wjert, 2024, Vol. 10, Issue 5, 1-13. *Original Article* **ISSN 2454-695X**

World Journal of Engineering Research and Technology
WJERT
www.wjert.org
SJIF Impact Factor: 7.029

IMPACT OF CLIMATE CHANGE IN THE AREA WHERE THE KALETA HYDROELECTRIC POWER PLANT IS IMPLEMENTED

Conte Alseny[1]*, M. L. Diallo[2], Ibrahima Bayo[3] and M. L. Keita[4]

[1]Uganc.
[2,3,4]Cerescor.

Article Received on 28/02/2024 **Article Revised on 17/03/2024** **Article Accepted on 07/04/2024**

***Corresponding Author**
Conte Alseny
Uganc.

SUMMARY

Hydroelectric developments have long-term impacts on project-affected people (PAP), whether they are displaced (physically and economically) or hosts. Budgets are provided in environmental and social management plans (ESMPs) and resettlement action plans (PAR) to mitigate the impacts of hydroelectric projects on biophysical and human environments. However, these one-off actions often present a lack of monitoring and availability of sustainable financing after the first 2 or 3 years of project implementation. It is then appropriate to think about sustainable approaches in order to properly restore the livelihoods of the PAPs in the long term, and thus allow these projects to support local development in the same way as national development. The problem of dams is a social issue, because it has a direct impact on it. It mobilizes numerous societal actors such as governments, local organizations, international non-governmental organizations and multilateral organizations. The construction of dams gives rise to numerous international controversies, local problems are now globalized. According to Éric Lambin, “Experience shows that taking into account the environmental effects of dams from the design stage of the project can maximize the positive effects and minimize the negative effects both on the environment and on neighboring populations. Past experiences can be used to learn from mistakes made and are therefore very useful in building projects today. Vulnerability is the degree to which a system is susceptible to the adverse effects of climate change, including climate variability and its extremes. It depends on the nature, magnitude and rate of climate variation to which the system considered is exposed, the sensitivity of this system and its capacity to adapt. In Guinea, one of the characteristics is the very marked contrast between

the different natural regions from the point of view of socio-economic conditions, population density, rainfall and hydrological regimes, relief, soil distribution, fauna, flora (Source: PANA, 2007).

KEYWORDS: Variability, change, climate, Hydroelectric power plant, Temperature, humidity.

The issue of climate change has for some time been at the center of concern for scientists and political decision-makers around the world.

For more than three decades, the climates of West and Central African countries have been affected by recurrent and severe drought. This phenomenon has resulted in significant rainfall and hydrometric deficits, the consequences of which have been devastating for the sub-region because of their immediate and lasting repercussions on the natural environment and on man. According to (Cissé, (2000))[1], most scientists support the idea that climate change has a negative influence on natural resources, ecosystems, infrastructure and human health and may ultimately compromise the survival of humanity and life on our planet. This is why, like many countries in the world, Guinea, by ratifying the United Nations Framework Convention on Climate Change (UNFCCC) in 1993, undertook to work for a national economic and social development (PNDES, 2016-20202) of sustainable development, based on the rational use of natural resources and the improvement of production techniques.

Africa is more vulnerable than any other region in the world to climate change, explains climate specialist.

The African continent will be hardest hit by climate change.

Climate change, in its many forms, has been a subject widely discussed since the beginning of the 20th century.

The advantages expected from dams are in particular the regulation of floods and more generally of rivers, the supply of water for irrigation or the supply of drinking water, and since industrial times, the production of energy. hydroelectric.

Past experiences can be used to learn from mistakes made and therefore are very useful in building projects today.

Problems

In this part of our work, the general problem, the specific problem, the general objective and the specific objectives are successively presented.

The problems of ecosystem degradation and some of their consequences are discussed in this chapter.

This Problem can be summarized as follows: By changing the composition of the atmosphere at the rate it currently does, humanity is transforming the planet into a vast laboratory experiment for which it has control over the initial parameters but has very little of control over the evolution and final result of the experiment.

General Problem

Generally, the problem of climate change is a global issue that mobilizes many actors such as governments, local organizations, international governmental organizations and multilateral organizations. It is still at the center of the concerns of scientists, the media, NGOs, and policy makers around the world. This is a challenge that all sectors will face (PARCS, 2012).

"It is an immediate and potentially irreversible threat to human societies and the planet," and that the fight against global warming must take into account the "right to health" of populations.

Its impact is manifested through rainfall deficits, disruption of the rainfall regime (early or late rains), droughts, violent winds, extreme temperatures, sea level rise, loss of biodiversity, migration, floods, silting of waterways, etc.

The overall prediction is that the effects of long-term climate change will cause flooding problems to become more severe in Asia and lead to more severe drought situations in the Mediterranean regions of Europe and Africa, Central America, of the southwestern United States and subtropical regions of the Southern Hemisphere (Hilton & Miller, 2017).

Moreover, climate change does not only affect meteorological parameters, temperature and precipitation, but also global warming affects the temperature of surface water and subsequently the temperature of fresh water sources such as rivers.

The temperature of the rivers increases by 0.5°C per decade as a result.

The climatic trends observed in terms of temperatures show that the country's monthly averages reflect the global trend, exceeding the normal average (1961-1990) by 0.1°C to 0.8°C on average.

Specific Problem

Specifically, this problem is a question of society, because it has a direct impact on it. It mobilizes many social actors such as governments, local organizations, international non-governmental organizations and multilateral organizations. The construction of dams gives rise to many international controversies, local problems are now globalized. (Bellier-, March 1990).

According to Éric Lambin, (Africa, 1988-cambridge.org)4 “Experience shows that taking into account the environmental effects of dams from the design of the project can maximize the positive effects and minimize the negative effects both on the environment than in neighboring populations.

In Guinea, to talk about the effects of climate change, we focused on the coast. We carried out a policy of mobilization of the various international communities for the mitigation of greenhouse gas emissions.

According to him, the 2000 -2100 projection provides for a temperature variation between 0.3 and 4.8 ° C in Middle Guinea and Upper Guinea.

From 0.2 to 3.9°C in Basse-Guinée and Guinée-Forestière.

(Dr Kandé Bangoura, April 14, 2014) Oceanographer researcher at the Conakry Rogbanè Scientific Research Center (CERESCOR), led a conference-debate on April 14, 2017 at the CIRD in Guinea.

According to (Bamba, (2012)) most socio-economic activities are today affected by the impacts of this climate change (high floods and particular floods).

This climate change could also have negative effects on agriculture, species composition and the productivity of marine ecosystems, which would ultimately have serious consequences for fisheries and downstream industries.

The Guinean territory, although sufficiently watered and located in the tropical climatic zone with abundant rains, was no exception to this drop in precipitation, flows, droughts,

The consequences of this drought were so devastating for the sub-region that several studies have been carried out since 1951 on the variations in rainfall and runoff in West and Central Africa by various authors, including Bamba (1996), Bangoura (1997), Sangaré (2006), Oliver (1988) and PANA (2007)6. These authors have all materialized the decline in rainfall and runoff since the 1970s following the major droughts that occurred in the sub-region.

II: MATERIALS AND METHODS

This part includes the study area, the bibliographical review and the methodological approaches developed for the collection, processing and analysis of climate data extracted from satellite observations and the images produced used.

Study Zone

The Kaléta site is located approximately 110 km north of Conakry on the Konkouré River. It corresponds to an area of falls located just downstream of a widening of the valley. The site is made up of a very wide sill of around 700 m at the bottom of this bed, creating a natural fall nearly 40 m high.

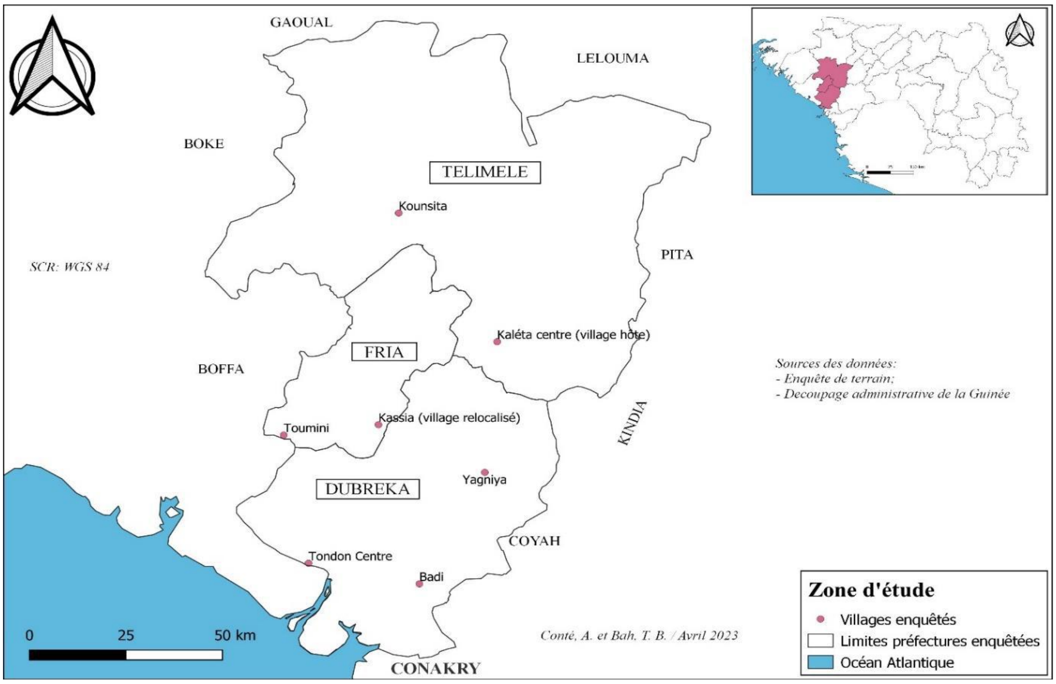
The coordinates are 10° 27 N and 13° 16 W.

The Kaléta hydroelectric development (launched in 2015) has an installed capacity of 240 MW). It is located on the Konkouré in Maritime Guinea, 115 km in a straight line northeast of Conakry and 130 km upstream from the mouth of the Konkouré River.

The dam is located in the rural commune of Tondon, prefecture of Dubréka. The number of people displaced by the Kaléta project is 750 people according to (CNU, study trip 2016).

Figure 1: Satellite photo image of the study area(Source: Google Earth 2020).

Figure: Administrative map of the Kaléta development



Source: DNM

The table below presents the villages visited in this study, by Rural Commune.

1- Work equipment

To create this article we used.

(i) documents archived at the Ministry of the Environment,

(ii) Meteorological information to the National Directorate of Meteorology (DNM),

(iii) Tools for field observations and photography;

(iv) data on the environmental situation of the area;

(v) means of travel for field missions;

(vi) an HP brand computer, Core i5 with MS Office Word 2013, for data entry and processing and a GPS to accurately determine the geographical coordinates of the study area.

2- Methodological approach

The approach adopted to conduct this study was as follows.

- The collection of climatic data, in particular rainfall (series from 19 to 19); the ambient temperature (series from 198 to 1988); consultations and bibliographic review.
- The field surveys were organized through individual or group interviews using a questionnaire drawn up beforehand.

The purpose of the field survey was to see how climate variability is experienced at the village and individual level in order to identify relevant indicators of vulnerability. This work was carried out in two stages: a first field mission was carried out in August (2019) as part of knowledge to inquire about the realities on the ground and the second in January 2020 for the survey. These two surveys targeted only 8 villages given the difficulties related to the insecurity that prevailed in the majority of the localities of the dam.

Tools used is Magicc SCENGEN

The use of this tool allows the construction of a climate change scenario in order to provide the future state of the climate for studies of impacts and adaptations in socio-economic sectors such as agriculture, livestock, water and health.

This tool allows us to use MAGGIC output results and climate normals (1961-1990) for temperature and rainfall.

The simulation results obtained allowed us to choose the GCM CSIRO–TR. Because its results under SCENGEN give good agreement with the real values of temperature and precipitation measured in certain localities that we chose for validation.

Depending on the nature of the data, different methods and statistical tools were used for their processing and analysis. Multivariate analysis methods using regression and correlation were applied to the precipitation time series in order to calculate on the one hand the rainfall indices and on the other hand to characterize the rainfall regime over time and in 'space.

III RESULTS AND DISCUSSIONS

The results of meteorological and hydrological parameter data for a period of 30 years (1983-2013) were used to study climate variability (see figure below). This made it possible to carry out a detailed analysis of weather-synoptic phenomena, such as temperature and rainfall in the coastal zone.

III-1: VARIATION IN AVERAGE MONTHLY TEMPERATURE

The monthly average values for the 30-year period (1983-2013) are shown in Figure 3-1: below.

Figure 3.1: Monthly average temperature curve.

From the figure, we see that the temperature is equal to 36°C (March) and 23°C (August).

Maximum monthly averages are generally observed during the months of March and April. Absolute maximum temperatures are highest between February and April (34 to 35.5°C) and lowest in August and September (23 to 25°C).

The daily thermal difference is very significant during the harmattan period (32 to 36°C from December to March) and decreases significantly with the arrival of the monsoon (23 to 25°C in August-September).

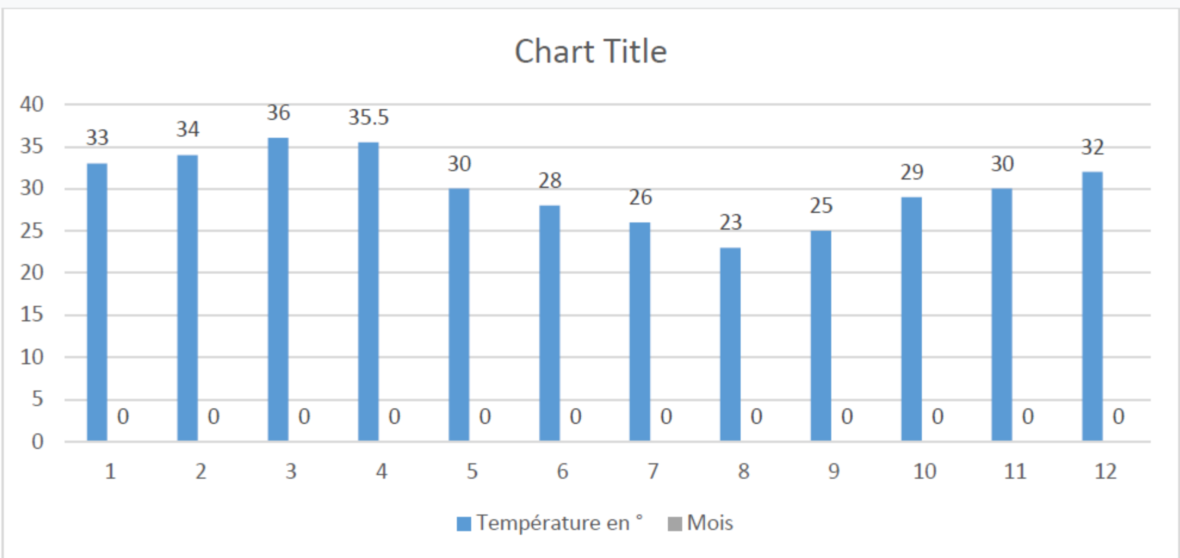


Figure 3.1: Monthly average temperature curve.

From the figure, we see that the temperature is equal to 36°C (March) and 23°C (August). Maximum monthly averages are generally observed during the months of March and April. Absolute maximum temperatures are highest between February and April (34 to 35.5°C) and lowest in August and September (23 to 25°C).

The daily thermal difference is very significant during the harmattan period (32 to 36°C from December to March) and decreases significantly with the arrival of the monsoon (23 to 25°C in August-September).

The monthly average values for the 30-year period (1983-2013) are shown in Figure 3-2: below.

III-2: ANNUAL TEMPERATURE VARIATION

The annual average values for the 30-year period (1983-2013) are shown in Figure 3-2: below.

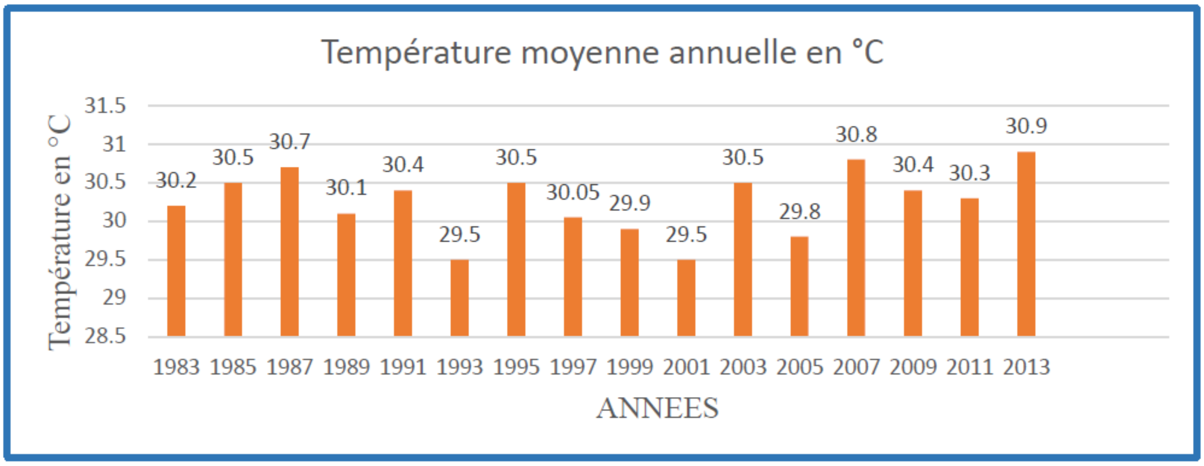


Figure 3.2: Average annual temperature curve.

According to Figure 3.2, it can be seen that the annual average temperatures in the area of the Kaléta dam vary between 29.5°C (1993 and 2001) and 30.9°C in 2013 (This maximum temperature was 30, 7°C in 1987 and 30.8°C in 2007).

Inter-annual variations show a remarkable peak in 1987, 2007 and 2013.

III. 3-1: Monthly average humidity

The monthly average relative humidity from January to December is shown in the following figure.

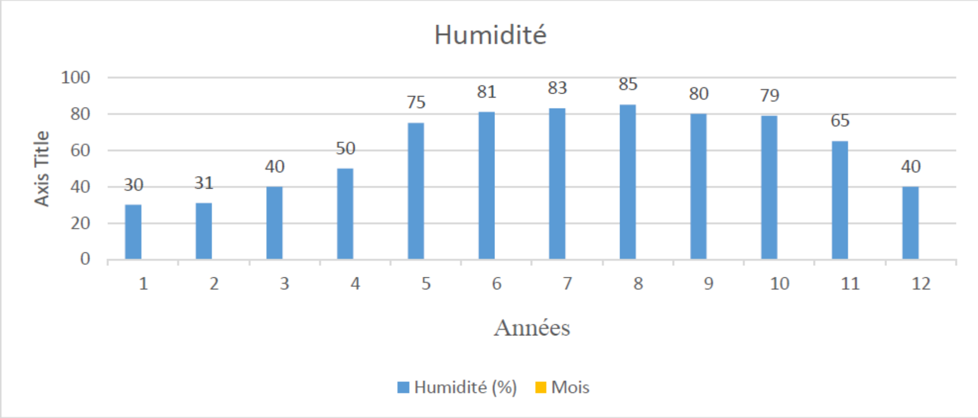


Figure: Monthly average humidity.

From Figure 3.1, it can be seen that the monthly average relative humidity varies between 30% (January) and 85% (August). However, it should be noted that the month of February also has low humidity (31%). The month of July, in turn, has a humidity as high as the month of August (83%).

III. 3-2: Average annual humidity

III.3-2: ANNUAL HUMIDITY VARIATION

Humidity defines the amount of water vapor present in the air. This amount varies from 0 to 100% depending on the form.

-If the humidity is below 35%, then the air is dry.

- If the humidity is between 35% to 65%, then the air is medium humid.

- If the humidity is above 65%, then the air is really humid.

Similarly, the more the humidity increases, the more the temperature decreases and that if the humidity decreases, the temperature increases.

The average relative humidities for the period (1983-2013) at the level of the Kaléta dam are represented as follows.

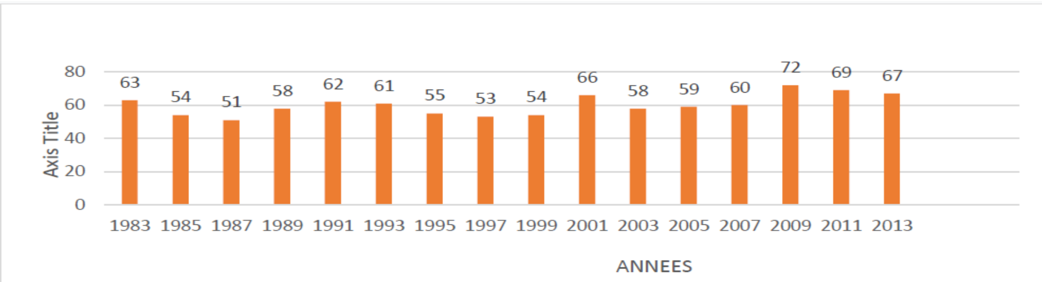


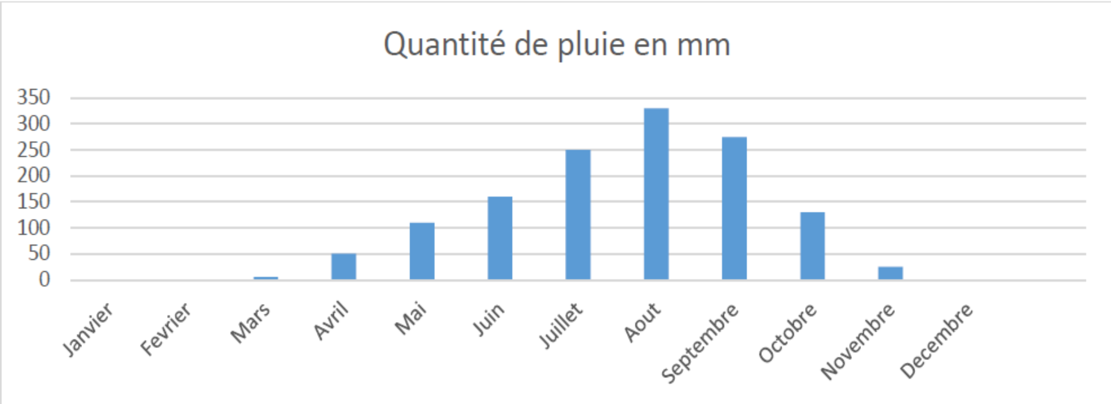
Figure: Average annual humidity.

According to Figure 3.2, we see that the annual average relative humidity at the level of Kaléta dam varies in sawtooth patterns. It has a minimum value equal to 51% (1987) and a maximum value 72% (2009).

III. 4: Rainfall

III-4-1: Average monthly rainfall

The variation in average monthly rainfall from January to December is shown in the following figure.



According to Figure III-4-1, we see that the average monthly rainfall, close to 0 in December and January, reaches the maximum in August (330 mm).

III-4-2: Average annual rainfall

The variation in average annual rainfall for the period 1983-2013 at the Kaléta dam is shown in the following figure.

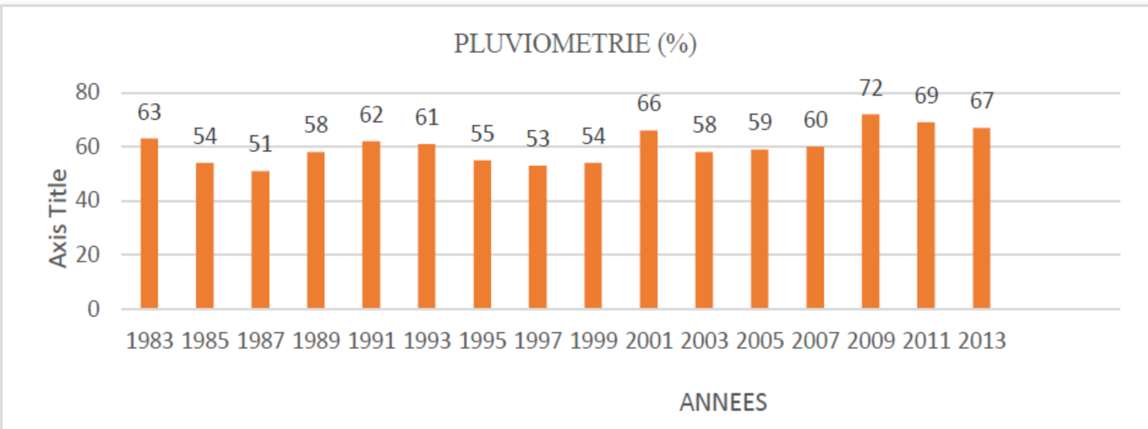


Figure: Average Annual Rainfall

According to Figure 4.2, we see that the average annual rainfall at the Kaléta dam varies in sawtooth patterns. It has a minimum value in 1987 (51%) and a maximum value in 2009 (72%).

DISCUSSION

During these last years after the analysis, it should be noted that.

The climate risks to which the populations, infrastructures and ecosystems of the Dubréka prefecture and its direct zone of influence are exposed are characterized by 2040 with a view to allowing all stakeholders to understand the impacts of climate change.

Individual and collective awareness of adaptation needs emerges from foresight exercises including climate risk scenarios constructed collectively and makes it possible to integrate these issues into territorial planning documents.

Awareness-raising and training actions for public authorities responsible for regional planning in the Dubréka prefecture are being implemented.

Civil society awareness-raising actions are implemented through an environmental education and eco-citizenship program focusing on information, awareness-raising and training seminars and conferences.

Pilot adaptation actions relating in particular to the reduction of the risks of flooding, water deficit and heat islands are implemented by all the stakeholders concerned with a view to significantly improving the environment and quality of life of the populations. of this prefecture and its direct zone of influence.

NB

The latest IPCC report (2007) indicates that the increase in average temperature between 2080 and 2099 compared to the period 1980-1999 could reach 3 and 6°C over the entire African continent, i.e. 1.5 times more than at the World level.

IV CONCLUSION

In short, we see that most socio-economic activities are today affected by the impacts of climate change.

Generally speaking, African coasts are subject to erosion phenomena (PANA 2007).[5]

The Kaléta hydroelectric plant, with a capacity of 240 MW, constitutes a significant component of the energy production capacity and any reduction in its water supply will result in a significant loss of production for the Guinean State.

It also knows the presence of specific ecosystems in coastal areas, such as the mangrove, whose ecological importance and economic role have been demonstrated in this chapter.

Natural disasters linked to weather and climate phenomena have become all too frequent and are reaching worrying extremes across the world.

The relative feasibility study of the Kaléta hydroelectric development highlights a marginal impact on the environment.

In this context, the construction and operation of hydroelectric developments raise environmental and socio-economic issues, including the involuntary displacement of populations and the proliferation of vectors of water-borne diseases.

In the case of the Konkouré basin in Guinea, similar problems could arise with greater effects. Particular attention must therefore be paid to its operation, so as to better take into account environmental and socio-economic issues.

BIBLIOGRAPHY

1. EDF INTERNATIONAL - COYNE & BELLIER - March 1990, Konkouré hydroelectric development. Garafiri-Kaleta complex.
2. PNDES 2016-2020 = National Program and Strategy. 82 pages National Report and Strategy. "Sustainable energy for all by 2030" Energy: Conference of partners and private investors of Guinea.
3. (Hartmann, 1990 and Cooley. 1990), Report on the impact of climate change and vulnerability of the basin, 56p
4. (servat et al. 1999) Adaptation to vulnerability and anthropogenic risks, 125p.
5. PARKS. (2012). Energy: Conference of partners and private investors of Guinea. Edition of the environmental and social impact of the Souapiti Dam, 2012.
6. Pana, 2007: National Adaptation Action Plan In The Republic Of Guinea, Conakry 2007, Pages 78.
7. S. CISSE, B. ZOUMANA et al, November 2000. Study of the vulnerability and adaptation of the coastal zone to climate change, final report, Conakry.
8. Environmental and social impact of the Souapiti Dam, 2012 Ministry of Energy and Hydraulics.