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## **14. NORWEGIAN HYDROPOWER DEVELOPERS IN TANZANIA**

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In this chapter, Tanzania is presented as an example of the international involvement of Norwegian hydropower developers.

The Norwegian Agency for Development Cooperation (NORAD) has chosen Tanzania as one of its main recipient countries, and no other country has received more development assistance from Norway. Even though Tanzania is one of the world's poorest countries, it represents a significant export market for Norwegian companies. During the 1980s, Norwegian companies exported goods worth 820 million Norwegian kroner (128 million US dollars). In addition, services provided by Norwegian consultants and contractors amounted to several hundred million Norwegian kroner. This export has to a large degree been financed by Norwegian development aid (Amland, 1993). Several Norwegian hydropower companies are presently involved in projects in Tanzania.

The consulting company Norplan is at the moment working on the Pangani Falls Redevelopment Project, collaborating with Finnish IVO International (see 14.5). Norplan has been hired as consultants for the rehabilitation of the older dams on the Pangani river, and has done substantial work on the so-called master plans for development of river systems in Tanzania.

Norplan is also doing consultancy work on the Kihansi hydropower plant in central Tanzania, which is partly financed by the World Bank. Kihansi is the largest hydropower project in the country, and according to plans it will be put into operation by 1998. The dam on the Kihansi

River will produce 180 MW of electricity, with a possible increase to 300 MW in a later phase. The costs are estimated to some 2.6 billion Norwegian kroner (400 million US dollars). NORAD has promised 400 million Norwegian kroner (62 million US dollars) in development support to the project, on the condition that environmental concerns are properly taken care of. In addition to the World Bank financed feasibility study, Norplan has also made the environmental assessments on the project, which have been far from satisfactory. As construction of the dam had already started when the environmental studies were commissioned, the studies are nothing but a rush job to assess the amount of damage made by this huge project.

The Norwegian company Norconsult International is doing engineering work and detailed design of the Kihansi dam. Norconsult has also made feasibility studies for several other dam projects in Tanzania, and has been involved in the Rufiji Basin Master Plan.

Noremco is the contractor on the Pangani Falls Redevelopment Project, and have also done some work for local authorities in Tanzania.

Kvaerner Energy and ABB have had large deliveries of equipment to hydropower projects in Tanzania. Both have their own agents in the country. ABB is a co-owner of the TANELEC factory in Tanzania, which produces smaller transformers for use in power stations and grids.

The remainder of this chapter presents two Tanzanian hydropower projects in which Norwegian companies are or have been involved. First the gigantic Stiegler's Gorge project, which was planned on the Rufiji river, is discussed. This part of the chapter is taken from the 1988 FIVAS report *Når Norge Legger Verden i Rør*. It was written by Dr. Ian Bryceson, a Tanzanian marine biologist who worked at the University of Dar es Salaam from 1972 to 1982, and was involved in studying the anticipated effects of the dam.

Finally, we discuss the Pangani project, which is presently under construction. Pangani is the largest NORAD project so far. After several years of economic crisis in Tanzania, Pangani represents new hopes and new contracts for the hydropower industry.

## **14. 2 STIEGLER'S GORGE**

This chapter describes how Norwegian hydropower interests were involved in the planning of a large dam at Stiegler's Gorge on the Rufiji River in Tanzania during the 1970s and early 1980s. Over 150 million Norwegian kroner (24 million US dollars) of Norwegian development support were spent on engineering studies and feasibility studies, although the dam has not been built. For the time being, the plans have been shelved.

The Rufiji River is the largest river in Tanzania with a huge catchment area comprising most of the south-eastern part of the country, which in turn receives relatively high annual rainfall. It has several large tributaries (Ruaha, Kilombero, Luwego and Mbarangandu) and many small. The tributaries meet and pass through a relatively narrow passage, Stiegler's Gorge, before descending to the flat lower plains, meandering down to a large delta area vegetated by mangrove forests, and finally flowing out through several mouths into the Indian Ocean.

The area immediately upstream of Stiegler's Gorge is the largest national nature reserve area in Tanzania, Selous Game Reserve, which is also the biggest in Africa. Further upstream on the Ruaha tributary are two hydropower dams, Kidatu and Mtera, and areas important for maize, groundnut, sisal, tobacco and cattle production.

The area downstream of Stiegler's Gorge is prime quality agricultural land with rich alluvial soil, naturally irrigated and fertilised by a cycle of annual flooding, with seasonal cultivation of rice, maize and cotton by small-scale peasant farmers. Coconuts, cashewnuts and other crops are also cultivated. Important seasonal fisheries are also dependent upon the natural flooding patterns. Furthest downstream are mangrove forests, constituting an important resource themselves, and an essential biotope for their contributions to marine productivity. The Mafia Channel's rich fishing grounds and the oceanic waters off the Tanzanian coast receive important inputs of nutrients from the river's outflow.

## **14. 3 Anticipated effects of a large dam**

During the 1970s and early 80s, there was a lot of Norwegian activity concentrated on the prospects of building a large dam at Stiegler's Gorge. As shown in [chapter 13](#), Norway has much experience and competence in hydropower technology from their own industrial development, and they now have a number of companies which export this technology abroad. Tanzania has been the main recipient of Norwegian development aid since the early 1970s, and it was natural that one area of activity could be hydropower.

If one is to consider the possibility of constructing a dam as a development aid project, it would seem obvious that one should investigate the following:

- - The various purposes that such a project could serve,
- - The various options in size and technology,
- - The positive and negative social and ecological impacts that could be anticipated.

The Norwegian proposed plans for a dam at Stiegler's Gorge concentrated only on one purpose (electrical power production), it opted for maximum size and most advanced technology, and it resisted those who raised questions about negative social and ecological impacts.

Those in favour of the "one-purpose/maximum-size" approach included Norwegian hydropower companies and engineering consultants, some NORAD key personnel and some key Tanzanian leaders and bureaucrats. Those critical to the approach included some Tanzanian and Norwegian researchers, some NORAD personnel (increasing with time) and a few Tanzanian leaders, and at a later stage (interestingly) the World Bank who did not consider the approach adequate nor the project financially viable.

Let us briefly examine the three questions raised above:

### **1. The various purposes that such a project could serve:**

A dam project could provide electricity, help in flood control, supply water for irrigation, be a reservoir for drinking water, and fisheries could be developed in the artificial lake.

### **2. The various options in size and technology:**

Many different dam sizes and designs could be used, taking into consideration the level of technology in the country and the short-term and long-term requirements which could be accommodated by a gradual building up of capacity. "Economies of scale" which may apply in Norway are not necessarily relevant in Tanzania.

### 3. The social and ecological impacts:

The positive impacts include the purposes stated above, and also economic stimuli which could result from a well-planned and well-balanced project. The negative impacts could be many and of far-reaching consequences. Some of the most important could be:

- a) A large area is inundated with water, flooding habitable areas and altering the ecology of that area and its surroundings drastically. This will probably have complex and irreversible effects on the vegetation and wildlife in the area, especially the Selous Reserve which contains threatened species.
- b) Settlements of migrant fishermen would arise near the lake, but these would probably be very unstable since the fish populations of artificial lakes are normally characterised by huge fluctuations, especially in early years after impoundment.
- c) Infrastructure lacks in the present Selous Reserve area, but the building up of such infrastructure would constitute a serious disturbance to the wildlife, and would probably aggravate the already serious problems of poaching.
- d) Floating plants would become a problem, as in the Kilombero area upstream. Herbicides may be used to control them, polluting the water.
- e) Sanitation and diseases would be immediate problems in a quickly-growing settlement. Sewage may be disposed into the lake untreated, and bilharzia and other water-related diseases would probably become a problem.
- f) Sediment from the rivers would be deposited at the rear end of the new lake and would fill it up, giving the dam a short effective lifetime.
- g) Fluctuating water levels in the lake can cause unstable ecological conditions for lake-shore fauna and flora and fish which breed and feed in shallows, and can be awkward for people living close to the lake.
- h) The construction of the dam would require a large community of workers and a lot of temporary infrastructure. Stiegler's Gorge is far from any other settlements and social problems may be rife.
- i) The sheer weight of water of an artificial lake 120 kilometres long and over 100 metres deep could cause seismic disturbances with obviously very serious consequences to the dam and everything downstream of it.
- j) The water leaving the outlets from the turbines would be absolutely sediment-free, causing erosion of the relatively soft soil around Stiegler's Gorge, possibly endangering the dam itself.
- k) The fact that major floods, such as the one occurring in 1979, were not properly accommodated in the design of the dam (completed in 1978), means that the danger of overflowing the dam is also very real.
- l) Downstream of the dam, reduced sediment transport may cause degradation and steepening of river banks so that seasonal flooding with water carrying nutrients and alluvium would no longer naturally irrigate and fertilise the huge Rufiji Basin area, one of the most fertile agricultural areas in Tanzania.
- m) Fallen water table levels would cause desiccation of soils and drastic effects on vegetation in the flood plain areas.
- n) Fallen water table levels would also cause a disruption of traditional agricultural practices and would also make artificial irrigation and supplementation of nutrients with chemical fertilisers necessary. This would be very costly, would take a long time to accomplish, and would have several longterm negative ecological consequences.
- o) Consequent salinisation of soils from artificial fertilisers and irrigation would also be a problem.

- p) Water-borne diseases are notoriously associated with irrigation schemes, and these would undoubtedly affect the Rufiji Basin area.
- q) The Rufiji Basin has a number of important seasonal lakes with a specially adapted fish fauna which are dependent upon seasonal flooding.
- r) The total trapping of alluvial sediments can result in excessive erosion of river mouths and delta areas and recession of shorelines and even disappearance of islands.
- s) Mangrove forests in the delta are also dependent upon the supply of sediments and nutrients. These would suffer due to erosion and also cause negative impacts for those species inhabiting the mangroves, including several important commercial fish and crustaceans which have juvenile stages in the mangroves.
- t) The loss of mangrove forests would effect people who harvest them for poles and firewood.
- u) Salt intrusion due to decreased flow of the river may cause increased salinisation of agricultural areas inland from the river mouth. Rice cultivation would be particularly seriously affected.
- v) Spawning and growth cycles of marine fish and prawn species would be impacted in near-shore delta areas and the Mafia Channel area.
- w) Further offshore the productivity of Tanzania's coastal waters and their fisheries would also be effected by reduced nutrient supply.
- x) The proposed aluminium refining industry would have several potentially negative impacts, both economically, socially and ecologically.
- y) The imported technology for an advanced power station and the necessarily advanced infrastructure for distribution of this electrical power would be a huge burden to Tanzania, and make the country even more dependent upon foreign technology.
- z) The enormous costs of such a project (over 2 billion US dollars) would put the Tanzanian peasants and workers into deeper debt long into the next century.

Having now reached point number z), I shall stop the list although I am sure that my Norwegian friends could probably suggest points æ), ø) and å) and many more, but I hope that this list gives some impression of the factors which should have been taken into account.

It can be insinuated that many of the negative impacts of large dams are much less serious or do not exist for smaller dams, and their positive effects can therefore be maximised.

## **14. 4 Norwegian involvement**

Peasant farmers, fishermen and traders have built up a body of knowledge of the Rufiji's flow and flooding over very many generations. The river is essential to agriculture, fisheries and transport in the region, and a knowledge of its normal rhythms and occasional excesses is important to the people in contact with it. People living in villages near to the Rufiji have memories of which years there were exceptional floods, which of the seven mouths has experienced the most flow at different times, the extent of salt penetration up into the delta region at various times, etc.

This part of Africa was colonised by the German imperialists through the brute force of military power during the last decades of the nineteenth century and the first years of the twentieth. After conquering the anti-colonial resistance, the German wished to exploit the natural resources of the country and they made investigations of the navigability of the river, and also examined potential for irrigated agriculture and hydropower production as early as

1904. The leader of an investigation in 1907, Stiegler, was killed by an elephant at the gorge, which was named after him.

The British imperialists took over colonial power in Tanganyika in 1919, and an investigation of the Rufiji's agricultural potential was made by Telford in 1929.

In 1952 a FAO team made a brief survey of the Rufiji basin, and then carried out a more thorough survey which was published in 1961. The report emphasised irrigated agricultural potential and flood control, but also examined hydropower potential.

Tanganyika gained independence in 1961 and after the union with Zanzibar in 1964, the country was named Tanzania. After independence the main studies carried out by foreign development aid agencies and consultants were the American USAID (1967), the Japanese JETRO (1968), Norconsult (1972) and Hafslund/Norplan (1980), both Norwegian.

The American and Japanese reports were primarily concerned with hydropower generation, and the Japanese suggested an aluminium refining industry to utilise this power. The Norconsult study also examined only hydropower aspects of the potential dam, with the economic assumption that power consuming industries should be established to make the project financially feasible. The Hafslund/Norplan study gave some consideration to flood control, irrigation and fishing in the anticipated artificial lake, but there was little information available to them on these aspects and their principal emphasis was concentrated on production of hydropower for power consuming industries.

The Rufiji Basin Development Authority (RUBADA) was established by the Tanzanian Government in 1975 in order to develop the region, and their main interest was also in the maximisation of hydropower production. They were supposed to provide inputs to the planning processes concerning agricultural production, etc., but did not have the resources or manpower to supply these in time.

During the 1970s, researchers from the University of Dar es Salaam began to raise criticisms of the planned project. Staff of the Bureau for Resources Assessment and Land-Use Planning, the Institute of Development Studies, Department of Zoology and Marine Biology, and Department of Economics, began to question various aspects of the project. Sandberg and Havnevik, both Norwegians working at the university, voiced their criticisms to NORAD from 1974. Within NORAD various people also began to see problems with the project. Criticisms were aimed at the socio-economic and ecological impacts of the dam, health problems, economic assessments (such as projections for electricity demand), and technical aspects (such as the proposed "artificial flood").

NORAD sought the views of the World Bank, which would not consider financing such a single-purpose project. NORAD then sent a delegation to Tanzania which stressed the importance of a multi-purpose approach to the dam project. They concluded that impact studies should be carried out by Tanzanian institutions and foreign consultants.

Initially, a good atmosphere of cooperation was created and there was progress in impact studies. But soon problems arose for university researchers who were critical of the project, who were marginalised and denied access to information and resources. Some, including those considered least critical, were able to complete their work. Of the 27 studies carried out during 1979-1982, 18 of the most strategic and expensive ones were carried out by foreign

consultants, two minor studies were carried out by RUBADA staff, two studies by expatriates at the university, and five studies by Tanzanians at various institutions.

An interesting case was when Dr Boni Mwiseje and I decided to visit the Rufiji delta and Mafia Channel to study possible effects the dam might have on the ecology and fisheries of this area. We were met with several obstructions and objections by a Norwegian/NORAD employee of RUBADA because he considered us "critical" towards the project. We were also refused access to reports and documents relevant to our study. Foreign consultants were called in to do quick "hit and run" studies on these aspects. It is interesting to note that they never contacted us in this respect, nor were we ever allowed access to read their reports.

The Bureau of Resource Assessment and Land-Use Planning at the university, which played an important role in coordinating Tanzanian researchers independent studies, also experienced great difficulty in gaining access to information.

In 1983, NORAD financed Norplan and Mark Segal to complete an "integration study". It is interesting to note that this was carried out by those whom had been involved in the earlier studies, without any independent views, and the conclusions were foregone: a hasty cosmetic attempt to present a single- purpose hydropower project as a multi-purpose one.

Some basic technical faults are obvious in this "integration study". They only considered flood data from 1956-1978, and ignored the record flood of 1979. They overlooked Hafslund's warning that releases of more than 2500 m<sup>3</sup>/s from the low-level outlets would cause erosion, and they persisted in using Mark Segal's absurdly large electricity demand prognosis in spite of drops in demand during 1981, 1982 and 1983. But more importantly, the "integration study" starkly shows how vested interests and lobbies can interplay to promote their own narrow interests against the broader interests of the people of the impacted areas, the ecological consequences in the area and the overall national economy of Tanzania.

Havnevik (1988) concludes that *"the project would have been a major national disaster both economically and socially if it had been carried out according to the plans from 1980 onwards"*. And NORAD's 1988 country programme review for Tanzania states: *"The development of power consuming industry during the eighties would have been impossible, and because of this Stiegler's Gorge would have become an economical disaster"*.

Fortunately for the Tanzanian people of the Rufiji area, for the ecology of the region and for the Tanzanian national economy, the project did not become a reality