projects to support regional integration. Implementation of these programmes and projects was initially carried out independently with limited focus on integrated planning.

The recently adopted ECOWAS Vision 2050 aims to achieve "*A fully integrated community of peoples living in a peaceful, prosperous region with strong institutions that respect fundamental freedoms, working towards inclusive and sustainable development*". One of the strategic objectives of Vision 2050 is to make ECOWAS a fully integrated economic zone through deepening infrastructure development. The broad vision is to ensure that infrastructure is the main catalyst to the achievement of the ECOWAS people-centric Regional Integration vision.

In support of policy development, sector specific plans and strategies for transport, energy, water and ICT were prepared over the years to steer sector developments towards the achievement of the ECOWAS Objective. These policy documents set out minimum regional infrastructure network requirements, clear targets of intervention are prioritized for immediate implementation. For several reasons and constraints, limited implementation success was achieved. Their impacts have

been plagued by inconsistencies and weak coordination. The overall contribution to regional integration has therefore been less significant.

As a way forward, the 41st Ordinary Session of the ECOWAS Heads of States and Governments underscored the importance of infrastructure in improving the competitiveness of the Region. It therefore directed the ECOWAS Commission to intensify its efforts for regional infrastructure development and the mobilization of the necessary resources towards this end. Furthermore, the African Union Commission (AUC) and the NEPAD Planning and Coordination Authority (NPCA), with support from the AfDB, have initiated processes to implement the Programme for Infrastructure Development in Africa (PIDA), which provides a vision and strategic framework for the development of regional and continental infrastructure (Energy, Transport, Information and Communication Technologies (ICT) and Trans-boundary Water Resources) in Africa for a period of 30 years.

A Meeting of ECOWAS Ministers in charge of Infrastructure, Transport, Energy, Water Resources and ICT held in November 2012 reviewed the status of the ECOWAS regional infrastructure projects and the PIDA-PAP to arrive at a short-term project list for West Africa. Amongst other matters, the Ministers endorsed the preparation of a long-term ECOWAS Regional Infrastructure Development Master Plan that defines benchmarks, minimum and ultimate regional requirements and development targets and a development framework to meet these requirements. They also recommended that technical and financial partners give high priority to capacity building within the framework of any financial or technical assistance and that AUC, NPCA and AfDB support the implementation of the ECOWAS infrastructure projects.

To achieve this noble initiative, the ECOWAS Commission recruited the Consultant Consortium SOFRECO/MWH/PTV/SEQUOIA, to carry out the study on the preparation of the ECOWAS Regional Infrastructure Masterplan. The Study is financed by the ECOWAS Commission and Spanish Co-operation for International Development (AECID). The Study Implementing Agency is the ECOWAS PPDU in collaboration with the Departments of Infrastructure, Energy, Water, and ICT of the Commission.

# EXECUTIVE SUMMARY

The ECOWAS PPDU organized a broad dialogue with the 15 ECOWAS member countries at the workshop of February 19 and 20, 2019, held in Cotonou in Benin. This workshop brought together representatives of the four sectors (Transport, Energy, Water and ICT) from these countries in order to review the ECOWAS Infrastructure Master Plan prepared and submitted by SOFRECO and presented to the PPDU.

The ECOWAS Infrastructure Master Plan covers the 2020-2045 period and is presented in an integrated, cross-sectoral form. It includes both “soft” projects (studies, regional project preparation, institution- and capacity building, the development of regional institutions) and physical investment projects. It also details the roles of the key actors and stakeholders in both its development and implementation. In addition, it explains the requirements and constraints for the PPDU unit to be in a position to take ownership and play its role of support and guidance for project preparation and launches in the ECOWAS region.

It is important to keep in mind that the ECOWAS Infrastructure Master Plan includes only investment and “soft” projects **with a regional dimension**, complementing the projects of a national scope that are in the different National Master Plans and not repeated in the present document.

The approach retained was to build on the long-term strategic planning work already prepared by most ECOWAS countries in each of the sectors as well as by regional institutions.

The ECOWAS Infrastructure Master Plan provides a broad diagnostic of the state, situation and performance of the infrastructure in each sector, followed by a presentation of the Outlook 2045 as a common sectoral vision in the long term, then by the regional priorities for integrative investments and soft projects by sector. It emphasizes the content and particularly the institutional and financing options necessary for its implementation. Finally, it details all the mechanisms that should be rolled out in order to mobilize the resources necessary for its fulfillment.

Based on ECOWAS priorities and the objectives that guided the preparation of the Master Plan, the selection criteria for regional projects are:

- Coordination of national policies;
- Regional integration;
- Environmental protection and gender;
- Liberalization of trade;
- Supporting partnerships with the private sector;
- Supporting landlocked countries.

# The diagnostic

The economic activities of ECOWAS are concentrated around Dakar and the Accra-Lagos coastal belt, making the integration of under-served inland countries a challenge.

ECOWAS ranks second in Sub-Saharan Africa in terms of quality of infrastructure, and first in some areas. Despite a reasonable performance by continental standards, the inadequacy of infrastructure services costs 5% of growth to ECOWAS countries, highlighting the importance of identifying the underlying causes of ineffective infrastructure services.

## Transport

Imports to the ECOWAS community are dominated by Nigeria (41%), Ghana (18%), Senegal (10%) and Côte d'Ivoire (10%). This four-nation pool monopolizes 79% of the sub-region's imports.

Intercommunity trade within the ECOWAS region constitutes a major source of goods movement and traffic. Over 5 years (2005-2015), inter-community trade was estimated at over USD 104.61 billion (USD 15 billion per year) including re-exports. This represents around 11% of total trade in the region.

**Transport infrastructure and services**

### The road network

The regional road development policy of the ECOWAS region is to *promote modern and quality infrastructure in order to ensure the permanent mobility of people, goods and merchandise in the community, in any season.*

It would be necessary to multiply two- or threefold the existing mileage to reach the same level as the Asian continent.

The second fundamental need is to ensure road continuity so that they are passable all year round.

Many countries in West Africa have managed to develop solid institutions for financing and building road infrastructure. However, the funds intended for the maintenance of this infrastructure remain largely insufficient.

### The rail network

ECOWAS had a total rail network of approximately 10,188 km, made up of three types of gauges.

Over the last 30 years, the economic importance of railroads in West Africa has diminished considerably due to the continued improvement of road infrastructure and the financial non-sustainability of railway services. Privatization under

concessions did not resolve the problem of declining and unprofitable passenger traffic.

On the whole, rail transport concession companies have prioritized goods transport, which seems to be somewhat profitable.

### Transport and air service

The air sector policy is based on the principle of State disengagement in the sub-region and on a progressive opening-up of the area to the private sector.

Each country has a daily air connection to one main air hub in the region. All of the ECOWAS Member States have at least one international-class terminal.

Since the Yamoussoukro Decision in 1999, the ECOWAS states have undertaken a progressive liberalization of market access.

### Maritime transport and port network

The West African sub-region has more than 50 maritime ports but only six of these play an important role, serving as transit ports for landlocked countries. Generally, these ports all have similar characteristics in terms of infrastructure and all see themselves as, or at least as becoming, the “sub-regional hub” for the maritime routes that service the entire West African coast. Given the current level of competition between them and their proximity to one another, it must be noted that not all of them will be able to carry out their ambitious short- and medium-term development plans.

The sub-regional ports are facing problems with insufficient infrastructure and port equipment, cumbersome bureaucracy, complex administrative procedures, a development gap in skills and logistics, and a lack of specialization. Poor connections with inland areas and challenges with maritime and port security and safety are complicating their situation.

### Sub-regional river and lake transport

The sub-region comprises three major navigable rivers: the Senegal River, the Gambia River, the Niger River and a lake, Lake Chad.

Inter-state goods and passenger traffic is marginal due to the development of major roads, other modes of transport and the seasonality of river transport. In addition, the cost, duration and risk of losing goods related to river-specific transshipment, penalize this mode of transport when compared to the road. This has very often led to river transport being relegated to a more rural dimension with a predominantly local impact.

## Analysis of transport performance in the sub-region

The cost of transport in African countries is 30% higher than in other developing countries in Asia. Consequently, this forces up input prices as well as the price of exported products.

The high logistical costs are due to the low capacity of transportation networks. They can also be the result of major physical and non-physical barriers that characterize the system and significantly affect costs and transport times.

The overall delivery times of goods from sub-regional seaports to the capitals of hinterland countries are too long. Exit procedures of goods from sub-regional ports

require between 7 days and 19 days. For distances in the corridors ranging from 980 km to 2,000 km, transport times of 3 to 13 days are excessive.

Furthermore, the number of road checks is too high. The amounts required from transporters range from between 999 F CFA and 7443 F CFA. Corruption represents 8.2% on average of the total cost of transportation along the Tema-Ouagadougou corridor for imports.

**Analysis of the problems and obstacles**

*Problems common to all transport subsectors:*

- Lack of effective implementation of policies and of the regional vision: the development of integrative projects still appears to be a secondary priority.
- Lack of financial resources within the Member States: the region's States do not always have the financial means and resources required to ensure the proper development of sub-regional infrastructure.
- The investment programs are overly ambitious in view of the available resources. Moreover, new constructions and new investment programs are favored to the detriment of the maintenance of existing infrastructure.
- Despite the official announcements, PPPs are still shy in the sub-region. They have not yet been able to mobilize large amounts of funding in the transport sector.
- The Road Maintenance Funds that have been instituted have not managed to cover all the needs or to fully play their role.
- The financing of regional and multi-modal transport systems and their upkeep remains a major challenge due to low intra-regional trade.

## Energy

Traditional energy (wood fuel and charcoal in particular) continues to play a critical role in the region's energy mix. It provides about 80% of the total final energy consumption while the shares of hydrocarbons and electricity remain low (15% and 5% respectively).

**Electricity resources**

Hydropower resources

The ECOWAS region's hydro endowment is 19 TWh, compared to the total potential of Sub-Saharan Africa of 1,091 TWh. This relatively modest potential is nevertheless underutilized.

Solar

West Africa has a lot of sunshine, estimated between 5 and 7 kWh/m$^2$/day on average. Since 2014, the region's use of solar PV technology remains limited.

Wind

The wind potential of the countries in the region other than Cape Verde is limited.

**Electricity supply system**

Grid-based installed capacity

Grid-based installed capacity in West Africa totaled 20 GW in 2012. More than half of this capacity is gas-fired, mostly in Nigeria, while hydropower accounts for 20%

of capacity and a smaller proportion of the power generated. Nearly all ECOWAS power plants are located on the coast. Landlocked countries have little installed capacity, reflecting both the low local demand and the lack of primary resources, although their solar potential is significant and better than on the coast.

**Energy system performance**

The ECOWAS electricity system is facing tremendous challenges including: (i) the persistence of low electricity access rates; (ii) the high demand not served and growing gap between demand and existing supply capacities; (iii) the inflated cost of production: electricity is produced and supplied inefficiently throughout the region as a high proportion of ECOWAS electricity generation capacity runs on expensive diesel or heavy fuel oil and imposes significant pressure on utilities' budgets; (iv) the financial distress of most energy utilities in the region, making it unattractive for private sector financing; and (v) high losses, in the range of 24% compared to 10% in South Africa and 7-10% in Europe. The implementation of power sector reforms aimed at stimulating private sector participation and liberalization has generally failed to mobilize significant private investment for power generation, except in a few cases in Ghana, Côte d'Ivoire and Nigeria.

Overall, low access to electricity, and modern energy in general, is one of the key issues in the ECOWAS region. Access to electricity services varies significantly across the region. Cape Verde has achieved nearly full access, while it is in the range of 10-15% in Guinea and Guinea-Bissau. Access also varies considerably between the main urban centers and peri-urban and rural areas.

Most West African countries experience daily outages, which are estimated to cost between 2%-5% of GDP in some of the worst affected economies.

Electricity is produced and supplied inefficiently throughout the region. Across Sub-Saharan Africa in 2012, the average cost of generating electricity was around USD 115 per megawatt-hour (MWh). The price of electricity to households is nearly double the price in other developing regions, with a serious impact on affordability and potential to contribute to poverty reduction.

Most West African refineries operate well below nameplate capacity, in particular in Nigeria and Ghana.

The key issue regarding natural gas in the ECOWAS area relates to the West Africa Gas Pipeline (WAGP), and the shortage of gas in Nigeria, due to the conflict between domestic demand and export contracts.

Transmission and distribution losses are above international standards.

This is due to:

Technical issues: Lack of maintenance, vandalism and cable theft, breakdowns in transformer and switchgear plants and unstable current.

Commercial issues: The critical problems are due to consumers' behavior, but also governance within the utilities, and particularly power theft.

Weak finances and a lack of resources for capital investment

Fundamentally, the main issue facing the West African power sector is one of reinforcing and stabilizing the sector's cash flow for maintenance, investment financing, and reinforcing borrowing capacity and attractiveness to the private sector.

There is a dilemma between electricity tariffs, cost recovery, subsidies and affordability. The inability to set electricity tariffs at levels that reflect costs is a major obstacle to the long-term sustainability of many utilities in West Africa. End-user electricity tariffs rarely reflect the costs of electricity supply. Low tariffs act as a deterrent to greater developments.

## Transboundary water resources

West Africa has considerable water resources but there is a chronic deficit in some countries.

Precipitation varies from more than a meter per year to less than 100 mm. Nonetheless, even the regions with low rainfall levels are not without water resources thanks to the two major river systems, the Senegal and the Niger.

The mobilization of water resources is low compared to the potential resources available. This is mainly due to poor resource management linked to considerable social and economic issues.

Another particularity in the region is that 80% of surface water found in transboundary water basins requires a participatory approach to water use from the different states involved, all the more so when we consider that countries that are “rich” in water lie upstream of the water basins. Similarly, the main groundwater resources are also found in transboundary aquifers.

West Africa, with around 1,300 km² of renewable water resources per year, is relatively well provided with water, even in the Sahelian zone. However, there are considerable disparities in space and time with some well-resourced countries (like Guinea) contrasting with others that fall below the international shortage standard.

*Depending on the geographic area, water consumption for different uses is very contrasted*:

- In the Sahelian zone, agriculture accounts for 95% of consumption, domestic water 4% and industry only 1%.
- In the Gulf of Guinea, agriculture only accounts for 71%, industry 9% and domestic water 20%.

Several factors explain this discrepancy: the climate (significant rainfall reduces the needs for additional water supplies), and high urban and industrial concentration along the coast.

In the 1960s, some states became aware of the need to manage water resources jointly to prevent a risk of conflict between the upstream and downstream areas of the water basin. International water basin management organizations were founded to facilitate dialogue between states. Some of these organizations endeavored to go beyond mere water management and positioned themselves as regional or sub-regional economic development organizations (e.g., OMVS and OMVG). Others, specifically created for economic development purposes (MRU), are also involved in the water sector.

28 transboundary water basins cover 71% of the 5,113,000 km² of the West African region, including some of the largest water basins. All countries in the zone (except, of course, the Cape Verde islands) have at least one transboundary water basin shared with their neighbors. For the moment, there is no international institutional body for the management of transboundary underground aquifers.

In the water sector, the summit of Heads of State held in December 2000 adopted a “West African Regional Vision for Water, Life and Environment for 2025", as well as the "Regional Action Plan for Integrated Water Resources Management (IWRM) for West Africa" (RAP-IWRM/WA) which commits countries to applying the principle of IWRM when managing their resources. To oversee the implementation of the RAP-IWRM, a Permanent Framework for Coordination and Monitoring of IWRM (PFCM) has been set up to provide States with support in implementing effective water management and ensuring the sustainability of uses.

Across the region, countries and water basin management organizations are concerned with food safety and crop-growing practices that allow for more efficient water use, and they have introduced irrigation development programs operating at several levels: village irrigation schemes, lowland irrigation, large-scale irrigation schemes.

All ECOWAS Member States have wetlands of considerable ecological (biodiversity) and economic interest along their rivers and around their lakes. In all, 63 wetlands are included on the list of Ramsar sites of international importance. Their future is largely dependent on water resource management in the water basins where they are located.

For the entire ECOWAS zone, an estimated 63% of the population has access to quality drinking water. There is a marked contrast between rural and urban areas.

Regarding sanitation, access rates remain very low across all ECOWAS countries, generally below 40%, except in the Gambia and Ghana.

Under groundwater is a significant water resource, most notably used for human consumption. There are three main underground transboundary aquifer systems in the region:

- the Senegalo-Mauritanian aquifer system in the west (Guinea Bissau, Gambia, Senegal and Mauritania)
- the Gulf of Guinea coastal aquifer systems (Côte d’Ivoire, Ghana, Togo, Benin, Nigeria)
- the Lullemeden – Tanezrouft – Taoudeni aquifer system (Benin, Burkina Faso, Mali, Mauritania, Algeria, Niger, Nigeria).

The largest of these aquifers is Lullemeden, linking the aquifers of Tanezrouft and Taodeni, shared by seven countries. Its annual recharge is estimated at 150,109 $m^3$/year.

The boundaries of these underground transboundary aquifers concern several countries, but they do not match the existing transboundary water resource management bodies, which mainly manage surface water.

Decreasing rainfall in the zone (a drop of 30%) over the past few decades has had direct consequences on water resources (fall in annual inflows) and on river and groundwater regimes. The impacts affect the environment (receding wetlands, biodiversity loss and faster desertification), agriculture (greater difficulties with rain-fed crops), resource availability (fall in groundwater levels – heightened due to overexploitation in some areas), and the socio-economic sector (fall in agricultural fields; fall in fishing potential, problems navigating for trade). The quantities of water stored in the large reservoirs remain insufficient to enable effective control of river levels and to plan aquifer recharges, or to deal with significant drought

episodes. Extreme climatic events result in potentially devastating floods, even more so where preventive measures are lacking.

At national level, even though most countries have a water policy, strategic plans and action plans, responsibilities for the water sector remain very scattered.

## ICT

Due to the increase in the number of submarine cables in the region in recent years, most ECOWAS Member States now have direct access to 25 submarine landing stations.

Apart from the increase in reliability of international capacity provided by several connecting cables, the new cables have combined the deployment of terrestrial backbone and last mile infrastructure (especially 3G) to have a dramatic effect on network traffic between 2010 and today.

In terms of overall national optic fiber connectivity, the ongoing construction of national backbones is bringing capacity to an increasing number of cities, towns and villages which have been beyond the reach of terrestrial networks. Over 77,500 km of fiber is now under operation in the region, with a further 32,000 km under construction, 25,000 km planned and over 16,000 km more proposed. If all of this infrastructure is completed the total would be over 150,000 km of fiber in the region.

In terms of fixed infrastructure operators (cable and wireless), the majority of ECOWAS countries still have a dominant incumbent operator, which may be state-owned or partially private. Most of these operators still provide a very limited amount of copper cable-based services and usually also operate some form of wireless service. The average access across the region is less than 2%, which is still considerably lower than the average for the developing world, which is just over 10%. Compared to mobile connectivity, fixed-line infrastructure is insignificant.

At present and although mobile infrastructure based on the GSM standard now covers virtually all the major population centers in the ECOWAS region, there is a lack of coverage outside of these centers.

Currently, the Independent Internet Exchange Points (IXPs) in the ECOWAS region are in Burkina Faso (2 in Ouagadougou and Bobo Dioulasso), Côte d'Ivoire (2 in Abidjan), Ghana (2 in Accra), Nigeria (5 in Abuja, Enugu, Kano, Lagos and Port Harcourt), the Gambia and Liberia, Mali and Sierra Leone. Other IXPs are being set up.

A text on cyber-crime was adopted as a directive due to the absence of a harmonized sub-regional penal framework. ECOWAS has also supported the establishment of Computer Emergency Response Teams (CERTs) at national level with the assistance of ITU and is considering setting up a harmonized framework on a Certification Authority for ECOWAS Member States.

ECOWAS is the primary regional institution with responsibility over the various ICT sectors with the aim of establishing an economic union through the harmonization and coordination of national policies and laws of Member States.

As in other regions, the ECOWAS Member States have a regional association of regulatory authorities called the West African Telecommunication Regulatory Association (WATRA), which was created in 2002. WATRA’s chief objective is to

coordinate dialogue and assist in the harmonization of telecommunications policy and regulation in the region.

All ECOWAS Member States now have a national telecommunication regulatory authority (NRA), some of which are also responsible for other utilities, such as PURA in the Gambia.

To address the issues faced by Member States in ensuring that their populations have access to broadband, national broadband plans are being implemented to help ensure that everyone, including those in rural areas, has access to fast and affordable Internet services. At a national level, most countries in the region have established some form of national broadband strategy, although some of them need updating.

The vast majority of people in the ECOWAS region access data services via mobile and fixed wireless networks rather than cable platforms, due to the lack of cable infrastructure in the region.

Mobile penetration in the ECOWAS region appears relatively high, at an average of 82% of total population. This compares to a developing country average of 91% and a world average of 96%.

In terms of Internet-use, the ECOWAS region has more Internet users than any other region in Africa – almost 80 million. In terms of Internet penetration levels and growth rates, at about 24% penetration and with a 16% annual growth rate in the number of Internet users, the ECOWAS region is similar to East and Southern Africa.

The average download speed available to the end-user in ECOWAS countries indicates that speeds are steadily increasing, from 3.3 Mbps last year to 3.5 Mbps measured in June 2019. This compares to a global average download speed of 24 Mbps. Average speeds have increased almost four-fold over the last 5 years.

Assuming that one 10 Gb bundle is purchased per month, the cost varies widely from about USD 2 (Gambia) to almost USD 20 (Sierra Leone) with a regional average of USD 7.

With regard to terrestrial networks, one of the main problems is that although most of the underlying infrastructure is in place, it is not efficiently used. This is one of the main problems. Landlocked ECOWAS Member States still pay more to get to the coast or to the rest of Africa than they do to get from the coast to Europe, the USA or Asia. Even routes within the same country, such as Abuja to Lagos cost more than getting from Lagos to London.

There is a significant gap when it comes to the international needs of the region in Guinea-Bissau and Liberia, as the countries do not have sufficient underwater landing stations or national backbones. The most obvious solution to provide diverse routing for Liberia is to connect to neighboring Côte d'Ivoire, which is connected to three submarine cables.

**ICT issues to be addressed**

- National fiber optic backbones in many countries need better management and more competition, as well as upgrading and extension to cover more population, and to achieve more affordable pricing.
- Missed potentials for use of utility/alternative infrastructure.

- Due to the limited development of Internet exchange points, much domestic and regional traffic is exchanged overseas, leading to poor network performance and millions of dollars in transit fees annually paid to foreign operators.
- Lack of access to radio spectrum: wired infrastructure is not well established, and so wireless systems can be more easily deployed to deliver services to population bases in dense urban environments as well as those in more remote areas. However, one barrier to this is the limitation in the amount of spectrum available, partly due the delays in the analog to digital migration process which should liberate spectrum for mobile broadband.

## Multi-sectorial aspects

**Multi-sector synergies**

The nexus between the infrastructure sectors calls for a global approach to produce synergies between them. A conclusion is that although synergies between infrastructure sectors are strong, they all have a nexus with the agriculture sector.

The main synergies are between water on the one hand, and:

- transport, as the management and development of river basins affects the potential for river transport;
- agriculture, for irrigation.

Energy on the one hand, and:

- ICT, through the parallel and coordinated inclusion of fiber-optic cable with transmission lines. Conversely, the ICT system is necessary for the development of SCADA systems for power systems dispatch and management in real time.
- water, as hydropower projects will contribute to water basin management.
- the transport sector. Investment in national and regional petroleum product pipelines can help decongest heavily transited road corridors, while investment in gas pipelines will displace diesel and heavy fuel oil, which is typically transported by road and rail.
- agriculture for irrigation.

Transport on the one hand, and:

- ICT: roads and railway lines should share rights of way with ICT. Conversely, ICT networks and systems are essential for facilitating the movement of freight and tracking location of freight, particularly containers.
- Agriculture, as the availability of a transport system that is accessible all-year around and the quality of transport (roads, rail, port and airport facilities) are important for moving agriculture products from the farm to the markets.

ICT on the one hand, and:

- Agriculture for market data sharing.
- A multi-sector approach between the water, energy, transport and ICT sectors involves developing joint mechanisms.

**Performance of ECOWAS with multi-sector synergies**

ECOWAS has successfully established a number of multi-sector institutions which have been in operation for many years, amongst which OMVS (water, energy, irrigation, transport); OMVG (water, energy, irrigation, transport); NRA (energy,

agriculture, forestry, transport, communications, and industrial resources). Despite a chronic shortage of resources, these institutions have played an important role in the development and implementation of major multi-sector infrastructure projects.

Multi-sector planning or Integrated Resources Planning (IRP) has proven to be extremely complex in practice, costly and ineffective in operational terms and has remained largely theoretical.

Few multi-sector projects have been financed in the ECOWAS. The most notable one is Manantali; the OMVG power project is another. Nevertheless, the financing of multisector projects has been a challenge.

**Financing infrastructure**

Overall, the ECOWAS region has received USD 14.6 billion of public and private funds for infrastructure.

- The transport sector, which represented 24% of ACI members' financing, received USD 1.3 billion in 2013.
- The water sector, which represented 29% of the new commitments, received USD 1.5 billion.
- The energy sector, which represented 47% of new commitments in the sector, received USD 5.5 billion.
- The ICT sector received USD 162 million.

The financing of infrastructure in ECOWAS raises several issues:

- Global figures for the energy sector indicate that the external financing available is about USD 6 billion, including private sector financing, whereas investment needs for new capacity and rehabilitation are about USD 12 billion, leaving a financing gap of 50%.
- Private sector financing in transport, energy and water in ECOWAS has not materialized up to expectations.
- Continued dependence on international aid remains a key issue. Infrastructure financing in ECOWAS is still dependent for 60% on international aid, illustrating the point that infrastructure sectors are far from achieving financial sustainability.
- The high cost of equity is a barrier to private financing. Investors require returns on equity ranging from 15% to 25%. Given that infrastructure projects require at least 25% equity financing, the impact on infrastructure tariffs provided by private infrastructure projects is high.

# Causes of infrastructure financing gaps

The explanations of the financing issues noted above can be traced to the following challenges:

- Low credit standing of ECOWAS countries scares financiers. The assessment of the attractiveness of the various regions shows that African countries rank on average 140 out of 185 in terms of attractiveness to private investors and is the lowest ranked region in terms of the ease of doing business.
- Low creditworthiness of the infrastructure sectors. In each country, the transport, energy and water sectors are in a weak financial position, resulting in a low creditworthiness restricting access to financing.

- Constraints on the capacity of ECOWAS Government to borrow and provide guarantees under HIPC rules. All ECOWAS countries benefited from the HIPC initiative of debt forgiveness. In exchange, Governments and public sector entities are submitted to strict rules concerning their borrowing terms.

The diagnostic of finances for infrastructure leads to the conclusion that the issues of creditworthiness and financial sustainability remain at the forefront and are exacerbated as the shortage of infrastructure services deepens.

# Outlook 2045

## Transport outlook

### Roads

Road traffic is projected to increase seven- to ten-fold from 2014 to 2045 in all regional corridors.

***Table 1 – Road development scenario***

| *Scenario 1a-Unconstrained* | | *Total trade volume/yr in K metric tonnes* | | | |
|---|---|---|---|---|---|
| *Name* | *Main geo. direction* | *2014* | *2020* | *2030* | *2040* |
| 1: Dakar-Bamako-Ouaga-Niamey | Northwards | 3,261 | 4,779 | 10,247 | 21,677 |
| 2: Conakry-Bamako | Northwards | 29 | 42 | 87 | 179 |
| 3: Abidjan-Ouagadougou /Bamako | Northwards | 3,347 | 6,167 | 18,892 | 49,430 |
| 4: Tema-Ouagadougou | Northwards | 4,000 | 6,127 | 14,374 | 33,723 |
| 5: Lomé-Ouagadougou | Northwards | 1,839 | 2,900 | 7,056 | 16,602 |
| 6: Cotonou-Niamey-Gao | Northwards | 2,233 | 3,536 | 8,867 | 22,236 |
| 7: Lagos-Niamey | Northwards | 1,102 | 1,745 | 4,376 | 10,974 |

### Railways

By 2040, the Dakar-Bamako and Abidjan-Ouagadougou rail corridors would require a capacity increase from 10 million to over 20 million metric tonnes. This level of traffic would justify the construction of a modern railway or the complete and total rehabilitation of all the existing tracks.

New rail connections (and efficient rail operations) will be required by new ports as well as by major port expansions. The corridors where this approach is most applicable are the Lomé-Ouagadougou-Niamey, Abidjan-Ouagadougou and Tema-Ouagadougou corridors.

### Air transport

There are seven existing airports that will face demand of more than 3 million air passengers per year by 2045 (over 2 million by 2030), requiring their expansion. This pertains mainly to airports like Lagos, Dakar and Abidjan.

The high-level air traffic control system will reach saturation between 2020 and 2030 and will need to be replaced with a satellite-based air traffic control system.

***Table 2 - Airports with capacity constraints by 2020***

| Country | Airport | % of capacity used with 2016 traffic | % of capacity used with 2020 traffic |
|---|---|---|---|
| Ghana | Kotoka International Airport | 70% | 126% |
| Nigeria | Murtala Muhammed International Airport | 80% | 110% |
| Senegal | Léopold Sédar Senghor International Airport | 70% | 156% |

**Ports**

In 2020, Tema and Lagos faced short-term port container handling capacity gaps, and this will continue even after currently planned port and terminal expansion projects are completed in West Africa. By 2045 these two ports will face much more significant shortcomings that will require both additional port expansion and new port developments. The main issue is that domestic demand for port capacity will rise and, in most cases, it will take up port capacity leaving no room for any extra capacity to meet the transit traffic demand.

## Energy outlook

Electricity demand is projected to increase by an average 8.1% p.a.

***Table 3 – Forecasts of electricity demand over the period 2020-2045***

| Period | Annual growth rate - energy | Annual growth rate - peak demand |
|---|---|---|
| 2013-2020 | 8.9% | 9.0% |
| 2020-2030 | 9.3% | 9.5% |
| 2030-2040 | 6.2% | 6.3% |
| 2013-2040 | 8.1% | 8.1% |

The outlook takes into account Nigeria's electricity consumption, which, due to low oil prices, significantly affects the overall outlook for the region in the short to medium term.

***Table 4 – Comparison of growth prospects by country***

| *Country* | *Annual growth rate - energy* | *Country* | *Annual growth rate - energy* |
|---|---|---|---|
| Senegal | 5.6% | Togo | 8.8% |
| Mali | 10.7% | Gambia | 7.8% |
| Liberia | 10.8% | Burkina Faso | 11.2% |
| Guinea | 9.3% | Nigeria | 7.9% |
| Sierra Leone | 12.% | Ghana | 6.3% |
| Guinea Bissau | 10.9% | Benin | 9.3% |
| Côte d'Ivoire | 9.4% | Niger | 7.8% |
| **ECOWAS** | **8.1%** | | |

Primary energy consumption shifts from high-cost diesel to renewables, heavy fuel oil (HFO) and gas, while coal only becomes an attractive option in some cases after 2025.

Natural gas demand is projected to multiply three-fold over the 2020-2045 period. The potential demand in ECOWAS is even higher, but the supply is limited by the high cost of infrastructure compared to the low volumes, limiting the supply by pipeline to the coastal region. LNG gasification terminals may develop in countries with a significant potential demand, but only a few countries have local demand that is high enough to fully utilize regasification facilities.

The expansion of regional trade can reduce the cost of electricity generation by up to 16%, thanks to fuel savings from the development of renewable energy and large regional hydroelectric plants.

***Table 5 - Impact of trade liberalization on investment in the electricity sector***

| | *Investment generation* | *Investment access* | *Total O&M cost* | *Total fuel cost* | *Transport investment* | *Total cost USD million* |
|---|---|---|---|---|---|---|
| Low trade | 96,921 | 41,351 | 40,243 | 363,612 | 24,230 | **566,357** |
| Regional trade | 92,653 | 41,351 | 40,243 | 275,642 | 23,163 | **473,052** |
| Gain - regional trade | 4,268 | - | - | 87,970 | 1,067 | **93,305** |

## Water outlook

The two-fold population increase by 2045 will trigger a need to increase agricultural output significantly, with specific requirements in terms of irrigation. Irrigated surface area should be doubled by 2045, given that the population is set to increase twofold and in light of the growth in urban population (set to reach 60% of the total population by 2045), which will lead to a smaller proportion of farmers, an increase in household revenues and hence higher consumption.

Sanitation is even further behind than drinking water supply in urban and especially rural areas. Overcoming this lag and responding to demographic growth is a major challenge but imperative, because the consequence of poor sanitation is a risk of pollution of surface water and groundwater. Urban growth requires considerable investment (in addition to the need to overcome the current lag) in wastewater collection networks and in wastewater treatment infrastructures.

Climate change will need to be examined in the Sahelian zone especially. There will be several objectives:

- Maintaining minimum flow rates in low-flow periods
- Protection and restoration of wetlands
- Flood control and protection against devastating floods
- Drought management

The current capacity of the major surface storage structures (all water uses taken into account, including evaporation) is around 200 $km^3$, or 570 $m^3$/inhabitant for a total population of 350,000,000. If we consider that capacity needs to be increased

to match the current African average (870 $m^3$/inhab), storage capacity in dams needs to reach 675 $km^3$, which means tripling current capacity.

Across the region and regardless of the sector, there is a huge need for education, information and awareness-raising among water users. Much progress could be made in the agricultural sector in particular (choice of crops, farming practices and better irrigation) through training and information for stakeholders in water.

## ICT outlook

The goal of ICT is universal access to high-speed broadband services, at a cost of less than 2% of average per capita income (GNI)[1] at speeds of at least 5 Mbps for residential/commercial areas and reaching at least 50 Mbps by the end of the forecast period.

A network of submarine fiber cables combined with a set of pervasive and affordable national fiber optic backbones reaching almost every village will be developed.

Due to the explosion in mobile telephony uptake, needs for basic voice services have largely been met in the region and the remaining voice coverage gaps are expected to be addressed in the short-to-medium term.

The Government policy will play an important role in establishing an enabling environment that encourages widespread services, not only by providing low-cost access to the radio spectrum and taking advantage of infrastructure sharing, but also by making sure the market for services is sufficiently competitive.

Cross-border connections between virtually all the neighboring countries in the region are expected to be implemented through ongoing deployments of national backbones which reach border areas, and through regional projects such as the OMVG, OMVS and CLSG, which include fiber cables.

The medium-to-long term goal will be to ensure that all countries in the region have two physically separate paths to at least two different cable landing stations of two independent submarine cable systems. This will provide the required level of reliability, as well as downward competitive pressure on prices.

The key ICT infrastructure resource – the existing fiber optic cables, will last 25-40 years and will cater for much increased levels of traffic and demand simply through low-cost upgrades of the electronics.

Thus, most of the investment in core infrastructure will be aimed at further increasing network coverage, extending it to additional settlements that are not yet connected by fiber, as well as fiber-to-the-premises (FTTx) deployment.

Costs for this are expected to be considerably lower than current costs provided infrastructure sharing regulations are adopted. This should result in ducts being included on all new transport and energy vectors, along with sharing of civil works between private operators. The private sector is expected to be able to finance virtually all long-term ICT infrastructure development, except perhaps in the most remote areas, where Government universal service funds, drawing on financing provided from the profits of private operators, could provide the necessary investment.

[1] This is the benchmark established by the United Nations Broadband Commission: http://a4ai.org/affordability-report/report.

## Infrastructure needs

### Transport

#### Roads

The completion of the connectivity of the ECOWAS roads infrastructure network will require the paving of more than 4,000 km of road and the rehabilitation/reconstruction of more than 7,500 km. More than 5,500 km of expressways with three or four lanes in each direction will have to be constructed and an additional 10,000 km of road would have to be rehabilitated and maintained during the next 25 years.

#### Railways

Modern railways should be built in the two corridors involving about 12,600 km of track.

#### Ports

Total port traffic (national and regional) in the West Africa ports that are part of ECOWAS reached about 320 million metric tonnes in 2014. This traffic should reach 635 million metric tonnes in 2020 and about 2,000 million metric tonnes in 2045.

#### Air traffic

A total of 7 of the 15 international ECOWAS airports are reaching saturation point in 2021. By 2045, the airport capacity will need to increase by 400% on average either through the extension of existing airports or the building of new airports.

West African air traffic control and navigation aids also need to be improved. This could be accomplished through the extension of the European satellite navigation system. The current satellite coverage of the system includes Africa but requires the development of complementary infrastructure on the ground to extend EGNOS services to the African continent.

## Energy

#### Investment for Access to Sustainable Energy under SE4All

The SE4All program for ECOWAS aims at connecting about 92 million households between 2013 and 2040. The connection cost of 92 million households is USD 41.3 billion over the 2013-2040 period. The investment requirements for access increase from USD 500 million per year presently, to USD 2.5 billion per year by the end of 2028, then stabilize.

The transmission investment program is estimated based on revised PIDA calculations. It amounts to USD 1.64 billion per year over the period 2020-2045 or a total of USD 41 billion.

The allocation of investment between hydro and thermal capacity indicates that investment in hydro is concentrated in the earlier years, prior to 2025.

### Water

The annual investments needed to meet the annual needs are summarized below, amounting to USD 5.4 billion annually.

Most of the investments will be private, local or national investments. Investments of regional interest (excluding dams) will mainly concern incentive or state support programs in sectors where improvements will have an impact on upstream-downstream relations between countries, improve well-being for the population while reducing poverty, or allow for better regional development.

**ICT**

In terms of the international capacity available, the total initial design capability for existing submarine cables in the region is at least 13.64 Tbps. However new data transmission technologies have already been developed to increase the design capacity of these cables by about 5 times, giving a potential combined design capacity of closer to 80Tbps.

Conservatively assuming that only half the design capacity of the submarine cables on the west coast is available to the ECOWAS region (40Tbps), this is more than sufficient to meet the estimated 18 Tbps required by 2045. The average international capacity per capita in the ECOWAS region could increase to about 150-200 Kbps, or about 150-200 times current usage levels before all the capacity would be utilized. As a result, the existing international submarine capacity is sufficient to cope with future demand over the next 25 years.

Of the USD 685 million in new project funding required for the identified projects, it is estimated that the private sector is likely to contribute USD 56 million. Assuming that in addition, a large portion of the fiber will need to be renewed by the end of the forecast period, in total, the funding requirement for renewal by the end of 2045 is expected to be approximately USD 2.4 billion, of which at least USD 2 billion would need to be funded by the private sector.

## Environmental outlook

CO2 emissions in Africa from the power sector will increase from 692 Mt CO2 in 2011 to 1,731 Mt CO2 in 2045, growing at an annual rate of 3.1%. The emissions of the power sector which, for the whole of Africa, represented about 2.7% of world emissions decrease until 2020, but increase thereafter to reach 3.8% by 2045, highlighting the relevance of low GHG policies for Africa, within affordability limits.

The projected growth rate of CO2 emissions is substantially slower than the projected electricity demand because of the shift to hydro, solar and natural gas. The share of low GHG technology increases from 25% at present to nearly 40% by 2045.

ECOWAS emissions represented 4% of Africa's emissions in 2013, as it is dependent on hydro and gas, both with limited emissions. This share remained around 4% until 2020. By 2030, the share of ECOWAS in Africa's emissions increases significantly to 27%, in spite of the development of considerable solar capacities. The share of ECOWAS in $CO_2$ emissions stabilizes after 2030 as other regions of Africa also use more coal and most hydro sites are fully developed.

## Gender perspectives

*Basic principles*

- The commitment of ECOWAS and its Member States to gender equality and gender parity;

- The responsibility of the entire ECOWAS system to ensure the adoption, adaptation and implementation of legal instruments and protocols on gender equality;
- Measuring the accountability of ECOWAS and Member States for gender equality and the promotion of women's rights in the sub-region;
- Understanding of the agreements of ECOWAS and of its Member States to address critical gender issues;
- ECOWAS' analysis/understanding of the history, context, rationale, ideology and implications of promoting gender equality in the sub-region;
- Consideration by ECOWAS and the Member States of the gender dimension in the preparation of projects;
- The programming and organizational system of ECOWAS and its member countries and their support for gender transformation at country and sector level.
- ECOWAS supports the allocation of financial, human and technical resources to address gender equality in its Member States;
- ECOWAS actively supports and communicates on gender issues in Member States.

**Energy**. Renewable energy offers an unprecedented range of opportunities. With public policy support, women can gain an increasing share of job expansion in this young and dynamic sector.

The distributed nature of off-grid renewable energy solutions offers significant opportunities for the engagement of women across multiple segments of the value chain. Many of the skills needed to take advantage of these opportunities can be developed locally and women are ideally placed to lead and support the delivery of energy solutions, particularly in view of their role as primary energy users and their social networks.

**Transport**. Transport can make a big difference in increasing women's productivity and promoting gender equality.

In developing countries, safety concerns and limited access to transport reduce the likelihood of women's participation in the labor market by 16.5%.

**ICT**. Women's access to ICTs is limited in some countries. Low levels of literacy limited technological access, technical expertise and often inadequate infrastructure and the high cost of connectivity in developing countries prevent many women from taking full advantage of the opportunities offered by ICTs.

For women around the world, information and communication technologies (ICTs) can be harnessed for personal security, better access to education and employment, financial inclusion or access to basic health care information.

Research and studies have highlighted the many benefits of ICTs for women's empowerment, improving their access to information on health, nutrition and education.

## Infrastructure financing outlook

### Action for the future

The top priority for infrastructure sectors and Governments alike is to ensure that the sector becomes financially sustainable. In countries with financially weak infrastructure sectors and frequent power shortages, the root of the problem is

generally transport, electricity and water tariffs below cost recovery level and/or poor billing and collection. Both of these issues are based on a misperception of the expectations of consumers, whose primary concern is a quality electricity supply, ahead of lower tariffs.

Unstable regulations or an unreliable judicial system present a higher risk according to financiers. In particular, changes in tax law, unilateral changes in terms of feed-in tariffs and unreliable or slow recourse to local courts are major concerns to financiers.

For small- or medium-size projects, particularly renewable energy projects, one obstacle to development is the high transaction cost of project preparation and structuring. The development cost of a pilot or prototype energy project of a few MW or small hydro projects, adapted to the small size of several African systems, can be several million USD, without guarantee that the project will reach financial closure. The risk on development cost is important for financiers. The transition from "tailor-made" project documentation to "ready-made" documentation would significantly reduce the development cost and shorten preparation time.

# The ECOWAS Infrastructure Master Plan

## A vision based on the ECOWAS Treaty

The ECOWAS vision is spelled out in the Revised Treaty[2] which specified, in particular in its Preamble that:

*"Affirming that our final goal is the accelerated and sustained economic development of Member States, culminating in the economic union of West Africa; […]*

*In order to achieve the aims set out in the paragraph above, and in accordance with the relevant provisions of this Treaty, the Community shall, by stages, ensure;*

- the harmonization and coordination of national policies and the promotion of integration programs, projects and activities, particularly in [….] natural resources, […] transport and communications, energy, trade, […]
- the harmonization and coordination of policies for the protection of the environment;
- the promotion of the establishment of joint production enterprises;
- the establishment of a common market through:
  - the liberalization of trade by the abolition, among Member States, of customs duties levied on imports and exports, and the abolition, among Member States, of non-tariff barriers in order to establish a free trade area at the Community level;
  - the adoption of a common external tariff and a common trade policy vis-a-vis third countries;
  - the removal, between Member States, of obstacles to the free movement of persons, goods, services […];
- the promotion of joint ventures by private sector enterprises and other economic operators,

[2] Art. 3 of the Treaty.

- the promotion of balanced development of the region, paying attention to the special problems of each Member State, particularly those of landlocked […] Member States"

**Vision for the transport infrastructures**

*"For the purpose of ensuring the harmonious integration of the physical infrastructures of Member States and the promotion and facilitation of the movement of persons, goods and services within the Community, Member States undertake to:*

- evolve common transport and communications policies, laws and regulations;
- develop an extensive network of all-season highways within the Community, priority being given to the inter-State highways;
- formulate plans for the improvement and integration of railway and road networks in the region;
- formulate programs for the improvement of coastal shipping services and inter-state inland waterways and the harmonization of policies on maritime transport and services;
- coordinate their positions in international negotiations in the area of maritime transport;
- encourage cooperation in flight scheduling, leasing of aircraft and granting and joint use of fifth freedom rights to airlines of the region;
- promote the development of regional air transportation services and endeavor to bring about the merger of national airlines in order to promote their efficiency and profitability;

Member States also undertake to encourage the establishment and promotion of joint ventures and of Community enterprises, as well as the participation of the private sector in the areas of transport and communications."

**Vision for the energy infrastructures**

*"Member States shall coordinate and harmonize their policies and programs in the field of energy. To this end, they shall:*

- ensure the effective development of the energy resources of the region;
- establish appropriate cooperation mechanisms with a view to ensuring a regular supply of hydrocarbons;
- promote the development of new and renewable energy particularly solar energy in the framework of the policy of diversification of sources of energy;
- harmonize their national energy development plans by ensuring particularly, the interconnection of electricity distribution networks;
- articulate a common energy policy, particularly in the field of research exploitation, production and distribution;
- establish an adequate mechanism for the collective solution of the energy development problems within the Community, particularly those relating to energy transmission, the shortage of skilled technicians and financial resources for the implementation of energy projects of Member States."

This policy statement is completed by the **Vision and Priorities of the WAPP**: "Integrate the operations of national power systems into a unified regional electricity market, which will, over the medium to long term, assure the citizens of ECOWAS Member States a stable and reliable electricity supply at competitive cost."

**Vision for the water infrastructures**[3]

- Support the river basin institutions in the development and implementation of transboundary projects;
- Integrate affected populations as actors, partners and beneficiaries of projects;
- Ensure that the various stakeholders in project development adequately play their respective roles;
- Assess and optimize the performance of large water infrastructure in West Africa;
- Build upon and share experiences in the ECOWAS framework;
- Adopt a regional framework for social and environmental evaluations and ensure the efficient implementation of the associated plans.

**Vision for the ICT infrastructures**

"[...] *In the area of telecommunications, Member States shall:*

- develop, modernize, coordinate and standardize their national telecommunications networks in order to provide reliable interconnection among Member States;
- complete, with dispatch, the section of the pan-African telecommunications network situated in West Africa;
- coordinate their efforts with regard to the operation and maintenance of the West African portion of the pan-African telecommunications network and in the mobilization of national and international financial resources.

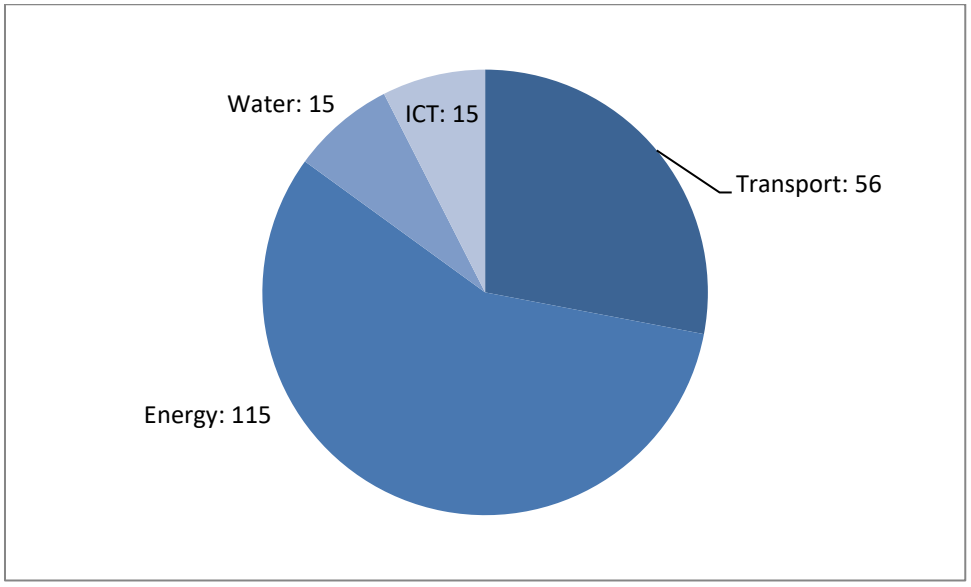
*Member States also undertake to encourage the participation of the private sector in offering postal and telecommunications services, as a means of attaining the objectives set out in this Article."*

[3]Based on the Water Resource Coordination Centre « *Lignes directrices pour le développement de l'infrastructure de l'eau en Afrique de l'Ouest* » [Guidlines for the development of water infrastructure in West Africa] October 2012.

## The content of the ECOWAS Master Plan projects

The ECOWAS Regional Infrastructure Master Plan includes 201 projects, of which 146 are investment projects and 55 are soft projects.

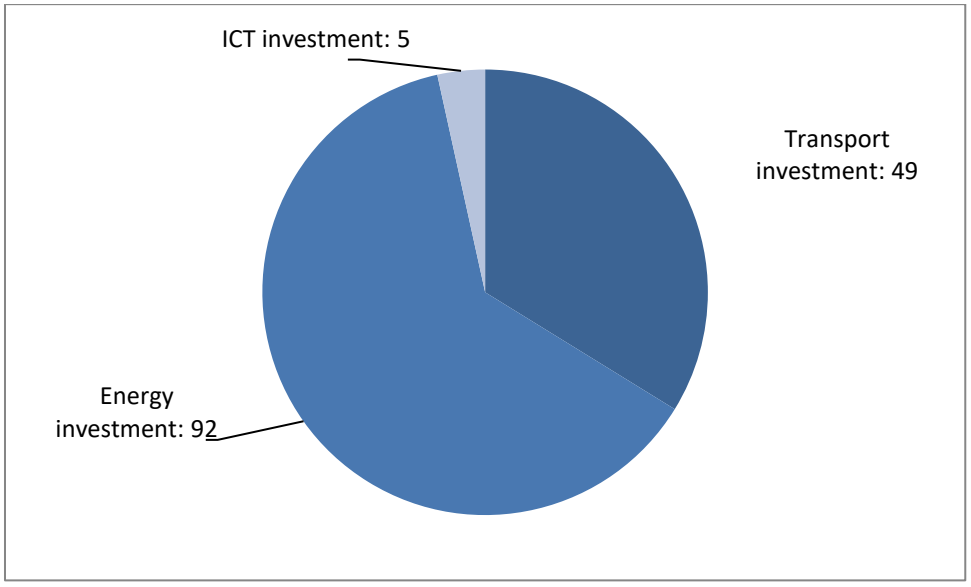
***Chart 1 - Number of projects by sector***




**Investment projects**

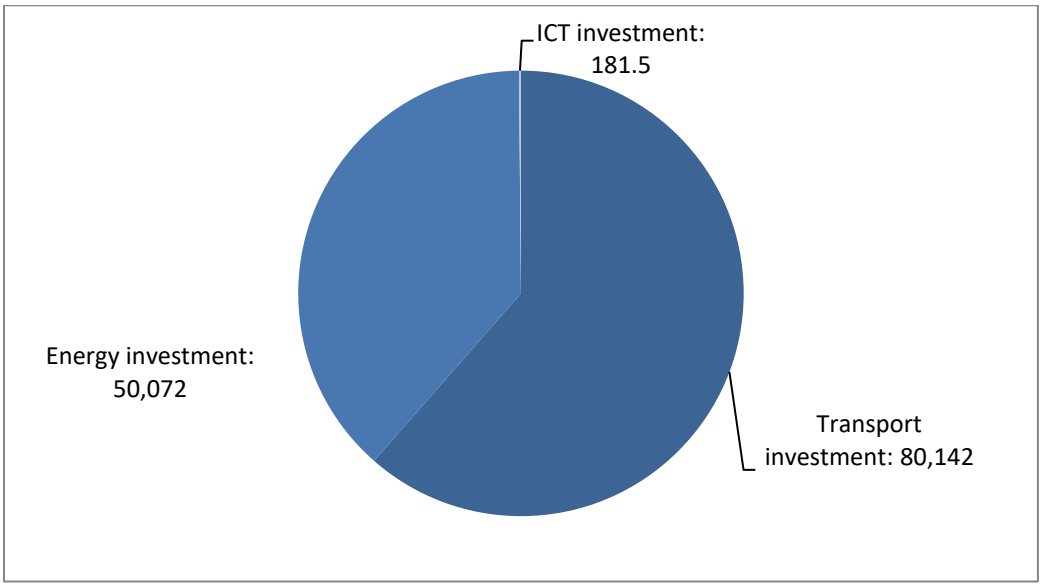
The 146 selected investment projects are broken down by sector according to the chart below:

***Chart 2 - Number of investment projects by sector***




The cost of the investment program retained in the Infrastructure Master Plan is USD 131.2 billion over the period 2020-2045.

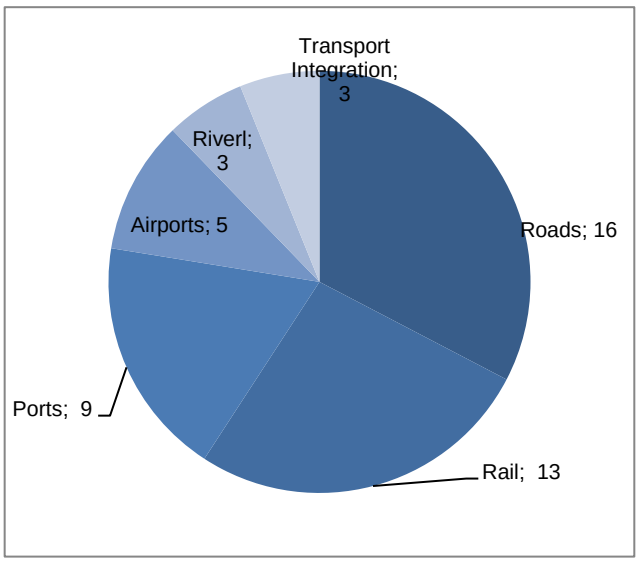
***Chart 3 - Cost of the ECOWAS regional investment program 2020-2045 (USD million)***




The transport sector is the one where most regional investment is needed, mainly due to major regional reconstruction projects, railway interconnections and extensions, and the high cost of the Dakar-Ouagadougou-Niamey, Dakar-Abidjan, Abidjan-Lagos highways, as shown in the tables below. In the energy sector, the dominant role of generation projects is due to the fact that the most economic projects need a regional market to absorb their output. In addition, significant investments have been made and are being made in the electricity transmission subsector by OMVS, OMVG and CLSG, which covers part of the medium-term regional interconnection needs.

***Chart 4 - Distribution in number by sub-sector of the Master Plan***

**Transport**




**Energy**

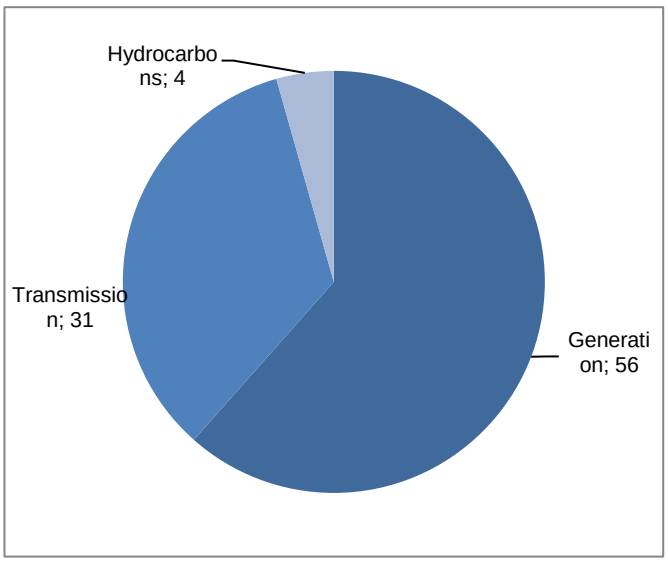
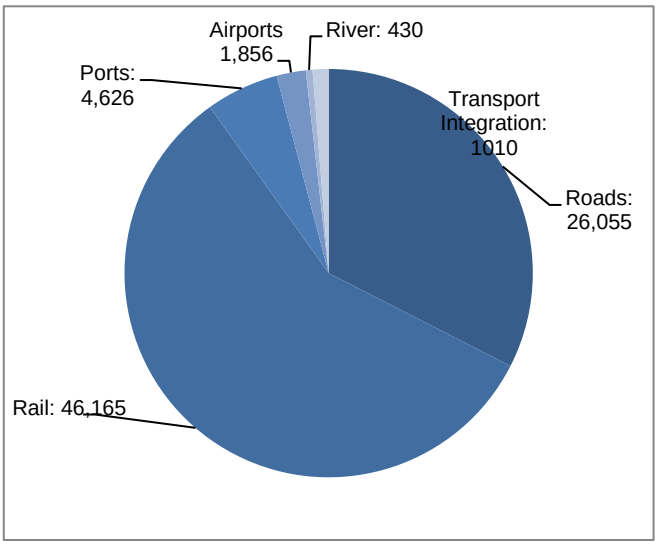
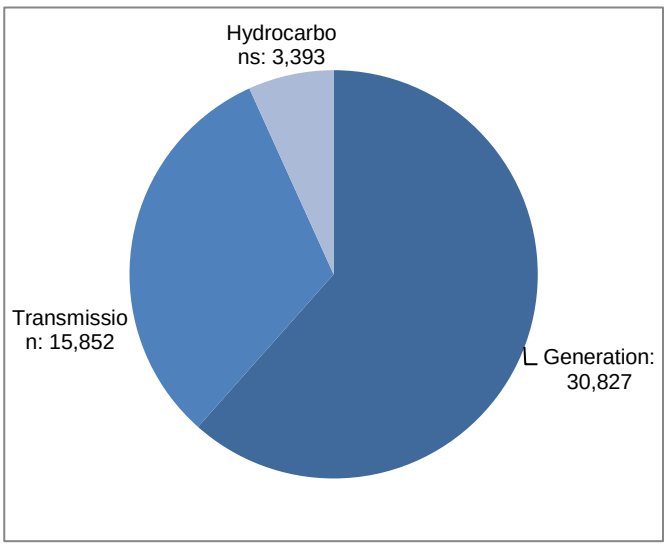


***Chart 5 - Distribution in amount (in USD million) by sub-sector of the Master Plan***

**Transport**




**Energy**




**Institutional development, capacity building and project preparation projects**

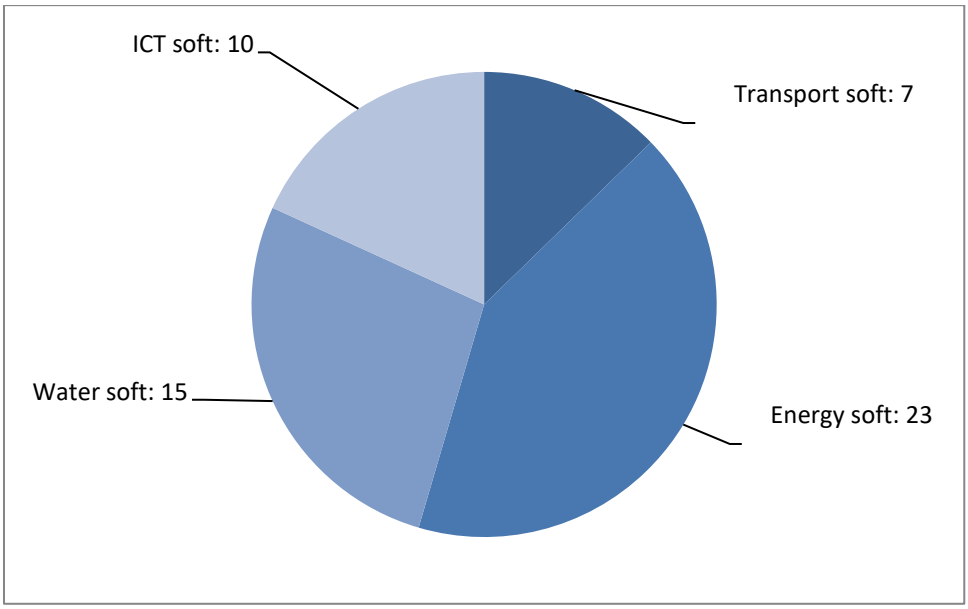
The 55 "soft" projects selected in the framework of the Infrastructure Master Plan are divided by sector as follows:

***Allocation of "soft" projects by sector***

The energy sector has the largest number of "soft" projects due to the high number of renewable energy projects under preparation, followed by transport and water, highlighting the need to accelerate the development of regional institutions and projects in the energy sector.

The number of projects also indicates a significant need for capacity building in the water sector and to some extent in the energy sector, whereas the transport and ICT sectors have greater needs in institutional development.

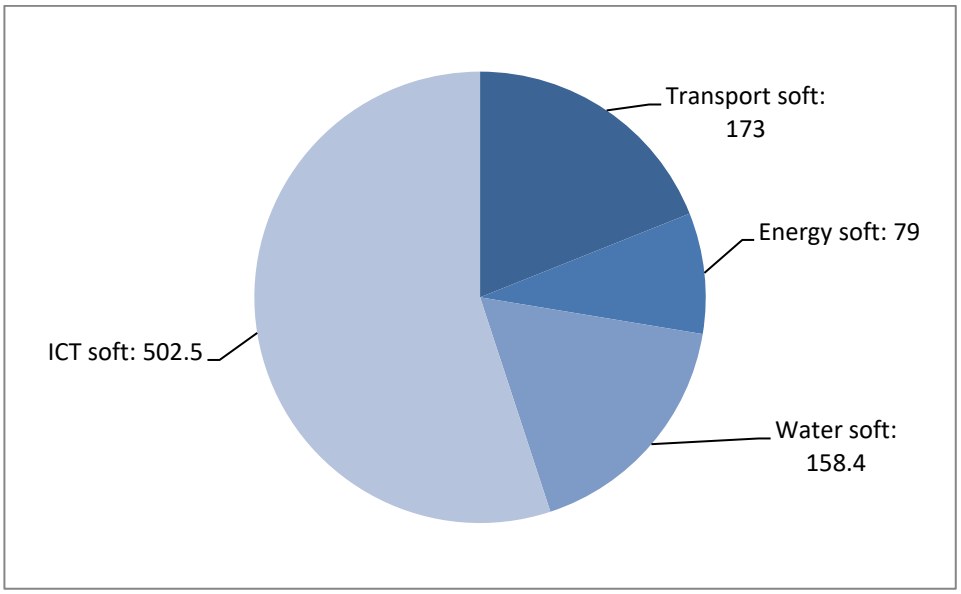
***Chart 6 – Number of "soft" projects by sector***



**Soft project costs by subsector**

The cost of the soft component of the ECOWAS Regional Infrastructure Master Plan is USD 852 million over the period 2020 to 2045. The allocation by sector is given below.

***Chart 7 - Cost of the soft element of the Master Plan (USD million)***




## List of the priority projects of the Master Plan

Investment projects retained

***Table 6 - List of projects of the Master Plan***

| *Code* | *Project* | *Cost in USD million* |
|---|---|---|
| **Transport** | | |
| | **Roads** | |
| TR01 | Lagos-Abidjan corridor highway construction project (1,022 km) | 2,266 |
| TR02 | Praia-Dakar-Abidjan corridor highway construction project (2,852 km) | 4,378 |
| TR03 | Upgrading of the Lomé-Cinkassé-Ouagadougou into a 2x2 lane expressway (950 km) | 222 |
| TR04 | Upgrading of the Cotonou-Niamey-Gao corridor into a 2x2 lane expressway (1,450 km) | 1,004 |
| TR05 | Upgrading of the Tema-Ouagadougou corridor into a 2x2 lane expressway (763 km) | 1,162 |
| TR06 | Lagos-Kano-Zinder-Agadez highway construction/upgrading project (3x2 lanes) (1,600 km) | 2,511 |
| TR07 | Upgrading of the Conakry-Bamako corridor into a 2x2 lane expressway (1,018 km) | 2,642 |
| TR08 | Construction of the Niamey (Niger) - Kano (Nigeria) - Ndjamena (Chad) corridor highway (1,779 km) | 2,660 |
| TR09-1 | Rehabilitation and asphalting of the Tambacounda-(Senegal) Gaoual-Labé-Tougue-Dinguiraye-Siguiri (Guinea) road (911 km) | 718 |

| Code | Project | Cost in USD million |
|---|---|---|
| TR09-2 | Construction of the 2x2 lane Tambacounda (Senegal)-Gaoual-Labé-Tougue-Dinguiraye-Siguiri (Guinea) road (911 km) | 1,208 |
| TR10-1 | Rehabilitation and asphalting of the Dassa-Savalou-Djougou-Natitingou-Porga (Benin) - Nadiagou, Fada Gourma-Ouagadougou (Burkina Faso) road (810 km) | 663 |
| TR10-2 | Construction of the Dassa-Savalou-Djougou-Natitingou-Porga (Benin)-Nadiagou, Fada Gourma-Ouagadougou (Burkina Faso) road as a 2x2 lane expressway (810 km) | 1,113 |
| TR11 | Construction of the Dakar-Tambacounda-Kayes-Bamako-Bougouni-Sikasso-Bobo-Dioulasso-Ouagadougou-Kaya-Niamey corridor highway (2,717 km) | 3,474 |
| TR12-1 | Rehabilitation and asphalting of the Siguiri-Kankan-Kerouane-Beyla-N'Nzerekore-Yomou (Guinea)-Ganta-(Liberia)-Danané (Côte d'Ivoire) roads (790 km) | 613 |
| TR12-2 | Construction of the 2x2 lane Siguiri-Kankan-Kerouane-Beyla-N'Nzerekore-Yomou (Guinea)-Ganta-(Liberia)-Danané (Côte d'Ivoire) road (790 km) | 981 |
| TR13 | Development of a harmonized institutional and regulatory framework for the protection and management of road assets in the ECOWAS zone and acquisition of equipment for controlling axle loads along Community roads and highways. | 440 |
| | **Total Roads** | **26,055** |
| | **Railways** | |
| TT01 | Construction and modernization of the high-speed train line of the Praia-Dakar-Abidjan railway corridor (3,500 km) | 6,010 |
| TT02 | Construction and modernization of the Lagos-Abidjan rail corridor high-speed line (1,000 km) | 4,561 |
| TT03-1 | Rehabilitation of the Senegal-Mali (Dakar-Bamako) railway corridor: Dakar-Bargny-Diass-Touba-Thies-Kaffrine Koalack-Tambacounda-Diboli-Kayes-Kita- Bamako (1,059 km) | 1,002 |
| TT03-2 | Construction and modernization of the Senegal-Mali-Burkina Faso (Dakar-Bamako-Bobo Dioulasso-Dabola) railway corridor as a high-speed train line (3,123 km) | 4,815 |
| TT04 | Construction and modernization of the Guinea-Mali (Conakry-Bamako) railway corridor: Conakry-Dabola-Kankan-Mandiana -Bougouni-Bamako (983 km) as a high-speed train line | 3,357.5 |
| TT05 | Construction and modernization of the Guinea-Liberia rail corridor via Kankan: Forécariah-Madina Oula-Tokounou -Beyla-Yekepa Sanniquellie and Tokounou-Kankan (1,476 km) as a high-speed train line | 2,751 |
| TT06-1 | Rehabilitation of the Cote d'Ivoire-Burkina Faso railway corridor: Abidjan-Dimbokro-Bouake-Ferkessédougou-Ouangolodougou-Bobo Dioulasso-Koudougou-Ouagadougou-Kaya (1,261 km) | 1,452 |
| TT06-2 | Construction and modernization of the Cote d'Ivoire-Mali/Burkina Faso-Niger railway corridor: Abidjan-Bamako-Ouagadougou-Niamey-Gao (2,513 km) as a high-speed train line | 5,904 |
| TT07 | Construction and modernization of the Cote d'Ivoire-Mali-Guinea rail corridor (San Pedro-Bamako-Kankan) (1,444 km) as a high-speed train line | 2,732 |
| TT08 | Construction and modernization of the Ghana-Burkina Faso railway corridor Tema-Ouagadougou as a high-speed train line (1,057 km) | 3,502 |

| Code | Project | Cost in USD million |
|---|---|---|
| TT09 | Construction and modernization of the Togo-Burkina Faso/Togo-Niger) Lomé-Ouagadougou/Lomé-Niamey rail corridor as a high-speed train line (1,626 km) | 2,796 |
| TT10 | Construction and modernization of the Benin-Niger rail corridor (Cotonou-Niamey) as a high-speed train line (1,474 km) | 2,778 |
| TT11 | Construction and modernization of the Nigeria-Niger (Lagos-Niamey/Lagos-Maradi) rail corridor as a high-speed train line (1,852 km) | 4,504 |
| | **Total Railways** | **46,165** |
| | **Ports** | |
| TP01 | Construction of a deep-water port at Morebaya (Forécariah) – Symandou in Guinea | 853 |
| TP02 | Buba deep-water port construction project (Guinea Bissau) | 323 |
| TP03 | Badagry deep-water port construction project (Nigeria) | 2,610 |
| TP04 | Construction project for the dry port of Ferkéssédougou on 732 hectares (Côte d'Ivoire) | 606 |
| TP05 | Construction of a dry port at Cinkasse on 100 hectares (Togo) | 51 |
| TP06 | Banjul dry port construction project (Gambia) | 26 |
| TP07 | Construction and development of the multimodal terminal at the port of Praia (Cape Verde) | 26 |
| TP08 | Construction and development of a multimodal terminal at the port of Dakar | 31 |
| TP09 | SeaLink Regional Project: Acquisition of a regional maritime fleet (ferry system or liner) for the transport of people, goods and merchandise between Praia and Dakar as well as other ECOWAS seaports. | 100 |
| | **Total Ports** | **4,626** |
| | **Airports** | |
| TA01 | Construction of Ouagadougou Donsin International Airport | 716 |
| TA02 | Construction of a modern international airport in Maferinya | 660 |
| TA03 | Construction of a modern International Airport in Nhacra near Cumere, in the Oio region (Guinea Bissau) | 120 |
| TA04 | Upgrading of the runway and modernization of Praia International Airport in Cape Verde | 300 |
| TA05 | Establishment of an aeronautical control and maintenance center | 60 |
| | **Total Airports** | **1,856** |
| | **River** | |
| TF01 | Construction and development of quays, ports of call, specialized terminals (naval repairs and maintenance, etc.), ports and river complexes along the Niger, Senegal and Gambia rivers | 320 |
| TF02 | Signaling of riverbeds, reinforcement of safety and navigation measures | 65 |
| TF03 | Acquisition of a light fleet and port equipment for the maintenance of navigable channels and transport on the Senegal, Gambia and Niger rivers | 45 |
| | **Total Rivers** | **430** |

| Code | Project | Cost in USD million |
|---|---|---|
| | **Integration** | |
| TI01 | Dematerialization of procedures for foreign trade operations with a view to facilitating transport and transit in the ECOWAS zone. | 20 |
| TI02 | Development of a satellite system (Single African Sky: design and initial implementation) EGNOS AFRICA-JPO Program | 500 |
| TI03 | Development of a system which interconnects ECOWAS customs systems and docking in the African Continental Free Trade Area (AfCFTA) | 490 |
| | **Total integration** | **1,010** |
| **Energy** | | |
| | **Generation** | |
| EG01 | Ghana Emergency Power CCGT - Thermal Power Plant (300 MW) | 390 |
| EG02 | 170 MW GPGC Combined Cycle, Takoradi (Ghana) | 221 |
| EG03 | Lomé Combined Cycle - Thermal Power Plant (450 MW) | 330 |
| EG04 | Kaduna Thermal Power Plant - Nigeria (215 MW) | 280 |
| EG05 | Senegal and Gambia - Windfarm (150 MW) | 230 |
| EG06 | Gouina Hydropower - OMVS (140 MW) | 462 |
| EG07 | Sambangalou - Hydropower OMVG (128 MW) | 454 |
| EG08 | Azito IV – Côte d'Ivoire (253 MW) | 302 |
| EG09 | Amandi Combined Cycle - Ghana (285 MW) | 312 |
| EG10 | OKPAI Combined Cycle - Nigeria (450 MW) | 585 |
| EG11 | Souapiti Hydropower - Guinea (450 MW) | 1,350 |
| EG12 | Gribo-Popoli Hydropower - Côte d'Ivoire (112 MW) | 345 |
| EG13 | CIPREL V Combined Cycle -Côte d'Ivoire (412 MW) | 505 |
| EG14 | Salkadamna coal-fired plant, Niger (200 MW) | 573 |
| EG15 | Zungeru Hydropower Plant – Nigeria (included in DtP) | 1,290 |
| EG16 | Fomi - Hydroelectric Power Plant (90 MW) | 620 |
| EG17 | Rotan Thermal Combined Cycle (330 MW) - Ghana | 429 |
| EG18 | Burkina Faso – Solar Power Park (150 MW) (included in DtP) | 139 |
| EG19 | Mali Solar Power Park (150 MW) | 139 |
| EG20 | WAPP Solar Park - Côte d'Ivoire (150 MW) | 143 |
| EG21 | AMARIA - Hydroelectric project (300 MW) - Guinea | 600 |
| EG22 | Bumbuna II - Hydroelectric power plant (143 MW) - Sierra Leone | 520 |
| EG23 | MMEI Sassandra Louga Hydroelectric Power Plant (280 MW) - Côte d'Ivoire | 647 |
| EG24 | 291 MW Grand Kinkon - Hydroelectric Power Plant - Guinea | 350 |
| EG25 | Boutoubre - Hydroelectric Power Plant (150 MW) – Côte d'Ivoire | 343 |
| EG26 | MARIA GLETA - WAPP Regional Power Generation Facility (450 MW) - Benin | 585 |
| EG27 | WAPP Solar Park – Gambia (150 MW) | 130 |
| EG28 | Koukoutamba - Hydroelectric Power Plant (294 MW) - Guinea | 689 |
| EG29 | Mambilla - Hydroelectric power plant (3,050 MW) - Nigeria | 5,800 |

| Code | Project | Cost in USD million |
|---|---|---|
| EG30 | WAPP Solar Power Park in Benin (150 MW) | 120 |
| EG31 | Alaoji II - Thermal power plant - Nigeria (285 MW) | 371 |
| EG32 | Morisananko hybrid solar hydroelectric power plant, Guinea (200 MW) | 353 |
| EG33 | Bonkon Diara hydropower – Guinea (174 MW) | 211 |
| EG34 | Saint Paul Hydropower plant I and II - Liberia (584 MW) | 511 |
| EG35 | Regional Solar Park Gwiwa Jigawa - Nigeria (1000 MW) | 695 |
| EG36 | Adjarala - Hydropower project (147 MW) - Benin/Togo | 333 |
| EG37 | WAPP Solar Park - Ghana (150 MW) | 108 |
| EG38 | San Pedro coal-fired Thermal Plant - Côte d'Ivoire (700 MW) | 1,900 |
| EG39 | Tiboto - Hydropower facility in Côte d'Ivoire/Liberia (225 MW) | 599 |
| EG40 | WAPP Solar Park – Togo (150 MW) | 90 |
| EG41 | Boureya - Hydroelectric Power Plant (161 MW) | 448 |
| EG42 | WAPP Aboadze Combined Cycle – Ghana (450 MW) | 585 |
| EG43 | WAPP Solar Park, Niger (100 MW) | 90 |
| EG44 | North Nigeria Windfarm (300 MW) | 190 |
| EG45 | Mano hydropower (MRU) - Sierra Leone/Liberia (180 MW) | 487 |
| EG46 | Songon Thermal - Côte d'Ivoire (372 MW) | 480 |
| EG47 | WAPP Solar Park – Burkina Faso, Phase II (included in DtP) | 84 |
| EG48 | WAPP Solar Park - Mali Phase II (180 MW) (included in DtP) | 77 |
| EG49 | Mangué Hydro Plant – Guinea (100 MW) | 282 |
| EG50 | WAPP Solar Park – Mali Phase III (347 MW) (included in DtP) | 300 |
| EG51 | WAPP Solar Park – Niger Phase II (192 MW) (included in DtP) | 300 |
| EG52 | WAPP Solar Park – Burkina Faso, Phase III (220 MW) (included in DtP) | 300 |
| EG53 | WAPP Solar Regional Battery Storage – 500 MW (included in DtP) | 500 |
| EG54 | Gas CCGT, Ghana (450 MW) | 650 |
| EG55 | Gas CCGT, Senegal (500 MW) | 700 |
| EG56 | Gas CCGT, Nigeria (1000 MW) | 1,300 |
| | **Total Production** | **30,827** |
| | **Power Transmission** | |
| ET01 | 330 kV Ghana-Togo-Benin (340 km) | 122 |
| ET02 | 225 kV Laboa Boundiali-Ferfessedougou (310 km) | 115 |
| ET03 | Kayes (Mali)-Tambaccounda (Senegal) – 225 kV transmission lines (288 km) | 94 |
| ET04 | 225 kV Côte d'Ivoire-Liberia-Sierra Leone- Guinea CLSG Circuit II (1303 km) | 517 |
| ET05 | 225 kV OMVG interconnection project | 722 |
| ET06 | 225 kV Guinea-Mali interconnection (1074 km) | 436 |
| ET07 | 225 kV Bamako-Manantali interconnection (317 km – Mali) | 85 |
| ET08 | 225 kV Kayes- Kiffa transmission project (included in DtP) | 187 |

| Code | Project | Cost in USD million |
|---|---|---|
| ET09 | 330 kV Burkina (northern backbone Nigeria-Niger-Benin-Burkina) (832 km) (included in DtP) | 541 |
| ET10 | 330 kV Bolgatanga-Bobo-Sikasso (555 km) | 341 |
| ET11 | 225 kV Manantali-Boureya-Koukoutamba-Linsan (462 km) | 166 |
| ET12 | 225 kV Labe-Koukoutamba (OMVS) (115 km) | 50 |
| ET13 | 225 kV Fomi-Boundiali (380 km) | 96 |
| ET14 | 330 kV WAPP median backbone Nigeria-Benin-Togo-Ghana-Côte d'Ivoire (1350 km) | 813 |
| ET15 | 225 kV Segou-Bamako (290 km) | 105 |
| ET16 | 330 kV coastal transmission backbone reinforcement (400 km) | 281 |
| ET17 | San Pedro (Côte d'Ivoire)-Buchanan (Liberia) 225 kV transmission line (400 km) | 129 |
| ET18 | 330 kV Côte d'Ivoire-Ghana interconnection reinforcement (387 km) | 156 |
| ET19 | 225 kV Boundiali-Bougouni (330 km) | 96 |
| ET20 | Reinforcement of OMVG western section (800 km) | 301 |
| ET21 | 330 kV 2nd North-South transmission line in Ghana (750 km) | 462 |
| ET22 | 330 kV eastern backbone in Nigeria (1856 km) | 966 |
| ET23 | 330 kV WAPP western backbone Senegal-Gambia-Guinea Bissau-Guinea-Mali (1600 km) | 912 |
| ET24 | 330 kV Bobo-Ferkessedougou (213 km) | 126 |
| ET25 | 330 kV Nigeria-Niger interconnection reinforcement (500 km) | 332 |
| ET26 | WAPP Senegal-North Africa interconnection through Morocco (1250 km) (included in DtP) | 615 |
| ET27 | WAPP (Nigeria)-Central Africa Power Pool (Inga) interconnection (3300 km) | 1,622 |
| ET28 | Cape Verde interconnection | 400 |
| ET29 | Niger-Ethiopia-Sudan transmission line (included in DtP) | 2,500 |
| ET30 | LNG Initiative 20/20 (facilitation of the purchase of bottles) | 100 |
| ET31 | Rural electrification of 20,000 villages (PRODEL) | 2,500 |
| ET32 | Desert to Power. Construction of 5,725 km of transmission lines and 2,611 MW of solar capacity. Includes projects EG15; EG50; EG51; EG47; EG52; EG18; EG48; EG53 and ET08; ET26; ET29; ET09 | {4 600} |
| | **Total power transmission** | **15,853** |
| | **Hydrocarbons** | |
| EH01 | Revamping and extension of the West African Gas Pipeline (WAGP) | 530 |
| EH02 | Regional floating storage and regasification unit (FSRU) | 600 |
| EH03 | Storage of petroleum products in Côte d'Ivoire | 1,048 |
| EH04 | Oil products pipeline from Côte d'Ivoire to Burkina Faso and Mali | 1,215 |
| | **Total Hydrocarbons** | **3,393** |
| | **ICT** | |
| II01 | Construction of the Amilcar Cabral submarine cable linking Cape Verde, Gambia, Guinea-Bissau, Guinea, Liberia and Sierra Leone | 40 |
| II02 | Construction of fiber optic cable: Nigeria-Niger-Algeria | 40 |

| Code | Project | Cost in USD million |
|---|---|---|
| II03 | Development of the national broadband backbone network for Guinea Bissau and Liberia | 20 |
| II04 | Cross border/national fiber backbone – Togo (Kétao)-Benin (Djougou) | 61 |
| II05 | Fiber optic connections between Fada-Pama-Porga; Ouahigouia-Thiou-Mopti; Seytenga-Tera; Ouargaye - Cinkansé | 20 |
| | **Total Investments - ICT sector** | **181** |

"Soft" projects

| Code | Project | Cost |
|---|---|---|
| | ***Transport*** | |
| TS01 | Creation of a transport database and of a geo-location and tracking system of transport infrastructure in the ECOWAS region | 1.5 |
| TS02 | Development of an institutional and regulatory framework for the organization and management of river transport in the ECOWAS region | 0.9 |
| TS03 | Implementation of the Yamoussoukro Decision | 0.5 |
| TS04 | Development and implementation of a regional database of air transport | 20 |
| TS05 | Establishment of a sub-regional aircraft leasing company. | 40 |
| TS06 | Setting-up of an ECOWAS zone transport observatory | 50 |
| TS07 | Drafting of a regional maritime agreement between the ECOWAS countries | 0.1 |
| | **Total Transport "Soft" sector** | **113** |
| | ***Energy*** | |
| ES01 | Support for the strengthening/establishment of national regulatory institutions for the electricity sector | 2 |
| ES02 | Regional energy project preparation facility | 15 |
| ES03 | ECOWAS Electricity Institute | 15 |
| ES04 | Support for the implementation of ECOWAS energy policies | 2 |
| ES05 | Support to the ECOWAS/PPDU Energy Group | 1 |
| ES06 | Gas Master Plan | 1 |
| EPG01 | Solar PV 150 MW in Mali | 1 |
| EPG02 | Solar PV 150 MW in Burkina | 1 |
| EPG03 | Grand Kinkon Hydro 191 MW in Guinea | 3 |
| EPG04 | Kassa Hydropower 118 MW in Guinea | 3 |
| EPG05 | Bumbuna II/Yben Reservoir 200 MW in Sierra Leone | 3 |
| EPG06 | Boureya Hydro (OMVS) in Guinea - 160 MW | 3 |
| EPG07 | Digan Hydro (OMVG) 93 MW in Guinea | 3 |
| EPT01 | Boureya hydro project - 225 kV interconnection - Linsan (Guinea)-Manantali (Mali) | 3 |
| EPT02 | Strengthening of the Manantali-Bamako-Sikasso (Mali) transmission line | 3 |
| EPT03 | 330 kV median backbone associated with the Zungeru Hydro (Nigeria); 713 km | 3 |
| EPT04 | 225 KV line Linsan-Fomi-Nzerekore; Fomi-Bamako; 1350 km | 3 |
| EPT05 | 225KV line Linsan-Boundiali; 380 km | 3 |

| Code | Project | Cost |
|---|---|---|
| EPT06 | Strengthening of the Linsan - Fomi transmission line: 430 km | 3 |
| EPT07 | 225 kV T/L Sakaldamna Coal Plant- Niamey (Niger); 190 km | 3 |
| EPH01 | Regional LNG FSRU pre-feasibility study, preliminary ESIAs and management plan | 1 |
| EPH02 | Petroleum product storage prefeasibility study | 1 |
| EPH03 | Petroleum product storage feasibility study | 3 |
| | **Total Energy sector "Soft"** | **79** |
| | ***Water sector*** | |
| W01 | Rehabilitation of existing networks and establishment of new irrigation networks and schemes | 16 |
| W02 | Fouta Jalon area integrated management program/5-year investment plan | 0.5 |
| W03 | Developing irrigation from underground water resources where surface water is not available | 10 |
| W04 | Technical and financial support to Transboundary Water Authorities | 2 |
| W05 | Support for the establishment of a Transboundary Authority for Underground Water Resources Management (Lullemeden) | 1 |
| W06 | Support to the States to improve national water facilities (drinking water and wastewater management) | 75 |
| W07 | Studies for new dam and storage sites, river flow regulation and irrigation | 12.5 |
| W08 | Support for R&D on new seeds adapted to drought | 12.5 |
| W09 | Training of staff of public sector organizations involved in water management | 1 |
| W10 | Support to States to improve IWRM (Integrated Water Resources Management) | 0.4 |
| W11 | Training and capacity building on irrigation and cultivation techniques adapted to farmers (rain-fed and irrigated agriculture) | 6 |
| W12 | Support and improvement of data collection and management among the States and the Regional Water Observatory | 0.5 |
| W13 | Awareness-raising and capacity building on water treatment in rural areas | 10 |
| W14 | Improvement of water quality in rivers and lakes and fight against algae proliferation | 6 |
| W15 | Investment against flood disasters (pre-studies to investment project) | 5 |
| | **Total Water sector** | **158.4** |
| | ***ICT*** | |
| IS01 | Enabling Environment for ICT | 130 |
| IS02 | ECOWAS Internet Exchange Point (IXP) Program | 25 |
| IS03 | Cybersecurity facilities | 6.1 |
| IS04 | SIGTEL | 1.2 |

| Code | Project | Cost |
|---|---|---|
| IS05 | E-Post | 182 |
| IS06 | Entrepreneurship and Technology Centers for Young People | 89.2 |
| IS07 | Development of a Regional Trade Information System (RTIS) | 4 |
| IS08 | Interconnection of immigration checkpoints | 2 |
| IS09 | West African regional education and research network (WACREN) | 45 |
| IS10 | Development of a regional network of national Science & Industry Technology Parks | 18 |
| | **Total "Soft" - ICT sector** | **502.5** |

**List of subsidiary projects of the Master Plan**

The evaluation of all of the projects considered has shown that some projects do not fully meet the selection criteria, but are close. These projects have been included in a list of subsidiary projects which could possibly replace the projects selected if any of these latter can no longer be carried out for a given reason.

**Desert-to-Power Program**

The Desert-to-Power program includes a coordinated set of renewable (solar) electricity generation projects. The Desert-to-Power Initiative (DtP or the Initiative aims to harness the solar potential of 11 countries across the Sahel (Burkina Faso, Chad, Djibouti, Ethiopia, Eritrea, Mali, Mauritania, Niger, Nigeria, Senegal and Sudan) to deploy 10 GW of solar PV power by 2030 and provide access to electricity to around 250 million people. The program includes, among other things, the implementation of a high voltage "trans-Sahelian backbone" which will deploy regional solar parks and provide access to electricity to the communities crossed by the transmission lines. The program includes the following projects that are part of the list of physical investments of the Master Plan:

- Mali : EG15 ; EG50 ; EG51 ; ET08 ; ET26
- Niger : EG47 ; EG52 ; ET29
- Nigeria : ET09
- Burkina Faso : EG13 ; EG49 ; EG54

The program includes the following transmission lines:

***Table 7 - Desert-to-Power transmission lines***

| | Segment | Developer | Length (km) | Estimated cost (USD M) |
|---|---|---|---|---|
| 1 | Nouakchott (Mauritania) - Kiffa (Mauritania) - Mopti (Mali) | OMVS-SOGEM | 2025 | 978 |
| 2 | Mopti (Mali) - Ouahigouya (Burkina), Kandadji (Niger), Tahoua/Salkadamna (Niger), Gwiwa (Nigeria) | WAPP | 2450 | 1192 |
| 3 | Gwiwa (Nigeria) and Ndjamena (Chad) | Lake Chad Basin Commission | 1250 | 580 |

| | Segment | Developer | Length (km) | Estimated cost (USD M) |
|---|---|---|---|---|
| | | | **5725** | **2750** |

It also includes the following generation projects:

***Table 8 - Desert-to-Power generation***

| | Country | Capacity to develop 2030 | Developer | Indicative number of solar parks |
|---|---|---|---|---|
| 1 | Mauritania (outside ECOWAS) | 420 | OMVS-SOGEM | 3 |
| 2 | Mali | 677 | WAPP | 5 |
| 3 | Burkina | 520 | WAPP | 4 |
| 4 | Niger | 292 | WAPP | 2 |
| 5 | Chad (outside ECOWAS) | 702 | Lake Chad Basin Commission | 5 |
| | | **2611** | | **19** |

Subsidiary investment projects

The projects ranked just below those selected are the following:

| Code | Project | Length | Cost (USD billion) |
|---|---|---|---|
| **Roads** | | | |
| TRS01 | Ekok - Mfum - Ikom - Abakiliki - Enugu - Nsukka - Lokoja - Ilorin – Kaiama (Nigeria) - Chikanda - Nikki - N'Dali (Benin) | 1,472 | 3.68 |
| TRS02 | Greenville – Zwedu – Tapeta – Gbarnga- Kakata – Monrovia – Freetown | 1,220 | 3.05 |
| TRS03 | Calabar – Ikom – Ogoja – Jalingo – Yola – Mubi – Bama – Maiduguri – Kano – Zinder – Maradi | 2,250 | 5.62 |
| TRS04 | Mubi – Yola – Gombe – Bauchi – Jos – Kaduna – Zaria – Gusau – Sokoto – Niamey | 1,939 | 4.85 |
| TRA05 | Makeni – Kabala – Faranah | 250 | 0.62 |
| TRS06 | Sunyani – Abengourou – Akoupe - Abidjan | 381 | 0.95 |
| **Rail** | | | |
| TTS01 | Cotonou – Lagos – Sagamu – Ijebu Ode – Ore – Benin City – Sapele – Warri – Yenegoa – Port Harcourt – Aba – Uyo – Calabar – Ikom – Mfum – Yaounde | 1,402 | 2.25 |
| TTS02 | Calabar – Ikom – Ogoja – Jalingo – Yola – Mubi – Bama – Maiduguri – Kano – Zinder – Maradi | 2,250 | 3.6 |
| TTS03 | Ekok – Mfum – Ikom – Abakiliki – Enugu – Nsukka – Lokoja – Ilorin – Kaiama – Chikanda – Nikki – N'Dali | 1,472 | 2.3 |
| TTS04 | Maradi – Zinder – Kano – Bauchi – Jos – Makurdi – Enugu – Port Harcourt | 1,875 | 3 |
| TTS05 | Sunyani – Abengourou – Akoupe - Abidjan | 250 | 0.36 |
| TTS06 | Katagou-Owade (route F 105) | 66.4 | 0.120 |

| Code | Project | Length | Cost (USD billion) |
|---|---|---|---|
| **Ports** | | | |
| TPS01 | Modernization of port Warri | | 2.00 |
| TPS02 | Modernization of port Onne | | 2.00 |

### Global implementation schedule

The implementation of the master plan spans the period 2020-2045.

***Table 9 - Regional Master Plan implementation schedule – number of investment projects***

| | 2020-25 | 26-30 | 31-35 | 36-40 | 41-45 | Total |
|---|---|---|---|---|---|---|
| Transport investment | 20 | 12 | 6 | 4 | 7 | 49 |
| Energy investment | 45 | 21 | 16 | 1 | 9 | 92 |
| Water investment | 0 | 0 | 0 | 0 | 0 | 0 |
| ICT investment | 1 | 3 | 1 | 0 | 0 | 5 |
| **Total investment projects** | **66** | **36** | **23** | **5** | **16** | **146** |

***Table 10 - Regional Master Plan implementation schedule* – number of *soft projects***

| | 2020-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | Total |
|---|---|---|---|---|---|---|
| Soft - transport | 0 | 6 | 1 | 0 | 0 | 7 |
| Soft - energy | 17 | 4 | 2 | 0 | 0 | 23 |
| Soft - water | 9 | 6 | 0 | 0 | 0 | 15 |
| Soft - ICT | 8 | 2 | 0 | 0 | 0 | 10 |
| **Total Soft projects** | **34** | **18** | **4** | **0** | **0** | **55** |

The number of projects to be developed and supervised simultaneously in the framework of the development, preparation and implementation of the Master Plan shows a strong increase in activity during the period 2021-2025, in particular due to the backlog of regional projects. After 2030, the number of projects decreases as the backlog for regional infrastructure is eliminated.

### Master Plan Financing needs

Overall, regional projects (excluding national projects) amount to USD 130.30 billion in capital investment and USD 852.9 million in soft projects over the period 2020-2045. The sectoral breakdown is USD 80.82 billion for the transport sector, mainly for railways (USD 46.2 billion) and roads (USD 26.05 billion). The second largest investment is in the energy sector, with a program of USD 50.07 billion, mainly in electricity generation (USD 30.83 billion), as the program includes a major renewable energy development program, followed by investments in electricity transmission (USD 15.85 billion) and hydrocarbons (USD 3.39 billion). The water sector has no physical investments, and the ICT sector has few investments (USD 181.5 million) requiring Government support, with a large number of soft investments in addition for USD 502.5 million.

Overall, public sector investment amounts to USD 68.78 billion and private financing amounts to USD 61.55 billion. Private sector investment is mainly in the energy sector, where private financing of production amounts to USD 29.24 billion, followed by transport for a total of USD 32.25 billion (assuming that a significant share of the investment for rail lines will be financed by the private sector). It is worth noting that most of the investment needs are between 2020 and 2030, with a total of USD 72.79 billion. Investment in the period 2020-2025 is relatively large, totaling USD 41.12 billion, due to the high level of unmet need for infrastructure improvements.

***Table 11 - ECOWAS regional infrastructure investment needs (USD billion)***

| | *Transport* | | | *Energy* | | | *Water* | | | *ICT* | | | *Total* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Public* | *Private* | *Total* | *Public* | *Private* | *Total* | *Public* | *Private* | *Total* | *Public* | *Private* | *Total* | *Public* | *Private* | *Total* |
| 2020-25 | 6.477 | 9.471 | 15.948 | 10.358 | 14.7779 | 25.137 | 0 | 0 | 0 | 0.012 | 0.028 | 0.040 | 19.841 | 21.285 | 41.125 |
| 2026-2030 | 13.047 | 8.703 | 21.750 | 4.070 | 5.245 | 9.315 | 0 | 0 | 0 | 0.101 | 0 | 0.101 | 17.691 | 13.948 | **31.639** |
| 2031-2035 | 6.402 | 4.520 | 10.922 | 5.674 | 2.714 | 8.388 | 0 | 0 | 0 | 0.012 | 0.028 | 0.040 | 12.088 | 7.262 | **19.350** |
| 2036-40 | 7.851 | 3.459 | 11.311 | 0.169 | 0.113 | 0.282 | 0 | 0 | - | 0 | 0 | - | 8.021 | 3.572 | **11.593** |
| 2041-45 | 11.057 | 9.094 | 20.151 | 560 | 6.390 | 6.950 | 0 | 0 | - | 0 | 0 | - | 11.617 | 15.484 | **27.101** |
| **Total** | **47.8294** | **32.25366** | **80.082** | **20.832** | **29.241** | **50.072** | **0** | **-** | **0** | **0.125** | **0.056** | **0.181** | **68.786** | **61.549** | **130.335** |

**Costs and resources needed at regional level**

At present, regional institutions are small in scale and they are only at the initial stage, which does not allow them to play their proper role in the development of regional infrastructure projects. The role of the institutions needs to be reviewed to ensure that they are in a position to play a key role in the development and implementation of the Regional Infrastructure Master Plan. This encompasses:

- their structure and organization;
- the expertise they need to deploy; and
- their financial resources for their administrative operation and for project and program development.

**Human resources needed at regional level**

The level of activity of the PPDU regional institutions will vary over time with the implementation schedule of the Master Plan. There is a surge of activity over the period 2020-2030 compared to the post-2030 period.

The regional institutions will need an increase in staffing resources of 24 employees by 2025. Thereafter, the number of management staff will decrease. In addition, support staff will be needed. The total number of employees is therefore estimated as per the table below.

***Table 12 - Personnel for the implementation of the Regional Master Plan***

| | *2020* | *2025* | *2030* | *2035* | *2040* | *2045* |
|---|---|---|---|---|---|---|
| Management staff | | | | | | |
| Transport | 4 | 4 | 7 | 6 | 2 | 8 |
| Energy | 21 | 21 | 13 | 8 | 1 | 5 |
| Water | 3 | 3 | 2 | - | - | - |
| ICT | 3 | 3 | 2 | 1 | - | - |
| Total management staff | 31 | 31 | 25 | 14 | 3 | 13 |
| Administrative staff | 5 | 5 | 4 | 2 | 0 | 2 |
| Support staff | 8 | 8 | 6 | 4 | 1 | 3 |
| **Total staff** | **44** | **44** | **35** | **20** | **4** | **19** |

Most of the staff is needed in the energy sector, because of the workload related to the preparation program for the large renewable energy projects, followed by transport.

**Costs and budgetary needs for the implementation of the Master Plan**

The evaluation of the financial resources required for the implementation of the Master Plan includes the structural costs of implementation (staffing, logistics) and the cost of preparing the projects, as well as the implementation of the capacity building and institutional development programs retained under the Master Plan. A budget of around USD 5 million per year is needed, which will decrease thereafter to USD 1.9 million in 2045.

The estimates provided below for the selected years are tentative and should be taken as orders of magnitude rather than firm budget estimates.

***Table 13 - Synthesis of the annual financial needs of the institutions for the implementation of the 2020-2045 Master Plan (USD)***

| | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 |
|---|---|---|---|---|---|---|
| Cost management staff | | | | | | |
| Transport | 436,364 | 436,364 | 811,636 | 685,091 | 261,818 | 981,818 |
| Energy | 2,534,545 | 2,534,545 | 1,614,545 | 981,818 | 65,455 | 589,091 |
| Water | 360,000 | 360,000 | 288,000 | - | - | - |
| ICT | 374,545 | 374,545 | 292,364 | 65,455 | - | - |
| **Total cost management staff** | **3,705,455** | **3,705,455** | **3,006,545** | **1,732,364** | **327,273** | **1,570,909** |
| *Cost administrative staff* | *257,323* | *257,323* | *208,788* | *120,303* | *22,727* | *109,091* |
| *Cost support staff* | *154,394* | *154,394* | *125,273* | *72,182* | *13,636* | *65,455* |
| *Total cost staff* | *4,117,172* | *4,117,172* | *3,340,606* | *1,924,848* | *363,636* | *1,745,455* |
| *Cost logistics* | *411,717* | *411,717* | *334,061* | *192,485* | *36,364* | *174,545* |
| *Cost technical assistance* | *630,000* | - | - | - | - | - |
| **Total ECOWAS implementation cost** | **5,158,889** | **4,528,889** | **3,674,667** | **2,117,333** | **400,000** | **1,920,000** |

The challenge for the regional institutions is the funding of the management and development of the Master Plan.

Possible sources of financing for the PPDU are:

- Contributions from donors and international organizations
- ECOWAS budgetary allocations
- Levies on selected regional activities which benefit from regional projects.

**Contributions from donors** are presently the main source of funds for financing the preparation of regional projects, but a significant drawback is that they are unstable, being linked in general to specific projects.

**ECOWAS budgetary allocation** is the main source of funds for the operation of the PPDU, but with the expected increase in the size and budget for implementation of the Master Plan, the effort required from ECOWAS is likely to increase.

**Levies on selected regional activities.** The justification for this approach is that the role of the regional institutions is to support the development of regional infrastructure. It is therefore logical that these same activities contribute to their support. Under this approach, very small levies would be applied to regional exchanges based on, and benefiting from, regional infrastructure. More specifically, it could be applied to regional exchanges of electricity, port services for goods in transit or airport dues. For water and ICT services, specific mechanisms for mobilizing resources from these sectors will have to be specifically designed for implementation of the Master Plan.