THE EPUPA DEBATE

A SUMMARY OF SOME OF THE KEY ISSUES AROUND THE PROPOSED HYDROPOWER SCHEME ON THE LOWER CUNENE RIVER

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THE DAM QUESTION: THE EPUPA DEBATE

The possible construction of a hydropower dam on the Cunene River has engendered much discussion and debate. The ***Legal Assistance Centre*** *would like to make sure that the voluminous information about this project is accessible to the public, to provide for more informed debate. To advance public understanding of the issues, we will present a summary of the findings of the feasibility study in this series.*

The Legal Assistance Centre as an organisation has no view for or against the construction of a dam at any of the potential sites. Our concern is to ensure that the legal rights of all parties are fully respected. We will endeavour to simplify the Feasibility Study Report as accurately and objectively as possible, and to present comments and opposing viewpoints fairly.

PART 1 - AN OVERVIEW

Where did the idea for a dam originate?

The idea of damming the Cunene was suggested as far back as the era of German occupation. The governments of South Africa and Portugal entered into water use agreements in 1926 and 1964. In 1969, they entered an agreement on the first phase of development of the water resources of the Cunene River, which made reference to a master plan for river development. This plan proposed a first hydropower project at Ruacana, to be followed by a series of hydropower projects beginning at Epupa and continuing downstream.

Chief Kapika and entourage at Epupa

The 1969 agreement resulted in the construction of the Gove Dam in Angola, the Ruacana hydropower scheme and the unfinished Calueque Water Scheme which facilitates water supply to northern parts of Namibia.

In the late 1980s, motivated by forecasts about Namibia's increasing need for power NamPower (then known as SWAWEK) began to advocate the construction of a hydropower scheme in the Epupa area. Namibian independence combined with increasing political stability in Angola made the concept more feasible.

The previous agreements between Portugal and South Africa were ratified in 1990 by the governments of Namibia and Angola. A 1991 agreement between the two nations then gave the official go-ahead for an investigation of a hydropower project in the Epupa area, and detailed technical and environmental studies began in 1992.

Who are the players?

The PJTC: Because the Cunene River lies on the boundary between Namibia and Angola, any river development must be agreed to by both countries. A "Permanent Joint Technical Commission of Angola and Namibia on the Cunene River Basin" (the PJTC) has been set up to address issues relating to the river, including the possible hydropower project.

The PJTC is chaired on behalf of Namibia by the Permanent Secretary of Mines & Energy -- Dr Leake Hangala when the project started, succeeded by the late Dr. Shimutwikeni, and currently Siseho Simasiku. The other core members representing Namibia have been drawn from Nampower (the late Pollo Brand, followed by Dr Leake Hangala), the Department of Water Affairs (in the person of Richard Fry who is now retired, Piet Heyns and Guido van Langenhove) and the Department of Environmental Affairs (Dr Chris Brown). Other persons have been seconded from time to time to give advice on particular issues. The Angolan representatives are drawn from similar bodies in Angola.

The day-to-day administration of the feasibility study is supervised by a sub-committee of the PJTC called the Supervising Committee for the Feasibility Study (the SCFS), which has administrative rather than decision-making powers. It is drawn primarily from the same institutions as the PJTC, and also includes both Namibian and Angolan representatives. Both the PJTC and the SCFS have been exclusively male throughout the process.

The Feasibility Study is being monitored by the International Union for the Conservation of Nature, a large international NGO which is well-known in its field.

NAMANG: The PJTC commissioned a group of experts to assess the feasibility of a hydropower project on the Cunene River. This group of consultants is called NAMANG (to indicate both Namibia and Angola). NAMANG includes the following groups: Norconsult International (Norway), Swedpower (Sweden), Burmeister & Partners (Namibia) and SOAPRO (Angola). It has also drawn on the services of individual experts from various countries The work of NAMANG was funded by Swedish and Norwegian donors.

The PJTC will consider all the relevant documents and make a recommendation to the Governments of Namibia

and Angola. The final decision on whether to build the dam, and on the appropriate site, rests with the two governments and will probably be made in the first half of 1998.

The three phases of the project

PHASE ONE: A **Pre-Feasibility Study** carried out preliminary technical, economic, social and environmental assessments of sites in the vicinity of Epupa Falls. This study, published in February 1993, identified three sites which warranted further investigation -- Site A upstream of Epupa Falls, and Sites B and C downstream of the falls.

The Pre-Feasibility Study advised that Sites A and C would have to be developed in combination to provide comparable power to Site B. The technical and economic studies were slightly in favour of Site B, but the report recommended that further studies should include both options. The environmental and social impact studies showed that undesirable consequences would result from both of these alternatives.

PHASE TWO: Because of public concerns about the negative impacts of dam construction in the vicinity of Epupa, the PJTC and NAMANG decided to expand the project by including alternate sites lower down the Cunene. A comparative study of such sites was presented to the PJTC in October 1995. On the basis of this information, the PJTC decided that Site E in the Baynes Mountains should be included in further studies. Thus, at this stage, there were three options: Sites A + C , Site B and Site E.

A **Project Formulation Report** published in October 1996 presented assessments of each of these three options. The original idea was to select one site to be the focus of the final phase of the project. NAMANG recommended that Baynes Site E should be the subject of the final round of investigation, because it would create fewer environmental and social problems while providing roughly the same energy potential. However, the PJTC was concerned about the fact that the energy output of Baynes Site E is comparable to that of Epupa Site B only if the Gove Dam in Angola is fully operational. Since this factor cannot be assured, the PJTC decided that the final stage of the feasibility study should also include Epupa Site B.

PHASE THREE: The third phase of the project was the feasibility study itself. The **Feasibility Study Report** comparing the Epupa Site and the Baynes Site was published in draft form in September 1997. This Feasibility Study Report has two major parts. Part A is an environmental assessment which includes an examination of the impact of each site on the physical environment, the ecology and the social and cultural life of those who reside in the region. Part B is a technical assessment which includes economic evaluations of each site, as well as a comparison with alternative energy sources. Both Parts A and B include two separate sets of reports – one set for the Baynes Site and one set for the Epupa Site.

The Feasibility Study Report is incomplete. The social investigation had to be suspended after statements made by the Deputy Minister of Mines and Energy at a public hearing on 8 March gave a strong impression that the decision to build the dam had already been taken. As a result, members of the Himba communities most directly affected by the dam felt that their input was irrelevant. They refused to continue with the household, water and health surveys which were still in progress. They also refused to discuss mitigation, which covers all aspects of compensation to persons who would be adversely affected by the construction of the hydropower scheme.

In addition, field staff who were conducting these portions of the study reported harassment and intimidation by local government officials. Another complicating factor was the government's failure to follow through on a promise to appoint a credible liaison body to facilitate communication between government and the Epupa community. Consultations with the community were broken off and have not been satisfactorily resumed to date.

Public input

The entire Feasibility Report is open to public inspection during normal office hours in the library at NamPower's head office in Windhoek. It is also available on the Internet at *http://burmeister.com.na*.

NamPower and NAMANG have organised three public meetings on the dam in Windhoek, as well as a few public meetings at various locations in the Cunene Region. The Wildlife Society of Namibia and Earthlife jointly convened a public meeting to discuss the dam in Windhoek last year.

Questions and comments from the public about the draft Feasibility Study Report are being accepted by NAMANG until 15 January 1998. A final public hearing is scheduled for 7 February 1998.

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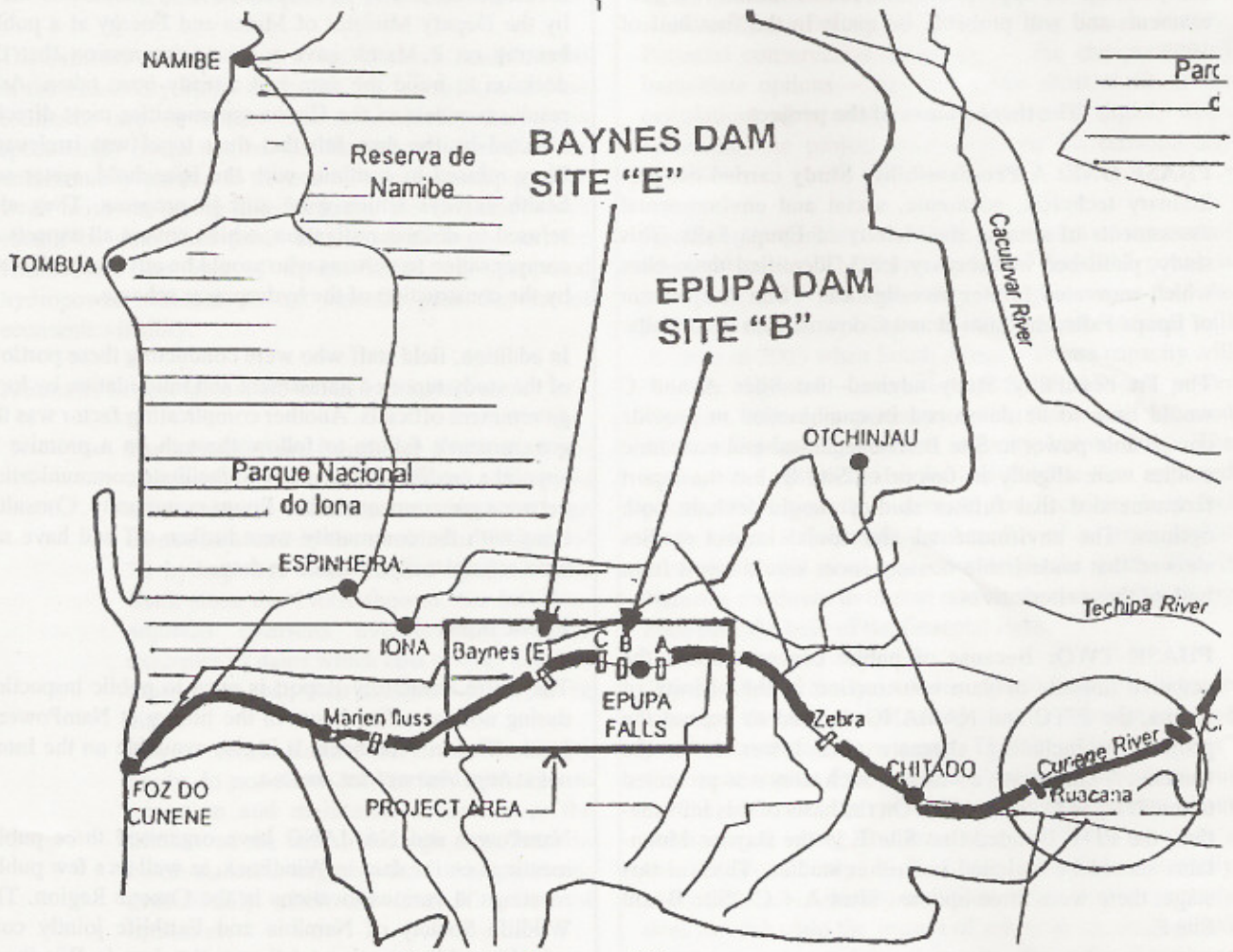

Map of the Epupa and Baynes Dam sites

PART 2 – EPUPA VERSUS BAYNES

This is the second column in a series by the Legal Assistance Centre about the Epupa debate. Last week's column gave an overview of the players and the feasibility process. This week's column looks at the first volume of the Feasibility Study, which is a "Strategic Summary" comparing the two potential dam sites. Following columns will look at some of these comparative issues in more detail.

COMPARATIVE SIZE

The total volume of the dam at Epupa would be about 4½ times larger than the dam at Baynes – 11,5 billion cubic meters, as compared to 2,6 billion cubic meters. As a point of comparison Namibia's largest existing dam is Hardap Dam, which contains just under 300 million cubic meters of water when full. So the Epupa dam could hold more than 38 times as much water as Hardap, while the Baynes dam could hold about 8
½ times as much.

The Epupa site would flood a much larger area – 380 square kilometres at the high water level, compared to 57 square kilometres at Baynes. This means that the Epupa site would take 6½ times as much land out of use as the Baynes site. In practical terms, the difference is even larger because the land at the Epupa site has a greater use value than the land at the Baynes site, being currently utilised for homes, gardens, seasonal grazing and access to water as well as being the location of culturally-important gravesites.

Expanses of barren land will be exposed at both sites when the water level is low, with this area being about 5 times greater at Epupa – 22000 hectares, compared to 3900 hectares at Baynes. This land, which is called the "drawdown zone", will not be attractive or useful, but it is not considered to be environmentally critical in either case.

Dam construction

The dam walls at both sites would be made of roller-compacted concrete, which is why they are both referred to as "RCC" dams. This type of construction is cheaper than conventional concrete dams and has been used in a number of dams in South Africa.

The appropriate structure for the dam walls is determined primarily by the shape of the river valley. The dam at Epupa would be a gravity dam. In this type of construc-

tion, the weight of the dam wall as it presses downward resists the pressure of the water behind it. The main dam wall at Baynes would be an arch-gravity dam, where the action of gravity is assisted by the strength of the wall's arched shape. The Baynes dam wall would be built in a deep gorge which widens out about 150 meters above the river, necessitating a smaller flanking wall on the right side.

The main dam walls at both sites would be massive. The Epupa dam wall would be 163 meters high, and the one at Baynes would be 200 meters high. To imagine this size, the Sanlam Centre, one of the tallest buildings on Independence Avenue in Windhoek, is just under 50 meters high. The dam wall at Epupa would be 590 meters long, and the one at Baynes 700 meters long – in other words, they would be both be between one half and three fourths of a kilometre in length.

Both sites are technically feasible. The Baynes site would involve more challenging design issues, but these are all within the realm of current technology.

Water and evaporation

It would probably take 29 months to fill a dam at the Epupa site to a level that is 70% of the dam's capacity. There is a possibility that it would take four rainy seasons to reach this level, which would mean delaying the present project schedule by one year. On the other hand, it would probably take only nine months to fill a dam at the Baynes site to 70% of its capacity. The risk of postponement at this site is very small.

Water loss through evaporation will be 8 times greater at Epupa than at Baynes. In fact, the amount of water lost *annually* through evaporation at Epupa would be equivalent to the amount of water which could supply the needs of the entire city of Windhoek for *42 years*. No cost is assigned to this immense water loss, however. Since no irrigation schemes or major water diversions are likely to be planned in the remote reaches of the Cunene River, the Feasibility Study counts the water loss as being of no economic value.

The role of Gove Dam

The Gove Dam is located inside Angola, upstream of Ruacana. It was built by the Portuguese government with South African finances. It was virtually finished in 1975 when the outbreak of hostilities prevented it from being completed in accordance with its original design. The dam complex suffered some war damage in 1988. A sabotage attempt in 1990 resulted in some cracking, while other flaws can be traced to faulty construction. As a result of these problems, the water level had to be lowered and the dam can now operate safely at only 40% of its full storage capacity.

The primary purpose of the Gove dam is to regulate the flow of the Cunene for more effective hydropower generation at sites downstream, including Ruacana. A hydropower plant at the Epupa site would not be reliant on water regulation at Gove Dam because of the large size of its reservoir. But the energy output at the smaller Baynes site would be significantly reduced in times of drought if Gove was not functioning. It is technically possible to rehabilitate the Gove Dam, which would have benefits in terms of irrigation potential and water supply for Angola as well as hydropower production for both nations. Political stability in Angola would be crucial to this approach.

Epupa Falls

One significant difference between the two sites is easy to understand. Epupa Falls will be lost forever if a dam is built at the Epupa site, but preserved if the Baynes site is chosen. The loss of such an imposing natural feature is immeasurable, and so is valued at zero in the cost comparison between the two sites.

Flora

Flooding the Epupa site will result in a much higher loss of living plant material ("biomass") than the Baynes site. Decaying plant material releases carbon into the atmosphere, contributing to the worldwide "greenhouse effect" that leads to global warming. The amount of carbon gases which would be emitted at Epupa would exceed international standards for such emissions, but would still be relatively low in comparison to other sources of carbon. No cost is assigned to this negative environmental impact.

If the Epupa site is chosen, the destruction of Epupa Falls will also lead to the loss of plants associated with the "spray zone" – the area around the waterfall which is affected by the spray from the falling water. Since the Ruacana Falls now remains dry for long periods, the loss of Epupa Falls will destroy the last significant remaining habitat of this type in Namibia. Such habitats are fairly rare worldwide, and limited knowledge of their ecology makes it difficult to assess this potential loss.

Another important aspect of the potential plant loss at the Epupa site would be the destruction of about 6000 palm trees which are a source of "omarunga nuts". These nuts are a key food resource for the local Himba in times of drought. If the Baynes site is chosen, only a few of these palm trees will be lost.

Fauna

The most profound impact on the animal kingdom will be in respect of fish. Two endangered species of fish have been found at both sites. In addition, at the Epupa site, a new species of fish has been found which is endemic to the area – meaning that it is not known to occur anywhere else in the world. The cost comparison of the two sites includes the cost of a breeding programme for all three kinds of fish – although this begs the question in the case of the newly-discovered species, as there may be no other natural habitat in the world where the fish can survive even if they are successfully reproduced in an artificial environment.

The human impact

This factor is the most complex one, and will be the subject of future columns. A few of the more quantifiable impacts are highlighted in the study's comparison between the two sites.

A dam at Epupa will result in the loss of ten times more ancestral graves than a dam at Baynes – 160 graves at Epupa compared to only 15 graves at Baynes. This loss "is highly significant and can not be valued in monetary terms". The Feasibility Study assigns costs to this item, but these represent only the costs of physically relocating the graves or taking other practical steps to appease the affected Himbas. No cost is assigned to the cultural impact on the affected communities.

The Epupa site will flood 110 permanent dwellings, as opposed to 15 such dwellings at Baynes. Although the Himba are nomadic, there are families who are very well-established in certain areas as well as others who visit these areas on a regular basis. The Epupa site will have an impact on about 1000 "permanent users" and 5000 "occasional users", as compared to 100 "permanent users" and 2000 "occasional users" at Baynes. The land which will be flooded at Epupa is also more significant in terms of seasonal gardening and reserve grazing during periods of drought. A dam at Epupa will result in the loss of two traditional river crossings which will constitute a major social impact., while the Baynes dam would not interfere with river crossings.

The Epupa site is expected to produce higher incidences of malaria and bilharzia (schistosomiasis), a disease caused by a parasite associated with still or slow-flowing water. The influx of a labour force from other areas will probably lead to the spread of sexually-transmitted diseases, including HIV which has been up to now absent from the local Himba communities. However this problem is likely to arise regardless of which site is chosen.

The more general social impact is particularly hard to quantify. Like most cultures, Himba society is already undergoing a continuous process of change, but a sudden and dramatic influx of outsiders into the region could endanger the social equilibrium – a problem which will be explored further in forthcoming columns.

Cost

According to the Feasibility Study, the Baynes site is more expensive. The total cost for Baynes is US$551,52 million, as compared to US$539,40 for Epupa. The costs of dam construction, power transmission facilities and slightly longer access roads are the components which make Baynes more expensive. However, the costs of the necessary waterways and environmental mitigation are higher for Epupa.

When the costs of the two projects are compared, it must be noted that some of the human costs are impossible to quantify fully. The financial implications of the various social and cultural factors are quantified in the report, but this does not capture the entire "cost" to the affected community or the nation. For example, how can one place a monetary value on the loss of human life? It may be possible to measure the amount the person would have earned during his or her lifetime, or the cost of the health care involved. The Feasibility Study measures the possible loss of life in terms of the costs of the steps which will be taken to minimise the negative health impacts.

There are other impacts which are even harder to measure. The report points to a number of key factors which cannot be adequately valued in monetary terms: (1) the loss of Epupa Falls; (2) the loss of biodiversity in the form of two critically endangered fish species at both sites, with the additional endangerment of a new species of fish at the Baynes site; (3) the loss of ancestral graves, which will be ten times greater at the Epupa site; and (4) the impact on the social environment. This is more minor and can be mitigated at Baynes while "for the Epupa Project these impacts in the shape of changed identities, lifestyles and production systems can not be fully mitigated". Thus, the values which are considered to be immeasurable are all weighted against the Epupa option.

This means that there is no objective way to decide on the relative merits of the two sites. In the words of the Feasibility Study, "the final decision will have to rest on a subjective valuation by decision-makers and is thus in the realm of politics".

PART 3 - THE IMPACT ON THE LOCAL HIMBA ECONOMY

This instalment in the Legal Assistance Centre's series on the Epupa debate focuses on the economic impact on the local Himba. The social impact assessments of the Feasibility Study are based on detailed studies by anthropologists and social scientists, which are published in full in the Feasibility Study Report. The information in this article is drawn primarily from the papers of Dr Michael Bollig, who provides a detailed study of Himba pastoral production, and Dr Margaret Jacobsohn, who reports on interviews with more than 1600 people in the area.

The reality of Namibia's Himba people has been obscured by inaccurate stereotypes. The tourist industry portrays them as unspoiled remnants of an ancient Africa, while the Namibian Government and various development agencies have presented them as a primitive and under-developed community with a lifestyle that should be upgraded. In fact, the Himba are the most successful and economically independent subsistent farmers in Africa – a relatively healthy and wealthy community with sound strategies for food security which have proven successful even in times of severe drought.

Before 1920, Himba pastoralists were engaged in various forms of economic diversification. They traded with Portuguese and Ovambo communities, fought as mercenaries for the Portuguese colonial army, and entered wage employment with traders, hunters and farmers. It was the

restraints imposed by the South African regime which blocked this trend. Restrictions on the movement of livestock cut off opportunities for trade. Opportunities for wage employment disappeared when the government refused to allow the Himba to cross the river for work in Angola and then ignored them in the official labour recruitment systems for "South West Africa". The economic activities of the Himba on the Angolan side of the river were similarly constrained by the Portuguese government. Thus, the subsistence economy which characterises Himba communities today was artificially created and enforced.
Wage employment remains rare among the Himba, but they have excelled in pastoral production. They herd sheep, goats and cattle, a combination which makes the most of the available resources by utilising different layers of vegetation. This mixture also provides a buffer in times of drought, since grasses are generally more susceptible to decreased rainfall than trees and bushes. So, for example, during the catastrophic drought of 1981, goat herds could be maintained even though cattle herds were reduced by up to 90%.

The Himba have developed a range of techniques which minimise economic risk to individual households while at the same time advancing the interests of the entire community.

The cattle post system

The cattle herd of one household can vary from 3 to 500 cattle. Livestock are used as sources of meat and milk, as well as being bartered for goods such as maize, alcohol, blankets and cloth. Marketing is usually limited to one animal at a time, unless there is a funeral or some other social occasion which requires food and alcohol for large numbers of guests.

Rich households usually distribute their cattle among several independent cattle camps which rarely if ever rejoin the main household. Farmers with smaller herds may have one dependent cattle camp which migrates separately in the dry season, then rejoins the main herd when grazing is more abundant after the rains. The poorest households are unable to split their herd at all. The movements of the cattle camps depend on the availability of grazing and water. This cattle post system provides an avenue for poorer relatives to gain access to the herd of a rich family member.

Livestock exchange and inheritance

An important aspect of stock ownership is the practice of stock exchange. All but the richest household rely heavily on borrowed stock. Young men typically begin to establish a household herd at the age of 25 or 30, when they visit scattered matrilineal and patrilineal relatives to ask for livestock loans. The borrowed animals and their offspring remain the property of the lender, but in practice the borrower is seldom asked to return all of the borrowed animals. The fact that cattle are borrowed from numerous owners reduces the risk that they will all be recalled at once.

It is not only the wealthiest stockowners who lend their cattle. Other households utilise the practice as a form of insurance against a sudden decline in the household herd from a disaster such as a localised outbreak of livestock disease. This intricate network of livestock exchange performs several functions – it offers young households or households which have suffered serious livestock losses an opportunity to build up a herd, it reduces the risks of catastrophe, and it cements kinship relations.

Livestock is also redistributed by means of inheritance through the matrilineal line. Because matrilineal relatives do not usually live together, inheritance usually means that a herd shifts its locality, thus making it possible for different groups of neighbours to benefit from it through the exchange system.

Communal management of resources

Land adjacent to settle households has an "owner" (perhaps more accurately described as a "guardian"), while outlying areas are jointly managed by the seniors of the community. The principles on which resource management is based are designed to ensure equitable and efficient utilisation. Firstly, cattle camps must not be located too close to settled households, to ensure that the lactating cattle which supply the household with milk will have adequate grazing during the dry season. Secondly, cattle camps must migrate to new pastures at the same time in a single front, so that no untouched grass is destroyed by trampling from the feet of an advance herd engaged in patchy grazing. Thirdly, camps must not move onwards until the grazing in a particular area has been completed depleted, as another mechanism for guarding against wastage from trampling. Fourthly, some grazing areas are off-limits during most parts of the year, so that they can be held in reserve for times of greatest need. These regulations are enforced by a grazing committee which can punish violations by imposing stock fines.

Gardening

About 75% of Himba households engage in some agricultural activity during the course of the year to produce supplementary food, with the alluvial soils along the Cunene being prime garden spots. Maize is typically intercropped with various types of pumpkins and melons. There are no cash crops. These gardens are particularly important for poorer households which find it difficult to survive off of the resources from their herds.

Drought strategies

During times of drought, several survival strategies come into play. Restricted grazing areas are opened up, and many households shift closer to the riverine forests along the Cunene. Grazing may be bad there as well, but the river provides a reliable water supply which decreases stress on the livestock and reduces their food requirements. The *Faidherbia albida* trees on the riverbanks also provide an abundance of pods which serve as nutritious

fodder for goats. The palm trees along the river, which are not very susceptible to low rainfall, provide a crucial source of "omarunga nuts" which are a crucial food resource in lean times. Food sharing also increases in times of scarcity, meaning that many people gather to share in the meal when an animal is slaughtered.

These strategies proved to be successful during the 1981 drought. Even though herds were devastated, few families dropped out of pastoralism, there were few famine-related deaths, and herds were slowly restocked without government support or subsidy.

The impact of a dam at Epupa on pastoral production

The inundation of the Cunene basin at Epupa will destroy the riverine forests which are a crucial source of grazing and browsing in dry seasons and in times of drought. It will result in the loss of an annual crop of hundreds of tonnes of the palm nuts which are so crucial in drought periods. The dam will bring an end to gardening in the fertile soils along the riverbank.

The Epupa Dam Site

These losses will produce a ripple effect which will multiply their impact. Bollig estimates that the cattle displaced by a dam at Epupa on the Namibian side of the river alone will require some 17 500 hectares of grazing elsewhere at all times, and an additional *70 000 hectares* of grazing elsewhere in times of scarcity – without even taking into account the needs of the small stock. which also use the river basin. The pressure placed on other grazing areas will be enormous. So, although only about 1000 people will actually be displaced if the river basin is flooded, the dam will affect the drought strategies of about 10 000 Himba (on both sides of the river) and place additional strain on countless others who will be squeezed in the search for alternative grazing. One possible result is an increased dependency on the state for economic and social security.

A dam at Baynes, on the other hand,. would have little effect on herding patterns and drought strategies, because the steep terrain of the riverbanks means that the area bordering the river there is little used.

The impact of the construction phase

Construction of a dam at either site will require about 1000 workers (450 drawn from Namibia, 450 from Angola and 100 expatriates). Their numbers will be increased by family members, traders and an informal sector. A reasonable estimate is a construction town of at least 5000 inhabitants on the Angolan side of the river.

The impact of this sudden and enormous new market for food is likely to be an uneven one. Richer households will be able to profit by selling substantial numbers of cattle. They will then be able to buffer themselves against risk by diversification into other forms of economic activity, such as agriculture or trade. But households with smaller herds will be unable to compete, and the livestock exchange networks which they rely on will shrink. Another possible result is that some of the newcomers will want to invest in livestock herds of their own, increasing local pressure by competing for scarce grazing. It is the abruptness of the monetarisation which will be particularly harmful, as there will be no time for the evolution of alternative economic and social strategies to accommodate the change.

Aside from trade in cattle, the benefits of the increased demand for consumer goods will most likely accrue to businesses based in Opuwo rather than to the Himba in the immediate vicinity of the project. And those who do profit may well go from "boom to bust" since the rise in demand is unlikely to be sustained once the dam is complete.

It is unlikely that many of the Himba in the project area will secure formal employment during the construction phase, given their low level of marketable skills and their lack of proficiency in English. But they may be part of the informal settlement which will probably grow up around the construction town, with attendant problems such as crime, alcoholism, prostitution and the spread of AIDS.

It is also possible that the sudden influx of outsiders may threaten budding community-based initiatives for women who harvest plants which are marketable in the international perfume and cosmetic industry, through uncontrolled access and harvesting.

Analysing the potential benefits

Both dams will result in the upgrading of existing gravel roads on the Namibian side of the river, along with 5-21 kilometres of new gravel roads, although no new tarred roads are contemplated on the Namibian side. Improved road access could have positive spin-offs for the local Himba in the form of increased livestock marketing opportunities and better access to social services. But improved transportation alone will not bring improved services. For example, many of those interviewed cited a need for better veterinary support services to combat stock disease, but problems experienced in the past reportedly stemmed from shortages of vehicles and medicine rather than from road conditions.

Easier access to the region may increase the number of tourists - depending on whether or not Epupa Falls is destroyed – but this will not necessarily benefit the local people, as most tour operations are run from Windhoek. An increased influx of visitors could also lead to environ-

mental degradation which then reduces the attractiveness of the area for tourism.

The introduction of more schools and clinics has been often-cited as a local benefit of the project, but this is more complex than it seems on the surface. For example, the existing school and clinic at Okongwati are under-staffed and ill-equipped. While about 29% of those interviewed would like an additional school closer by, 12% were opposed to all schooling. One perception is that a low level of schooling may lead to dissatisfaction with the Himba way of life while not equipping youth with marketable skills – with the result that a school-leaver ends up as a low-paid wage labourer rather than a self-employed and relatively wealthy herder.

There is also an inherent conflict between a nomadic lifestyle and a sedentary model of education. For example, English language skills are more likely to be acquired by means of mobile English teachers who travel with a group of households for several months than through English courses in a fixed place.

Some local people fear that improved hospitals, schools and shops would simply attract outsiders who would then compete for local resources. Furthermore, there is a strong feeling in the area that the provision of services such as hospitals and schools should not be conditioned on the acceptance of a dam.

The electricity which will result from a hydroelectric project is locally perceived as something that may be beneficial for others, but not of much use to a pastoral lifestyle. However, electrification may improve the efficiency of local schools and clinics, as well as stimulating business in the region. The same is true of improved telephone services.

Local attitudes to change

Himba opposition to the dam does not stem from a blind rejection of all forms of change, or from a lack of understanding of the project. Himba people living in the vicinity of the proposed dams engage in detailed discussions about various prospects for development, and have shrewd opinions about the costs and benefits of a dam as far as they are concerned. There is intense local resentment to the allegation that local opposition to the dam is something which has been engineered by outside groups.

The opposing viewpoints about the dam within the Cunene Region are understandable. Those who are for the dam tend to be businesspeople, merchants, regional government officials and politicians – those who have nothing to lose if a dam is built, but see it as an entree into a western-style market economy. On the other hand, the Himba pastoralists in the project area see no prospect of tangible benefit from the dam, but only the loss of resources, the loss of control over their land and the erosion of socio-economic structures which have sustained them in a successful and independent existence for decades.

PART 4 - EPUPA AND THE HIMBA'S ANCESTRAL GRAVES

A dam at Epupa would flood 160 graves, while only 15 graves would be flooded if the Baynes site is chosen. According to the Feasibility Study, this loss "is highly significant and cannot be valued in monetary terms". This column by the Legal Assistance Centre explains why the graves are so important. The information is drawn primarily from an article by anthropologist Dr Bollig which appears in Part A3 of the Feasibility Study, with additional information from a subsequent article by Dr Bollig called "Contested Places: Graves and Graveyards in Himba Culture" (Anthropos 92.1997:35-50).

Himba in the Epupa area frequently name the destruction of ancestral graves as their major objection to the proposed dam. While Himba leaders say that their culture will be at risk if the ancestral graveyards along the Kunene are inundated, advocates of the dam maintain that the graves can be relocated, pointing to the relocation of the remains of Samuel Maharero from Botswana to Okahandja in 1923 as an example. But the Himba assert that relocation will destroy the significance of the graves just as much as flooding them would.

The debate stems from different understandings of what constitutes a grave. For the Himba, a grave is not just the location of the physical remains of a deceased person -- it is a focal point for defining identity, social relationships and relationships with the land, as well as being a centre for important religious rituals.

All places which are permanently used as settlements have at least one graveyard associated with them. People are generally buried in the place where they feel most at home – most often the place where they were settled during their last years, but sometimes the place of their birth, or simply the place they loved most during their lifetimes. Chiefs were formerly buried in the community's graveyard, but have more recently tended to be set somewhat apart. Graveyards are usually located near a watercourse, often under a large bush or tree.

The preference for riverine locations is partly a practical one – alluvial soils are usually deeper and easier to dig. But riverine areas are also heavily loaded with emotion, as the points where communities congregate, the starting points of the annual cattle migrations, the places where people struggled to survive droughts, and the sites of graves of other family members. The river courses and the stories which are associated with them are common subjects of Himba praise songs.

Graves as an expression of social status

Graveyards express a social order which is dominated by kinship. A son will usually be buried alongside his father, and somewhere near his mother and siblings. There are exceptions, of course, which reflect the society's social flexibility and physical mobility. The selection of grave-

yards changes over time as settlement patterns change, making their locations a history of the community's history and movements.

The way that Himba graves are decorated has changed over time, even though their religious beliefs and rituals have remained fairly stable. The oldest graves were decorated with *ozondongo* stones. The graves of rich older men would be marked with two or three large quartz stones together with one or two dark-coloured stones, while young men, poor men and women were likely to have only one small quartz stone among the black ones, or only black stones. The graves of rich men would be surrounded by a mopane fence, while the graves of poor men and women were covered with branches.

The most telling symbol of the deceased's wealth would be the number of oxen skulls mounted at the grave site. It was not unusual for 20 to 30 oxen to be slaughtered to provide skulls for a rich man's grave, while a poor man's grave would have no more than three or four. Women had even fewer skulls, or often none at all. To obtain these skulls, the oxen would be slaughtered in a special ritual manner. The meat of these oxen would not be eaten by any of the Himba, being left for dogs or perhaps bartered to traders. The carefully-prepared skulls would be placed on carved poles or mounted in nearby trees. The graves of the richest and most senior men would also be decorated with a broken trumpet displayed on a pole or in a nearby tree.

The style of grave decoration changed in the 1940s and 50s. Oxen skulls, fences and broken trumpets continued to play symbolic functions, but the individual stones were replaced by rectangular heaps of stones covering the grave. At first the *ozondongo* stones were incorporated into this arrangement, but they have gradually given way to other signs of status and wealth. For example, expensive gravestones are becoming increasingly popular, carved or painted with symbols and phrases that depict the status of the deceased – such as references to cattle, lion or elephants to indicate wealth and power.

The restrictions placed on the Himba during the colonial era meant that there was little access to other means of expressing wealth, such as clothes and consumer goods. So grave decoration functioned as an important avenue for expressing the deceased's relative influence in Himba society. Aspects of grave decoration changed over time to incorporate more sophisticated ways of depicting social status. The grave sites are thus important emblems of the community's social hierarchy.

Graves, land and political influence

Because graves demonstrate a continuity of settlement, they determine the influence of the "owner" of the land. The "owner" of a particular area is usually the oldest male member of a family which has been present there for generations. He does not normally have the right to exclude others entirely, but he will usually have the power to prevent outsiders from placing an unreasonable burden on scarce resources, and he will have an important say in communal decisions. The "owner" of the land will found his claim for political power on the numerous graves of generations of ancestors in the area. A family with only two or three generations of graves in a certain place will be "outsiders" who were allowed to use the land but have no right to change patterns of land tenure or to represent the interests of the area to those outside of it. Those who can demonstrate the longest connection with the land will have the strongest say over key land-related matters such as rights of access and control over resources. Because graves are so important in the land tenure system, senior elders can recall the location and identity of even the most ancient graves.

For example, in debates about issues such as naming a chief, permitting a trader into the area, or taking a stand on a development such as the Epupa dam, the Himba will point to the number of their ancestral graves as the major indicator of their right to influence a decision. Speakers will ask rhetorically, "Whose ancestral graves are older, ours or theirs?" The key point is not the physical fact of the graves themselves, but the connection between the graves, the family's history and the community's system of land tenure and decision-making. This nexus cannot possibly be preserved if graves are relocated. When told that the Epupa dam will flood large numbers of grave sites, many Himba have asked, "Who will then know who is owning the land?"

The religious aspect of graves

The most important religious rituals in Himba society involve the ancestral graves. After a deceased person has been buried, relatives and guests who can number in the hundreds will gather for a funeral which may last up to two months. Many animals will be slaughtered to provide meat for the gathering, and large quantities of maize and alcohol will be furnished. Additional oxen will be ritually slaughtered to provide skulls for the grave site, after first being displayed at the household's holy fire. Relatives adopt special hairstyles, clothing and ornaments to show that they are in mourning, and they will continue in this mourning style for the next year.

After a year has passed, the relatives and guests will return to the grave for the first commemoration ritual. Again, the gathering will include a large number of people, entailing the slaughter of many oxen to provide meat for them. The entire herd of the deceased is gather from even the most distant cattle camps. The central actors in the ritual are introduced to the ancestors at the holy fire, and then the party visits the graves with a large portion of the herd. Each person in the party passes slowly around the grave, touching the stones. Senior male relatives put mopane leaves on the grave, smear the stones with butterfat, and then smear the stones and the sons of the deceased with curdled milk from sacred cattle. Holy cattle may be consecrated to the deceased during the ceremony.
At the end of the ceremony a fire is kindled at the foot of

the grave, and ashes from this fire together with some of the mopane leaves from the grave are taken back to the homestead to the holy fire. Inheritance will be settled a few days later, as wives, children and herds are formally given into the care of the heir who is introduced to the holy fire as the successor of the deceased. The connection between the grave and the holy fire signifies the harmonious relationship between the ancestors and their living descendants, a relationship which is considered crucial to the wealth and health of the remaining members of the household.

The grave will be visited again at subsequent commemoration rituals, which take place at irregular intervals. These commemorations decline in frequency as the years go by, but even very old graves are still the site of rituals.

Funerals and commemoration rituals are the only occasions which bring large groups of Himba together, drawing in people who are normally scattered over hundreds of kilometres. Their significance is underscored by the fact that years are named after them. Naturally, other issues are discussed at such momentous gatherings – cases are judged, marriages are arranged and migration routes are planned. In this way, the grave sites become the focus of intense and important social activity.

Dr Margaret Jacobsohn comments, "Such cultural customs should not be viewed as quaint, 'traditional' rites which are irrelevant to the present and the future. They serve as a robust and practical mechanism for the living to share and disseminate local knowledge and values, and as a forum to plan and co-ordinate socio-economic activities... Elders are thus able to pass on their knowledge and experience to younger generations. This includes the social and environmental information which underpins the communal management of natural resources".

The grave is also the focus for the expression of grief (*oruhoze*), which is a more complex feeling that the English term denotes. *Oruhoze* entails respect for the deceased and also for the heirs and descendants. It also involves the desire to comfort those who are suffering most from the shock of losing a loved one. *Oruhoze* is further expressed through a number of specific behaviours. The widow of the deceased is secluded. Songs sung to honour the deceased are interspersed with periods of loud wailing. The mourning attire serves as another outward sign of grief. The Himba consider *oruhoze* to be the essence of human feeling.

The significance of graves

The multiplicity of meanings and functions centred around ancestral graves explains their great significance in Himba society. The Feasibility Study includes in it's cost estimation an amount which could be used for grave relocation, if this were requested by the local Himba. But, as Dr Bollig puts it, to the Himba "graves are not simply an accumulation of stones under which some bones rest, they are places laden with emotion and memories". The bones and stones could be relocated, but the meaning of the graves within the Himba world view would inevitably be left behind and destroyed.

THE CUNENE FILM PROJECT

Doxa Productions has produced four half-hour documentary films which chronicle the feasibility study from November 1995 until the publication of the final report. The video cassette containing the four films is available free to the libraries and to interested parties and organisations. Others can purchase it for N$40. To obtain a copy contact:

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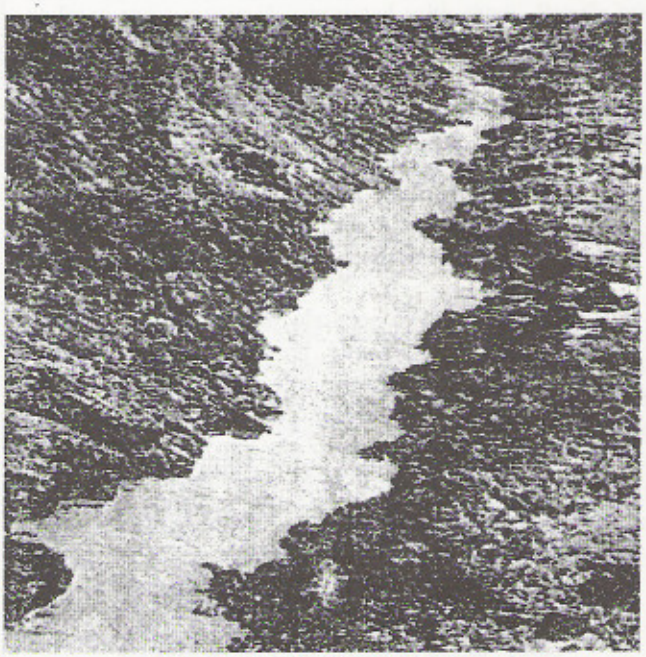

A section of the Cunene River downstream of Epupa Falls

PART 5 - ELECTRICITY NEEDS AND ALTERNATIVE ENERGY SOURCES

This column in the series by the Legal Assistance Centre on the Epupa debate looks at Namibia's demand for electricity and at various energy sources. The information in this article comes primarily from the Feasibility Study, as well as from critiques offered by various groups. Next week's column will take a closer look at criticisms of the Feasibility Study in general.

According to the Feasibility Study, individual consumers are the largest users of electricity, despite the fact that 70% of Namibia's population lives in rural areas which consume only a small proportion of the nation's electricity. Mining was once the largest energy consumer, but as the mining industry stagnated, consumers who purchase electricity from municipalities began to outstrip the mines with their demands for power. Electricity distributed by municipalities now accounts for more than half of the electricity consumed in Namibia, with mines using about 40%.

Windhoek is the largest municipal user. Based on statistics from 1994, some 36 000 residential households consume about 43% of the electricity used in Windhoek, with another 34% going to commercial enterprises and government. Manufacturing accounts for only 9% of the city's electricity demands, with the remaining 14% going to hotels, schools, hospitals and other institutions, or to general uses such as street lights, pumping stations and traffic lights. Walvis Bay and Swakopmund are the other significant municipal users.

Predictions of future demand for electricity

Energy consumption in the entire country has increased by an average of 3,7% each year from 1987 to 1995. In municipalities such as Windhoek, consumption has increased partly because of population growth and partly because of increases in household income accompanied by a slower growth in the rates charged for electricity.

It is difficult to make accurate projections about future electricity use. For example, household use depends on pricing policies -- if the price of electricity goes up, there is more impetus for households to conserve energy. Demand by mines depends in part on world prices for a variety of minerals, as well as on whether or not new mining projects which are on the drawing board will actually materialise.

Under the most likely scenario for economic growth, the Feasibility Study predicts an average annual increase in electricity demand of 6,9% over the next ten years. Demand will not actually increase smoothly each year, but will move forward in uneven jumps as new mining or water pumping projects are established. The Feasibility Study anticipates that the increase in demand will level off to a steadier rate of about 4% each year after 2005.

Namibia's Current Sources of Electricity

There are four major sources of electricity in Namibia at present. The primary source of power is the Ruacana hydropower plan. The output of this plant depends upon the seasonal river flow and has dropped to virtually nil during drought periods. The inadequate operation of Gove Dam in Angola makes it impossible for the flow of the river to be regulated as planned, to offset the effects of irregular rainfall. Part of the electricity produced at Ruacana is exported to South Africa, at times when Namibia is not able to absorb the total output.

Electricity from Ruacana is supplemented by electricity generated from coal at the Van Eck thermal power plant on the outskirts of Windhoek. The cost of coal makes this a relatively expensive source of energy, so it has been used primarily as a back-up source of electricity for hours of peak demand in recent years. A relatively small amount of electricity comes from Paratus diesel power plant in Walvis Bay.

A significant proportion of Namibia's electricity is imported from South Africa, with imports accounting for 38% to 55% of Namibia's total supply during 1994-1996. NamPower recently began construction of a higher-capacity transmission line from South Africa, which will make it possible to ensure an adequate energy supply well into the next century. However, according to the Feasibility Study, this is incompatible with the goal of greater energy self-sufficiency. The major concern is that the price of importing electricity from South Africa will rise in future once South Africa no longer has power to spare, even though the tariff is already set by agreement up until the year 2005. Eskom itself (which is the South African equivalent of Nampower) plans to utilise excess power generation capacity in the region (such as relatively cheap power from Cahora Bassa in Mozambique) and anticipates that it will have no need to invest in new power-generation capacity before 2010.

Even if a hydropower plant were built at Epupa or at Baynes, this would not be sufficient to meet Namibia's power needs at all times. Either of the proposed hydropower projects would have to be supplemented by other supply sources. This means that a careful consideration of all the options is important no matter what decision is made on the dam.

Kudu Gas

The Kudu Gas Field offshore of Oranjemund was discovered in 1973. It is a large deposit by international standards, and the gas is of a high quality. Natural gas is a efficient, clean-burning energy source which causes minimal pollution. The discussion of Kudu Gas in the Feasibility Study has already been overtaken by events. In November 1997, an agreement was signed between NamPower, Eskom and Shell Exploration & Production Namibia (the lead company in an investment group which also includes Texaco Inc USA and Energy Africa). The

agreement commits these partners to going forward with a feasibility study for a gas-driven power plant.

The envisaged power plant will have a power generation capacity of 750 MW (megawatts) -- as compared to 240 MW for Ruacana and 360 MW for both of the proposed hydropower projects. In other words, the maximum output of the Kudu power plant will be more than twice that of the proposed Epupa hydropower plant at its peak.

The Kudu power plant can be brought on line as early as 2001, and the Kudu Gas Field contains more than enough gas to operate the plant at full capacity for at least 20 years. In order to make the investment a viable one (at least in the early years of operation), much of Kudu's output will have to be exported to South Africa in terms of a contractual agreement drawn up between the two countries. The reason for this is that Namibia cannot initially absorb all of the energy produced by Kudu, and it must operate at full capacity in order to pay for itself.

The Kudu power plant will not necessarily exhaust the resources of the gas field. Further explorations are presently underway to investigate additional volumes of gas for use in Namibia or for export to South Africa.

Earthlife has pointed out that the development of gas-fired power plants can have positive spin-offs, such as the development of a chemical industry with gas by-products and greater opportunities for Namibian workers to acquire jobs and technical skills in supporting industries and back-up services. Excess heat from a gas-powered plant could be used to power a large-scale desalinisation plant which could eliminate the need for a costly and environmentally questionable pipeline to carry water from the Okavango River to Namibia's central regions.

Other alternative energy sources

Coal

The production of electricity from coal is more expensive than the other options available, as well as being environmentally unfriendly, and thus is not a viable option for Namibia. In fact, the Feasibility Study assumes that the Van Eck power plant (along with the Paratus diesel power plant) will be retired by 2004 , in favour of more cost-effective options.

Solar power

Electricity can be generated from the sun in two ways. One is to use the heat of the sun to make steam, which is then used to drive a conventional steam turbine. This is called solar thermal generation. Solar thermal generation systems in other parts of the world normally rely on natural gas for power generation when the sun is not shining.

The other type of solar system uses photovoltaic cells (which many people know as solar panels) to transform solar radiation directly into electricity. Solar energy can also be used to heat water directly, without being transformed into electricity, as a replacement for electric water heaters which use large amounts of electricity. Solar power has the advantage of being a completely renewable resource which normally causes little or no harmful environmental impact.

Namibia receives an average of 3300 hours of sunshine each year, more than almost any other country in the world, making it a strong candidate for solar power. The ability to draw on a local source of natural gas (from the Kudu Gas Field) also makes solar thermal generation a particularly suitable option for Namibia. However, the Feasibility Study concludes that solar thermal power generation would not be cost-effective for Namibia at this stage.

International experts who have analysed this portion of the study say that the Feasibility Study makes unwarrantedly conservative assumptions about solar power which make the cost of electricity from a combined solar-gas thermal plant appear unrealistically high. For example, the costing in the Feasibility Study assumes that a gas-solar thermal plant would have a lifetime of 20 years, although similar facilities in operation in the US are rated as having a 30-year lifespan. Making less conservative assumptions would lead to the conclusion that solar thermal power can be produced at a more competitive price.

The type of solar power which uses photovoltaic cells is currently used primarily in the form of stand-alone systems for individual households or for specific uses such as water pumping. However, the price of solar panels has been falling steadily over the past three decades, as their efficiency and reliability increases. The possibility of using a photovoltaic system for bulk electricity supply should be reassessed in the coming years in light of this trend. In the meantime, such systems can be useful energy source for households far from the existing grid. Also, the substitution of electrical geysers by solar water heaters (which pay for themselves in 3-7 years, depending on usage) could help reduce the growth rate of electricity demand, depending on whether or not the government is prepared to provide financial incentives such as tax and import duty exemptions to encourage this approach.

Wind power

Windmills have long been used for water-pumping in Namibia. The high wind speeds along the coast open the door to the possibility of electricity production with wind turbines in these areas. Wind power already makes substantial contributions to the power supply in other countries, such as Germany, India and Denmark, where 10% of the total national demand for electricity will be met by wind power by the year 2010. Among the attractions of wind power are its renewability and its low environmental impact. Almost the only environmental hazard from wind-generated power is the need to consider danger to birds in the siting of wind turbine installations. The technology is well-advanced, and there are numerous international examples to draw on.

The Feasibility Study concludes that wind power is not economically attractive at present. It recommends that an

experimental wind farm should be set up and monitored for at least 10 years, with the establishment of wind-generated power projects taking place over the next 5 to 10 years after that. Critics assert that this is an unrealistically long lead time, given the wide experience with wind power around the world and the time frames required to establish wind power projects in other countries.

In fact, Namibia is already proceeding with a detailed investigation into the possibilities of wind power. The Ministry of Mines and Energy has been carefully monitoring wind speeds at Luderitz and Walvis Bay over the past year. These measurements indicate that wind speeds at both locations are sufficient for large-scale power generation, and a full feasibility study into the establishment of wind plants is expected to be complete by April 1998, followed by a decision on whether such plants will be economically viable.

Energy conservation

The Feasibility Study assumes that there is little potential for reducing electricity demand through conservation measures because per capita energy consumption in Namibia is already low by international standards. However, the report by its own admission does not consider the possibility of stimulating conservation through awareness campaigns or credit schemes to encourage the use of more efficient appliances such as energy-efficient refrigerators and energy-saving lights. Conservation could also be encouraged by an increase in the rates charged for electricity, which are presently low in comparison to those elsewhere in the world.

Some issues to ponder

- *The concept of self-sufficiency*

Concerns have been raised about energy self-sufficiency. The dependency inherent in Namibia's current reliance on direct imports from South Africa is obvious, but many other current and future options for supplying Namibian's energy needs also involve co-operation with other countries. For example, the development of the Kudu Gas Field depends on financial inputs from foreign-based companies, and exports to South Africa are necessary to insure the financial viability of the project.

Foreign co-operation is also involved in the proposed hydropower projects. For example, the Feasibility Study was financed by foreign donors, and construction of the proposed hydropower projects would in all likelihood involve foreign capital. Both the Epupa and the Baynes options for hydropower production depend on co-operation with Angola in several respects. It has often been noted that Baynes (like Ruacana) can operate at optimal efficiency only if the Gove Dam inside Angola is properly functional. But the success of Epupa also depends on co-operation with Angola. The Cunene River lies on an international border, meaning that its use must be governed by bilateral agreements between the two countries concerned – and the potential output of both Baynes and Epupa could be adversely affected by the withdrawal of water upstream for irrigation by Angola.

The idea of energy "self-sufficiency" may be an illusory goal which should not be allowed to obscure more fundamental issues.

- *The "cost" of different energy sources*

The cost of power produced at Epupa or at Baynes will almost always appear cheaper than the cost of alternative sources of energy, because so many of the "costs" of a hydropower dam are impossible to quantify. Many of the costs in the analysis presented by the Feasibility Study are for mitigation measures which do not capture the full losses entailed in the social , cultural and environmental impacts. As the Feasibility Study itself concedes, factors such as the negative cultural impact on the local Himba people and the loss of Epupa Falls cannot be measured in monetary terms. In contrast, alternative energy sources such as wind power and solar thermal generation systems have fewer "hidden" costs, because of their low and predictable environmental and social impact. This means that comparing the bottom line alone is not an adequate way to compare the desirability of the various options.

- *Integrated approaches to meeting water and power needs*

Critics of the Feasibility Study fault it for looking at Namibia's electricity needs in isolation from its water needs. The study includes an analysis of alternative uses of water from the Cunene, but there is no overarching examination of Namibia's water and power needs in combination.

For example, the fact that an efficient hydropower plant dam at Baynes would be dependent on the rehabilitation of Gove Dam in Angola has been cited as a negative factor -- despite the fact that such a rehabilitation (in addition to enabling full utilisation of the existing facilities at Ruacana) would facilitate the supply of water to northern Namibia from Calueque.

As already noted, Earthlife has appealed for a closer look at the integration of gas-fired power production and water desalination schemes which could replace the proposed pipeline from the Okavango.

Little attention has been given to the fact that a large new hydropower dam on the Cunene would ironically mean *reduced* potential for irrigating the fertile alluvial soils in the vicinity for future agricultural projects, since the water needs of the hydropower plant would have to take priority.

- *The time frame*

Certain developments have taken place since the Feasibility Study was drafted. NamPower is proceeding with the construction of a higher capacity transmission line to allow for the import of larger quantities of electricity from South Africa. An agreement has been signed which is likely to lead to the development of a Kudu gas-fired power plant with a lifespan of at least 20 years. Namibia has a range of

options which can secure its future power supply. So why rush into a decision on building an extremely problematic dam at Baynes or Epupa? Why not continue to assess the various possibilities over the next five years as the development of Kudu moves forward, with a more in-depth look at alternatives such as wind and solar power which need not have a damaging environmental or social impact?

The overall objectives of Namibian energy policy are oriented towards sustainability, security of supply and social upliftment – goals which all Namibians can probably agree with. The nation's highest priority should be the achievement of these goals through a well-balanced, well-thought-out combination of the potential energy sources.

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SUPPLY AND DEMAND 1994/95

Energy consumption and production are measured in gigawatt hours (GWh), with one gigawatt hour being equal to one million-kilowatt hours (kWh). The figures for supply are higher than those for demand because around 10% of the power generated is inevitably "lost" in the process of transmission. Also, some power is exported to South Africa from Ruacana if there is no demand for it in Namibia at the time it is produced, with 146 GWh being exported in 1994/95.

SUPPLY		DEMAND	
Ruacana	1134 GWh	municipal consumers	868 GWh
Van Eck & Paratus	124 GWh	mines	631 GWh
Import from RSA	764 GWh	rural & water supply	139 GWh
TOTAL	**2022 GWh**	**TOTAL**	**1639 GWh**

MAXIMUM CAPACITY OF VARIOUS ENERGY OPTIONS

The measures kilowatt (kW) and megawatt (MW) -- with a megawatt being equal to 1000 kilowatts -- refer to how much power is used or produced at any one moment in time. This measurement does not indicate how much power can actually be produced by a particular source, because it may not be possible for the plant to operate at maximum capacity at all times. For example, in a hydropower plant, actual output depends on the amount of water available. Power output must also be co-ordinated with demand, which differs from hour to hour and from season to season. The highest peak demand ever recorded in Namibia (which could have been a moment on a cold dark day when lots of people were using electric lights, heaters and kettles all at the same time) was 279MW. The following chart illustrates the peak capacity of various energy sources.

CURRENT ENERGY SOURCES	PEAK CAPACITY
Ruacana	240 MW
Van Eck	120 MW
Paratus	24 MW
Import from RSA (existing transmission line)	225 MW
PRESENT INSTALLED CAPACITY	584 MW

PLANNED ENERGY SOURCES	PEAK CAPACITY
Additional import from RSA (with new transmission line)	500 MW

POSSIBLE ADDITIONAL SOURCES	PEAK CAPACITY
Additional import from RSA (if new transmission line is upgraded)	175MW
Kudu gas-fired power plant	750 MW
Epupa or Baynes hydropower plants	360 MW

PART 6 - CRITICISMS OF THE FEASIBILITY STUDY

This is the sixth and last column in the series by the Legal Assistance Centre on the Epupa debate.

Presentation of the Feasibility Study

The International Rivers Network (IRN), working in consultation with the Himba community as well as Earthlife and a number of other organisations in various countries, coordinated a team of international experts in various fields to prepare a critical review of the Feasibility Study. The IRN is a international NGO which has experience with 80 river development projects on five continents. Its goals are to protect and restore the integrity of the world's rivers; to promote the wise management of freshwater resources for the benefit of the people and ecosystems that depend on them; and to create a worldwide understanding of river ecology. IRN works by invitation with environment, development, human rights and grassroots groups around the world in cooperative campaigns for community-based watershed protection and sustainable development. The various international experts all provided their input without charge.

This column summarises the highlights of these critiques. No attempt has been made to analyse the critiques or to double-check them for accuracy. The main points are simply presented here as a contribution to the Epupa debate.

SOCIAL AND CULTURAL IMPACT

Both international law and recognised professional standards require an elaborate investigation of the impact of projects such as Epupa on the people who are directly affected. The Feasibility Study itself calls attention to the fact that it is "incomplete" because it fails to include information on social mitigation, which refers to methods for minimising the detrimental social impacts. (This portion of the report was derailed after a government official announced at a meeting in Opuwo last March that "the dam will be built", even though the Feasibility Study was still underway.) But this work was not "impossible", as the Feasibility Study asserts. After all, the consultants had N$34 million, access to world-wide expertise and several years to carry out the various studies. Full participatory input by the local Himba is so crucial that no further discussion of the Feasibility Study should take place until this gap is filled.

Experience with dams in other parts of the world shows that mitigation and relocation schemes have a history of failure, leaving indigenous peoples with shattered cultures and shattered family structures, as well as high rates of alcohol and substance abuse, crime and prostitution. Yet international experience and methodological approaches were not even used to frame the Feasibility Study inquiry, which contains only cursory and misleading references to experiences in other countries.

The legal land rights of the Himba are acknowledged by the study in one line and then generally ignored in the rest of the document. Even if the government owns the land, indigenous occupants hold well-defined legal rights to land tenure under both international and Namibian law. The Himba's water rights and the impact of lost access to a significant portion of a key water resource are similarly downplayed. The issue of relocation is addressed superficially, with a focus on the financial costs alone. There is no discussion of *where* the Himba might be resettled given the fact that there is no more grazing land available in Namibia. There is also no assessment of the social meaning of such a relocation for the people in uestion.

> *"What data is included on social issues is flawed to the point of being misleading. The scant information on the social impacts trivialises the Himba culture and economy, minimises the project's impacts on the Himba way of life, glosses over the Himba's land and water rights, and offers a glib assessment of the resettlement costs. " (Prof Sidney Harring, lawyer & sociologist)*

The social critique concludes that there should be no public hearings at all on this "woefully incomplete report". According to Prof Harring, "Large scale dams are no longer simply engineering matters: the human and environmental impacts are fundamental and must be given full weight. Since this information was not included in the study, the study should not be used further, in any context, until it is complete."

AQUATIC ECOLOGY

The construction of a dam would unavoidably alter sediment patterns and river temperature downstream, as well as the nutrient content of the water. The potential consequences of these dramatic changes are not fully acknowledged by the study.

Water flow downstream from the reservoir can be regulated, but the impact of flow variations and the minimum flow needed to sustain the existing river ecology have not been properly investigated. What is needed is an "instream flow requirements study" which provides complete data about the river's biology, water chemistry and seasonal flow variations which can be crucial to river

life. But the Feasibility Study contains no such data, basing its recommendations only on assumptions. A reduced river flow may also allow salty seawater to push its way up into the river month, which could have serious consequences for riverine plants and animals.

"Many riverine invertebrates are dependent on flow cues for reproduction and on the supply of organics and nutrients from upstream for their survival. Therefore, it can be stated that these species will be affected by both the Epupa and Baynes dams. The lack of detail on these very important riverine inhabitants in the report is of great concern." (Kate Snaddon, Freshwater Ecologist)

The aquatic ecology of the Cunene River has not been previously described, but the Feasibility Study does not provide any detail on invertebrates which live in the river and how they will be affected by the dam. For example, the freshwater prawn depends on seasonal flow variations for reproduction and so may be adversely affected by flow regulation which does not take this fact into account. Attention should also be given to the blackfly, an insect which often proliferates below dam structures and can cause stock deaths. This pest could have a devastating effect on Himba herds, but it has not been considered in the study. Another issue which is inadequately addressed is the possibility that algae could thrive in the reservoir, releasing toxic chemicals which will give the water an unpleasant odour and taste, and prevent the establishment of fisheries in the reservoir.

The study also underplays the impact of the loss of the spray-zone and "riffle" habitats surrounding Epupa Falls, which could result in an irreversible loss of biodiversity if the Epupa site is chosen.

In general, although the Feasibility Study contains some detailed specialist reports on certain flora and fauna of the Cunene River, other aspects of the aquatic ecology lack the detail that is necessary for a proper assessment of the dam options -- or a decision on whether any dam should be built.

THE USE OF CUNENE WATER

The Feasibility Study acknowledges that water would evaporate from the reservoirs behind the dams at an annual rate which is equivalent to many times the total urban consumption of Namibia. Even these estimates may be on the low side. More importantly, the Feasibility Study assigns no cost to the loss of this huge amount of water on the grounds that there are no alternative uses for it. But it makes no sense to set the value of a natural resource at nil just because it has not yet been utilised. This disregards possible future developments in a nation which has a desperate need for water. In the long term, the value of water will increase considerably. Potential future uses of the water which will be lost should have been factored into the cost-benefit analysis.

"The authors of the Feasibility Study appear to have complete disregard of the overall water scarcity in Namibia, focusing instead only on the immediate problem at hand. The possibility of using Cunene water for urban consumption rather than for power generation, for example, deserves detailed study." (Dr HC Eggers, energy physicist)

HYDROLOGY

The Feasibility Study had to deal with the problem of limited hydrological data. There is no historical record of the flow of the Cunene River at either of the proposed dam sites. There is a short flow record from Ruacana which is 200 km upstream, and a longer flow record from the Okavango River at Rundu. So the Feasibility Study created a hydrological model based on the 12-year period for which the Ruacana and Rundu records overlap. The validity of this approach depends on the assumption that the two river basins are similar in hydrological terms, but there is no evidence to back up this assumption. This means that the hydrological projections cannot be confidently relied upon. This point is crucial, because the simulation in question is the core of all the predictions about the economics of both of the proposed hydropower schemes.

Another flaw in the study's analysis is its assumption that future river behaviour will be the same as in the past. But the Cunene's average flow has decreased over the past twenty years, reaching an all-time low in 1997. There is evidence that drought periods are increasing in duration and severity in many parts of the world, and global warming trends must be considered. It is risky to rely on the theory that future streamflow will continue as before. If flow conditions worsen, the performance of a hydropower plant will be below predicted levels, meaning that a dam might not be economically viable. Lower natural flow could be exacerbated by the extraction of water upstream by Angola for irrigation purposes, which makes viability even more questionable.

The Feasibility Study generously assumes that there will not be more than one dry year in a row – a conclusion that flies in the face of the findings of other scientists and contradicts emerging understandings of the El Nino phenomenon. If future years do in fact occur back to back, the economic performance of the proposed dams would be considerably worse than the study estimates.

"From a hydrologist's point of view, the Feasibility Study of proposed hydroelectric power dams on the Cunene River has some serious deficiencies... The conclusion is that the Feasibility Study is not a sound basis for evaluating either the costs or the benefits of the project, nor for proceeding with major financial or other irreversible commitments to the project." (Dr Peter Willing, hydrologist)

THE ECONOMICS OF THE PROPOSED HYDROPOWER SCHEMES

The numbers which are used to calculate costs and benefits in the Feasibility Study are estimates, not facts, and these estimates are in some case unavoidably based on speculation. But a number of the assumptions made are unreasonably slanted in favour of a hydropower project. Even without taking into account the impacts which cannot be quantified (such as the social impact on the Himba and the loss of Epupa Falls), the proposed hydropower schemes do not actually pass the test of economic viability.

A number of cost factors are omitted or understated:

- For example, the Feasibility Study does not adequately address the likelihood of cost and time overruns, which are common in large dams elsewhere in the world. An analysis of 70 hydropower dams funded by the World Bank since the 1960s showed that inflation-adjusted overruns averaged 30%, and examples of dams which cost several hundred times more than their estimated price can be cited.
- The economic simulations in the Feasibility Study do not allow for the inevitable rise in operation and maintenance costs over the lifetime of the dams, although experience in North America suggests that these costs rise dramatically after the first 30 years of operation.
- The Feasibility Study contains no reference to the costs of disassembling the hydropower plant after its projected 50-year lifetime. Even though these costs do not loom large because they are so far in the future, they should still be taken into account. These costs can rise even higher if the cost of rehabilitating the river is taken into account.
- Other costs appear to be underestimated – such as the cost of compensating the local Himba, and the estimate of lost tourism income stemming from the destruction of Epupa Falls, considering that tourism could increase in future as the falls become an increasingly rare example of natural beauty. The costs of health problems such as HIV infection, hepatitis and waterbourne diseases are also underestimated, being limited to mitigation measures without including the direct losses to those who will suffer.

The "benefit" side of the cost-benefit equation is also based on questionable assumptions. For example, the study overestimates the increase in demand for electricity. Between 1988 and 1995, energy demand grew 3,7% on average, during a period when the price of electricity fell slightly. But the study predicts substantially higher rates of increase in future, even though the cost of electricity is expected to rise. The demand projections also assume that Namibia's rate of population growth will remain constant at the present level of 3,1% -- even though birth rates world-wide are falling faster than at any time in history. Potential conservation measures -- the cheapest of all immediate options -- are also given short shrift. If the calculations of increased demand are even slightly over-optimistic, the project will no longer be economically feasible.

Another questionable area is the discussion of the cost of imported power. The current price of imported power is extremely low. The Feasibility Study assumes that the price of electricity imported from South Africa will increase in 2005 when South Africa's excess capacity will be fully digested – even though South Africa's power supplier, Eskom, is quoted as stating that it will not need additional power generation capacity before 2010. The hydropower option is also far less flexible than imported power. If the growth in demand for electricity is in fact slower than anticipated, the benefits of a large capital investment will no longer outweigh the costs. But if Namibia continues to import power, the exporting country must bear the bulk of the financial risks.

The Feasibility Study includes calculations which try to measure the impact of errors in the assumptions and predictions about future events. This "sensitivity analysis" tries to determine if the proposed hydropower projects will still be economically viable if some of the guesses about the future are wrong. But there are two flaws in the study's calculations. Firstly, it does not include a sensitivity analysis for all of the key variables. For example, the study does not calculate the impact of errors in its assumptions about future demand for electricity. Secondly, it analyses problems as if they could happen only one at a time, even though some of them are likely to be linked. For instance, if there is one-year delay in the construction of a dam there will probably also be a cost over-run – but the Feasibility Study calculates the impact of these scenarios separately, as if they could not happen at the same time.

"This project would devote a substantial amount of resources to a single large project that is unlikely to be economically viable even ignoring the nonquantifiable costs... Because there is no immediate demand for the additional electricity, and because there are better options, there is no reason to undertake this uncertain, high-cost, nonreversible investment at the current time." (Dr Steve Rivkin, economist)

ALTERNATIVE ENERGY SOURCES

The price of the various energy alternatives is expressed in US cents per kilowatt-hour, abbreviated as USc/kWh, for purposes of comparison.

"Contrary to assertions in the Feasibility Study, the Epupa hydropower scheme is not the 'least cost' power alternative for Namibia." (Jamal Gore, expert on renewable energy sources)

Imported power: Imported power is a cheap option. South Africa currently sells power to Namibia at about 1,8 USc/kWh. The cost of constructing the new transmission line from South Africa is estimated as 1,5 USc/kWh. This means that the total cost of electricity imported through the new line would be about 3,3 USc/kWh at present import prices, rising to about 4,5 USc/kWh if the price charged by South Africa for imported electricity rose as high as 3 USc/kWh. This means that the estimated cost of imported electricity is less than the 4.4 to 4.9 USc/kWh estimated for Epupa.

Gas: Gas-produced power is also a more cost-effective option than Epupa. The Feasibility Study's evaluation of gas-produced power from Kudu is based on erroneous assumptions. For example, it compares Epupa with a small (360MW) gas power station whereas the agreement on Kudu recently signed by Nampower envisages a 750 MW plant. This means that the price of gas-generated power is overestimated in the Feasibility Study, since economies of scale in the larger plant will lower the unit costs of the power. The larger plant should generate power at 3,55 USc/kWh (instead of at 5.3 USc/kWh for the smaller plant), which is substantially cheaper than the costs calculated by the Feasibility Study for Epupa. Furthermore, this initial power plant would cover many of the initial costs of developing the gas field, meaning that additional gas power plants which might be built in future could provide additional energy at a considerably lower cost. The Feasibility Study also presents the price for the supply of gas from the Kudu field to a gas-power plant in the most unfavourable light possible. It asserts, without explnation, that the price quoted by Shell for the supply of gas is unrealistically low, even though a World Bank analysis predicts an even lower price. In this way, the Feasibility Study misleads the reader into believing that a gas power plant would necessarily be more expensive than Epupa, when the gas option is actually cheaper and safer.

> *"Kudu gas power would be a more competitive option than Epupa." (Dr HC Eggers)*

Solar and wind power: In its discussion of solar energy, the Feasibility Study uses extremely conservative estimates which push the assumed cost of power from a solar-gas thermal plant higher than it would be using more conventional assumptions. For example, the study assumes that such a plant would have a lifetime of 20 years, even though similar facilities in the US have a 30-year lifespan. The study also fails to take into account the fact that Namibia receives a higher level of solar radiation than most other places on earth, meaning that a solar plant could be expected to operate more efficiently here than elsewhere. The use of a low-cost supply of local gas from Kudu for backup power would also reduce the cost of power from a solar-gas thermal plant in comparison to plants in other countries which must sometimes rely on very expensive sources of gas. The actual cost of solar thermal power could reasonably be half the cost estimated by the Feasibility Study.

> *"It is characteristic of the Feasibility Study's bias against alternatives that negative remarks are made towards the time needed for developing a wind power project while hydro projects are known for their long construction times." (Dr HC Eggers)*

The Feasibility Study's economic analysis of wind power is also conservative, but not unreasonable. However, the Feasibility Study assumes that wind power could not be brought on line in Namibia without another decade of study, followed by another five to ten years for implementation. This long start-up time is out of line with world experience. Wind power is a mature technology that could easily make a substantial contribution to Namibia's energy portfolio by 2005.

> *"The consultant inappropriately uses assumptions in the analysis that underestimate the viability of alternative energy sources. Some assumptions are unnecessarily pessimistic, while in other cases the consultant ignored or misapplied relevant information from other countries." (Jamal Gore)*

The Feasibility Study compares the cost of wind power and solar power with the theoretical cost of 3 USc/kWh. But the current electricity price is 3.7 USc/kWh, while energy from Epupa is estimated to cost 4.5 to 4.9 USc/kWh. The projected costs of wind power given by the Feasibility Study are 4.9 USc/kWh. Thus, while the costs of wind power may not be competitive with some unattainable ideal, they would be competitive to Epupa. And a 1993 study commissioned by the United Nations estimated a much lower international wind power cost of 2.7 to 3.8 USc/kWh in the year 2000. Furthermore, the possibility of reducing the costs of wind and solar power by utilising international grants made available by the World Bank for this purpose is not incorporated into the Feasibility Study's cost analysis.

The Feasibility Study itself states that its purpose is to evaluate a possible hydropower project and not the present a full master plan for the electricity sector. For example, the Feasibility Study does not even consider the option of repairing Gove and upgrading Ruacana. Surely it would have been better to identify and investigate *all* the available energy alternatives instead of focusing single-mindedly on one particular project. But even if the Feasibility Study did not do this, it will the duty of the government to consider the overall energy picture before making a decision on Epupa.

OTHER CRITIQUES OF THE FEASIBILITY STUDY

The commentary co-ordinated by International Rivers Network is not the only critique of the Feasibility Study. For example, the Wetlands Working Group of Namibia, composed of professional aquatic ecologists, is in the process of evaluating the Feasibility Study with a view to filling in gaps arising from the study's failure to draw on

the knowledge of local scientists who have been carrying out research on the Cunene for years.

A technical paper prepared by Earthlife and the German environmental organisation Urgewald on the Kudu Gas option is available from Earthlife, as well as a paper by a group of engineers from the region which discusses the possibility of an integrated approach to supplying Namibia's needs for power and water.

SUMMARY

The various critiques emphasis the fact that the Feasibility Study is unavoidably based on assumptions and educated guesses. Critics say that the Feasibility Study has made wrong assumptions and drawn conclusions in the absence of appropriate data – or in some cases presented biased and misleading information. Given the fact that the expenditure of some US$500 million is at stake, it is necessary to proceed with caution. The criticisms of the study should be considered carefully before any decision is made on Epupa or Baynes.

The individuals who prepared the comments on which this article is based are as follows:

- *Prof Sidney L Harring, City University of New York School of Law, a lawyer and sociologist active in the area of the rights of indigenous peoples for more than fifteen years*
- *Dr Steve Rivkin, Department of Economics, Amherst College, Massachusetts*
- *Dr Peter Willing, Water Resources Consulting, LLC, a hydrologists who has experience with hydroelectric system design and technical reviews of African river basin development plans*
- *Kate Snaddon, FreshwaterResearch Unit, University of Cape Town*
- *Dr Bryan Davies, Associate Professor, Freshwater Ecologist and Senior Lecturer, University of Cape Town*
- *Jamal Gore, formerly with the US Environmental Protection Agency, now director of a non-profit renewable energy organisation in Washington, DC*
- *Dr HC Eggers, Institute for High Energy Physics, Vienna*
- *Steve Rothert, International Rivers Network, Gaborone*

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