The Efficiency and Impacts of Dams: A Case Study of the Challawa Gorge Dam

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Abstract

The debate on whether dams are sustainable or not is becoming interestingly complex. While many large co operations, international finance organizations like the World Bank and many governments especially in developing countries still see dam construction and operation as developmental, many scientists, environmentalists, conservationists, and social activists see it otherwise. A study was carried out to determine the efficiency and the social and environmental impacts of the Challawa Gorge Dam (Latitude 11^0 50' N and Longitude 8^0 01' E) is located in Karaye Local Government Area of Kano State, Northern Nigeria. It has a reservoir capacity of 930,000,000 m^3. The dam was constructed across River Challawa, which empties into Lake Chad in North-Eastern Nigeria. About five communities were displaced and resettled to construct the reservoir. Farm lands and numerous trees were destroyed to build the dam. Although, one of the major purpose of the dam was to irrigate farm land of local farmers, up till date the irrigation scheme is yet to be developed. The presence of the dam has greatly reduced the farmland available to farmers. Water is taken from the dam to supply water to Kano City, yet the communities around the dam do not have access to pipe-borne water. The presence of the dam has significantly affected the hydrology of the wetland. Changes in flow regime of the river brought about by the dam have drastically reduced the area, depth and duration of annual floodings thus affecting the communities which depend on the wetland for cultivation of crops. Dam construction programmes will continue to radically altar the hydrological regimes downstream with negative effects on downstream user. Moreover, the emission of greenhouse gas from the dam reservoir is a significant ecosystem impact. It is recommended that regular EIA should be conducted around large dam appraise the management, efficiency and impacts of dam. Government should exploit more renewable options to dams.

Introduction

The debate on whether dams are sustainable or not is becoming interestingly complex. While many large co operations, international finance organizations like the World Bank and many governments especially in developing countries still see dam construction and operation as developmental, many scientists, environmentalists, conservationists, and social activists see it otherwise. Scientist, NGOs and professional groups such as the International Commission on Large Dams (ICOLD), International Hydropower Association (IHA) and International Energy Agency (IEA) have written extensively on the impacts of large dams.

Reports around the world have shown that the story of dams is the story of violation of basic rights of the people who live in the area flooded by dams. The obstruction of thousands of watercourses has impacted negatively the environment and riparian lives. Reports have shown that the impact of dam is not limited to the area of their reservoirs, but it goes beyond it. And yet, Over 60% of World Rivers have been affected by dams and diversions. The impact of dams

on people's livelihood, health, social systems and culture are not easily quantified and often not considered in the analysis of the benefits of dams. The direct benefits they provide to people are typically reduced to monetary figures for economic analysis and are not often recorded in human terms.

Conflicts over water and dam are probably as old as dam building itself. Over the years, the positive economic and social benefits of dams have been projected especially by the financials of dams. As knowledge increases and more researches were being done to unveil the adverse impacts of dams, opposition to dam grew stronger. In 1910s, conservationist John Muir unsuccessfully lobbied public opinion and the United State Congress against the building of O'Shaughnessy dam in Yosemite National Park in California. In many countries, the populations affected by dams have fiercely resisted dam building throughout the last century, because they are often isolated without help from outside sympathizers.

In Nigeria, there has been an upsurge in dam construction in the past three decades (Ofoezie, 2002). A total of 323 dams were identified in literature out of which 246 (76.2%) were constructed between 1970 and 1995. The effect of the sahelian drought of 1972 – 1975 aggravated the already stressed food security situation in the country prompting the various levels of government to embark on a rigorous policy to increase food production. To achieve this, impoundment of river basins was seen as inevitable to provide sufficient water for year-round irrigation which led to the construction of over 246 dams (Imevbore et al, 1986).

With many more dam still under construction in Nigeria, the story is not different from what holds in other parts of world. The current project was carried out to appraise the management, efficiency and impacts of the Challawa Gorge Dam, located in Kano State, northern Nigeria. The project focused on the impacts of dams on the environment and people of Nigeria. It looked at the current conflicts surrounding the dams in that region of the country.

The Challawa Gorge Dam

The Challawa Gorge Dam (Latitude 11^0 50' N and Longitude 8^0 01' E) is located in Karaye Local Government Area of Kano State, Northern Nigeria. It an earthfill (zoned) with concrete dam.The Dam was completed in 20th July, 1992. It was started by the Water Resources and Engineering Construction Agency (WRECA) of the Kano State Government, and was later handed over to the Federal Government under the auspices of Hadejia-Jama'are River Basin Development Authority (HJRBDA) who contract it to Julius Berger, a German-base construction firm. The dam was financed by the Federal Government of Nigeria, owned by the Hadejia-Jama'are River Basin Development Authority. The dam was constructed across River Challawa, which empties into Lake Chad in North-Eastern Nigeria.

Length of spillway	609.6m
Volume of concrete	58,500m^3
Catchments area	3859km^2
Crest length	7760m
Crest width	10m
Maximum height	39.62m
Volume of fill	6,116,424 m^3
Reservoir Storage Capacity	930,000,000 m^3
Dead Storage Capacity	26,000,000 m^3
Active Storage Capacity	904,000,000 m^3
Spillway Design Flood	3850 m^3/sec.
Area of Reservoir	70km^2

Efficiency of the Dam

A publication of the Federal Ministry of Water Resources and Rural Development titled "Nigeria Register of Dams" published in 1995 revealed that the Challawa Dam was initially constructed for irrigation, water supply, hydroelectricity, flood control, recreation fisheries, and wild life conservation. Currently, the irrigation scheme is yet to be developed. Water is taken from the reservoir to supply water to Kano Municipal, yet the communities around the dam do not have access to pipe-borne water supply. Challawa Dam supplements Tiga Dam which is located in the downstream section of the dam. Also the hydroelectric scheme is yet to be developed.

Social Impacts

About five communities were displaced and resettled to construct the reservoir. Members of these communities are mainly farmers and cattle rearers. They depend largely on irrigation to cultivate their crops. Kano State falls into the Savana region of Nigeria, and it is characterized by few months of rainfall. So, farming activities in this area depend chiefly on irrigation. Before the construction of the dam, the Challawa River was use by locals to irrigate their farmland.

Though one of the major reasons for constructing the Challawa Dam is to irrigate farm land, the irrigation scheme is yet to be developed, which has resulted in the reduction of farm land of the surrounding communities. Five communities were displaced to construct the dam. Sources revealed that the communities displaced were adequately compensated when the dam was being built under WRECA. It was gathered however, that under Julius Berger, the community people complained over the compensation they were given. Farm lands and numerous trees were destroyed to build the dam.

Emission of Greenhouse Gases (GHG)

The emission of greenhouse gases (GHG) from reservoirs due to rotting vegetation and carbon inflow from the catchments is a recently identified ecosystem impact of storage dams. With reservoir area of 70 km^2, the release of CO^2 from the reservoir will significantly affect the amount of GHG in the atmosphere. . It has been estimated that the gross emissions from reservoirs may account for between 1% and 28% of the global warming potential of GHG emissions (WCD, 200l). This challenges the conventional ideal that hydropower produces only positive atmospheric effects such as a reduction in emissions of carbon dioxide, nitrous oxides, sulphuric oxides and particulate when compared with power generation sources that burn fossil fuels (Bosi, 2000).

Impact on the Wetlands

The Challawa Dam and it neighboring Tiga Dam have greatly affected the hydrology of the Hadejia-Nguru Wetlands. Most of the flow in the Hadejia River system, which is a tributary of the Yobe River is now controlled by the Tiga and Challawa dams. Because of relatively high soil moisture and fertility, the wetland is a prized area in developing the floodplain agriculture where farmers are able to grow one crop (rice or maize) during the rainy season and then plant the dry season crops on the margins of flooded wetland utilizing the residual soil moisture to secure the second harvest. The dams have significantly altered the wetland hydrology.

Changes in river regimes as brought about by dams have drastically reduced the areas, depth and duration of annual flooding; thus, this has affected communities which depended upon these ponded wetlands for fishery and cultivable wetlands. And also, the dam has reduced the habitat area for migratory birds and other wildlife. In particular, the recession agriculture on the wetland has been seriously curtailed both in respect to the area under cultivation and the market-value crops being planted, for instance, in some places where farmers cultivated the wet season rice, they are presently obliged to cultivate Guinea-corn or millet due to the reduced flood water and the consequent loss of residual soil moisture. The reservoirs effectively trap a greater part of the sediments that were formally deposited on the wetlands during the flood period. The floodwater no longer spreads the same amount of enriched silt over the cropland thereby reducing the natural maintenance of soil fertility. As it is difficult to purchase more fertilizer in order to avoid reduced yields, crop production and values are reduced.

Discussion

As we look at the future of the clean development mechanism (CDM), it is pertinent to clearly define projects that are CDM compliant and those that are not. CDM projects should display high environmental integrity and additionally. The dam projects, whether small, medium or large dams have failed to meet this requirement. The Challawa Gorge Dam project is a case of degradation of the environment. Down stream communities are starve of water for irrigation and domestic use. Moreover, the wetland hydrology has been greatly affected that it has reduce crop production in the region. This also, has greatly affected livestock production. Farming and livestock rearing is the major occupation of the inhabitants of the wetland areas. Because of the enormous size of dam reservoir, 70 km^2 in the case of the Challawa Dam, biochemical activities in these reservoirs is contributing significantly to global warming through the emission of greenhouse gases.

During, the relocation of people to build reservoirs, many people are robbed of their livelihood and in many cases compensation paid to them are not adequate. Some may not have been compensated at all. Five communities were displaced and relocated to construct the Challawa Dam. Such relocations have resulted in lost of livelihood and cultural heritage.

Every developmental project should address the need of the poor. In the case of Challawa Dam, communities around the dam do not have pipe-borne water even if one of the primary objectives of the dam was for water supply. Water is taken from the dam reservoir to supply Kano City, the state capital, It a case of “robbing Peter to pay Paul”. Here, we can see a case of causing poverty in one region and enriching another region. The dam was also meant to irrigation for an area of 3859km^2, yet about fifteen years after construction, the irrigation scheme has not been developed. While it s agreed that dam can be beneficial, actual benefits are usually lower than the projected benefit on which decision to build a dam are based.

It is clear from the current research that dam projects are undesirable CDM projects. It is recommended that regular EIA should be conducted around large dam appraise the management, efficiency and impacts of dam. Government should exploit more renewable options to dams. The world should begin to look at other options to dams. Many alternatives exist for the supply of water and electricity. The choices available to a society at any given time also depend on factors such as natural resource endowment, technological capability, institutional capacity, financial, market condition, cultural preferences, awareness and education. In combating climate change and poverty, new renewables create a decentralized option that generate jobs and income and empowers local communities and strengthens self reliance.

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