ANNEX 4
CASE STUDIES MOZAMBIQUE

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Acronyms and Abbreviations

DAC	Development Assistance Commission (of OECD)
Danida	Danish Development Cooperation
DNE	National Energy Directorate, (Mozambique)
EDM	*Electricidade de Moçambique* (National Electric Utility)
Eskom	South Africa's national power utility
EU	European Union
FIDIC	International Federation of Consulting Engineers
FRELIMO	*Frente de Libertação de Moçambique*, political party Mozambique
FUNAE	*Fundo Nacional de Energia* (National Energy Fund, Mozambique)
FTE	Full time equivalent
GDP	Gross Domestic Product
GNI	Gross National Income
GOM	Government of Mozambique
GWh	Giga Watt hour, unit of energy
HCB	*Hidroeléctrica de Cahora Bassa* – largest hydro plant in Southern Africa, 2,075 MW
HEP	Hydro Electric Project
HV	High voltage (line), commonly above 33 kV
ME	Ministry of Energy, (Mozambique)
MIREME	Ministry of Mineral Resources and Energy (ceased to exist end 2005)
KPI	Key Performance Indicator
kW, kWh	Kilo Watt, kilo Watt hour, power and energy units
LV	Low voltage (line), commonly less than 1.000 volts
ME	Ministry of Energy
MFA	Ministry of Foreign Affairs (of Norway)
MOU	Memorandum of Understanding
MN	Mphanda Nkuwa: name of giga hydro power project
MV	Medium voltage (line), commonly 6 to 33 kV
MZM	Currency: Mozambique *Meticais* (being phased out) 1,000 MZM = 1 MZN
MZN	Currency: Mozambique *Meticais* (new): 21 April 2007 1 MZN = 0.231 NOK
MW, MWh	Mega Watt, Mega Watt hour, units of power and energy
NOK	Currency: Norwegian *Kroner*, 21 April 2007 – 1 NOK = 0.168 USD
Norad	Norwegian Agency for Development Cooperation
NVE	*Norges vassdrags- og energidirektorat*, Norwegian Water Resources and Energy Directorate
ODA	Overseas Development Assistance
RENAMO	*Resistência Nacional Moçambicana*, political party Mozambique
RERA	Regional Electricity Regulators Association
SADCC	The Southern African Development Coordination Conference
SADC	Southern Africa Development Community (replaced SADCC ca. 1994)

SAPP	Southern Africa Power Pool
SEK	Currency: Swedish *Krona*, 21 April 2007 – 1 SEK = 0.880 NOK
Sida	Swedish International Development Agency
STEM	Short Term Electricity Market
TA	Technical Assistance
TAU	Technical and Administrative Unit (of SADCC, located in Luanda)
TOR	Terms of Reference (of the evaluation, unless specified otherwise)
TV	Television
UN	United Nations
USD	Currency: United States Dollar, 21 April 2007 – 1 USD = 5.95 NOK
UTIP	*Unidade Técnica de Implementação dos Projectos Hidroeléctricos*, Hydro power promotion unit (Mozambique)

Note: Abbreviations or acronyms used only once in the text are not included, but explained in the context.

Energy Unit Definitions[1]

Power: Electrical power is the rate at which electrical energy is converted to another form, such as motion, heat, or an electromagnetic field. The common symbol for power is the uppercase letter P. The standard unit is the watt, symbolized by W. In utility circuits, the kilowatt (kW) is often specified instead; 1 kW = 1000 W. One watt is the power resulting from an energy dissipation, conversion, or storage process equivalent to one joule per second.

Energy: In electrical circuits, energy is a measure of power expended over time. In this sense, one joule (1 J) is equivalent to one watt (1 W) dissipated or radiated for one second (1 s). A common unit of energy in electric utilities is the kilowatt-hour (kWh), which is the equivalent of one kilowatt (kW) dissipated or expended for one hour (1 h). Because 1 kW = 1,000 W and 1 h = 3,600 s, 1 kWh = 3.6 x 10^6 J.

Note: Energy is power applied over a time period, and is calculated as power multiplied with time, e.g. kW x h = kWh.

[1] From: http://searchsmb.techtarget.com/

A4.1 Overview

The Republic of Mozambique is located in South Eastern Africa, bordering the Mozambique channel, between South Africa and Tanzania. It has a total population of 19.4 million (2005 estimate) and a total area of 801,590 km2. The electricity production during 2002 was around 12,713 GWh, mostly of hydro.

The gross theoretical hydro potential of Mozambique is estimated to be at least a technical feasible 37,647 GWh/yr (6,610 MW).

Installed capacity of hydro power that is currently operational is 2,136 MW, about one third of the technically feasible potential. No hydro power schemes are currently under construction, but more than 2,000 MW of new hydro capacity is planned over the next eight years. Most significant of these is the 1,300 MW Mphanda Nkuwa scheme which had originally been planned to be completed by 2010. As there was no signed project agreement by June 2007, earliest possible completion is 2014.

Other projects include Boroma (444 MW), Lupata (654 MW) and Alto Malema (80 MW). The total potential capacity of small hydro power plants in Mozambique is 364 MW, but just 18.3 MW has been exploited.

Sources of information:

CIA Fact sheet and IEA Energy Statistics

Fig. A4- 1: Map of Mozambique

The Norwegian support to the power sector in Mozambique which is evaluated in this report started in 1977. The policy, planning and implementation of aid have clearly been influenced by the economic, social and political developments in the country and the region, as well as by the prevailing ideas in the international community as they changed over time. An ex-post evaluation of development cooperation will have to take into account these circumstances to provide a fair assessment. This section outlines some salient features of the situation which first met administrators of aid and experts in Mozambique and of developments up till today. In particular, it seems important to point out the changes in circumstances from the war time to the long period of stability and growth after 1992.

The civil war in Mozambique lasted from 1976/77 until the peace agreement between Frelimo and Renamo in 1992 and was devastating for the nation. By the early nineties - of a mid-1980s population of 13-15 million - 1 million had been killed, 1.7 million were refugees in neighbouring countries, and at least 3.2 million were "deslocados" (dislocated people) typically living near to towns and cities, often in abject poverty, and large parts of the physical and administrative infrastructure of the new Mozambique had been destroyed.[3] The country probably had the world's lowest GDP per capita.[4]

It was part of Renamo's strategy to "destroy the gains of independence". Advances in health and education were some of the main reasons for Frelimo's initial popularity, and thus schools and health posts were targeted, along with students, teachers, nurses and patients, who often were kidnapped or killed. A large amount of the physical infrastructure like water pipes, electricity, roads, rail tracks etc. were destroyed during the war.

Many factors contributed to the spectacular downturn (and later upturn) of the Mozambican economy depicted in Fig. A4- 2. There was a nearly uninterrupted decline in GDP from the early seventies to the early nineties. Just after independence some 200,000 Portuguese settlers which had constituted the mainstay of the colonial economy left virtually over night. They were only partly replaced by East bloc personnel and UN experts of which the country had some 20,000 in the early eighties. The closing of Mozambique's harbours and transit transport for South Africa as well as natural disasters also contributed to the decline of the economy. It is noted that 12 of the 18 years from 1975 to 1992 were in some way affected by droughts and floods.[5] One should also add that the experiment with a centrally directed economy must have had negative effects.

Clearly, the sabotage and violence had consequences beyond Mozambique's borders. The Beira corridor with the main oil, gas and petrol pipeline to Zimbabwe cut across the provinces of Manica and Sofala. It is known that armed groups, often alleged to be Renamo, blew up parts of the pipeline numerous times to damage both the Frelimo state and also independent Zimbabwe. It is said that Lonrho in 1982 signed a secret protection agreement with Renamo leaders covering the Beira oil pipeline.[6] In the power sector, installations in many parts of the country were sabotaged. According to Sida (1995) "the decline of domestic power consumption mirrored a parallel decline in economic development. The technical installations were exposed to sabotage and the main objective in this period became to maintain a reliable electricity supply to the major urban and semi-urban population centres and centres for economic activities". The main power station and dam system at Cahora Bassa was however not extensively damaged. It has been suggested that this was 'spared' by Renamo as it was so important to South African interests being dependent on its energy.

A deep economic crisis in the early eighties was precipitated by the refusal in1981 of continued financial assistance by the Soviet-bloc Council for Mutual Economic Assistance (CMEA). To confront the crisis Mozambique turned to the west, and from the early 80s a major increase in ODA took place (see Fig. A4- 3). While the dire social and economic needs of the country was a key driver for increasing aid inflows it is fairly clear that western countries to varying extents had a political interest in strengthening neighbouring countries of South Africa, which then was under an Apartheid regime.

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[3] Hanlon 1996
[4] Braathen and Palmero 2001
[5] Arndt, Jones et al. 2006
[6] Vines 1998a

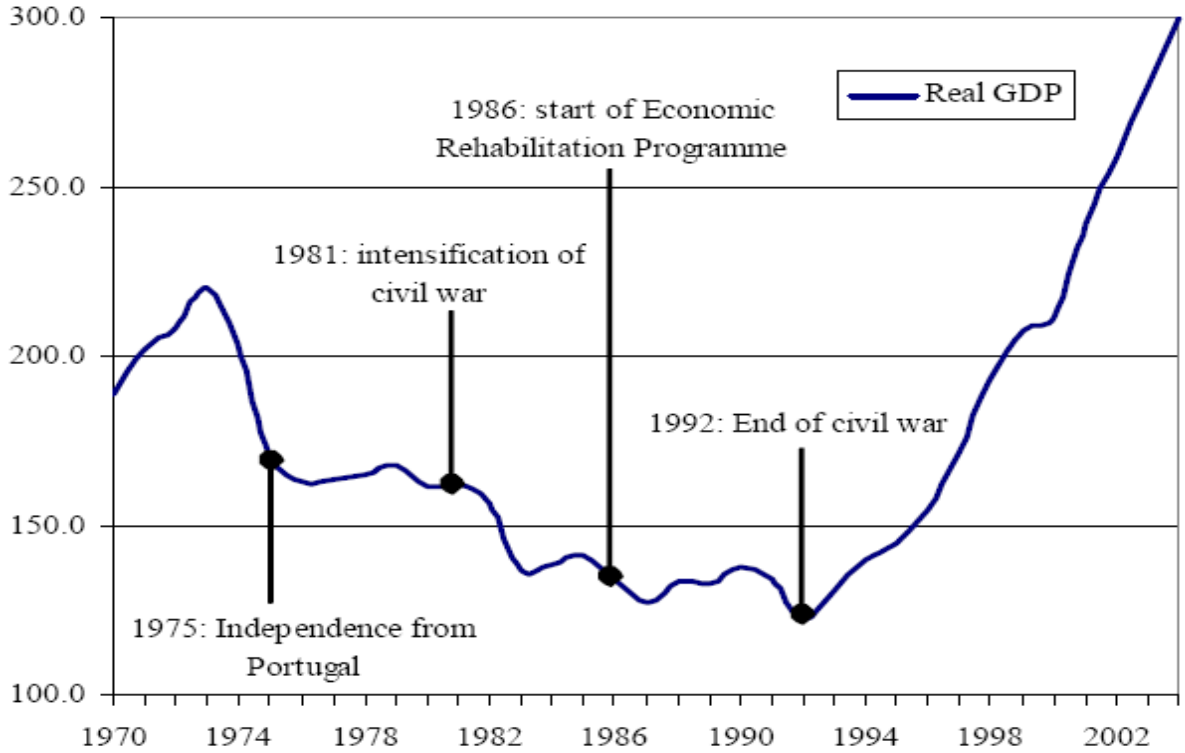

Fig. A4- 2: Mozambique real GDP 1970-2004, in billions of Metical at constant 1980 prices[7]

The overtures by Mozambique for western economic support as early as 1982 and the Fourth Congress of FRELIMO in 1983 led to market-based economic reforms. Later, in 1984, came the first Paris Club debt rescheduling agreements and the 1986 membership of the Bretton Woods institutions finally led (in 1987) to the adoption of the Rehabilitation Programme (ERP). Mozambique was then set on a path which would make it one of the most aid dependent countries in the world and, from the end of the war in 1992, would lead to a growth period which by and large still lasts.

[7] Source: Arndt, Jones et al. 2006

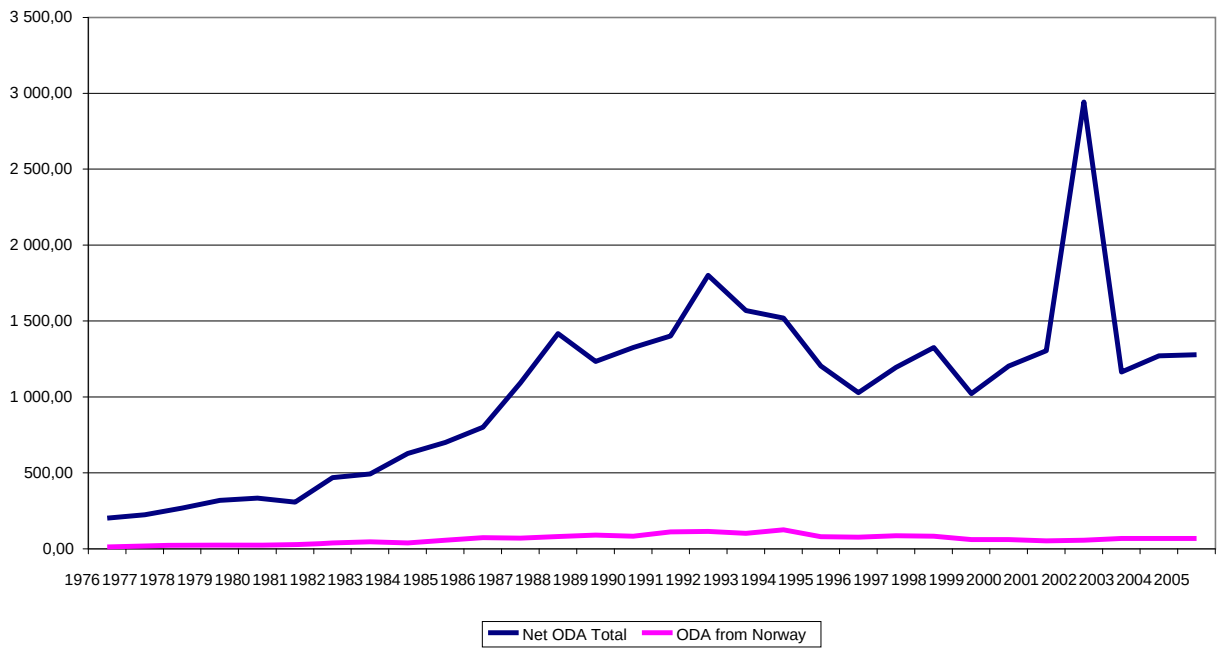

Fig. A4- 3: Net ODA to Mozambique: Total and from Norway, mill USD 2004 prices[8]

Internationally, aid in the 70s and 80s was characterized by the maturing of the aid industry and increasing cooperation between bilateral donors through e.g. DAC and the World Bank.

Aid to Mozambique from Norway started soon after independence and the country became a "main cooperation country" in 1977. During the country programme negotiations in 1977, Norway was requested to support the power sector. During the period 1978 - 86 the cooperation between Norway and Mozambique resulted in a number of project agreements including hydropower studies, construction of the small hydropower plants in Lichinga and Cuamba, pole impregnation plant, supply of equipment and spare parts, and institutional cooperation between the Norwegian Water Resources and Energy Authority (NVE) and *Electricidade de Moçambique* (EDM, the national electric utility). The financial support increased from NOK 25 million per year to about NOK 45 million per year at the end of the period.

The early period was however characterized by the war and the day to day crisis-management and, somewhat later, problems of aid absorption. Norwegian aid seemed to rest on the political imperatives rather than the efficiency and effectiveness of aid delivery. Quote: "The Norwegian aid to Mozambique during the early years is an example of how the political objectives were seen as superior to the realities and considerations of development cooperation and how an increase in the aid was independent of the difficulties of implementation of aid projects" [9] – Unquote.

Although one may criticize the attitude of aid authorities that allowed political views to override considerations of aid effectiveness it is clear that it will be unfair to evaluate aid to Mozambique before the end of the war on the basis of pure technical and economic conditions. The situation is different from the time after 1992 when the use of such methods will be appropriate.

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[8] Source: World Bank Africa database 2006 (based on OECD statistics)

[9] Ruud and Kjerland (2003) Norsk utviklingshjelps historie 2. 1975-1989: Vekst, velvilje og utfordringer. Bergen, Fagbokforlaget Vigmostad & Bjørke AS

A4.1.1.1 Economic Situation

In terms of economic development, the Gross Domestic Product (GNI) over time gives an indication.

Mozambique	1980	1990	2000	2005
GNI per capita (PPP[10] USD)	370	490	820	1,160

Table A4- 1: Development of Gross National Income[11]

A4.1.1.2 Brief on Power Sector

The features and constraints of the power sector may be summed up in numbers in table Table A4- 2.

Feature	**Mozambique**
Total Land Area	784,090 km^2
Population (2007 estimate)	20,900,000
Population Density	**26.6 pers./km^2**
Total length of transmission grid (2004)	3,568 km
Total Annual Energy sold, including at HV and MV	1,145 GWh
Total Annual Energy sold at LV	649 GWh
Total number of consumers (2004) incl. HV and MV	284,562
Total number of customers at LV	283,528
Indicator: **Energy sold per km of grid**	**321 MWh**
Indicator: **Energy sold per consumer** (incl. bulk sale at HV and MV)	**4,024 kWh**
Indicator: **Energy sold at LV**, per customer, year	**2,289 kWh**

Table A4- 2: Features and Characterising Sector Indicators

The power sector history of Mozambique is revealing, and unexpected. In 1980 and earlier, access to electricity was widespread, apparently throughout the country. Power was supplied from a large number of municipal diesel sets during colonial times. However, Portuguese operators left the country practically over night when the country gained independence, and in the civil war that followed, most electricity supply installations were damaged, or abandoned otherwise. According to graph Fig. A4- 4, power consumption nation-wide was about 4,400 GWh, as early as 1980. In 1985, it had dropped to 600 GWh, and Electricidade de Mocambique (EDM) developed the power sector over the following twenty years to reach about 1,600 GWh, still not much more than one third of consumption in 1980.

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[10] Relative PPP refers to rates of changes of price levels, that is, inflation rates. This proposition states that the rate of appreciation of a currency is equal to the difference in inflation rates between the foreign and the home country.

[11] From Global Virtual University: http://globalis.gvu.unu.edu/indicator_detail.cfm?country=MZ&indicatorid=19 for values 1980 to 2000, and http://siteresources.worldbank.org/DATASTATISTICS/Resources/GNIPC.pdf for 2005

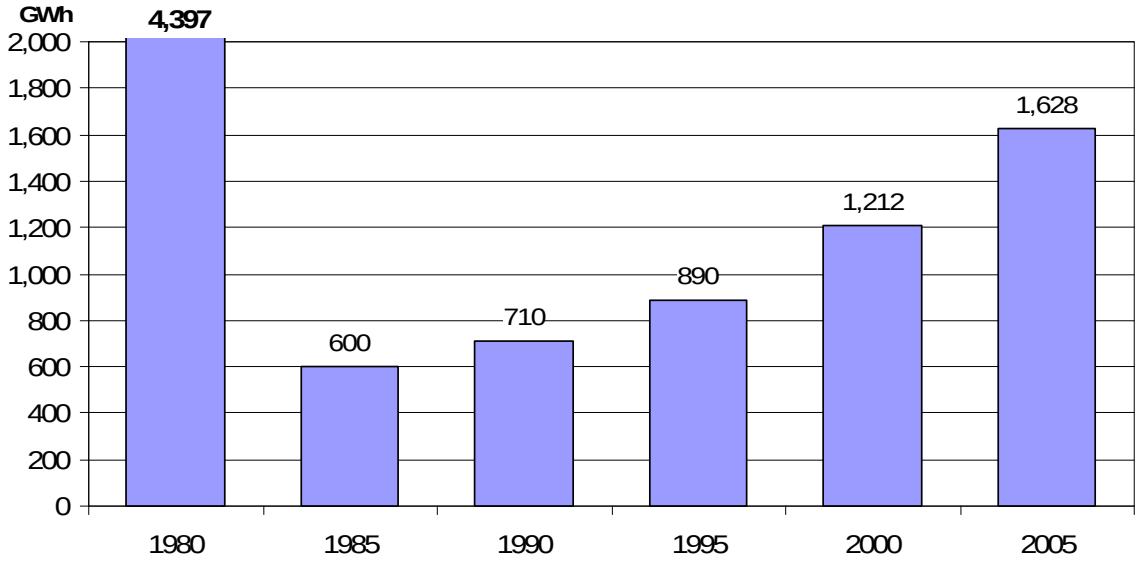

Fig. A4- 4: Mozambique: Development of Annual Electricity Consumption

A4.1.2 Total assistance provided

Norway has supported power sector development in Mozambique massively, from about 1980 onwards. It has provided about 1.622 billion NOK at current value to Mozambique.

On average, this has amounted to NOK 60 million per year, with considerable variation in actual yearly disbursements.

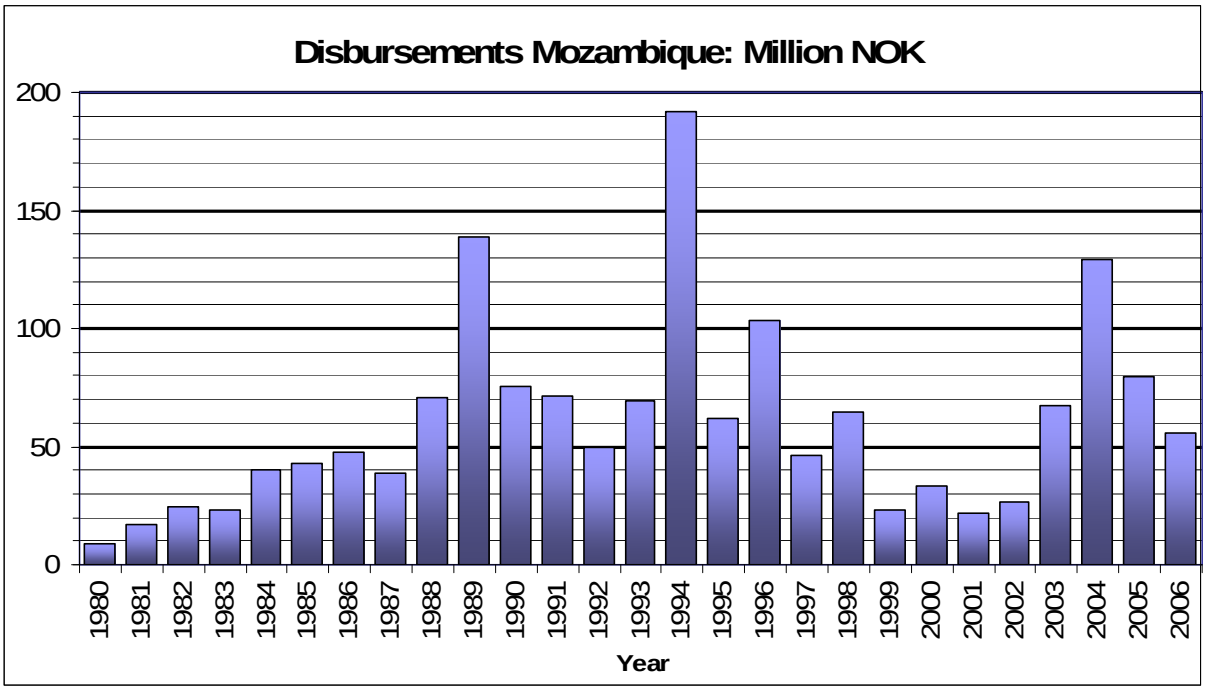

Fig. A4- 5: Annual Disbursement of Norway to the Mozambique Power Sector

The total number of major projects was about 25. Many of these were actually medium to long-term programmes. An overall summary is provided in the following table.

Period	Agreement Title	Disbursed 1,000 NOK
1981-96	030 INSTIT.SAMARB. VANNKRAFTUTBYGGING	69,925
1981-96	021 UTSTYR KRAFTSEKTOREN	428,795
1982-01	VAR OTHER SERVICES	3,264
1982-83	028 KRAFTVERK LICHINGA	19,720
1982-94	018 HYDRO POWER STUDIES	44,607
1983-90	035 CUAMBA HYDROPOWER PROJECT	67,692
1984-06	VAR CONSULTING SERVICES (14 contracts)	2,754
1987	ELECTRICITY SUPPLY BEIRA	6,377
1988-89	IDA + IBRD ENERGY T.A. REHAB.	38,830
1988-91	REG034 MWI/MOZ INTERCONNECTION	17,961
1987-98	ZIMBABWE INTERCONNECTION, STUDY+IMPLEM	171,000
1988-97	048 TRAINING & PERSONNEL FUND	39,623
1989-92	POWERSTATION + TRANSMISSION MAPUTO	57,376
1990-94	REG042 CORUMANA HYDROPOWER PROJECT	91,164
1995	NORCONSULT MOZ-SWA INTERCONNECTION	4,148
1995-98	JACOBSEN ELEC;ELECTRICITY MAPUTO PROV	19,848
1996-98	087 ENERGY SECTOR RURAL ELECTRIFICATION	76,854
1998	06 EXTEND ELECTRICITY GRID ZAMBEZIA	21,639
1998	099 COMM ASS:RECONSTR ELECTRIC GRID	25,000
1998-06	DNE (LATER ME) INSTITUTIONAL ASSISTANCE	36,700
1999-06	ASSISTANCE TO LARGE HEP PROMOTION,UTIP	34,900
2001-04	ALTO-MOLOCUE GURUE TRANSMISSION	41,847
2002	Niassa Electrification (SIDA co-financed)	190,901
2002-06	Namacurra Electrification Project, Zambezia,	41,401
2006	Pebane electrification project	40,542
2006	Sofala-Manica-Tete Electrification project	28,907
	Total volume identified (NOK)	**1,621,775**

Table A4- 3: Norwegian Assistance disbursed to Mozambique's power sector 1980 – 2006

Note: The total volume disbursed must be taken as approximate. It was found that Norad's statistical database is error prone in that a typing mistake in an identifying entry field, or a missing entry, may lead to omission of the disbursed amount in the year that the erroneous entry occurred. The total for the project in question is then not correct. Such errors were identified particularly prior to 2000.

A4.1.3 Mozambique Interventions Evaluated

- Small Hydro Studies including implementation of: Lichinga (730 kW), Cuamba (1 MW) and Corumana (14.5 MW)
- Cahora Bassa – Zimbabwe interconnection: Feasibility study and implementation
- Alto Molocue – Gurué transmission line project
- Institutional Development, in: EDM, MIREME/ME and UTIP for the promotion of mega projects
- Regional Assistance SADC/SAPP

Total assistance provided for the evaluated projects amounted to roughly NOK 500 million. This represents about one third of all assistance in the period covered.

A4.2 Small Hydro Studies and Implementation

Support has been provided by Norway to study the development of small hydro resources. This has been carried on throughout the Eighties and Nineties, but it has then been stopped. As far as is possible to determine, this decision is heavily influenced by the strategic focus on supplying the country with low-cost and abundant power from Cahora Bassa.

In the period from 1982 to 1994 about twenty studies were carried out, at a total cost of close to NOK 45 million. Only three projects were implemented. Apparently, finance for the implementation of more projects was not readily available, not in the least because of the shift to transmission grid extension mentioned above, and the realisation that the latter was likely to result in overall larger economic benefit, and that it would reach a larger part of the population in the longer term, in relation to the unit of investment.

A4.2.1 Lichinga Small Hydro Electric Project

Lichinga included the building of a small (mini) hydro power plant in the Niassa province of Mozambique. The purpose of the project was to secure supply to the local area and to save diesel cost. It also included training of unskilled workers and local personnel.

A4.2.1.1 Project Description

The small hydro scheme is located about 10 km east of the town of Lichinga. It utilizes a gross head of 52 m in the upper reaches of Lucheringo river. In order to utilize this head, an intake dam, headrace culvert, surge chamber, penstock, power house building, and a tailrace canal were required to be built. The dam is 12 m high and has a crest length of 130 m, forming a reservoir of about 66,000 m3 storage volume. The head race is almost 2.5 km long. It follows the natural topography, and spans swampy areas on concrete piles in two places, and by means of a bridge to cross a small creek.

The surge tank is 15.5 m high, with a 6 m diameter, built in concrete on a rock foundation. It is located at the end of the head race, above the penstock, and serves to provide operational stability in transient load situations. The connected penstock of 1 m diameter is 280 m long, and is made from ductile cast iron. It rests on concrete anchor blocks and is placed under ground.

The power house near Lucheringo river, but at a safe level above the high water mark, is built in reinforced concrete, and is equipped with a 6 tonne crane. It also has a small workshop for routine maintenance and repairs. From the power house, a 80 m long tailrace canal discharges the water to the irrigation reservoir of the Matama state farm.

The electro-mechanical equipment consists of a single horizontal Francis turbine with a rated output of 730 kW, and a synchronous generator, including electrical switch gear. Further, there is an outdoor transformer which transforms 400 V generator voltage to 33 kV, to feed a transmission line to Lichinga, where voltage is again transformed in the sub-station. The turbine requires 1.7 m3/s water flow for full output.

Norway provided funding amounting to NOK 19.72 million towards financing of the scheme. Local currency costs were to be borne by EDM.

A4.2.1.2 Results

Outputs

The project was carried out as planned, beginning in 1980, and the physical result was achieved successfully. Construction was completed in late 1983. Initial operation showed promising results, but it became clear then that hydropower production to fulfil the demand without supplement by diesel would only be possible during the wet season. A “final history report” was produced in June 1984. Full costs are accounted for, but the report does not give any information whether costs have exceeded initial estimates. Following are the main components of the scheme.

#	Item	Supplier
1	Design, study, construction supervision	Norconsult
2	Construction of dam and spillway	Local
3	Reservoir of 66,000 m3 volume	Local
4	Headrace conduit, power house and ancillary works	Local
5	Penstock of 280 m length, diameter 1 m	Halberger-Hütte, Norway
6	Francis turbine (horizontal type)	Sørumsand Verksted AS
7	Synchronous generator 850 kVA, 400 V, 50 Hz	Norsk Elektrisk & Brown Boveri (NEBB) AS
8	Transformer 0.4/33 kV, 850 kVA and switchgear	Norsk Elektrisk & Brown Boveri (NEBB) AS
9	Power house crane	Levahn Mekaniske Verksted AS
10	Intake and outlet gates, trash rack, service gate	Stensli Mekaniske Verksted AS
11	Various construction equipment and supplies, 4 trucks, 2 concrete mixers, 1 tractor with trailer	Various sources
	Total cost 4.18 million USD (at NOK 6.90)	NOK 28.82 million

Table A4- 4: Components and Cost for Lichinga HEP

The project resulted in the 0.73 MW power station with a 66.000 m^3 reservoir and a transformer station connecting to the local grid which was already in place. Unskilled labourers were given on-the-job training to take positions as assistant foremen and local personnel were trained to maintain and operate the plant.

Outcome

The production in the Lichinga station varies with water availability. After the transmission line reached the town, the station's importance has diminished and it is currently out of operation due to lack of maintenance. This is assumed to be due to setting priority of maintenance budgets elsewhere, and the availability of power from the grid, after the transmission line had been completed by about the end of 2005.

Impact[12]

The benefits were high in terms of boosting the morale during the war and bringing activity to this remote area, but it is low compared to the cost of investment. Included in quantitative terms is the savings in diesel expenditures over the years. Since grid extension has reached Lichinga in recent years, there is no essential need for the hydro scheme, and it was reported shut down at the time of evaluation. Such limited use reduces impact to much less than would be technically possible.

A4.2.1.3 Findings

General

Environmental concerns have been addressed and mitigation measures proposed. Gender and poverty were not seen as specifically applicable concerns.

The project has been implemented successfully in a difficult environment with a scarcity of skilled personnel in EDM as well as at the local level. This has required heavy expatriate input throughout the project. It appears that the main justification was political and symbolic: It was felt important for EDM, representing the government, to take initiatives that would demonstrate a commitment to

[12] Impact, strictly speaking, is a finding, and could be discussed in the successive section. However, it is included here in summary form, because impact is also the last stage in the “results chain”.

improve the power situation, aimed at providing local benefits, such as more reliable power supply with less dependence on imported diesel fuel.

In implementing the project, reporting requirements have been met, and a final history report was prepared by the consultant and supplied to the client. Reporting was limited to immediate outputs of the project. Longer term results monitoring and reporting were not specified or required by the donor, and consequently not done.

Quality of Inputs

A detailed inspection of the entire plant, done in June 2006, has found all components in generally good condition, but to an extent lacking in maintenance[13]. Plant and equipment were 23 years old at the time of inspection, and the condition it was found in indicates good quality of workmanship and materials. This finding supports the general impression from the final report, that considerable care was taken about the quality of work done and components delivered.

Efficiency and Effectiveness

Cost-efficiency has not been good, as unit cost of construction were very high. A total cost of USD 4.18 million is shown in the project records, resulting in more than 5,720 USD/kW. This is high for the time in question by any standard. There are a number of reasons for this:

- A plant of this size, with a relatively low head, but including a storage reservoir tends to have high costs.
- Except for unskilled and skilled workers, engineering and supervision required expatriate personnel.
- Equipment was imported from Norway, and needed to be transported to a remote location.
- An implementation set-up needed to be built up from scratch, and it needed to be equipped with tools, machines and trucks. Most of these costs are included in total project cost.

Effectiveness

Effectiveness was good, as the objective of constructing the hydro scheme was fully achieved.

Relevance

EDM felt the project to be highly relevant at the time, with the motive of needing to do something for the local people. In economic terms, relevance was over estimated. The project in fact, was and is not economically relevant in view of the limited energy it produced. Letting the plant sit unused since more than a year, further reduces its overall relevance.

Sustainability

When the transmission line reached Lichinga, further operation of the scheme was not maintained. Minor maintenance problems with the transmission line led to shut-shown of the plant. Sustainability is therefore low.

Benchmark and Economic Benefits

In comparison with all other projects included in the evaluation, the Lichinga HEP shows very low impact and sustainability, moderate efficiency, and average effectiveness and relevance. The graph Fig. A4- 6 of accrued net benefits also indicates that the project will not recover the investment over the technical life of the installation.

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[13] Inspection of Hydro Electric Power Station Lichinga, Norconult, June 2006

Benchmark factors compared to all other interventions						Net benefit over useful lifetime: 25 yrs	
	Efficiency	effectiveness relevance	sustainability	impact country	impact poor		mill USD
Lichinga	68%	100%	25%	18%	41%	country	1
best	249%	129%	115%	273%	278%	the poor	0.2
Worst	16%	78%	25%	7%	18%	project	-6

Table A4- 5: Lichinga Benchmark of DAC criteria and net benefits

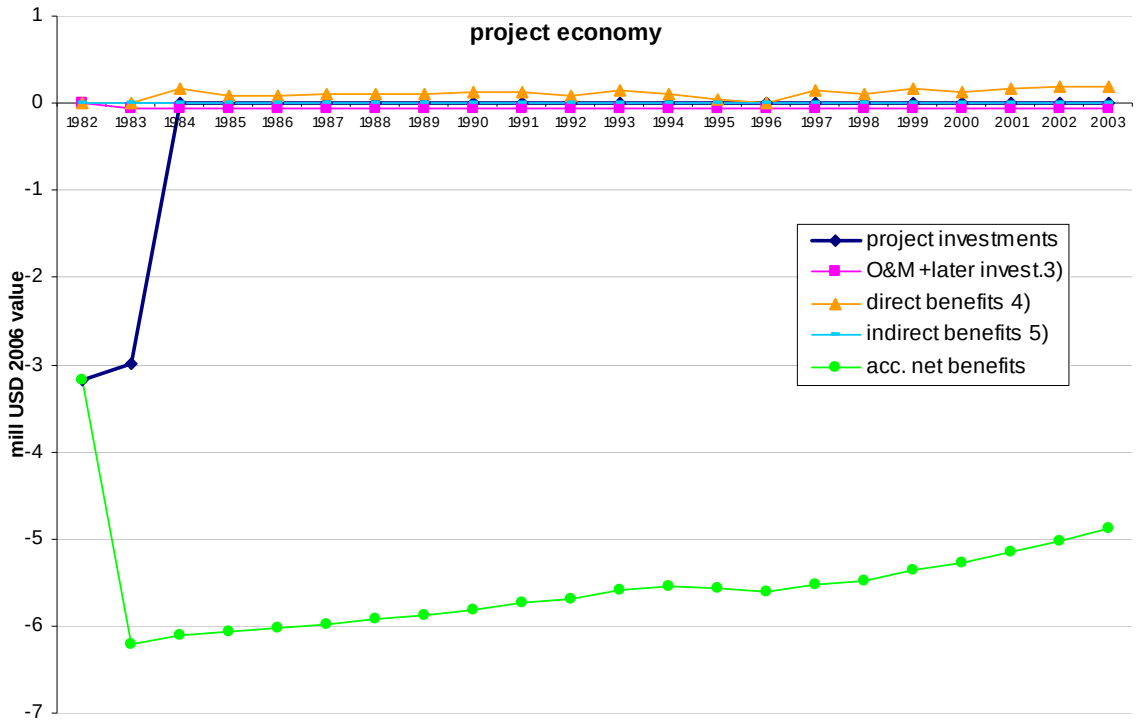

Fig. A4- 6: Lichinga HEP Economy

A4.2.1.4 Conclusion

The project was implemented successfully under adverse conditions. It has provided power to Lichinga at a time when diesel generation was not able to meet requirements. However, this was at high costs and to a limited extent. The benefits from the scheme have been limited due to a lack of water in the dry season, and due to its stand still practically soon after the national grid reached Lichinga.

A4.2.2 Cuamba Small Hydro Electric Project

The project is of a similar nature like Lichinga. However, the rationale for its implementation was also seen as an opportunity to further build up implementation capacity.

A4.2.2.1 Project Description

Cuamba included the building of a small hydro power plant in central Mozambique to replace diesel and secure supply in a nearby area. It also includes training of local personnel to operate the plant. The initial grant made available amounted to NOK 47 million, to be used for imported equipment and materials, as well as consultancy costs, while local costs were to be met by EDM. And agreement to this effect was signed in September 1983, and completion of the project in March 1987 was planned.

Due to war the project period was extended from 38 to 70 months and the cost increased by 37%. This resulted in total grant fund allocation of NOK 66.758.000.

Objectives

To supply electric power to the Cuamba area, and to extend the experience in the construction, operation and maintenance of small-scale hydro-electric power plants, which had been gained under the construction of the Lichinga scheme.

A4.2.2.2 Results

Outputs

Outputs included the 1 MW power station, a 2.600 m3 reservoir and some high voltage distribution grid. In addition 35 km of roads were upgraded and ca 10 km built to allow the necessary transports. EDM personnel were trained to operate the station.

The project consists of a 21 m high rock/earth fill dam, a 2,160 m long headrace pipe, and a power plant containing two Pelton turbines with an aggregate capacity of 1 MW. The available head is 350 m, hence it is a high head scheme. Firm power of the plant was planned to be 320 kW. Due to the high head, a flow of only 0.19 m3/s. is required for full power output.

Outcome

The power is transmitted to Cuamba town through a 28 km long 33 kV transmission line. This has improved the power situation, as previously the Cuamba diesel supply was notoriously unreliable.

The production in the station varies with water availability, but has generally been much lower than the estimated average production capacity of 5.6 GWh. After the transmission line reached the area, the station's importance has diminished and it is now out of operation due to lack of maintenance. It is assumed that production will resume and continue for the remainder of the technical life time.

At a cost of NOK 47 million, the scheme had been calculated to produce power at a cost of USc 30 /kWh, equivalent to diesel generated power at that time. In reality, unit costs turned out to be much higher, as costs had increased by about NOK 20 million.

Impact

The benefits were high in terms of boosting the morale during the war, but the financial benefits are low due to the high cost of investment. Included here is only the savings in diesel over the years, since the area already had diesel power; albeit of low regularity.

A4.2.2.3 Findings

General

Cross cutting issues have not been specifically elaborated on in any project documentation.

The consultant prepared a “Final History Report” of the project in September 1989An official completion document was prepared by Norad in April 1996. It held that the partners had fully met all obligations. The cost overrun of about NOK 20 million was attributed to: a) the fact that the

construction period needed to be extended by almost 3 years, b) the need to buy and operate a small aircraft, because over land travel had become too dangerous in the war situation., and c) the need to buy local materials in Malawi, where costs were high.

The final report of the consultant gives a detailed account of costs, fully explaining the massive cost overrun. It is noted that one single item, air transport, including purchase and maintenance of a small aircraft and the employment of pilots accounted for a cost increase of NOK 8 million. Norad funds were directly disbursed to contractors and the consultant, and there was no obligation for EDM to provide audited accounts.

Reporting was limited to immediate outputs of the project. Longer term results monitoring and reporting were not specified or required by the donor, and consequently not done.

Environment

It is found that a number of environmental issues have been identified by the consultant during project implementation and in the final report. Several issues regarding potential water pollution, and other negative impacts on the local population near the dam were analysed, and mitigation action recommended to the government. The project did not follow up on these concerns, and it is not known if any action had been taken by local or central government agencies.

Efficiency

Efficiency in terms of translating inputs into outputs was low, mainly due to the war situation, delays, and poor transportation infrastructure. Total costs, including local costs of EDM of NOK 27 million equivalent, are estimated at about NOK 94 million in total. This brings cost per kW of installed capacity to NOK 94.000, or about USD 14.500/kW. At such high unit cost the plant could not ever have been considered economically viable.

Effectiveness

The project, despite the adverse situation, was effective in achieving its objective of improving local power supply and implementing various social projects.

Relevance

The project was of high political relevance, and it had some limited economic relevance. It appears that the spontaneous support to local social institutions, which the project provided, were highly appreciated, and very much needed at this time of war.

Sustainability

When the transmission line from Gurué reached Cuamba, operation of the hydro scheme was not considered important any more. Due to some operational problem, the scheme has been shut down. Hence, it cannot be regarded sustainable, unless an effort is made to re-commission the plant, and maintain it in the future. In this, automation of the scheme may be helpful.

Benchmark and Economic Benefits

In a comparison with all other projects, the benchmark shows the lowest rating in terms of efficiency, a low rating in sustainability, very low impact, but above average relevance and effectiveness.

Benchmark factors compared to all other interventions						**Net benefit** over useful lifetime: 25 yrs	
	efficiency	effectiveness Relevance	sustainability	impact country	Impact Poor		Mill USD
Cuamba	16%	112%	42%	13%	37%	country	3
best	249%	129%	115%	273%	278%	the poor	0.7
Worst	16%	78%	25%	7%	18%	project	-16

Table A4- 6: Cuamba HEP Benchmark of DAC criteria and net benefits

Project economy is such that the investment will not be recovered during the technical life of the project (see Fig. A4- 7). It is noted that a break even of the project would not occur, even under an assumption of benefits increased by a factor of 5.

The benchmark results are confirmed by the above verbal assessment of DAC criteria, and this is supported by the shown graph of economic benefit.

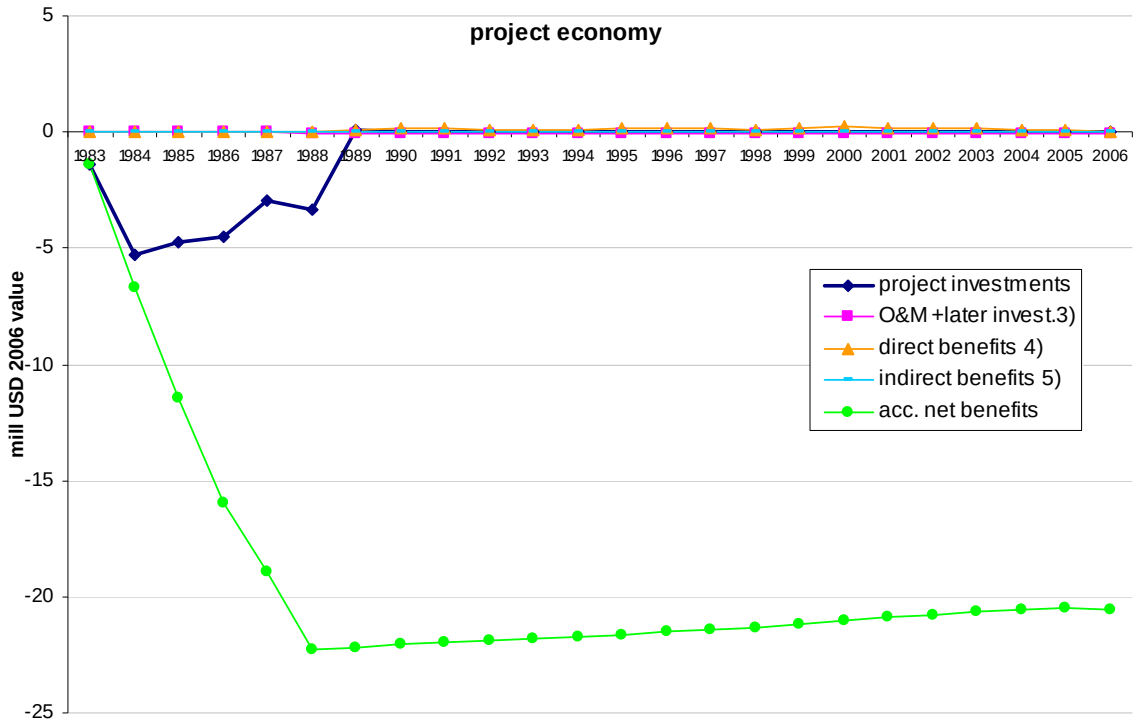

Fig. A4- 7: Cuamba HEP Economy

A4.2.2.4 Conclusion

With hindsight the project was a doubtful investment, but it is fair to state that the massive cost overrun could not have been foreseen. Despite an extremely difficult situation the project was successfully completed after considerable delay. In financial terms, Norway has born the risks by taking on all cost overrun.

In terms of environmental management, the risks and problems have been identified, and corrective measures have been suggested. This may or may not have been adequate action from the project at that time, it is not possible to ascertain. The evaluation finds that today, responsibility would go beyond what was actually done: the project should be responsible for making sure that mitigation action is being taken, and not limit itself to make recommendations.

A4.2.3 Corumana Hydro Electric Project

The site of the Corumana scheme is close to the border with South Africa and Swaziland. Regional relevance was therefore assigned, and the project was financed under the "regional heading".

A4.2.3.1 Project Description

Corumana included the building of a hydro power plant in southern Mozambique to exploit a water reservoir which was already in place. The distance from the border with South Africa is about 10 km, while Maputo is 140 km far away.

The purpose of the project was to secure the power supply to Maputo and thereby reduce the dependence upon supply from South Africa which was under the apartheid regime. The project was also assigned importance with regard to the relationship with Swaziland. The project was budgeted at NOK 105 million, to be funded about 50/50 by Norway and Sweden. Norway administered the project on behalf of both donors.

For reasons referred to below, total project cost reached about NOK 183.5 million. Norwegian disbursements show a total amount of NOK 91.164 million.

A4.2.3.2 Results

Output

A feasibility study was completed 1984, and this served as the basis for project implementation which was taken up in 1988. Construction was completed in 1991

Outputs include the power station of 14.5 MW installed capacity and the sub station to the transmission grid. Civil works required were minor, because of the existing dam. A transmission line of 110 kV to evacuate power to Maputo is also not part of the project, as it had been built under separate funding.

Outcome

Even before construction had started, EDM was informed by the authority responsible for the dam, that the flood gates foreseen would not be installed any time soon. This resulted in a lower head for the scheme than anticipated, affecting possible maximum output and production volume. For this, and possibly other reasons, the production has varied and has generally been considerably lower that planned. Further, in 1993 the Department of Water resources wanted to impose a fee on the water used. The dispute led to minimal production in 1994. From 2003 onwards EDM pays for the water used. Due to costs involved, production has been limited to peaking power, but is expected to increase in the future due to power shortage.

Impact

Initial high political impact in demonstrating reduced dependence to South Africa. The change of the situation with South Africa, and the difficult co-existence with the water authorities have then reduced the benefits of the Corumana station. The savings come from reduced imports from South Africa valued at about 2 US cent/kWh[14]. Half of this is paid to the Water Authorities for the water and considered in the benchmark as a local tax (from 2003 onwards). The station may have contributed to better quality of supply in Maputo, but this could not be quantified.

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[14] Value determined by EDM. It may be argued that the savings per unit have been much higher during the war. Even if so, due to low volumes produced, this does not change overall negative economics of the project.

A4.2.3.3 Findings

General

In retrospect, the regional justification for the project, i.e. the expectation to export power to Swaziland, and to lessen the dependence on South Africa for Maputo have been overstated expectations in itself. When the facts of almost 80% cost escalation, the permanently lacking flood gates that reduce effective head, and the water charges levied are added, it becomes evident that the project largely failed to achieve its objectives. It appears that the external risks related to the situation in South Africa and Swaziland on one hand, and related to the partnership with the water department on the other hand, were not assessed. So, the scheme has been of very limited use in terms of power generated, and the cost at which it is doing it, so far. A more positive aspect is that it may well gain in importance in the future, if regional power shortages increase. It may then find late justification.

Reporting was limited to immediate outputs of the project. Longer term results monitoring and reporting were not specified or required by the donor, and consequently not specifically done. This lack of monitoring is compensated, at least to a degree, by routine operational data collection of EDM, that applies to all generation plants.

Efficiency and Effectiveness

Investment cost amounted to about USD 1.800 per kW. Given the fact that the dam and reservoir already existed, the cost is high, and good efficiency cannot be considered achieved. The project was effective in making a political statement, but it was relatively ineffective in terms of achieving the projected economic goal. The cause is that the plant could never operate at its full potential due to the failure of installing proposed flood gates. Moreover, the water department insisted on payment of water charges, which EDM actually pays from 2003 onwards, that had not previously been counted on.

Relevance

Relevance turned out to be much inferior to what had been argued in the planning phase. Due to high operation cost, the scheme is today only used for peaking, to cut the high demand charge of Eskom to an extent.

Sustainability

With the investment written off, operation of the scheme to provide peaking power appears sustainable, but at a level of very partial productivity.

Benchmark and Economic Benefits

All criteria show poor results, as is shown in Table A4- 7. This supports the verbal assessments above.

Benchmark factors compared to all other interventions						**Net benefit** over useful lifetime: 25 yrs	
	efficiency	effectiveness Relevance	sustainability	Impact country	impact poor		Mill USD
Corumana	65%	84%	60%	7%	38%	country	3
Best	249%	129%	115%	273%	278%	the poor	0.12
Worst	16%	78%	25%	7%	18%	project	-33

Table A4- 7: Corumana HEP Benchmark of DAC criteria and net benefits

See graph Fig. A4-8 on the next page for economic indicators.

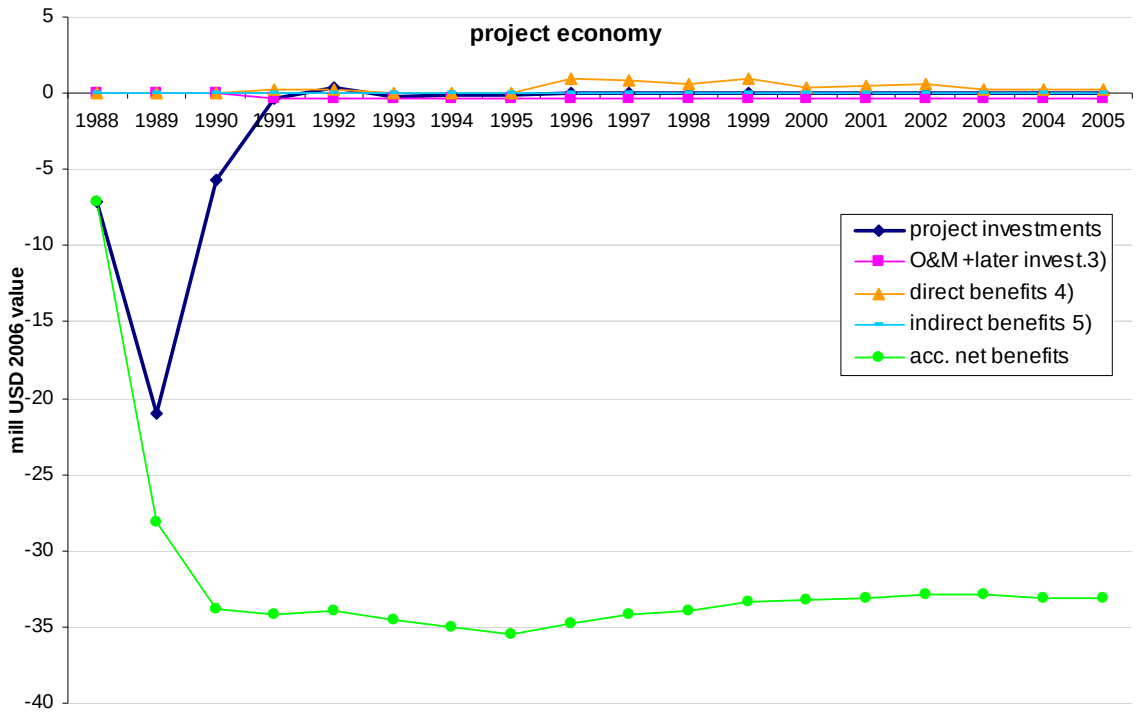

Fig. A4- 8: Corumana HEP Economy

A4.2.3.4 Conclusion

The Corumana HEP appears to have been implemented with mainly political motives. The benchmark shows comparably very low impact, low sustainability and efficiency and below average relevance, not considering the political signal sent to South Africa. The graph **Fig. A4- 8** indicates that the investment will not be recovered. There is no net benefit to be expected. Because of low productivity, this picture does not change, even if the value of benefits, such as greater power supply reliability in the event of unavailability of the Cahora Bassa transmission line, is assumed increased several times. Due to the water charges that need to be paid, operating costs are high, limiting the plant to peak power production. While this is valuable, it is unlikely to result in break even of the project during its remaining economic life.

A4.2.4 Summary on Small Hydro Activities

The study of small decentralized hydro development in Mozambique was a commendable concept at the time. It was considered to be able to supply more reliable power at lower cost than the failing diesel plants in the municipalities. Implementation of just three of the schemes proved to be difficult under partly very adverse conditions. Costs were high, and predicted economy could not be achieved in any of the projects. Poor economy, and a change of focus in the development strategy, adopted when rehabilitation of Cahora Bassa became an expected reality, led to a loss of interest in small hydro. The programme was discontinued, and this also resulted in the loss of built up capacity and competence for implementation.

It appears that the entire sub-sector activity was dominated by one single Norwegian consulting company (Norconsult), who provided all services required, such as: Planning, surveying, economic analysis, tendering, construction supervision and management. Its mandate was going on for many years, and for a period it was the mainstay of the business of Norconsult Mozambique. In an internal review of past activities[15] Norad criticizes EDM for not taking charge of the project, but leaving it all to the consultant. EDM, on its part, has stressed in reports of that time and in interviews, that it simply did not have the personnel resources.

As for the benefits accruing to other Norwegian stakeholders, it was equipment suppliers for hydraulic and electrical equipment that were involved. These firms are not in business anymore today, or have been merged with others. It was therefore not possible to obtain any information, but it may be assumed that the contracts were relatively small, and not of major importance.

Regarding benefits for Mozambique, in summary, all the schemes show relatively poor overall performance, with decreasing production in recent years, and an overall low utilisation factor (Table A4- 8). This is particularly pronounced with only 18% utilisation in the comparably large Corumana scheme. Speaking for all plants, poor performance is due to poor hydrology, lack of cooperation and coordination at the national level, and loss of interest at the EDM local level in the longer term.

An acceptable minimum plant performance, which could eventually have led to economic break even, would be approximately 40% by a widely accepted rule of thumb. As far as water is available, it is possible to move closer to this mark in the remaining technical life of the schemes, but it will take a reactivation effort, and high-standard future maintenance. In this connection, full automation of the schemes would help, and should be looked into.

SMALL HYDRO SCHEMES					
Station Name	Installed Capacity (kW)	Cumulated production (MWh) per time period			Average plant factor %
		1980-90	**1991-00**	**2001-05**	
Lichinga	730	9,120	19,778	12,612	31%
Cuamba	1,000	3,240	26,016	12,460	28%
Corumana	14,500		213,051	95,241	18%
Total	16,230	Total for period 1980-2005		**391,518**	

Table A4- 8: Production and overall Plant Factor of Small Hydro Schemes of EDM[16]

[15] MOZ 042 – Prosjektskisse, elektisitetssektoren, Norad 3.Afrika, 18.6.1991

[16] Data from EDM Annual Reports and internal data. Plant factor calculated by the evaluation against design capacity full output.

A4.3 Alto-Molocue – Gurué Transmission Line

Gurué is the most important centre of tea growing in Mozambique. Tea processing industry was traditionally powered with individual diesel sets, only in part owned and operated by EDM, and the immediate goal of the project was to supply industry with reliable grid power. A more strategic goal was to extend power transmission northwards to Gurué, from where it could later be extended to Niassa province, by way of Cuamba to Lichinga.

Other formulated objectives were:

- Provision of a reliable all-year electricity supply through a 33 kV line to the 14 tea estates and their factories.
- Provision of an extended and improved distribution system to Gurué town through medium voltage distribution extension and low voltage distribution rehabilitation.

In the document[17] justifying the project, a demand forecast for Gurué was presented reaching a peak load of about 5 MW, up from 0.2 MW in 1996, with an expected energy consumption of 17 to 22 GWh in 2006.

Norway provided a total of NOK 64.8 million for the implementation of the project.

A4.3.1 Project Description

The project consists of a regional transmission line from Alto Molocue to Gurué and a transformer sub-station and local distribution in Gurué. It was initially started up in the eighties when most of the equipment was purchased, but due to the civil war the project was postponed. The purpose of the project was to replace the local diesel fired power plant in Gurué with grid electricity and to facilitate electrification of the area.

The project consists of two main contracts, one for the construction of a 110 kV transmission line between Alto Molocue and Gurué substations and the other contract for the design, supply and erection of a new substation in Gurué. The transmission line contract also includes design, supply and erection of a 33 kV distribution network in the Gurué area.

Linjebygg AS from Norway had been awarded the contract for the lines in the project. Jacobsen Elektro AS, also from Norway, had the contract for design, supply and erection of the new substation in Gurué.

Oslo Energi Konsult's contract for engineering services also included an appointment as "The Engineer" in accordance with the FIDIC (International Federation of Consulting Engineers) definition. To co-ordinate, serve and supervise the other parties, Oslo Energi Konsult (that became Eco-Partner), had established a site office at Gurué.

Project implementation suffered from delays for a number of reasons, partly the responsibility of one of the contractors, customs difficulties, a fire in which steel parts on stock were damaged, and quality deficiencies that needed replacements.

The implementation process was complicated due to the fact that most material had been on stock for more than ten years, but its condition was not known in all detail. A case in point was a transformer. A defect in insulation was only discovered when it was connected.

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[17] Alto-Molocue to Gurué 110 kV Transmission System, EDM Project Memorandum, November 1996

A4.3.2 Results

A4.3.2.1 Outputs

The project resulted in the 75 km 110 kV line, the RT station for Gurué town and 42 km of high voltage distribution and 12 distribution stations in the area. It also provided on-the-job training for unskilled and skilled workers in construction and maintenance. Local distribution line rehabilitation and customer connections are also included in the outputs and in the costs.

A4.3.2.2 Outcome

Energy transported on the line has shown a rapid increase partly due to increased consumption as new customers are connected and electricity use per customer increases, but also because the output from the local hydro- and diesel stations have gone down. The grid connection and rehabilitated local distribution network has ensured delivery at an acceptable quality level. The future increase is assumed to follow 50% of historical trends.

	Before	**After**				
	1996	2002	2003	2004	2005	2006
GWh	**1.93**	**3.88**	**4.54**	**5.31**	**6.04**	**7.37**
Clients	500	1,021	1,194	1,379	2,082	2,917

Table A4- 9: Development of Power Consumption in Gurué: 1996 – 2006

Source: EDM Distribution centre Mocuba

A4.3.2.3 Impact

The main benefits are replacement of diesel power and local electrification, including replacement of kerosene for lighting, and indirect benefits from commercial activities, higher level of education, health benefits, and other public services. Also, the basis for further electrification of Niassa province has been established as the transmission line is a pre-condition for the transmission line project Gurué - Cuamba - Lichinga. The socio-economic impact has been studied through a field survey, and results of this are elaborated in the discussion of findings (paragraph A4.3.3.7).

A4.3.3 Findings

In addition to general findings, the five DAC criteria are discussed here: Efficiency, effectiveness, relevance, sustainability, and finally rural impact, based on the field survey conducted. A full description of the field survey and its results is attached as annex 6.

A4.3.3.1 General

The bilateral agreement on the project stipulates that EDM, as the responsible recipient shall strictly adhere to Mozambique's Environment Law. To support the recipient, E-CO-Partner of Norway was assigned as the client's engineer, with terms of reference specifying the various supervisory tasks. Control of adherence to environmental concerns was not specified. There is, however, some evidence that routine environmental concerns were addressed by the consultant. Gender and poverty were not deemed applicable concerns in the project. No internal or external risk factors were identified.

The transmission line project connecting Gurué (and later Niassa) to Cahora Bassa power, has been successfully implemented, within budget, but with a time delay due to slow performance of a contractor.

The transmission line is of significant importance to the tea industry in the area, and it stimulates the economy of the municipality and its surroundings. The project has not targeted rural electrification of villages and hamlets along the line. It has also not emphasized connection of poor households, for most of which electricity remains inaccessible because of cost. It appears that poverty has decreased in the area, but this cannot be attributed directly to electricity access, but is thought to be the result of an overall improving economic environment, to which electricity definitely contributes. Economic

growth is seen to follow the general trend in Mozambique also in Gurué, and it is attributed to a combination of aid interventions, revitalisation of industry and commerce, particularly in the agricultural and tea sector, aided by improving transport, public and power infrastructure. Resulting increased employment and incomes also gives raise to growth in the informal business sector. The latter appears not to be driven by access to electricity, but by increasing market demand for services. Many of the small businesses of micro scale benefit the poor.

Reporting was limited to immediate outputs of the project. Longer term results monitoring and reporting were not specified or required by the donor, and consequently not done. Monitoring of electricity consumption is done by EDM. However, this is specific to the distribution centre (Mocuba), and not to the transmission line project.

A4.3.3.2 Quality of Inputs

Norad, through NVE had prepared specifications for quality assurance through contracting a "clients' engineer". Oslo Energi was awarded a FIDIC contract by EDM for that role. The engineer took charge of this role and monitored the construction contracts.

Contracts were awarded to Jacobsen Elektro for the works related to the sub station, and to Lijebygg for the erection of the transmission line. There were some quality and specifications issues with some of the equipment, and resolving these cost time. Eventually, all work was completed in acceptable quality. Reporting by the engineer to the donor and the client was complete and timely, and provided cost transparency.

Funding	Available amount [NOK]	Jacobsen Elektro [NOK]	Linjebygg [NOK]	E-CO Partner [NOK]	NVE [NOK]	Un-allocated funding
Original Contract	**51.367.450**	22.920.000	23.746.000	4.235.000	335.997	130.453
Contingencies	6.632.550	1.146.000	5.274.800	211.750		
Addition June 2000	3.800.000	1.154.000	2.634.433			11.567
Addition June 2001	3.000.000	0	1.700.000	1.275.000		25.000
Total Budget	**64.800.000**	25.220.000	33.355.233	5.721.750	335.997	167.020
Contract expenses		23.983.291	33.812.135	6.536.450	233.583	
Balance/reallocation	234.541			132.127	102.414	

Table A4- 10: Financing and Total Cost of the Alto-Molocue – Gurué Project

A4.3.3.3 Efficiency

There have been several delaying factors in project implementation that have increased costs. According to the client, at least in part, this has been due to inefficient work in the phase of material ordering and transport on the part of the contractor. To be fair, it is also documented that the contractor had to deal with new customs regulations that were not well understood. There is no basis for comparison of unit cost, because a good part of the material was already on stock, and it is not clear what needed to be procured. Overall, efficiency may be assessed moderate.

A4.3.3.4 Effectiveness

The project was effective in achieving the immediate goal of providing sufficient and reliable power to industry, businesses and the public sector. It was less effective in achieving the projected growth in power consumption, and economic success, which was grossly exaggerated when compared to actual consumption growth. The transport volume in 2006 is estimated at 7.4 MWh, against the projected target of 17 to 22 MWh, i.e. less than 44%.

A4.3.3.5 Relevance

There are several areas of high relevance:

- Reliable supply to the industries and economy of Gurué

The field study reveals that electricity supplied, especially to the industries, is more reliable and cheaper than previous alternatives of using own diesel generation. When production is increased and more power is needed, this is easily provided by the grid, while any dedicated generator would ultimately come to a limit, and units would need to be added. Hence, not only operating costs are saved but future investments in generation is avoided.

- Basis and precondition for the grid-based electrification of Niassa

In building out and extending the transmission network in the country, the project is indispensable, in particular with regard to supplying power to Niassa province. This has already happened in the mean time, thanks to the project under review, and another more recent transmission project reaching Lichinga, also financed by Norway.

- Indirect benefits of electrification accrue to the entire population

While, as mentioned above, only few of the households received direct access to electricity, the whole population within the reach of the grid gained indirect benefits. These are found in education, health, and other public and private services, personal security and last but not least, a growth in employment.

A4.3.3.6 Sustainability

The transmission line is sustainable. On the basis of increasing transport volumes due to extension to Lichinga, the line has become a very important section of the transmission system that must be sustained. Because of good quality of the line, technical sustainability is assessed as high, assuming that necessary maintenance is done routinely.

A4.3.3.7 Rural Impact

The following is summarised, and drawn from the rural field study. Full details are in Annex 6).

Overall, the people's living standards, conditions, and livelihood have improved moderately. Family size has slightly increased but so has the number of rooms in the average dwelling. Subsistence agriculture is still the main occupation but home business activities have increased by 50% though very few new types of businesses have appeared. Moreover, only about a third of all businesses require electricity as a production factor. Overall, therefore, improvements at the home or household level are directly attributable to the availability of electricity for a significant minority of our interviewees. Indirect effects and favorable impacts on the socio-economic environment have also occurred as discussed in other sections.

Impact on Earnings and Employment

Of the respondents, 26% reported that a family member had found permanent employment after the project came. An additional 7% reported that a family member had gotten casual employment. Two family members in different households had actually worked on the electrification project as stone masons or construction workers for the assembly of the high tension poles.

Electricity has increased the opportunities for small businesses while also stimulating competition. Electricity helps those who are clever, understand market mechanisms, and can exploit niches to grow their businesses.

The Energy Situation and Electricity

The major energy need is for cooking. Before the project, 85% of the families use fuel wood for their cooking needs. Today, it is 79%, and of these, the share using it only sometimes has increased. A significant shift has been towards charcoal: an increase of more than 20% against the reference year, and those that use it frequently have increased quite dramatically. Those that never use electricity for cooking have decreased somewhat, 12% use it for cooking, but only 2% do it very frequently. Gas and kerosene are not important for cooking. Only an insignificant number of households use fuel wood, charcoal, kerosene or gas for any other purpose than cooking.

Fuel wood is obtained by about half by collecting it, the others buy it. Collecting wood requires more time than before the project: two thirds of the respondents need two hours or more, while earlier, the

percentage was 56%. Those needing less than half an hour today are 15%, while it was 20% in the earlier period.

The main use of electricity is for lighting. 79% of the respondents use it today, against 42% before the project. 75% of those using electric light have between 4 and 8 light bulbs in their home. Six percent have fewer, the rest more. The use of kerosene for lighting has disappeared, but more candles are used as backup..

Electricity also has replaced dry cell batteries to a significant extent. Dry cell battery energy costs at least a factor 20 more than mains electricity. This results in a seemingly small but very important saving, as people have little money available. Other uses for electricity is for Television, (80% use it against 5% before), a surprising number of different appliances, and the home business. Cell phones did not exist before, now almost two thirds of the respondents use one, often limited to receiving calls because of cost.

Supply of Electricity

EDM applies a differentiated tariff, depending on a number of factors: consumer category, such as domestic, commercial, agricultural or industrial, the level of consumption, and the level of load, as well as the voltage level of supply. It is seen that the social tariff is heavily subsidized: Consumers with a monthly 100 kWh or less, pay less than half of the next domestic category. The domestic tariff is progressive, and ranges from MZN 1 per kWh to about MZN 3 per kWh. All categories, except social tariff, also pay a connection charge, recurring fixed charges, and have to make a deposit.

The quality of supply, according to some respondent's perception, has decreased, but this has been contradicted by others who said the opposite.

Social effects

Security: The number of people that use to leave the lights on during the night has increased. The perception is that it gives better security.

Night Activities: People that are connected to electricity like it for the convenience and the extra hours it gives them to interact with their friends and family. Some have also started to work at night to earn income. Women have more work to do, and now work longer hours at night. Entertainment (TV) has become an important night activity. Those that have a TV have it on several hours every evening. Hence, with electricity, evening activities increase in both entertainment and work and may well reduce the time for resting.

Education: Undoubtedly, electricity increases opportunities for people to study during the evenings. With electricity, technical courses—including computer classes—were introduced in the city and have attracted significant demand. However, as many interviewees said, though electricity brings more opportunities for longer hours of light, one cannot measure its pedagogical impact in isolation. Many other factors are at play.

Health: Electricity has brought good results and increased trust for the health sector. Modern machines were brought to the district, surgeries are now possible, and medicines, including vaccines, can be stored in fridges, which is very important for the national vaccination campaigns. With increased lighting at night, people also feel more confident to go at any time to the hospital to get treatment.

Findings on Industry

The tea industry of major importance for Gurué, and it has been revived after reliable electricity became available. It is the major driver for economic growth in the area, but some other firms in the agro-industrial sector are also important. More than 7.200 persons are employed, although most of these are on daily wage employment (about 90%). Only few women work in industry, but in some tea companies the share of female leaf collectors is 20%.

For all the firms, electricity is of major importance. Some would not have opened without grid supply, others need grid supply because their own generating equipment is getting old, unreliable and expensive. All firms today use significantly more electricity than before, on average plus 50%, in one case almost 70%. Industrial production has shown considerable growth over recent years, and various companies have invested amounts from USD 20.000 to one million.

It appears that the reliability of supply is improving, seen by reduced use of stand-by generators. Some of the industrialists praise this reliability and are very satisfied about the situation, while others complain that there are still power cuts, and that electricity is too expensive. However, comparing tariffs of EDM with today's cost of diesel generation indicates a saving of about two thirds on electricity.

A4.3.3.8 Benchmark and Economic Benefits

Table A4- 11 shows benchmarks for efficiency at less than average, effectiveness and relevance near, but somewhat below average, while sustainability and impacts are calculated at above average. The direct impact on the poor however, is only a fraction of the best performer, simply due to the fact that none, or very few of the poor households, are connected. To be fair, it needs to be recalled, that this was not the intention in the first place. The graph Fig. A4- 9 shows that positive net benefits will accrue over the life of the project. Such benefits will be larger than shown, if future consumption growth turns out to be above the assumed half of historical trends.

Benchmark factors compared to all other interventions						**Net benefit** over useful lifetime: 25 yrs	
	Efficiency	Effectiveness Relevance	sustainability	impact country	impact poor		mill USD
AMG	75%	93%	106%	101%	113%	Country	47
best	249%	129%	115%	273%	278%	the poor	4.3
Worst	16%	78%	25%	7%	18%	Project	61

Table A4- 11: Gurué transmission Benchmark of DAC criteria and net benefits

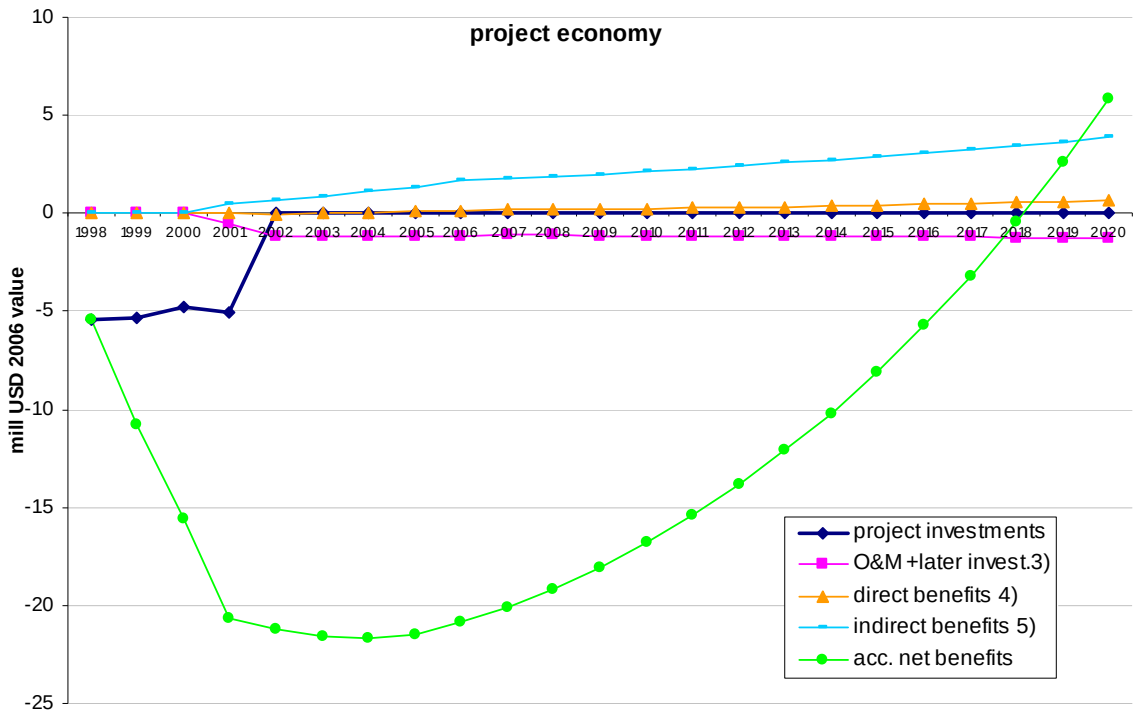

Fig. A4- 9: Alto Molocue – Gurué Transmission Line Economy

A4.3.4 Conclusion

In general terms, the project was a routine operation for both, EDM and Norad, and standard procedures were followed. In addition to the assigned clients' engineer, NVE had an advisory role in the project.

The transmission line is an essential part in the national system, not only bringing power to the Gurué district, but connecting to further transmission lines to Niassa province.

The impact at the district level is considerable on business, commerce, and most important, the tea and other industry that are revived. Due to this, there is strong economic growth, which spurs the consumption of electricity further. Households benefit directly from electricity by saving kerosene for lighting, and the indoor air quality is much improved. Indirect benefits can be seen in the education and health sectors, and security is perceived to have improved.

A4.4 HCB – Zimbabwe Transmission Line

A feasibility study was financed by Norway at a relatively early stage, in 1987. It recommended the construction of the transmission line for power export from Cahora Bassa. This was done on the basis of an understanding with Eskom that it would make available a part of its capacity quota (500 MW) to HCB for export to Zimbabwe up to the year 2003. This required an intergovernmental agreement between Mozambique and Zimbabwe, which was signed in 1992.

An agreement was signed between Mozambique and Norway at the end of 1994 for financial assistance towards the implementation of the transmission line. Work started in January 1995, and the line was completed and in commercial operation since November 1997, within the total frame of NOK 171 million (for the MOZ part, including NOK 6 million for the feasibility study).

The project was promoted under the Southern Africa Development Community (SADC), and various donors participated. This involved also agreements with France and Sweden for parts of the work in Mozambique, and another group of donors on the Zimbabwe side, consisting of Finland, the European Investment Bank, the Nordic Development Fund, France and Sweden.

A4.4.1 Project Description

A transmission line was built to allow export of Cahora Bassa power to Zimbabwe and thus ensuring an alternative route for power exports. In technical terms, the transmission line is a steel tower mounted single circuit 400/330 kV line of 250 km length, specified for 500 MW capacity. The line was designed for 400 kV, but is being operated at 330 kV because this is considered a standard voltage in Zimbabwe. On the Mozambican side, a sub station required to be built at Songo, the location of Cahora Bassa power plant.

The project was termed as complex because it involved two countries, various donors, and all together eight different suppliers/contractors. The role of coordinating all activities and reporting to the donors was shared by Norconsult and Swedpower, funded by Norad and Sida, respectively.

Financial assistance of Norway comprised a total budget of NOK 171 million, NOK 6 million for the feasibility study, 150 million for the construction contracts and NOK 15 million for engineering services. The construction contract implementation resulted in a cost overrun of NOK 550,000 (0.36%), while engineering cost were reported at an estimated NOK 3.3 million under budget.

A4.4.2 Results

A4.4.2.1 Outputs

The output of the project is the 250 km 400/330 kV line and the necessary sub-stations for transformation. The Mozambican part of the line up to the border was connected to the line that had at the same time been built on the Zimbabwean side, with funding from several donors.

A4.4.2.2 Outcome

The line transported between 1.400 and 3,500 GWh annually between 1998 and 2007, but the volume is expected to be reduced to 50 GWh per year by 2009 due to under-balance in Mozambique.

A4.4.2.3 Impact

Long-term economics are doubtful, but the project has achieved the political objective of an alternative route for power exports. Up to 2001 the connection facilitated power export to Zimbabwe and revenue (for HCB) accrued. After 2001 only EDM's wheeling charge per year is credited to the project, and this is expected to continue in spite of Zimbabwe's current problems, that caused a current

debt of ZESA in EDM of about USD 8 million[18]. Overall, the impact is moderate in economic terms, but important for regional integration.

A4.4.3 Findings

A4.4.3.1 General

Direct environmental impact control measures are assumed, but were not reported on. Other cross-cutting issues, i.e. gender and poverty were not addressed by the project.

Reporting on the project was limited to immediate outputs. Longer term results monitoring and reporting were not specified or required by the donor, and consequently not done. It would be relatively simple and straightforward to do however, because the transported volume is measured meticulously for invoicing purposes, by both HCB (sale of power) and EDM (wheeling).

The project was an undertaking bearing high political risk, with severe economic consequences in the event of such risks occurring. The feasibility study for the project was already started 1987, but implemented only about 8 years later, and only completed 1997. The delay is due to the political complexity of the project, in what was partly a war situation. The impression is that external risks were not taken into account, when making a time plan and when calculating economic returns.

Economic returns of the project had been calculated on the basis of an agreement with Eskom that provided for 500 MW of capacity for Zimbabwe from Cahora Bassa, up to the year 2003. Delayed implementation resulted in the fact that the transmission line could transport the designated load only for five years. After 2003, only a fraction of that capacity was available for Zimbabwe. At the same time, demand, or the ability to pay, deteriorated in Zimbabwe below actually available power, further reducing returns to Mozambique.

It appears that the situation did not really matter to HCB, who could either sell to South Africa or Zimbabwe in any case. However, the impact on EDM as the owner of the line was negative. What had been planned to be a highly profitable investment through the earning of wheeling charges, turned out to be just barely economically viable, if not a financial burden.

It is assumed that the operational life of the transmission line is exceeding the period of public mismanagement in Zimbabwe, which means that economic returns may improve in future.

The point that must be made here is that such regional projects should be assessed in terms of the political and economic risk in a regional context. There is no evidence that this was seriously done, when the exaggerated economic returns from the investment were projected.

A4.4.3.2 Quality of inputs

The project was implemented professionally with a minimum of delay in implementation. However, the political complexity of the undertaking required a lot of time and effort, which resulted in an extended planning period. Final inspection of the line was done at the expiry of the maintenance period. Minor deficiencies were identified, which were duly rectified. The final project report was prepared in March 1999. It stated that since commissioning and commercial operation start in November 1997, the line had been in continuous operation with only a few minor disturbances. This indicates satisfactory quality of inputs of all contractors, including Linjebygg, who carried out the contract with Norwegian finance.

A4.4.3.3 Efficiency

Taking the whole process from feasibility study to completion of construction entailed the need for considerably more time than anticipated. Consequently, implementation efficiency is lower than planned. During implementation, time delays occurred which were reported to be due to inefficient work processes of the contractor.

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[18] Owed by the end of 2006, as per informally received verbal information from EDM.

A4.4.3.4 Effectiveness

The project was effective in achieving physical interconnection between Mozambique and Zimbabwe. It was less effective than expected in terms of achieving economic returns. Only 5 years of operation were left for which Eskom had agreed to make 500 MW available. After 2003 that quota was reduced to 200-150 MW, and is expected to be further reduced to perhaps 50 MW in the years to come, because of increasing regional scarcity. This coincides with the economic downturn in Zimbabwe, which has resulted in lower than anticipated demand. Combined, these factors greatly reduce the effectiveness of achieving planned economic returns.

A4.4.3.5 Relevance

For the reasons discussed above, relevance for the project was considerably higher at the planning stage than could be assigned today, twenty years later. Depending on circumstances, such as renewed economic growth in Zimbabwe, and availability of power for export in Mozambique, relevance may or may not increase in the future. This is also the case in relation to the possibility of Mozambique importing power from Zimbabwe, which, depending on circumstances, is conceivable.

A4.4.3.6 Sustainability

The transmission line is marginally sustainable in economic terms, and fully sustainable in technical terms, assuming that routine maintenance is done throughout its life. What would boost relevance (discussed above) would also positively impact on sustainability.

A4.4.3.7 Benchmark and Economy

Except for country impact, all benchmark values are from somewhat to massively below average (Table A4- 12). In fact, it could be argued that any impact on the poor is debatable, as it consists entirely of indirect benefits, and it is well known that there is a distributional issue when it comes to the actual accrual of such benefits. Country impact on the other hand, is better than average, and this is so when it is assumed that EDM will eventually receive payment for the wheeling charges it is owed by Zimbabwe.

Benchmark factors compared to all other interventions						**Net benefit** Over useful lifetime: 25 yrs	
	Efficiency	effectiveness relevance	sustainability	impact country	impact poor		mill USD
CBZ	74%	96%	37%	139%	18%	Country	161
best	249%	129%	115%	273%	278%	the poor	1.7
worst	16%	78%	25%	7%	18%	Project	33

Table A4- 12: HCB-Zimbabwe Transmission DAC criteria benchmark and net benefits

The overall economic situation of the project is ultimately positive, despite the downturn of direct benefits after 2003. The remaining calculated life of the project is about 15 years, which means that most of the benefits are to accrue in the future. This constitutes an uncertainty in the presentation of the overall project economy (refer to Fig. A4- 10), as it is notoriously difficult to predict the future.

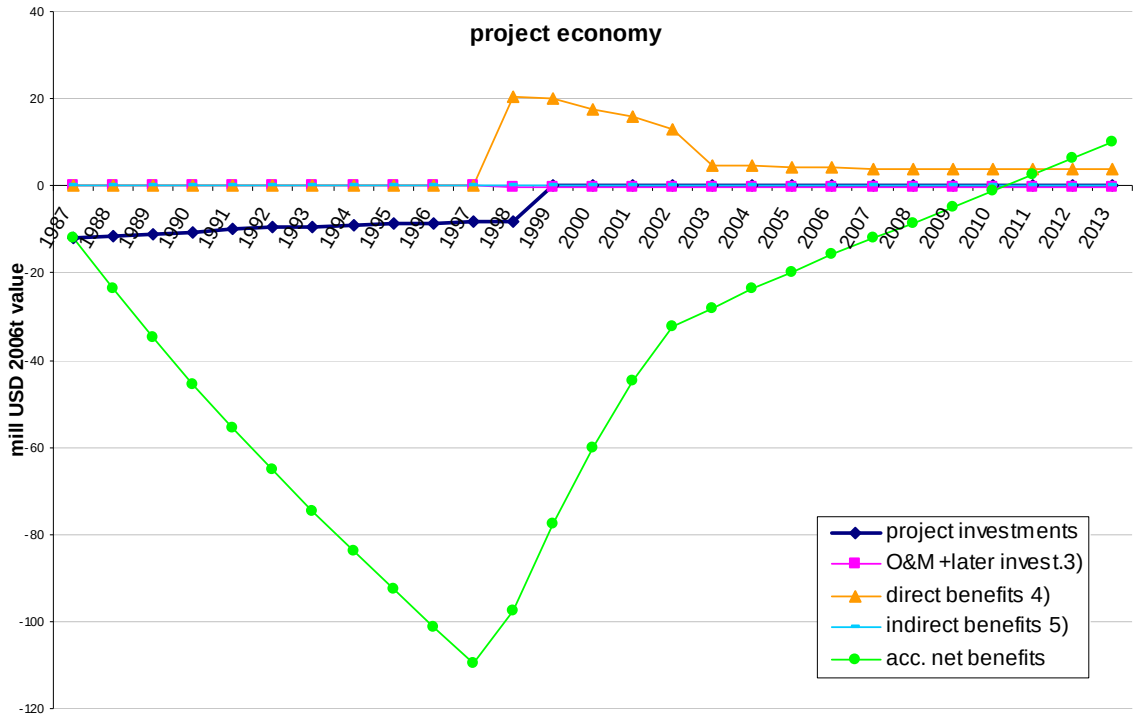

Fig. A4- 10: HCB-Zimbabwe Transmission Economy

A4.4.4 Conclusion

In technical terms, the project was successfully completed with some delay due to not foreseeable circumstances. What was planned was delivered.

For a big project involving many international donors, the outcome is only modestly successful in economic terms. At the same time, if regional integration is an ultimate goal, the project has been a big step in that direction. Better than assessed project economy could be achieved if two major assumptions change radically: a) Substantial base-load power is available for export from Mozambique in the medium term, and b) demand from Zimbabwe increases commensurate with such availability. There is no evidence that indicates that both changes will occur any time soon.

A striking concluding finding is that the political risks that may have caused time delays and reduced economic returns, appear not to have been assessed or taken into account.

A4.5 Institutional Assistance to the Ministry of Energy

The National Directorate of Energy (DNE) was originally established in 1976 as part of the Ministry of Industry and Commerce. Around 1985, it then moved to become part of the Ministry of Industry and Energy. In 1997, it was again re-established in the Ministry of Mineral Resources and Energy (MIREME). The goal of the institutional co-operation with the Norwegian Water Resources and Energy Directorate (NVE) was stated as "to improve the energy sector management, in order to promote the social and economic development of the country."

In early 2005, the new Ministry of Energy (ME) was established and DNE ceased to exist. The mandate and responsibilities of the former DNE was absorbed by new directorates and departments within ME. Terms and plans for the cooperation between DNE-NVE were re-established, although the main goal of the cooperation remained unchanged.

DNE's mandate in the energy sector was wide; it was responsible for both the demand for and supply of energy (except for the management of the biomass supply). Furthermore, DNE was responsible for the planning, formulation, and monitoring of energy policies and regulations on safety and environmental aspects related to the energy sector. Responsibilities further included the management of the demand for biomass for energy purposes, for the general management and conservation of energy resources, including energy efficiency, as well as for the development of renewable energies.

NVE was established in 1921 under the Ministry of Petroleum and Energy, where it remains to date. It is responsible for the management of Norway's water and energy resources as well as regulation of national power supplies. NVE has been involved in development assistance financed by Norway for more than 30 years, mostly providing assistance to other institutions within the work areas of water resources and energy.

A4.5.1 Project Description

The original agreement for the Institutional Support was signed in March 1998 between the DNE of the MIREME and NVE. The Agreement covered the period 1998 - 2002 and carried a budget of NOK 16.7 million. Phase 2 covered the period 2002 - 2005 with a budget of NOK 20 million. The Development Objective of the institutional cooperation is stated as "ME performs as a credible authority with a relevant set of legal instruments and regulatory tools in place".

The original agreement stipulates the modalities of the institutional support to be:

(a) DNE will enter into a contract with NVE regarding institutional co-operation,

(b) DNE will allocate the necessary personnel resources for the co-operation.

The Agreement also state that training would be incorporated in the Project and be reflected in most activities. Activities given priority in the Agreement were:

- Establish and implement appropriate administrative routines;
- Finalise and maintain an appropriate legal and regulatory framework;
- Increase the capacity within energy planning;
- Develop bidding procedures and model licences concession agreements;
- Establishment of a library function, a documentation centre and a website.

Norway provided financial assistance amounting to NOK 36.7 million in the period from 1998 to 2006. DNE provided 3 resident advisers, each of them for a period of about 3 years. In addition, part of the funding was used for the engagement of short-term consultants on various tasks.

A4.5.2 Results

In the following, results in terms of Outputs, Outcome and Impact are discussed.

A4.5.2.1 Outputs

More than 80 ministry staff were trained with the support of the Norwegian cooperation, including Provincial Directorates, through more than 149 training activities in Mozambique and abroad.

Planned outputs for the institutional cooperation were included both in the original agreement and in the addenda in the following areas:

- Structuring of DNE: It was planned that the institutional cooperation would increase DNE's efficiency and human resource capabilities for managing the institution's functions in sector co-ordination and planning, policy and strategy formulation, program management, data bank and model utilization. The institutional cooperation developed procedures for institutional building with the assistance of long-term adviser and consultants, but did not produce outputs that document the introduction of tools that significantly improved DNE's institutional efficiency and management capacities.
- Energy Master Plan: Its preparation was intended in the original agreement, but this was later abandoned.
- Energy Planning: It was planned that the cooperation would increase DNE capacities within energy planning, but has no documented output in this area, except for training of staff in energy planning.
- Rural electrification: A National strategy for rural electrification of peri-urban and rural areas was planned and delivered.
- Regulatory Framework: It was planned that DNE would develop a relevant set of legal instruments and regulatory tools, based on the Electricity Law of 1997. The output produced was according to plan. In addition, a draft concession contract for power distribution was produced.
- Energy Audits: It was planned that DNE would continue to conduct energy audits and extend its current target groups, but the actual output was poorly reported on.
- Not explicitly planned, but produced on the basis of emerging needs, were several contracts for large power supply projects (such as: Motraco, Moma and Corridor Sands titanium minerals), and the Massingir hydro scheme concession.

A4.5.2.2 Outcome

DNE has ceased to exist, but capacities built through the institutional cooperation have been transferred to the Ministry of Energy. According to ME, approximately 95% of the staff trained through Norwegian support remained in the sector. Five of the eight staff trained through Norwegian support who left ME are currently working in the Energy Sector in Mozambique. Five courses and seminars were delivered at the institution by staff trained through the Norwegian cooperation and possibly trained staff have been able to pass on skill and knowledge gained through training to their peers. Approximately 90% of the equipments and software acquired through the Norwegian support are currently in use by ME.

A very positive outcome is that the set of regulations was approved by the Government in 2005 (Decreto No. 42/2005).

The Development Objective of the institutional cooperation of assisting "[to] perform as a credible authority with a relevant set of legal instruments and regulatory tools in place" has not been achieved as DNE ceased to exist. The Regulatory Framework was nevertheless produced, as a basis for further development in the new Ministry of Energy.

The upcoming Norwegian assistance to ME has assimilated an important lesson learned from the DNE-NVE institutional cooperation. The support will be provided based on a recent needs assessment of the newly created Ministry, and a participatory planning exercise. Assistance will thus be designed as a result of a systematic procedure aiming at identifying and making available the best possible assistance package through a competitive process.

A4.5.2.3 Impact

It is not possible to determine an impact at present, as with the exception of the Inhambane concession, neither other small concessions, nor large generation projects have been licensed or have materialised. It is expected that a more capable and efficient Ministry will facilitate power sector development with more private sector participation. However, replication potential of distribution concessions appears very limited.

A4.5.3 Findings

A4.5.3.1 General

This project did not itself address cross-cutting issues, in coordination with other donors/projects, such as Danida (gender, poverty) and NDF/ERAP (environment).

Earlier findings[19] are largely confirmed by the evaluation: For various reasons, the institutional cooperation between DNE and NVE has suffered from a lack of efficiency. The period between the mid-term review and the end of the project appears to have been somewhat more efficient, once the new Ministry became operative, but overall, the impression of low efficiency remained.

Reporting was limited to immediate outputs of the project, and more often on activities, but this is incomplete. Poor reporting was a point of contention in several annual meetings, raised by the embassy. Information collection during the evaluation's visit to Maputo was constrained by non-availability of Ministry staff. An official completion report of the most recent phase has not been prepared yet, as the project was concluded only a few months before the evaluation. An audit report is not available yet.

A4.5.3.2 Quality of inputs

The inputs of the DNE-NVE institutional cooperation have not been documented in a systematic form. According to documentation accessible to the evaluation, and additional information provided by ME, the inputs are:

- Three long-term advisers.
- Short-term consultancies
- Financial support for training
- Equipments and software

At the onset of the DNE-NVE institutional cooperation, DNE was seriously lacking in both managerial and technical capacities to carry out its extensive mandate. It lacked personnel, and was not able to recruit new staff because well educated nationals were not available. It also lacked office space.

At the outset of the institutional cooperation, DNE was channelling much of its resources onto the execution of rural electrification projects. There was thus a significant degree of overlapping and ambiguity between the functions of DNE and FUNAE as to the development of models and modalities for rural electrification.[20]

Given DNE's wide mandate, weak institutional base and resource management, an institutional diagnostic assessment would have been a helpful starting point to the strengthening of DNE's institutional capacities, which would in turn enable DNE to perform as a credible authority in the energy sector. Such was not done, however, as the starting point for the DNE-NVE cooperation.[21]

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[19] Mid-term review, Scanteam 2005

[20] Energy Sector Programme Support, DANIDA, 2001

[21] The first institutional diagnostic assessment carried out at the MIREME was done by the World Bank in 2004-2005.

The cooperation between the two institutions was a condition for the support to be provided. Nevertheless, the model suited well the constraints and needs of DNE as it offered the possibility of substantially increasing DNE's technical and administrative capacity without imposing on the institution's modest resources. The model offered DNE expatriate staff and expertise without the associated costs of recruitment and salaries. The method for inputs was thus designed as a pool of technical, managerial, and administrative expertise available to DNE on an on-going basis, in order to develop the priority activities stipulated in the agreement, according to yearly planning.

While the model was in principle very suitable for the circumstances of DNE, its implementation, especially in the early stage of project, was characterized by a lack of focus. The very reason for the support was DNE's weak resource basis and capabilities, thus at the outset NVE needed to provide stronger leadership and focus in developing and implementing activities. According to Ministry informants, the role NVE played was rather that expected in cooperation between two strong institutions; it expected DNE to define its needs and lead in the implementation. However, DNE did not have that capacity.

DNE expected NVE to take on a stronger mentoring role and provide strategic guidance to the partnership, based on NVE's long experience in building its own capacities and in assisting other institutions. It was expected that NVE would be able to identify DNE's key capacity needs, provide detailed planning to address them, as well as guide and monitor implementation. DNE expected to see at work how the management of a strong and experienced institution plans and implements solutions for addressing weak institutional capacities. Besides of seeking a role management model, DNE expected NVE to bring additional capacities to its weak human resources base. This would entail that NVE would engage more in decision-making and play a mentoring role.

Contrary to expectations, according to informants in the Ministry, NVE played a role of a "consultancy", meaning they relied on a working relationship dependent on DNE's leadership, in which needs assessments, planning, implementation and monitoring had to rely more on DNE's capacities. Thus, lack of clarity of roles between DNE and NVE was one of the main constraints for an effective use of inputs. Work plans for the institutional cooperation were characteristically vague to provide direction and to serve as a management tool for the institutional cooperation. Moreover, the absence of an institutional diagnosis early on in the cooperation, weakened the ability of the assistance to define sequencing of activities, monitor progress, and refine planning.

A4.5.3.3 Efficiency

The efficiency of the DNE-NVE institutional cooperation is assessed as low, due to high costs of resident advisers, in relation to the lack of their specific tasks and outputs during some periods, combined with a lack of staff in DNE. Some outputs from the institutional cooperation were eventually realized, most substantially the complete set of regulations.

A4.5.3.4 Effectiveness

The institutional cooperation was effective on power sector regulation and concessions/licensing. The Rural Electrification Plan, produced at the end of the cooperation, was a contribution to DNE's mandate in Energy Planning. Results were moderately effective in the area of energy efficiency auditing. Overall, effectiveness is regarded as moderate given the resources available to the cooperation, including long time frame for output production.

According to some informants, once capacities at DNE were somewhat liberated from other projects, it enabled the institution's management to pay closer attention to the institutional cooperation. NVE responded promptly and positively to such shift in absorptive capacity from its partner institution, and much more effective use of the resources available was made henceforth.

The provision of training through the institutional cooperation was effectively designed since it was provided in line with the institution's need for flexibility in the choice of subjects and selection of staff. Some of the training, combined with the provision of computers, software and other equipment, improved the absorptive capacity of DNE, so such training appears effective in building up human resources capabilities at the institution.

A4.5.3.5 Relevance

However, the training program was not based on any training needs assessment and it lacked a clear purpose and focus. Hence, relevance is in doubt. While in general training seemed to have been provided matching training content/instrument and qualification of staff, mismatches in other ways, and wastage took place. For example, training abroad on Gender Analysis in Energy Planning and Management was provided to numerous staff, yet no institutional outcome regarding gender ever came. Various staff went to South Africa to take English courses after they had received training in technical subjects in English or went on study tours in countries where they had to communicate in English. Numerous staff went to a study tour in the UK, but the subject of training is not specified.

Because of the lack of focus, the training program of the institutional cooperation is thus regarded as only moderately relevant.

Most other areas of institutional cooperation were highly relevant to the needs and role of DNE and its alignment with Mozambique's energy sector strategy at the time of the assistance.

A4.5.3.6 Sustainability

DNE ceased to exist and thus sustainability at the institutional level was not achieved. However, capacities built through the institutional cooperation have been transferred to the Ministry of Energy, including trained staff and equipments. Regulatory frameworks produced through the institutional cooperation benefit the sector regardless of the survival of DNE. The institutional cooperation thus impacted the sector by enabling private sector involvement (concessions).

Given the lack of documented information on the training activities and their results as well as the recent restructuring of the Ministry, the basis for assessing sustainability impact of training is doubtful. Loss of key staff, such as DNE's lawyer, also negatively affected the sustainability of the institution.

A4.5.3.7 Benchmark

Results for calculated benchmarks show low efficiency and somewhat less than average effectiveness and relevance. However, there is a methodological problem associated with measuring efficiency. The concept is simple enough, i.e. dividing the volume of outputs by total cost of the intervention. The problem is the value of outputs such as "a set of regulations" or "concession contracts", for which there is no identified rational valuation basis. Hence, the calculated efficiency does not assess this in monetary terms. However, the "value" is reflected in effectiveness and relevance of the intervention.

Benchmark factors compared		
	Efficiency	Effectiveness Relevance
MIREME	48%	90%
Best	249%	129%
worst	16%	78%

Table A4- 13: DAC criteria benchmark MIREME

A4.5.4 Conclusion

Overall, circumstances have not been favourable for the institutional cooperation between DNE and later the Ministry of Energy, and NVE. Institutional cooperation was initially not well planned, and at an early stage, cooperation was affected by a lack of staff in DNE. Later, DNE was transferred to the new Ministry of Energy, a process that took considerable time for the assignment of staff and responsibilities. Nevertheless, some good results have been achieved in the area of power sector regulation and power distribution private sector concessions. Further, considerable training was delivered, and core competencies of staff were improved.

A4.6 Institutional Assistance to UTIP

The Zambezi river and its major tributaries have to some extent been developed for hydro power generation. Hydroelectric schemes have been constructed in Mozambique, Malawi, Zimbabwe and Zambia. There is still however, a substantial potential in the river basin that appears feasible for development.

The Technical Unit for Implementation of Hydropower Projects (Unidade Técnica de Implementação dos Projectos Hidroeléctricos, UTIP) was established by Government decree on 26 November 1996, as an autonomous public institution for implementation of hydropower projects in the Zambezi River Basin, namely Cahora-Bassa North Bank and Mphanda Nkuwa[22] (MN).

Following a series of studies, a staged development of the hydro power potentials in the Mozambique section of the Zambezi was defined. The first stage of this development concerns the 1.300MW Mphanda Nkuwa project, to be developed as a run-of-river scheme.

A4.6.1 Objective

According to its mandate, UTIP's main tasks are to:

1. Realize technical studies and submit for approval the above mentioned projects and accompanying development and implementation of the projects.
2. Advise the Minister and other interested entities on the decisions that have to be taken in relation to the large scale hydropower schemes above mentioned and keep the Minister informed about the development of these projects.
3. Coordinate the activities and tasks of the various public and private actors, including analyzing and proposing the approval of technical-economic viability studies, tender documents.
4. Prepare the Terms of Reference (ToR) for feasibility studies as well as viability and environmental impact studies and tender documents for adjudication.
5. Assess and propose the approval of contracts on association and financial agreements.

The main justification for creating UTIP was that existing Mozambican institution in the power sector, namely the DNE and EDM, had neither sufficient capacity nor human resources to follow up the Zambesi River Basin projects. The significance to Mozambique, and the scale and complexity of tasks involved in developing hydropower mega projects made it necessary to create a responsible institution that would safeguard management attention and focus.

The Government decree of 1996 thus empowered UTIP to build its institutional capacity as an independent institution. Nonetheless, until June 2000 UTIP was housed within EDM and resourced from EDM's structures and mostly relied on EDM staff. UTIP, however, attempted to establish itself as an independent institution since its foundation. In the December 1996 Project Document for Institutional Support Services, UTIP proposes its organizational structure and the commissioning of a Core of Experts to function as gap-filler of key positions within the institution. The rational presented in the document for filling key positions with expatriates was the limited available expertise for development of large scale hydropower schemes in Mozambique.

The project was then incorporated into the joint EDM-DNE-UTIP Project Document, dated May 1997. Assistance to UTIP was foreseen as follows:

- The Technical Assistance (TA) comprises initial equipment for office and logistics functions of UTIP,

[22] The name *Mepanda Uncua*, is also being used, particularly in early documents. The two are different spelling for the same project.

- The professional assistance is “ad hoc specialized competence” technical, legal and financial services - over the 2 year feasibility and project organization and finance phase identified in the above MoU,
- It will also include preparation and implementation of (a) management model for UTIP, (b) a human resource development programme to identify “the more permanent qualifications of UTIP” and (c) more specialist in-house ad hoc expertise through on-the job training when so required as specific tasks arise, and
- UTIP also needs expertise to manage daily operations, and to identify and manage the ad hoc expertise to be acquired from outside.

A program for technical assistance to UTIP was then formally agreed upon by signing of a bilateral agreement between the Governments of Mozambique and of Norway dated 10 September 1999.

A4.6.2 Project Description

The objective of Institutional Support to UTIP is *“to establish UTIP as an effective institution with strengthened capability and capacity to perform in accordance with its functions and responsibilities stated in its statutes.”*

The Project financed the commissioning of a “Core Consultant”, a lead consultancy company that could supply the various expertise needed to build UTIP’s technical and administrative capacities, and a “Panel of Experts”, an international group of high calibre experts to review and advice on the Study of Hydropower Development options in the Zambezi River downstream Cahora Bassa study. Finance to UTIP’s recurrent budget was added latter.

The Project was originally financed by a grant of NOK 20 million for a period covering 1999-2001. Extensions were financed through three addenda, as shown in the table below. Assistance is still ongoing, and operation during 2006 and 2007 has been covered by the most recent allocation.

1999 to 2006:	Original	Reallocation	Actual	Expenditures
Core Consultant	8.000.000	984.162	8.984.162	20.045.288
Promotion		2.068.622	2.068.622	
Panel of Experts	6.000.000	-1.583.561	4.416.439	4.092.483
UTIP	6.000.000	530.777	6.530.777	7.655.535
TOTAL NORAD	20.000.000	2.000.000	22.000.000	
Bridging Finance. Add. Nr 2			8.900.000	
Addenda no. 3			4.000.000	
Grand Total by end 2006			**34.900.000**	31.793.306

Table A4- 14: UTIP Budgets and Expenditure (Source: UTIP)

Under the Agreement, UTIP has signed on December 1999, after an international tendering process, a co-operation contract with Norconsult as their Core Consultant and contracts with independent consultants forming the international Panel of Experts. UTIP has also been managing funds under the programme for training and for procurement of local consulting services, travel, vehicles and office facilities.

The planned **Core Consultant Programme**, as defined in the proposal of Norconsult in December 1999, comprises two main elements:

Multidisciplinary services:

Technical services within hydropower and transmission engineering including: Preparing studies, evaluation of feasibility study, including statements from the Panel of Experts and other consultants.

- Legal and institutional services including licensing, contract negotiations, market studies, electricity pricing and advice on policy and strategy issues.
- Environmental services including evaluation of EIA, environmental management and mitigation.

- Institution building activities with the focus on providing UTIP with:
    - Sustainable administrative routines and procedures
    - Technology transfer and training.

In agreement with UTIP's management, Norconsult has provided services to UTIP within the above frame through various methods. Three Resident Advisers were supplied between January 2000 and April 2007 to fulfil functions of Project Manager, Financial and Technical advisers to the institution. A number of short-term consultancies were provided in technical, administrative, and technology areas (Power Economist, Environmental Specialist, Hydropower Planner, Administrative Advisor, Legal Advisor, Human Resources Development, ICT Specialist). Norconsult has also assisted UTIP in commissioning the Panel of Expert and in following up with their advice.

The **Panel of Experts** was formed and provided advice on the Cahora Bassa Feasibility Study. In the period 1999-2002, UTIP commissioned and supervised a study of hydropower development options in the Lower Zambezi River financed by Germany and France. The study was done under a contract between UTIP and a consortium of 3 consultants, executed in two phases: 1999 March-2000 July. The Panel of experts was commissioned to review the various draft reports of the Feasibility Study for Lower Zambezi, which later included Mphanda Nkuwa and Cahora Bassa North Bank, and to advice UTIP on how to follow up on the Study and its implementation. The experts met in Maputo six times during this period.

The Cooperation Agreement has also financed the purchase and installation of Equipments and Software necessary for UTIP's establishment (e.g. furniture) and IT equipment (e.g. computers, software, communication, as listed in **Table A4- 15**).

Goods	2000	2001	2002	2003	2004	2005	2006	Total NOK
Vehicles: 2 Nissan Terrano; 1 Nissan Sentra	534,400							534,400
Office Furniture	343,806	65,394						409,201
10 AC Units	82,371							82,371
WebSite		7,324						7,324
Overhead Proj.		1,948						1,948
Notebook Proj.		4,353						4,353
Notebook		11,585						11,585
Photocopier	35,288							35,288
Computers	294,407		9,281			-	100,326	404,013
Network			25,987	9,622		2,350	9,188	47,147
Software			43,790	10,365	22,213	10,142	8,342	94,853
Comm. Equip.	32,454				-	11,191	-	43,644
Total Investments	1,322,725	90,604	79,058	19,987	22,213	23,683	117,856	1,676,127

Table A4- 15: UTIP: Equipment and Software Provided (Source UTIP)

A4.6.3 Results

In this section a description of outputs for each institutional support component is first described, followed by analysis.

A4.6.3.1 Outputs

Under the agreement, **training** at UTIP was to take place through internal and external programmes. 10 UTIP staff have attended 10 Courses, 6 Conferences, 5 Workshops, and 10 Seminars in Maputo

(17) and abroad (14). Staff training has been provided internally by the Core Consultants through on-the-job training and through a number of workshops.

The **panel of experts** reviewed the various draft reports of the Feasibility Study for Lower Zambezi, which later included Mphanda Nkuwa and Cahora Bassa North Bank, and advised UTIP on how to follow up on the Study and its implementation. There is no structured reporting of their activities and outputs.

The outputs from the **core consultant** were divided into six categories as shown below.

Outputs Core Consultant
Technical Documents and Tasks: 1. Development Prospect, MN 2. Economic Model MN 3. Hydrologic Model MN 4. Draft Concession Agreement, MN Generation 5. Draft Concession Agreement, MN Transmission 6. UTIP Transmission Study 7. Updated Feasibility Study with BHP Billiton 8. Project Definition Document, MN generation 9. Updated Development Prospect, MN 10. Prepared the Memorandum of Understanding between GRM and GRSA (MOU) concerning development of the Project 11. "Tentative Schedule of Implementation, Mepanda Uncua HPP" was prepared towards the end of September 2001 and presented to MIREME 12. Reviewed and commented the Transmission and Telecommunication report 13. Ongoing support (comment, discussions, etc) to the feasibility study 14. Participation in two sessions of the 5th Panel of Expert meetings 15. Technical workshop
Work related to Government Memorandum of Understandings (MoUs) Follow up of GOM responsibilities in relation with the following MOUs related MN development: 1. MOU between GOM A and BHPBilliton; 2. MOU between GOM and Exibank of China 3. MOU between GOM and Sinohydro of China; 4. MOU between GOM and Camargo Correa (Brazil), Energia Capital and EDM (Mozambique).
Follow-up Activities: 1. UTIP Transmission Study Follow-up 2. Coordination and Discussions with CVRD of Brazil 3. Follow-up of Activities Involved in Transmission Infrastructure 4. Economic Evaluation of Different Operation and Financing Scenarios 5. Completion of the Joint Study between GOM and BHPBilliton 6. Preparatory Work for a Possible PPA Negotiation with BHPBilliton 7. Contacts and Promotion of the MN Project in the SAPP Context and with Other Relevant Investors, Suppliers and Contractors 8. Follow-up of the MOUs
Promotion of the MN project and contact with organizations: 1. Standard Bank; 2. Knight Pieshold; 3. Companhia Vale do Rio doce (CVRD); 4. Black and Veach; 5. Hydro Aluminium; 6. Consolodated Contractors International 7. Southen Africa power Pool (SAPP) 8. ENRON; 9. The World Bank; European Investment Bank; 10. BHP Billiton, Camargo Correa of Brazil ,Sinohydro of China.

Outputs Core Consultant
Administrative Tasks: 1. Established budgeting and accounting for UTIP according the agreements between Norway and Mozambique, including independent annual auditing of accounts, making UTIP complying with GOM regulations and the Country Agreement 2. Developed a Filing Code for UTIP. 3. Plan for UTIP Organisation including Job Descriptions for managerial staff 4. Installation of a new accounting system – Agresso – which was in operation in 2000 5. Training for the locally developed accounting system, GestOrc, implemented in 2004 6. Human Resource Development (HRD) Program, first half of 2002; 7. Training Needs Assessment 8. Developed a modern computer network for UTIP, with main server and gateway server, including virus and fire-wall protection 9. Connected all employees to data-bank, in the main server, to e-mail and internet 10. Installed and put in operation state of the art back-up hardware and software 11. Established routines for computer network maintenance 12. Designed and put in operation a WEB-site for UTIP, 2002 13. A workshop on "Policy Strategy and Agreements" was arranged by UTIP 17-18 October 2001 14. Draft Project Promotion Document (PPD), a Project Promotion Program and design of a WEB-site, 2001
On-the-job training: Training took place during visits by the Core Consultant staff, including those of the Administrative Advisor and the Legal Advisor. The Administrative Advisor visited UTIP's office from 01 to 14 February and the Legal Advisor from 11 to 18 February and from 29 June to 03 July of 2004. The ICT expert in the Core Consultant Team visited UTIP 23 August to 10 September. The Power Economist also visited UTIP from 03 to 26 March 2004 and worked with power economics in relation with the SAPP together with UTIP personnel. The UTIP local staff and foreign technical advisors have worked as an integral team to solve the tasks of UTIP. Technology transfer has been provided by the Resident Advisers. This includes work on executing the transmission study, discussions related to the power sector master plan for Mozambique and application of the HEC-RAS model for simulation of downstream water fluctuations. Other important activities in this regard are the joint study with BHP Billiton, also including work in the field related to power transmission and hydrology, as well as discussions with contractors, banks, and others. On-the-job training has also taken place through workshops, seminars and participation in conferences including preparation and presentation of papers including the Workshop on "Draft Concession and Project Agreement (Concession Contract) held at the VIP Hotel in Maputo early in July 2004 Other examples of work resulting in technology transfer include review and follow-up of Feasibility Study, preparation and discussion of strategy and structuring of MN, preparation and convening of the Investor Conference (May 2001), presentations to and discussions with potential investors, banks, contractors including visits to Eskom of South Africa, EdF (France), Tractebel (Belgium), ABB, Siemens, General Electric, World Bank, Deutsche Bank and European Investment Bank, development of administrative routines (correspondence, templates for letter and faxes), preparation of budgets, development of ICT set-up and design and implementation of WEB site.

Table A4- 16: Outputs, Institutional Support to UTIP (1999-2006)

Source: UTIP informants and various UTIP reports.

A4.6.3.2 Outcome

The MN did not become a reality within the time-frame UTIP had envisioned, the organization was then left with no clear mandate and became engaged with work beyond its directive, hence overlapping the mandate of other organizations, creating inefficiencies in the sector and generating problems at the political level. For example, UTIP became a member of the Northern Mozambique Power Development (NMPD) Technical Committee, but this rarely meets. This changed the focus of UTIP's work towards coordinating MN with the other projects in the NMPD.

Currently MN has attracted increased interest by private investors. Memorandums of Understanding have been signed or are currently being negotiated between GOM and with BHPBilliton, Exibank and Sinohydro of China, Camargo Correa (Brazil)/Energia Capital and EDM (Mozambique). Although UTIP's 'integration' into the Ministry of Energy has resulted in high workload for the reduced staff, the Norwegian support has enabled UTIP to promptly respond to the increased demand. UTIP's technical and managerial contributions to the MoE have been crucial in enabling the new contracts with private investors. UTIP's institutional capacity has improved. It has better understanding of hydropower and power transmission technology; better routines and coordination of activities, well functioning computer network; and a functioning "institutional memory" through common code and filing systems.

As a result of the Norwegian support, UTIP also has good working conditions and absorptive capacity. UTIP is increasingly being regarded as a "one-stop-shop" for development of Zambezi hydropower potential. Although UTIP has lately lost three staff, most staff trained through Norwegian support remains in the institutions. Two of the staff who left UTIP remain in Energy sector institutions (Ministry of Energy and EDM). Staff trained by the Project have developed and delivered 12 Workshops and Seminars, including preparation and presentation of papers (Concession Contract, etc) and made presentations in the 3 international seminars/conferences. UTIP staff can thus contribute to training other staff.

The prospect of development objective achievement of the Norwegian assistance to UTIP, i.e. "effective and sustainable use of energy resources aiming at improved social and economic growth in Mozambique", depends on the outcome of the existing MoUs between Mozambique and private organizations. Hence, the goal achievement of the Norwegian support depends heavily on external factors, which past experience shows that a long time-horizon is a necessary ingredient. The uncertainty regarding when decisions will be taken by those external stakeholders constitutes a considerable external risk, quite outside the influence of UTIP or Norway.

Nonetheless, Norwegian assistance to UTIP left a solid institutional legacy for the MoE to rely and build upon in its efforts to build partnerships with the private sector in order to increase energy production and in Mozambique.

Regarding cross-cutting issues, such as environmental impacts and gender, the Project has neglected to address gender in any meaningful way. It has, however, paid attention to environmental and social impacts of the MN. It has done so throughout the feasibility study, presentation materials and formulation of regulation. In the feasibility study, it has also addressed issues of poverty alleviation. In this way UTIP has adopted procedures for sound development, which directs work towards achieving the goal of the project in the longer term perspective. It is noted however, that the feasibility study itself is an activity additional (and mostly prior) to Norwegian assistance.

The Project has benefited also Norwegian Stakeholders. Although aid to UTIP was not tied, UTIP staff stated that Norwegian support made the institution look more carefully at the issue of using Norwegian companies. The comparative advantage of Norwegian assistance is the flexibility in which the support was provided.

A4.6.3.3 Impact

UTIP's main task remains to develop large hydropower resources in the Zambesi River Basin. The impact of the Program could be significant if the MNK is realized, which would influence the energy sector in Mozambique in numerous ways such as bring benefits to the Mozambican Government from concession fees, taxation and direct equity participation. The main features of the project are shown in Table A4- 17 on the following page for illustrative purposes.

PROJECT FEATURES

Mphanda Nkuwa (MN) Project Data Summary

MAIN PROJECT FEATURES	FEASIBILITY DESIGN		
Catchment Area (total - from sources to MN)		1 086 000	km²
Annual Mean Flow at MN		2 578	m³/s
Fully Supply Level (FSL)	before CB extension	205	m a.s.l
Tailwater Elevation at full capacity		138.3	m a.s.l
Normal Gross Head, all units at full load	before CB	67	m
Reservoir Area at FSL			
Resettlement Requirement	approximate population	1 400	persons
Live Storage	before CB extension	840	10mil. m³
Dead Storage	before CB extension	1 484	10mil. m³
Design Discharge, all units at full load		2 200	m³/s
Installed capacity at plant HV terminals	4x325 MW vertical Francis	1 300	MW
Firm Power Capacity at 95% availability	before CB extension	827	MW
Design Plan Factor		64	%
Mean Energy Production at plant HV terminals	before CB extension	9 070	GWh/a
Secondary Energy Production at plant HV terminals	before CB extension	1 817	GWh/a
Dam - RCC gravity type	heigt above fundation	101	m
	crest length	457	m
Power House - Surface	overall length	200	m
Transmission to Cahora Bassa	2x400kV AC	60	km
Transmission to Maputo	2x400kV AC	1 540	km
Power Loss to Maputo	vs full generation capacity	8	%
Energy Loss to Maputo	vs firm annual generation	5	%
Estimated Cost w/o interest during construction	dam power plant	871	10mil. EUR
	transmission lines	953	10mil. EUR
	enviro. management	17	10mil. EUR
	total	1841	10mil. EUR
Estimated Construction Time		6.5	years

Table A4- 17: Mphanda Nkuwa Project Features

The estimated total financing requirement of this project, including price contingencies and interest during construction, is in the order of USD 2.5 billion. Considering the size and complexity of the project, coupled with the international trend of power sector reform taking place in Southern Africa, the option for financing of Mphanda Nkuwa is as a private hydro power project with public support, on a build, own, operate and transfer (BOOT) basis. This will be organised in project companies registered in Mozambique. Two companies are envisaged, one for generation and one for transmission. The two companies can have different ownership and financing arrangements, but shall be organised so that co-ordination of project implementation is secured.

According to UTIP, the conference, held on 30 May in Maputo, Mozambique, attracted great interest. More than 200 representatives of large energy companies, investment banks, contractors, equipment manufacturers, consultants and government officials participated and four ministers of the Government of Mozambique were among the VIP attendees.

The Conference was opened by the Minster of Mineral Resources and Energy, Castigo Langa. Subsequently, short presentations were made on the investment climate in Mozambique and the technical, environmental, legal and financial aspects of the project.

"Our government hopes that in the follow up of this conference, a consortium capable of forming the implementing company for Mphanda Nkuwa can be constituted", commented Langa. "Based on law, the government is prepared to provide appropriate incentives, capable of ensuring the financial robustness of the project and safeguard earnings for all parties."

The conference marked the launch of the project and investors were invited to pre-qualify for implementation of the project by 1 October 2002. Following review of the pre-qualification documents, a limited number of the candidates considered to be qualified for implementation will be invited for competitive negotiations. Dependent on the response from interested parties, such negotiations are expected to start soon.

A4.6.4 Findings

A4.6.4.1 General

Reporting was limited to immediate outputs of the project, and to activity reporting in the area of training. As the intervention is ongoing, there are no completion reports or final audit reports.

Regarding cross-cutting issues, environment has been addressed (in the feasibility study) as is mandatory for large hydropower development undertakings. However, the impression is that environmental concerns have not been given a prominent place, commensurate with the huge impact such a mega project will have. Gender and poverty have not visibly been addressed by the project, except through employment of female staff.

A4.6.4.2 Quality of inputs

Institutional building through multi-disciplinary consulting services, training, and support to expenditures were the main pillars of the assistance provided by the Norwegian support. The inputs for the Institutional Support Project are (see also Tables 4-17 below).

Panel of Experts

The inputs for the Panel of Experts was a total of 42 person-weeks, or six persons-weeks for each of the seven experts. Total cost was NOK 4.092.483.

The feasibility study of the Mphanda Nkuwa project, the actual reason for the existence of UTIP, has been brought to a mature level, and assistance has been effective and of good quality. According to informants, the Panel of Experts provided good advices and endowed, at least for a time period, the MN mega project with credibility and visibility due to their reputation in their fields of expertise and association with the project. Nonetheless, much better use of their expertise could have been achieved as stated in memoranda from UTIP-Norad annual meetings. According to documentation, the Panel of Expert model was contested by NORAD and the Norwegian Embassy during project design. Norad argued that the Terms of Reference for the Panel of Experts was too vaguely designed and the task of monitoring and evaluating MN feasibility study should rather be part of the Core Consultant task.

Core Consultant

The Core Consultant also provided UTIP with support throughout the feasibility study and, according to all informants, their inputs have been of good quality. The three resident advisers and numerous consultants have assisted UTIP by providing additional advice to the study and in following up with the recommendations from the panel of experts. They have also worked with UTIP in an integrated fashion to build the institution's capacities to promote the commercial viability of the MN mega project through market studies and promotional activities. In doing so, they provided services in drafting regulations, concessions and technical documents and promotional materials and workshops. In the technical area, the core consultant has substantially improved staff understanding of hydropower and power transmission technology and development. Support was also extended to other projects UTIP undertook, as the resident adviser provided technical planning and liaison with other advisers and consultants, as well as preparation of Terms of Reference and budgets for projects to be studied and implemented. The personnel involved from the side of the core consultant illustrates the broad range of subjects addressed, as shown in **Table A4- 18**.

1999-2006	Are of Assistance	Home	Field	Total mm
Resident Advisers				**73.3**
T. Stavsholt (Jan 2000–Apr 2001)	Resident Project Manager			
O.K. Ystgaard (June 01–Dec 03)	Resident Project Manager/ Financial Specialist			
Trond Westeren (October 2004 – April 2007)	Resident Project Manager / Technical Adviser			
Consultancies		**86.8**	**35.6**	**120.6**
Tor Stavsholt / Trond Westeren	Team Leader/Engineer	59.9	7.8	67.7
Odd K. Ystgaard	Project Manager/Financial Specialist	4.4	2	6.4
Truls Holtedahl	Energy Economist	2.7	2.1	4.8
Erik Børseth / Kevin Burton	Environmental Specialist	2.2	1.5	3.7
Sverre Edvardsson	Hydropower Planner	3.1	5.4	8.5
Stein Waale / Anders Stølen	Administrative Advisor	5.0	0.3	5.6
Kjell Haagensen	Legal Advisor	1.8	2.1	3.9
Tore H. Bockelie	HRD Specialist	0.7	0.3	1.0
Other	ICT specialist	6.7	14.1	19

Table A4- 18: UTIP: Core Consultant Personnel Provided (Source: UTIP)

Although Norconsult's main strength as a milieu is within technical disciplines (engineering is its core business), the Core Consultant has made significant contributions in helping UTIP build its administrative and managerial capacities. They provided expertise in project and financial management, energy economy, environmental specialist, hydropower planning and administrative, legal, human resources and ICT advisory. Their Resident Advisers and consultants have aided UTIP in selecting, installing and maintaining office equipments, hardware and software necessary for the institution's functioning.

According to the previous evaluation of UTIP[23] and confirmed through document review and field interviews, Norconsult's performance was relatively weak during the first year of its contract with UTIP. This was mainly due to lack of institutional leadership at UTIP at that time, as the then UTIP director was often absent. The efficiency of the Core Consultant promptly increased once change in UTIP management occurred in July 2001.

A4.6.4.3 Efficiency and Effectiveness

The efficiency and effectiveness of the Norwegian Institutional Support to UTIP is assessed as medium. This means that the Norwegian support contributed to substantive increase in UTIP's institutional capacities to perform according to its mandate. Yet, support could have been more effective and efficient if some of its inputs had been better designed (panel of experts) and utilized (training). The summary result is shown in Table A4- 19.

	Panel of Experts	Core Consultant	Training	Project
Efficiency	Low	Moderate	Medium	Medium
Effectiveness	Moderate	High	Medium	Medium

Table A4- 19: Project Overall Assessment

A training needs assessment did not form the basis for UTIP training program. A human resources assessment, which could have been the basis for a training plan, was carried out by Norconsult in 2004, but training plan was not an outcome and training activities started before such assessment.

[23] "Review of Institutional Support to UTIP in Mozambique", ECON, 2002.

Nevertheless, training was effective in terms of mixing of training instruments and, according to UTIP staff interviewed the quality of training was good. The model was effective because it was provided in line with the institution's need for flexibility in mixing and selection. While most training provided matched training content/instrument and qualification of staff, plus scope of responsibilities at UTP, some mismatch took place. For example, an accountant attended a course in Public Private Partnership, an administrator attended workshops on "Alternative Power: A Solution for Future with Future" and "Public Private Partnership", and UTIP's driver was provided with a course in "Administration and Management Program" abroad. In addition, the project financed ICT staff to attend a Conference on United Nations convention parts in Argentina. Given UTIP's scarcity of own funds and great need for training, this mismatch created both inefficiency and decreased the effectiveness of the training program. The training program is thus assessed as relatively effective and efficient.

A4.6.4.4 Relevance

Given that UTIP was a newly created institution, the external training was relevant for various reasons. It was given flexibly, since it was part of the total financial support to the institution and could thus be adjusted according to changing needs and priorities over time. It enabled UTIP to select a mix of training instruments, namely technical and administrative courses, seminars and workshops as well as finance long-term training for employees. UTIP's ability to select training instruments enabled the institution to attract some staff, as training could be offered as an added value to the salary and benefits package. This was especially relevant for long-term training, which in the case of UTIP meant a university degree.

Inputs from the Core Consultant were highly relevant in building UTIP's technical and administrative capacities to fulfil its mandate. Inputs were provided flexibly, able to fulfill UTIP's capacity needs on demand and on-time. The Core Consultant helped to build technical, managerial, and administrative capacities in a holistic way by playing diverse roles: gap-filling, advisory, and coaching. The support overall was relevant since it was aligned with the Government's visions and subsequently with the sector strategy. It supplied UTIP with necessary inputs to achieve its future objectives.

A4.6.4.5 Sustainability

From humble beginnings, UTIP has made good progress towards sustainability, which is assessed as good, on the basis of the solid institution building efforts over almost ten years. UTIP is seen as a politically prominent institution. As long as this remains so, there is little doubt that sustainability can be maintained.

A4.6.4.6 Benchmark

Benchmark values shown, somewhat below average for efficiency and slightly above average for effectiveness and relevance, is largely in agreement with findings above.

Benchmark factors compared		
	Efficiency	effectiveness relevance
UTIP	91%	102%
best	249%	129%
worst	16%	78%

Table A4- 20: DAC Criteria Benchmark for UTIP

A4.6.5 Conclusion

The combination of providing a core consultant and a panel of experts has been conducive to wide recognition of UTIP as a credible promoter of mega projects. However, the cost of the expert panel was considered high, indicating inefficient resource use. It was therefore not continued beyond a first phase. The core consultant has continued to provide inputs covering a broad spectrum, and efforts are still ongoing. This has resulted in further and decisive strengthening of UTIP, which today handles negotiations with potential project development proponents on behalf of the government competently.

Progress has been made on the challenging path to project implementation through signing of MOUs with a number of actors. Ultimate success however depends not only on the quality of work of UTIP and its competence, but to a major extent on external decision processes. Nonetheless, the perception is that the institution strengthens sector competence and credibility in several ways. By its integration into the Ministry of Energy, it is also able to influence work of the Ministry in a positive manner, and enhance coordination.

A4.7 Institutional Assistance to EDM

A4.7.1 Introduction

The Electricidade de Moçambique (EDM) is Mozambique's national utility company. Created in 1977 as a state company, in 1995 EDM was transformed into a public company through Government decree 28/95 of 17 July. EDM's mandate is transmission, distribution, commercialization and some production of energy.

EDM began its operations with a very limited resource base: equipment was in bad condition and of different origins and models and a pool of weak technical and administrative personnel. During the civil war, equipments were further damaged. Since its creation, EDM has been focusing on repairing and acquiring new equipments, building new infrastructures, increasing the capacity of its human resources and explore production of hydro power.

Up until 1995, EDM's receipts from energy sale were highly insufficient to support EDM's investments in infrastructure and human resource development. EDM's budget was then complemented by allocations from Government budget and external donors and financiers. Since the Electricity Law of 1997, EDM has increasingly been able to sustain its operations and investments. In 2005, EDM's revenue from selling energy and associated services amounted to almost NOK 760 million.[24]

In 1977, EDM had two transmission networks: Maputo (transport of 275 KV) and Beira (110 Kv). There was also a transmission line of 220 kV from HCB to Chibata for the interconnection with SHER system. Since then, EDM has developed[25]:

- Central-North transmission line (1000Km extension of 220kV and 1100Km of 110 kV, investment of USD 90 million. The Project enabled energy produced at Cahora Bassa (HCB) to arrive at Tete, Caia, Nicoadala, Quelimane, Mocuba, Alto Molocué, Nampula and Nacala.
- Beginning in 1984, South transmission line (expanssion of 400 Km of 110 kV, about USD 25 million
- Developed hydro production through Corumana, Cuamba and Lichinga.
- Extension or construction of thermal production centres in Lichinga, Pemba, Nacala, Angoche, Quelimane, Mocuba, Inhambane and Lionde, of capacity above 44 MW, around USD 17 mill.
- Reparation of the generators at the Maputo, Nampula, Pemba e Xai-Xai thermal production centres, USD 10 mill.
- Acquisition of 58 groups of generators with total capacity above 8.7 MW, USD 4 mill.
- New emergency centre in Beira, and extension of Inhambane, Cuamba e Pequenos Libombos, USD 36 million.

As a result of continuous investment, EDM accounts for the bulk of electricity distribution in the country. In 2007, EDM produced 2.352 GWh (HCB acquisition 2.132 GWh, own production 184 GWh, and import 36 GWh) and sold 1,793.3 GWh of electric power. The peak load in the EDM system is currently on the order of 270 MW, still well below the total capacity available from Cahora Bassa and its own smaller hydro schemes.

From 1996, EDM's Board embarked in a process to re-organizing and decentralizing the company aiming at increasing the efficiency and effectiveness of EDM. As a result, appointments of new central, regional and operational directors were made. EDM is also undergoing a restructuring process through the separation of accounts and the creation of business units. With support from the African Development Bank, EDM has prepared a Master Plan for the expansion of the country's national power

[24] EDM Audit Report, 2005: MZM 2.620.132.875.000 converted at 0.00029 NOK/MZM

[25] www.edm.co.mz

grid and distribution networks with the goal of reaching 15% of the population by the year 2020, from the present 5%, at a cost of more than USD 800 million.[26]

A4.7.2 Project Description

Norwegian support for institutional development to EDM begun in the early 1980s. Institutional support was part of the first Sector Agreement for the Power Sector between Norway and Mozambique, which took place in March 1987, with a total finance frame of NOK 200 million over a period of four years. This agreement was extended through an Addendum dated August 1991. Norwegian support has been a stable source of finance for EDM and has covered the areas of institutional development, hydropower studies and consultancy support, construction/electrification, equipment for power development, and a training and personnel fund.

The objective of the Norwegian institutional assistance in the 1980s was "to encourage a direct cooperation between EDM and NVE" aiming at assisting EDM in developing the power sector. Institutional assistance of NOK 22.3 million supported direct cooperation between EDM and NVE. Assistance to training activities and support to expatriate personnel was also provided in the amount of NOK 2 million.

The 1993-1996 Agreement provided NOK 32.4 million to institutional development and NOK 10 million for training and NOK 2 million for support to expatriate personnel. The objective of the Project was "to support and strengthen Mozambique's ability to provide a regular power supply of electricity to its consumers".

The team could not access the data regarding total inputs and total outputs of the Norwegian support to EDM. Final or completion reports were requested, but none received. Norad has throughout the Project noted the insufficiency on reporting. For example, regarding insufficient detailed reporting on inputs, outputs and performance, on the minutes from the 1997 annual meeting, the Norwegian delegation commented on the lack of details in EDM's reporting and requested compliance with reporting. Although it is stated in the minutes that EDM would provide detailed reports in the future, the team did not locate evidence of improvements. Thus figures regarding inputs and outputs are limited. The team's assessment of quality of inputs and results is based on incomplete data.

A4.7.3 Results

A4.7.3.1 Outputs

More than 697 EDM staff received training form the Norwegian assistance in technical subjects, but most administrative and management training. 268 staff received training from 1987 to 1990 in the areas of administrative clerk (67), electricity - distribution, transmission, and operators (136), electronics (18), and mechanics (47). 429 staff received training from 1992 through 41 training activities, mostly in Mozambique.

A Portuguese firm was contracted by the Norwegian assistance to provide training in the early years. This proved to be effective due to readily accessible didactic materials in Portuguese language and communication during training. Personnel trained by the Norwegian assistance were involved in the daily operation of EDM all over the country. The assistance was highly relevant in increasing EDM's pool of middle-level professionals.

1. Zambezia and Nampula hydropower studies.
2. Study of the energy systems on Maputo and Gaza
3. Revision of the Zambezi Basin Hydropower potential, smaller scale development in Niassa and in the South.
4. A number of EDM staff visited Norway to study the maintenance system and programs for Norwegian hydropower and transformer stations.
5. Analysis of hydrological data for Chicamba-Mavuzi Hydropower System and introduction of the

[26] Scanteam,Review of the Norwegian Assistance to the Energy Sector in Mozambique (Scanteam 2005).

	model by NVE. EDM staff visited Norway for 2 weeks for further introductions to the model. Subsequently three EDM staff went to Norway and Portugal to transfer and convert the data from old to new computer.
6.	Visit of two Bærum Energiverk staff to assess need of support to establish a distribution utility in Cuamba, including organisational structure, development of tariff, etc.
7.	Two EDM staff visited Norway and Sweden to study the organization and work methods in Vattenfall and NVE.
8.	The chairman of NVE Board and NVE director visited EDM.
9.	Strengthening of internal routines to the statistics office, enabling system planning and tariff studies.
10.	Tariff studies
11.	Improvement of information and presentation, and use of information centre.
12.	Assistance in recruitment planning (NVE)
13.	Assistance to the Power by Saving Programme

Table A4- 21: Content of EDM Institutional Cooperation

A4.7.3.2 Outcome

In the early 1980s, the Norwegian support to EDM occurred under the harsh conditions imposed by the war and the project during worked as one source of stabilization in the region, serving as a stimulus for other sectors to keep on working.[27]

When EDM was created in 1977, 50% of its personnel was unskilled. The Norwegian support to training that took place between from 1987 to 1990 helped to change this scenario. By 1990, less than 40% of EDM staff was unskilled. After 1990, Sweden has played a major role in supporting training, while Norway's role was minor, but both efforts have improved the situation further.

A4.7.3.3 Impact

EDM has shifted its human resources profile from an unskilled to mostly skilled labour force and Norwegian support has significantly contributed to it. EDM is one of the very few business entities in Mozambique that has a structure, management and measurable output delivery that permits performance monitoring. Norwegian support to EDM's information management system has contributed to it.

A4.7.4 Findings

A4.7.4.1 General

There is no documented evidence of cross-cutting issues having been addressed in any manner in the project.

An uncertainty exists as to the exact amount spent for the interventions under review, as these have been part of an overall budget and accounting procedure for many years. This affects reliability of efficiency value calculations, which therefore must be taken as indicative rather than absolute. In terms of accountability however, such uncertainty is not relevant, as total spending has been accounted for, and audit reports provided.

According to EDM informants, the organization achieved a saving of about 30% due to change in the provision of assistance from tied to untied aid. However, EDM staff also noted that international bidding process also has its inefficiencies due to long processing time at the Ministry of Finance. Because EDM is state-owned, they experience is delays in implementation of about fours months due to bidding processes, and approval by authorities. Nonetheless, preference remains to untied aid, because best value has been achieved through open bidding.

[27] In EDM Proposal for New Agreement, 1999.

A4.7.4.2 Quality of inputs

In the 1980s, Norwegian institutional support was tied aid, meaning EDM would commission Norwegian organizations to support the institution with capacity development activities. NVE, Statkraft, Norconsult, and Bærum Energiverk are examples of Norwegian firms and institutions that provided support to EDM. Norwegian advisers were also commissioned to supply EDM with its needs for short-term and long-term expertise. Activities were supported under the EDM-NVE institutional cooperation agreement, and activities designed based on agreed sub-projects between EDM and NVE.

Training activities were also supported based on planning between EDM and NVE. Training was provided in all areas, but it was reported to lack coordination with Sida, resulting in overlapping activities and provision of different approaches and methodologies for similar training subjects.[28]

From 1992 on, Norwegian assistance was no longer provided on the basis of tied aid. According to EDM informants and documents, the previous institutional cooperation with NVE was effective but EDM preferred to open its possibilities regarding institutional development. Even so, EDM continued working with Norwegian private firms (Norconsult, HITEMA) and institutions (NVE, Statkraft) for the provision of institutional support. Coordination with Sida was reached and Norwegian support to training was focused on non-technical and management training activities, as stipulated in the 1993-1996 Agreement.

A4.7.4.3 Efficiency

The efficiency of the institutional assistance is regarded low for the first phase, due to high costs of expatriate resident advisers, but improved in the second phase as EDM was able to increase the value of the support via international bidding.

Norwegian assistance was also easy to administer, an important factor for providing support to organizations with weak administrative capacities as was the case of EDM at the beginning of the institutional support.

After EDM coordinated Norad and Sida assistance, it also managed an efficient training programme. According to EDM, one of the most significant contributions of the Norwegian support was support to the formation of 80 to 90 instructors. This enabled EDM to substantially increase the efficiency of its training programme since national instructors replaced foreign trainers.

A4.7.4.4 Effectiveness

As stated by EDM informants, the way the Norwegian assistance was provided through a single agreement encompassing all activities endowed the assistance with the needed flexibility to adjust to changing needs. According to EDM, this applies to the Norwegian assistance throughout, even when the institutional assistance support was tied, hence conditioned to cooperation with Norwegian institutions. Norwegian assistance was thus seen as effective, as it could be adjusted to EDM's core needs and to areas where funding gaps from other donors occurred. It enabled EDM to focus on its own strategy for institutional development. Assistance through the institutional cooperation with NVE was considered effective up to about 1990, but it was found inefficient and was eventually discontinued.

A4.7.4.5 Relevance

Early on EDM gave priority to human resources development through training. EDM established its Training Centre in Maputo soon after the establishment of the utility. It received support from France and Germany to carry out a training needs assessment and produce a training program. Based on these inputs, EDM developed and followed an approach to its human resources upgrading, based on:

- unqualified staff reduction through retirement program,
- recruitment of qualified staff, and internal and external training.

[28] Norplan, "Review of Electricity Sector in Mozambique and the Support by Norway and Sweden" (Apr. 1995).

Hence EDM produced a solid basis for the effective use of Norwegian assistance to training.

A4.7.4.6 Sustainability

Norwegian support to the formation of instructors to replace foreign trainers enabled EDM to substantially increase the efficiency of its training programme. Of high relevance, Norwegian assistance enabled sustainability to EDM's Training Centres as most of the instructors supported by the assistance remain at EDM.

A4.7.4.7 Benchmark

Benchmarks calculated show low efficiency, and moderate but below average effectiveness and relevance of overall institutional assistance. This is roughly in line with the findings formulated above.

Benchmark factors compared		
	efficiency	effectiveness Relevance
EDM	69%	89%
best	249%	129%
Worst	16%	78%

Table A4- 22: DAC Criteria Benchmark for EDM

A4.7.5 Conclusion

The combination of EDM institutional cooperation and the provision of training have helped the utility in difficult times, when its own capacity was severely limited. Norwegian assistance has been crucial for many years, but so has assistance by Sweden, of a similar nature and extent, and some relatively minor contributions from other donors. EDM was able to improve previously poor coordination between Swedish and Norwegian assistance, resulting in efficiency gains.

The Norwegian institutional support was instrumental in filling EDM's shortage of expertise through support of expatriate staff (resident adviser and consultants). That need has been greatly reduced over time, although it still exists for some posts. Nonetheless, this can be taken as a positive indicator of the impact of assistance, and EDM's own efforts in staff recruitment.

A4.8 DAC Criteria Comparison of Institutional Assistance

A4.8.1 Efficiency Comparison

The major factors positively affecting the efficiency of Norwegian support to institutional development in the energy sector were:

- Adequate planning for and implementation of knowledge and technology transfer to national staff (e.g. EDM's training program)
- Institutional leadership and focus on project management (UTIP's institutional support from year two and EDM's institutional support)

The major factors negatively affecting the efficiency of Norwegian support to institutional development in the energy sector were:

- Inadequate planning and reporting, which hindered use of resources and inability to use planning (annual plans) as management tools (e.g. UTIP's training program, MIREME's institutional cooperation and training),
- High cost of inputs to low outputs (e.g. UTIP's Panel of Experts, MIREME's Institutional cooperation)
- Lack of leadership and sufficient staff, and clarity of roles, stalling project implementation (UTIP's first year, MIREME's first phase)

Project	Project Identification	Management and Supervision	Reporting
UTIP	High	Medium to High	Medium
MIREME	Low	Medium	Low
EDM	High	Medium High	Low
Overall	Medium-high	Medium High	Low-medium

Table A4- 23: Summary Institutional Assistance Efficiency

A4.8.2 Effectiveness Comparison

Norwegian assistance to institutional capacity development to the energy sector institutions had a mixed result in terms of effectiveness. Norwegian support produced better results in producing institutional transformation/improvement at UTIP and EDM, much less so at DNE. A good reason accounting for better results in strengthening at UTIP and EDM was better designed and implementation of support. In terms of human resources development/skills upgrading, support to EDM was the most effective. EDM assessed its human resources at a very early stage and designed a human resource development program consistent with its own objectives and with the pool of financial resource it expected to have in the short and long-run, focusing on the sustainability of the assistance. Effectiveness is thus a result of EDM's vision, leadership and planned use of assistance and Norwegian flexibility to change assistance to support EDM's institutional development.

All Norwegian assistance to energy sector institutions included support to policymaking. Norway provided support to the development of a national Energy Strategy, Power Sector Regulations, and the Rural Electrification Plan. Norwegian support to institutional capacity development enabled Mozambique to improve energy sector resource mobilization and management through:

- Support to technical studies (e.g. on-going support to MN by UTIP, Zambezia and Nampula hydropower studies and revision of the hydrological data for Chicamba-Mavuzi Hydropower System by EDM, hydropower potential study in Niassa and Zambezia Provinces by MIREME).

- Production of legal and regulatory tools including draft contract concessions contracts for the production, transport, distribution, commercialization as well as import and export of electrical energy by MIREME, elaboration of the Memorandum of Understandings between the Government and various prospective private-sector investors to MN)
- Support to the development and implementation of administrative and management systems and tools in energy sector institutions (e.g. accounting system at EDM and UTIP, management information system at EDM, library function at UTIP, strengthening of internal routines of the statistics office at UTIP, enabling system planning and tariff studies).
- Provision of technology (computers and software) to MIREME, EDM and UTIP. In the case of UTIP, Norwegian assistance has enabled the institution to function.
- More than 787 energy sector staff have been trained with Norwegian support.

Project	Policy-making	Resource Mobilisation & Management	Oversight & Accountability
UTIP	High	Medium	High
MIREME	Medium	Medium	Low
EDM	High	High	High
Overall	Medium-high	Medium-high	Medium-high

Table A4- 24: Summary Effectiveness of Capacity Development and Training

A4.8.3 Relevance Comparison

Norwegian assistance to institutional capacity development to the energy sector institutions was highly relevant. It was consistently aligned with Government's goals and strategy. Change in the institutional support to UTIP and current negotiation for the support to ME clearly reflects Norwegian timely response to nationally driven sector restructuring. Although Norwegian institutional support projects were not based on systematic ***diagnosis*** (e.g. institutional needs diagnosis, training needs assessment), Norwegian support to energy sector institutions focused on identified core needs of the sector at the time of the intervention: lack of qualified staff, insufficient national expertise, and deficiency in technology (hardware and software). Inputs to all institutional support projects focused on these core areas.

The institutional support was designed in different ways. Decision whether support was provided through tied aid (MIREME, EDM) and untied aid (UTIP, EDM's second phase), was the outcome of political decision rather than based on best value assessment for the support. Different design produced mixed results to the overall portfolio:

- UTIP: The design for the institutional support to UTIP had three main components - core consultants, panel of experts, and training, financed through untied aid. Design has to match the fact that UTIP was a newly created institution and thus needed flexible and ongoing provision of inputs. The design of the Core Consultant and training had a good fit with institutional diagnosis. Support to training was designed based on yearly plan, hence flexible to adapt to institutional growth. The Core Consultant was designed as a continuous source of a pool of expertise to respond to wider need of the institution. The Panel of Expert had too narrow focus (and too high cost) to more fully fulfil UTIP's diagnosed need for on-going support, adaptable to changes in UTIP and its environment. The selection of the Panel of Experts model encountered resistance from Norway, but defended by UTIP. It was finally accepted in order to provide ownership of the total design to the institution.
- The design for the support to MIREME was through a conditional institutional cooperation between EDM and NVE, what is known as institutional twining. The mandate of these two institutions mismatch as the mandate of DNE is much wider, what contradicts the principle of

institutional twining. Misfit in mandate becomes a limitation to the model when the institution supposed to lead the partnership due to its strong capacities and historical experiences (NVE in this case) has a much more limited mandate. In this case, the design for the institutional cooperation program should be focused to the areas the institution's mandate match.

- The design for the EDM institutional support changed from tied to untied aid. Originally Norway supported cooperation between NVE and EDM. The design of the support was changed as a request of EDM, to achieve better fit with the needs of the organization. Change to untied aid enabled EDM to design a support model where it commissioned expertise based on best value and the company's changing needs. Training was provided flexibly, based on a human resources assessment and training program.

Project	Alignment	Diagnosis	Design
UTIP	High	High	Moderate
MIREME	High	High	Moderate
EDM	High	High	High

Table A4- 25: Summary Relevance of Capacity Development and Training

A4.8.4 Sustainability Comparison

Overall Norwegian support to training has had a sustainable outcome in the energy sector in Mozambique as most staff trained through Norwegian support remains in the institutions where they received training. This can be explained by the small number of private companies in the energy sector in Mozambique, hence low employment opportunity outside the public institutions. However, according to data provided by ME and UTIP, the number of staff loss to EDM, which is a public company has been minimum. This is explained by EDM strategy to develop their own human resources through provision of own training.

One of the institutions receiving Norwegian support ceased to exist, DNE. Thus the outcome of the institutional support in terms of sustainability was extremely low. Decision to dissolve DNE was due to the restructuring of the energy sector. However, it would probably been unlike that DNE would had ceased to exist if the Norwegian assistance had achieved its aim of making DNE an effective and efficient institution. The status of another institution receiving Norwegian institutional support also changed prior to DNE. In 1995 EDM became a public company (from a state-owned institution), but the organization was sufficiently strong to withhold its independent status and promote further institutional growth and strengthening. The Norwegian assistance had and continued to contribute to such institutional achievements. The energy sector institutional restructuring also affected UTIP, which is now more integrated within the new Ministry of Energy (ME). While Norwegian support to UTIP has changed in response to the sector restructuring, the fact that the institution had achieved significant institutional capacities played a role in securing its place within the sector. UTIP's current semi-independent status form the ME reflects the institution's success in having effectively used the Norwegian institutional support to guarantee its role in improving the energy sector in Mozambique.

Project	Sustainability
UTIP	Medium
MIREME	Low
EDM	High

Table A4- 26: Overall Sustainability of Capacity Development

A4.9 Macro and Meso Level Impacts

A4.9.1 Introduction

An evaluation of the specific social and economic impact of *Norwegian* cooperation in the power sector is only possible in cases where one has access to data dealing with specific projects where Norway has been the most significant donor. Much of Norway's support to the power sector in Mozambique has been interventions like the construction of transmission lines and institutional support. Such support categories have been evaluated in this report in terms of outputs or outcomes for the specific projects or programmes. The *ultimate* impacts of such interventions however lie in the social and economic effects of better power supply. It would be impossible or meaningless to try to calculate the social and economic impact of the *Norwegian* input in the overall development of the power sector. The approach taken below is therefore to consider the socio-economic impacts of the development of the sector as a whole and then at the end illustrate what may be called the specific Norwegian share in the impact by looking at Norway's share in the total effort (investment and capacity building) which was behind the impact. The report considers below first (A4.8.2) the effect on the macro economy and growth and then the effects (A4.8.3) on the households. Then Norway's particular role as a donor is considered (A4.8.4), before analysis is done (in A4.8.5) of the advantages for Mozambique of Norwegian support to regional cooperation through the case of the Southern African Power Pool (SAPP).

A4.9.2 Economic Impact at the National Level

The direct economic effects of selected investment projects funded by Norway have been analysed in previous sections. This section deals with the overall economic effects of Norwegian supported power sector interventions in Mozambique. Available methods and statistics do not permit an analysis that determines the specific effect of *Norwegian* aid to the power sector on key macro economic variables. Therefore, it is attempted to consider the contribution of overall aid to the sector and then indicate the effect of the Norwegian assistance by looking at its share of the total of interventions.

What role did the support to the power sector play in the economic decline during the seventies and eighties and in the growth period after 1992. It is clear from interviews conducted by the evaluation with long standing politicians and civil servants in Maputo, that the aid inflow in the form of import support for equipment and spare parts and indeed technical assistance were critical for the crisis management that kept power supply to central urban areas running through the crisis.

What role did the power sector play during the growth period from the beginning of the nineties? One may consider this at least in two ways: a) the expansion of value added of the power sector itself and b) the effect on the rest of the economy of a functioning power sector supplying reliable power to other sectors and delivering electricity to households.

A4.9.2.1 Power sector share of GDP

The *first* effect may be determined by looking at national accounts data obtained for the period 1996 to 2005[29]. Whereas (in 1996 prices) GDP increased by some 8.4 % per annum during the period, the value added for the electricity sector increased by nearly 40%. This increased the share of value added of the power sector from 0.25 % of GDP in 1996 to 5.71% in 2005. If the power sector contribution to GDP had been the same (in fixed prices) in 2005 as in 1996 this would have had a significant effect on overall growth.

A4.9.2.2 Power and economic growth

The *second* effect concerns the supply of electricity as a *driver* for overall economic growth beyond its direct contribution to sectoral value added. The relationship is infinitely much more complicated than

[29] INE 2007, exercise for the evaluation

a simple causal relationship between the availability of power and growth. On the basis of examination of an extensive body of literature the Norad "State of the Art Study"[30] points out two key issues which makes the cause and effect relationship between power and growth complex; the importance of synergy effects between different kinds of infrastructure[31] and the necessity of institutional reform.

A study of the direct relationship between electricity use and economic development in over one hundred countries[32], analysed and compared correlations between *electricity* consumption per capita and GDP per capita with those between *total primary energy* supply per capita and GDP per capita. The general conclusions of this research are that wealthy countries have a stronger correlation between electricity use and wealth creation than do poor countries and that, for the global economy as a whole, there is a stronger correlation between electricity use and wealth creation than there is between total energy use and wealth. A regional analysis of the results indicated that for African countries the correlations were weak and sometimes negative. (Hansen 2006) however, indicates that the underestimation of the institution reform challenge has caused estimated impacts of growth via infrastructure investments on poverty reduction to be lower in Africa than in other regions.

A number of later econometric studies have confirmed the positive effect of electricity supply in developing countries. In Sri Lanka, Morimoto and Hope (2001) concluded that "current as well as past changes in electricity supply have a significant impact on the change in real GDP in Sri Lanka". A study of 10 Asian countries (Chen, Kuo et al. 2007) whereas uncertain about causal directions in the shorter run, found that the examination of "long-run relationship indicate that a sufficiently large supply of electricity can ensure that a higher level of economic growth". Yoo (2006) presents similar findings for Asean countries. For 17 African countries Wolde-Rufael (2004) concludes that "the empirical evidence shows that there was a long-run relationship between electricity consumption per capita and real GDP per capita for only 9 countries and Granger causality for only 12 countries. For 6 countries there was a positive uni-directional causality running from real GDP per capita to electricity consumption per capita; an opposite causality for 3 countries and bi-directional causality for the remaining 3 countries. The result should, however, be interpreted with care as electricity consumption accounts for less than 4% of total energy consumption in Africa and only grid-supplied electricity is taken into account."

Although the evidence from Africa on direction and strength on the power-GDP connection appears weaker, the evaluation tends to subscribe to the wider view on the importance of infrastructure expressed by Hansen (2006, p.45), after having considered the evidence provided by Estache (2005) that "The clear message from this research is that there will be no growth and no significant poverty reduction in Africa without a major improvement in the level and state of infrastructure".

Although the data for a fully convincing analysis of power / GDP relations for Mozambique are lacking, it appears reasonable to conclude that the strong growth in the sector has spurred overall economic development in Mozambique. Comparing to Newbery (2005) who studied energy intensities in Asian countries by calculating power consumption in kWh per 1,000 USD-PPP GDP. Mozambique, around the level of 70 kWh per 1,000 USD-PPP GDP by 2005, could be compared to countries like the South Asians with a slightly increasing trend. This is likely to be well above similar ratios for other African countries.

A4.9.2.3 Imports and Balance of payments

To what extent has increasing power availability had a dampening effect on the demand for imported petroleum products and therefore a positive effect on the balance of payments? One argument heard was that although a number of generators existed throughout the country they were largely out of

[30] Hansen 2006, p45-46

[31] This is for example implicit in the observation that electrification accompanied by improvement of the road network will have a greater effect on growth and poverty reduction than electrification and road works in isolation.

[32] Ferguson, Wilkinson et al. 2000

order or the institutions running them were not able to purchase the oil or run or maintain them. Macro figures (as illustrated in **Fig. A4- 11**) however indicate that in the late eighties and nineties there was a drop or flattening out of oil demand at the same time as GDP and electric power consumption increased significantly.

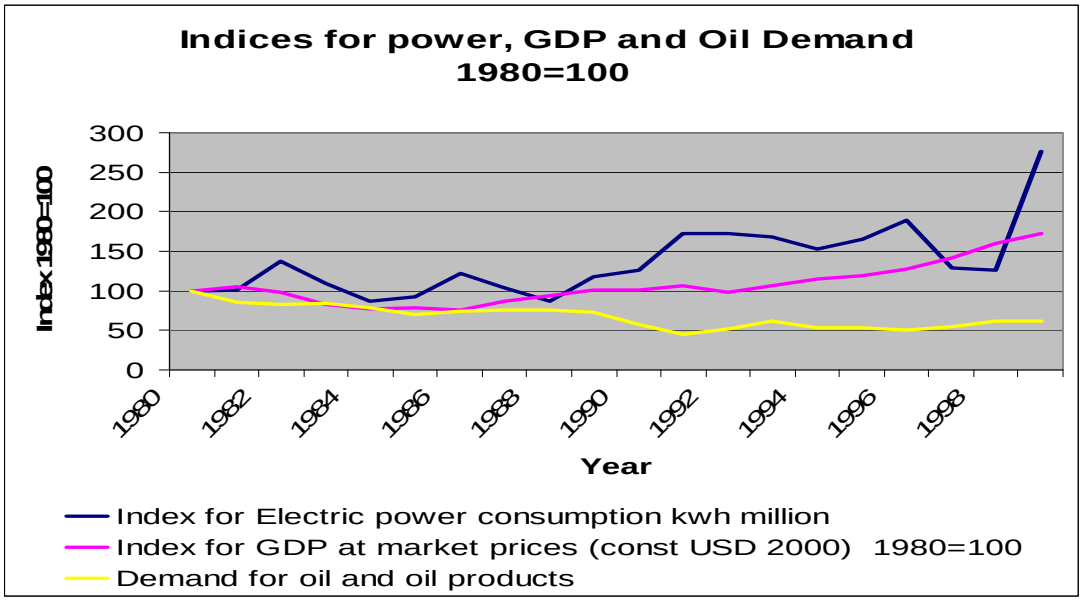

Fig. A4- 11: Macro Energy Data

Source IEA: Oil information 2001. **Note**:Demand refers to net inland deliveries (including refinery fuel and international marine bunkers).

Oil import value data from the time before 2000 was not available to the team. From 2000 to 2004 the overall import bill was on average just above USD 1,500 million with the petroleum bill at USD 220 million and foreign exchange expenditure on oil imports nearly 15% of overall foreign exchange cost. Any savings on oil imports would therefore have a significant effect on the total import bill. In addition, power sector exports, mostly from HCB to South Africa (Eskom) but also to other neighbouring countries has had an increasing trend and in 2005 amounted to 12,000 GWh which calculated in USD would be a considerable contribution to foreign exchange earnings.

A4.9.2.4 Effects on the manufacturing sector of power hook up.

A company level survey for Mozambique was carried out in February 2006 by CTA - Confederation of Mozambican Business Associations and DNEAP - National Directorate of Studies and Policy Analysis. The survey covered six cities (Nampula, Nacala, Gurué, Chimoio, Beira, and Maputo) within five provinces (Nampula, Zambezia, Manica, Sofala, and Maputo) with 158 enterprises. The main objective was to facilitate policy research on firm dynamics (survival and growth) and to update information on the constraints faced by manufacturing enterprises.

The 2006 survey included “Electricity” in a 24 point list of “factors problematic for the operation or growth of your business” and respondents were asked to answer by numbering the constraint from 0 “no constraint” to 4 “serious obstacle”.

The analysis of the electricity aspect in the report is as follows: ”Firms reported a mean constraint level of 2.1, implying that issues relating to electricity supply still pose a moderate problem to most firms. The mean for micro firms (1.5) was relatively lower than small (2.1), medium (2.1) and large firms (3.3), potentially reflecting a variation in capital intensity of production and thus varying degrees of dependence on a steady and reliable flow of electricity.

The perceived severity of the constraint varied considerably with location, from a low of 1.1 in Nampula to a high of 2.9 and 3.0 in Nacala and Gurué respectively. Indeed the median levels of perceived constraints to business caused by the electricity supply vary from 0 in Nampula, to 1.0 in

Chimoio, 2.0 in Maputo, 3.0 in Beira and Gurué[33] and 4.0 in Nacala, implying that locating in Maputo and Beira does not necessarily convey a benefit in this regard."

A4.9.2.5 Did Norwegian aid contribute?

The balance of evidence is, in general, that the expansion of the power sector in the majority of cases, also for the poorer countries, has been a driving factor for overall economic growth. Given the fairly dramatic growth of electricity consumption in Mozambique, the sector is likely to have spurred growth in the period from 1992. To what extent could then Norway be said to have contributed?

The approach taken here is to consider the *share* of Norway in power sector investment. Since investment or data on Gross fixed Capital Formation (GFCF) by sector for Mozambique does not exist for longer periods and most investment in the sector has been donor financed[34], a reasonable approximation for investment in the power sector would be the aid inflow for capital investment purposes to the sector. Norway's share of the inflow would then be an indicator for the importance of Norwegian support.

Aid inflow data were extracted from the OECD database on ODA commitments which, although incomplete and deviating from the disbursed amounts, is the best indicator for the purpose of the evaluation. For the Norwegian share, data collected from Norad were used with appropriate currency recalculations. The numbers indicate that over the entire period 1980 to 2005 Norwegian aid to the sector could have contributed somewhat less than one fourth of the entire aid inflow to the sector. For several years in the beginning of the period, the statistics indicate that a clear majority of total aid inflow to the sector came from Norway. During the time after 1992 Norway's contribution declined to just over one fifth.

Since this study overall does not find any indication that Norwegian aid to the sector in any way was *less* effective than that from other donors, it is safe to conclude that the contribution to the sector could have been a significant reason for the growth of the overall economy since 1992 – although one of many reasons. Also, indications are that the power sector's effect on the balance of payments during this period, through savings on oil imports and through exports of power may have been significantly positive. The signals from the manufacturing sector about the importance of electricity supply as a bottleneck for further progress indicates that electrification has had a positive effect on the growth of business.

A4.9.3 Socio-economic Impact

The evaluations' analysis of the effect of Norwegian support to the power sector in Mozambique in the section above, dealt with the overall effect of the development of the sector. This was found to have imparted significant benefits to overall growth as measured by GDP and probably likewise of the balance of payments. Norway was found to have a significant share in investment and management of the sector. Analysis of individual investment projects and other aid interventions where Norway has been centrally involved provided a more specific analysis of Norway's contribution.

An evaluation of Norwegian development cooperation in the power sector will of necessity have to complement the macro-economic picture by analyzing the socio-economic impact of electrification of urban and rural areas in Mozambique, in particular with respect to the situation for social amenities and the poor. The specific effects of a programme where Norway has been directly involved will be

[33] The observation from Gurué may seem to be inconsistent with the overall impression from the field study that companies were content with the electricity supply situation. However, it is clearly due to the fact that the sample drawn for Gurué for the DNEAP study referred to contained only one large firm and would therefore not be representative for all business in Gurué. Since large firms generally appear to have greater problems with electricity supply the result appears consistent with our findings in the Gurué study.

[34] A statistical exercise on OECD aid (commitment) data shows that from the late eighties about 100% of general government fixed investment (as given inn the World Bank database for Africa 2006) has been covered by aid inflow.

demonstrated through the analysis of the baseline field survey in Gurué. The present section will attempt to find evidence for effects of power supply improvement on socio economic development at the national level. The focus will be on two separate areas, household incomes and education.

Data for "double difference" evaluation of socio economic impact as considered as "ideal" in the 2006 World Bank methodology booklet (World Bank 2006) are not readily available in Mozambique. The evaluation however found good and relevant secondary data sets produced by the National Statistics Office (INE), some used in earlier analysis by DNEAP.

A4.9.3.1 Analysis of family incomes and electrification

The ADB study (Cook, Duncan et al. 2004) on the major question of whether electrification, all other things equal, would have a significant effect on poverty reduction appears to come out *undecided*. This is in line with a key conclusion from a World Bank assessment of electrification in Asia presented in the World Development Report 1994 which holds that rural electrification can support rural growth but not *initiate* it. Other factors have to work *together* with supply of electric power.

The literature is replete with descriptions of the beneficial effects of electricity supply. The Norad state of the art study (Hansen 2006) says that "there is no contradiction between the above development impact conclusion and the conclusion that there are significant benefits of an electricity supply to a family which previously had to rely on candles, kerosene lamps, dry cell batteries and car batteries. Households experience a marked improvement in their living standards as soon as they obtain electricity supply. The more they invest in further house-wiring and additional appliances, the greater the benefits become. The biggest improvement is in the quality of lighting, and there is extensive survey evidence (however not referred to in the review report commissioned by Norad) that extended hours of good reading light has contributed significantly to the performance of schoolchildren and students, and has helped to increase the likelihood that girls complete their schooling and women in the households become literate."

The analysis below attempts to test whether the blessing of electricity for households in one particular sense is true also for Mozambique by exploring the relationship between access to electricity and household incomes.

The key dataset for analysis of family incomes are the IAF - *Inquérito aos Agregados Familiares* 1996/97 and 2002/03. This is a standard household income and expenditure survey, the latter based on sampling of over 8000 households and collecting data over a wide range of social indicators, including information on household use of electricity. The sample is drawn to make estimates significant at provincial and national levels only.

Also other data sets are available. The *QUIBB - Questionário de Indicadores Básicos de Bem-Estar* 2000 is a less extensive household survey than IAF but with many of the same indicators based on a large sample of households. The more recent *IFTRAB - Inquérito Integrado à Força de Trabalho 2004-2005* is a labour force survey based on an extensive household sample that also includes power supply data and social indicators.

These surveys all contain information about the households' access to electricity in addition to a number of socio economic indicators. Since the most relevant overall indicator for household welfare is likely to be household income, it was decided to consider the effect of electricity on this variable. The dataset used in the below analysis is the IAF 2002/03.

Although dedicated "before and after" data for "with and without" cases do not exist, it will be possible to use regression techniques to analyse social and economic differences of families with and without access to electricity, adjusting for other factors. This is in line with what the (World Bank 2006) calls "Design 4: *Post-intervention project and comparison groups with no baseline data"*.

The dataset for IAF 2003/03 was used for a linear regression. The objective was to find out whether the households which get access to electricity manage to increase their family incomes. Ideally this would be done by assessing household incomes before and after the introduction of electricity, taking into account other factors that might have had an effect on incomes. In addition, for an ideal analysis, it would be necessary to do an analysis of a "control group" that did *not* get access to electricity during the same period and with the same "other" influencing factors as the first group.

Given the data available, the approach taken here was essentially to try to find out whether families which used electricity for lighting had higher incomes than those who did not. Since clearly the causal link may go the other way, i.e. households have electricity *because* they have high incomes; a multiple regression method was used, which has the effect of allotting influence on incomes to a large number of factors (21). In a sense, this means that one takes into consideration how the *other* factors influence incomes and then find what influence "is left" for electricity.

Table 1 below gives the full regression results, the names and a brief explanation of the variables. The data documentation (INE 2003) contains full information on the actual questions asked in the field. The explained variable, "household income" was compiled by the National Directorate of Studies and Policy Analysis in Ministry of Planning and Development (DNEAP) for use in the main report (DNPO, (DNPO) et al. 2004). To be used in poverty analysis, the income figures are adjusted for price differences over time and by location.

Source	SS	Df	MS	No. of obs	= 8574
				F(21, 8574)	= 116.39
Model	1.9796e+12	21	.4265e+10	Prob > F	= 0.0000
Residual	6.9443e+12	8574	809925802	R-squared	= 0.2218
				Adj R-squared	= 0.2199
Total	8.9239e+12	8595	1.0383e+09	Root MSE	= 28459

Cr2:household uses electricity for lighting	cr2	Coef.	Std. Err.	T	P>t
Household has:					
Electricity for lighting	Ilum	10059.910	1248.735	8.06	0.000
Toilet or latrine	Lats	-586.719	860.482	-0.68	0.495
Dwelling with cement or brick walls	Pare	1650.358	676.340	2.44	0.015
Number of assets	Asst	4342.616	317.672	13.67	0.000
Number of dependents (<=15 or >=60)	Dep	938.030	489.647	1.92	0.055
Number of women	Numfem	-917.794	463.933	-1.98	0.048
Number of literate males	Nummlit	-1537.360	799.741	-1.92	0.055
Number of literate females	Numflit	-522.501	457.506	-1.14	0.253
Number of males with EP1	nummep1	-10373.230	977.997	-10.61	0.000
Number of school children (>=7 or<=17)	Schage	-118.511	355.085	-0.33	0.739
Female head	Chef	2895.179	844.193	3.43	0.001
Highest level of education (1)	Mxed	-12593.800	1049.662	-12.00	0.000
Highest level of education squared	Mxe2	4363.415	221.347	19.71	0.000
Dependency ratio	Depr	-6725.813	2032.414	-3.31	0.001
Ratio of females to total hh members	Gend	4178.428	2408.612	1.73	0.083
Ratio of literate males to total hh members	Hnml	6092.502	3711.449	1.64	0.101
Ratio of males with EP1 to total hh members	Hnm1	65111.670	4501.015	14.47	0.000
Ratio of females with EP1 to total hh members	Hnf1	4547.870	3048.910	1.49	0.136
Dwelling in distr. with mean ratio fem h'ded hh	Pach	-1040.471	2703.164	-0.38	0.700
Dwelling in district with mean ratio having toilet	Pala	-3715.259	1424.767	-2.61	0.009
Dwelling in district with mean 7-17 enroll. Rate	Papc	2204.032	2599.602	0.85	0.397
Constant term	_cons	8415.994	2001.736	4.20	0.000

(1) 0 none,1 EP1, 2EP2, 3 ESGC1 &ETB, 4 ESGC2& ETM, 5 post sec

Table A4- 27: Regression Results

The key variable indicating access to electricity by the family comes from question F12 under "Characteristics of the dwelling" in the IAF questionnaire. The actual question was "What is the principal source of energy for lighting for the household". Answer alternatives were Petroleum /paraffin, Gas, Electricity, Generator/solar batteries, Candles, Firewood or "Other". Note that the

question therefore differentiates between electricity from generators or batteries and those from grid connection. The variable as used here measures access to grid electricity only.

The *other* explanatory variables may be seen as different characteristics of four different groups.

- *The state of the dwelling* (*ilum, lats and pare*) which are indicators of the wealth of the family.
- *Number of assets* (*asst*) will indicate to what extent the family owns assets used in production or consumption (note that the variable does not indicate the value or size of assets).
- *Characteristics of household members* (*dep, numfem, nummlit, numflit, nummep1, schage, chef, mxed, mxe2, depr, gend, hnml, hnm, hnf1*) are important since most of the productive power of the households in Mozambique is derived from the household members and therefore comprises a large number of variables.
- *Characteristics of the districts where the household* is situated (*pach, pala, papc*). This will take account of the effect on incomes of living e.g. in a well to do area where the family may do better only because of the better market and opportunities for earnings.

The results appear quite striking and indicate that access to grid electricity has a very clearly significant and positive effect on household income. Only four of the 21 explanatory variables (*lats, numflit, mxed* and *pala*) came out with an unexpected sign but three of these had very low levels of significance. The only variable which came out with an unexpected sign and also was significant at a higher level than the 0.95 was *mxed* This might be seen as surprising as it indicates that a higher the level of education of the highest educated in the family, contributes to a lower household income but could be partly due to the fact that education above a certain level does not contribute to incomes.

Still, a conclusion has to be drawn with care. The evaluation has not managed to measure the effect of electricity supply in isolation. The range of effects attempted to measure does not properly take into account the parallel improvement in other infrastructure that has taken place over the same period and is widely held to have a synergetic effect on the supply of electricity.

A4.9.3.2 Analysis of effects of electrification on education outcomes

One important sector where literature indicates positive effects of electrification is *education*. Whereas one may agree with statements like “The often claimed health and education benefits from provision of electricity to clinics and schools are by and large exaggerated.” (Hansen 2006) proof has been found in many circumstances that electrification has positive effects on school work and school attainments, both because it is possible to run night classes in schools, because it is easier for children to study in the evenings and because electricity has a tendency to reduce drudgery and free up time for study and other activities. This has been found in particular to concern women.

On the one hand it is however clear that provision of electricity for schools can not make up for a deficiency in the fundamentals like good teachers, books, adequate buildings and teaching equipment. If these are lacking it may be wrong to invest in electrification. On the other hand, given certain basics the social rate of return of education expenditure will increase if schools have electricity and schoolchildren have light for doing homework after dark.

Since one is able to determine in a rough way when grid power became available in the various provinces and (administrative) school data from 1980 to 2006 are available, it will be possible to approximate a “before and after” situation. Also, it will be possible to adjust for factors which may have had positive effects on the level of education.

The data for the analysis undertaken by the team was extracted from INE. The data base consists of the following variables per annum over the period 1982 to 2004 for the 11 provinces of Mozambique for each of the educational levels EP1, EP2 and ESG (high school level).

- *Pass rates* (or continuation rates) defined as the average per cent of pupils being moved up one step (as a percentage of total number of pupils in the class).
- *Teacher quality* defined as the percentage of teachers teaching in each year, educational level and province who have not undergone pedagogical training.

- *Class size*. Average number of pupils in class for the various educational levels, years and provinces.
- *Enrolment*, defined as number of pupils in the province at the given educational level and year.

From the EDM information was obtained which enabled a rough assessment for the years 1981 to 2006 of the various provinces access to grid power. From this an *Electricity dummy* (Eldum) was created and valued "0" during the years before it was considered that the province was hooked up and "1" during the years after. Clearly this will be at best a rough approximation since transmission and distribution does not follow provincial borders and all schools and homes in the various locations in a province are not electrified when lines reach to somewhere in the province. Part of the problem was dealt with by lagging the electricity dummy for two years, thereby taking into account the time for hook ups to spread within the province and the time before the access to electricity would get an effect on school performance.

A linear panel data regression applying SPSS was used to test the effect of electrification on school performance as one of several variables. Given the data available, the *pass rate* was used as the dependent variable. As other explanatory variables were used *Teacher quality*, *Class size* and *Enrolment*. To reflect other improvement factors which it is likely to assume has taken place over time in terms of books, buildings and equipment the variable *"year"* was inserted defined as the number of the year in question.

It is clear that a better specified model would have done better in "explaining" pass rates and isolating the effect of electrification. One might have for example split up the factors mentioned above which are subsumed under *year*. There are also a number of socio economic variables, family characteristics etc which would play a role. Despite these shortcomings it is still felt that the present model and data given the time span and different provinces and educational levels covered should give a robust indication of the role of electrification. The regression results are presented in the table Table A4- 28.

	Un standardized Coefficients		Standardized Coefficients	T	Sig.	95% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
Constant term	-1481.933	144.248		-10.27	.000	-1765.15	-1198.71
Year	.772	.073	.406	10.533	.000	.628	.916
Teacher quality	-.067	.024	-.106	-2.793	.005	-.114	-.020
Class size	-.046	.084	-.021	-.550	.582	-.211	.119
Electricity dummy	2.870	.792	.121	3.623	.000	1.315	4.426
Enrolment	2.311E-05	.000	.178	4.576	.000	.000	.000

Table A4- 28: Regression results: Dependent variable: *Pass rate*

It is quite clear that the introduction of electricity in the province, after all the other variables have been accounted for is significant and has a positive effect on the pass rate. A preliminary conclusion is then that the quality of education measured by the pass rate reacts positively to the introduction of electricity in the province. As expected, the year variable, representing improvement in other explanatory factors is positive and so is enrolment (meaning that more pupils put through the higher the pass rate).

In addition to a regression on the entire dataset, separate regressions were performed for the three different educational levels and for the different provinces and came out with broadly similar results. Tests were done with longer lags of the *Electricity dummy* but the effect on pass rates did not seem to increase.

There are however some worrisome features with some of the variables:

- *Class size* has the right sign. Larger class sizes would make pass rates lower. However the variable is *not statistically significant* as an explanation of the pass rate.
- *Teacher quality* has a negative sign although one should expect that better quality teachers should increase the pass rate. This feature has been a constant throughout the regression exercise and come through with many types of model specifications. A possible explanation, hinted in (World Bank 2003) is the uneven spread of teachers by province and management at the provincial level. If the best teachers are allocated to the best schools one may expect that it will not affect pass rates or even make them negative.
- In some (unlikely) specifications of the model it was possible to make the contribution of electricity to come out with a negative sign for the coefficient.

Note on data quality and results reliability

For regressions performed on household information, the dataset came from the official Mozambican household income and expenditure survey 2002/2003 conducted by Mozambican statistical bureau (INE). and was formerly used by DNEAP for income/poverty analyses). Quality control of the data has been undertaken by the INE and sets some limits to the further controls that may be made. The sampling for the official household income and expenditure survey was done to enable significant statistical conclusions only at the **provincial** level. Thus, analysis of **community** level data would not give significant results and there would be no advantage (in terms of statistically significant conclusions) to analyse and present these data on the 'community level'.

In order to measure the effect of electricity supply on a most important public service sector, education, a dataset by province containing pass rates, teacher quality indicators, class size data and enrolment for the years 1980 to 2006 was obtained from the Ministry of Education. The analytical method used was a standard panel data regression based on these variables and 'time' with pass rates as a dependent variable and including an electricity 'dummy' indicating in what year major parts of the given province was hooked up to the national grid.

For the analysis of Socio Economic Impact at the national level in Mozambique the evaluation used a regression analysis of factors influencing household consumption (including availability of electricity. An OLS (Ordinary Least Squares) regression was used with the variables that were believed could be of relevance for household consumption to make as sure as possible that variation in incomes was due to availability / non-availability of electricity and not to other factors.

The reliability of the regression results are mostly dependent on the data used and the method used. Clearly the data availability sets some limits, while the method used is straightforward and standard, and therefore fairly reliable.

A4.9.3.3 Conclusions

The above analyses which were done for two important socio-economic areas, household incomes and education, have concluded for each of them that in Mozambique electrification appears to have had significant positive effects. The conclusions should however be handled with care. The results obtained are overall results and does not prove that increasing the supply of electricity to a household or an economic activity will necessarily bring positive contributions at all times for all social groups and under all circumstances. The Gurué study sheds more light on the issues involved in specific Norwegian interventions.

Also, the benefits have not quantified and compared with the socio-economic return to other interventions than those in the power sector. The question of Norway's share in this is also unclear but with its major contribution to the development of the sector as demonstrated at the macro level it is hardly doubtful that the effect has been significant.

A4.9.4 Impact on EDM Business

A review[35], for both, Norad and Sida, regarding sector support, basically provided to EDM exclusively, noted the following:

Quote: "EDM's financial performance has gradually deteriorated to a point where it can no longer cover its operating costs without subsidies in the form of foreign aid. The emergency and civil war related rationale for the generous flow of aid to the power sector no longer prevails. EDM must therefore ensure that revenues are increased and costs decreased to levels where the enterprise can service their present loan commitments, borrow for future investments, and provide a reasonable return on existing assets.

With this background, an institutional reform and restructuring process of the power sector is now taking place. A draft Law on Electricity is expected to pass the National Assembly in near future, and new draft statutes for EDM have been prepared in accordance with the Law on Public Enterprises which has been in force since 1991.

The NORAD and SIDA supported programmes represent a well composed package of grant assistance which is vital in the much needed restructuring and institutional development programme of EDM. The main activities in this support are designated Institutional Development, Training, Technical Assistance and Loss Reduction.

In this connection it is important to observe that the NORAD and SIDA programmes have been provided on a long term basis and given EDM a relatively stable and predictable basis. They may even unwittingly have contributed towards continued aid-dependence and relieved the organisation of the pressure of necessity to change. It is the Review Team's impression that the new situation with a prospect of autonomy has injected some business spirit and understanding of needs into management. The best service NORAD and SIDA can do to EDM is to direct the support so as to ensure that this process does not loose momentum.

The result of these efforts is that EDM is now on the way to becoming a self-sustained, commercially oriented enterprise, but will not be able to achieve this without continued support for another 2-4 years. The support should be contingent upon unremitting follow-up from EDM's management of the on-going programmes for institutional development." – Unquote.

In the mean time, ten years have passed, and it is the task of the present evaluation to briefly assess the present situation. A full evaluation of EDM is a complex undertaking and outside the scope of the evaluation. However, an attempt is made to look at four indicators over time with a view to see if developments appear to go in the right direction.

The four selected parameters are:

- Total losses
- Access rate to electricity
- Ratios of consumers and energy sales per Employee
- EDM's revenue and cost structure

A4.9.4.1 Total Losses

Losses constitute a useful indicator because, to an extent, it reflects how well the utility runs its business. Also, it would indicate the success of loss reduction efforts that have been undertaken in the past with the assistance of both, Sida and Norad during different periods. Efforts have been ongoing to reduce these. The method used to arrive at total losses is to take total power supplied and total power billed from annual reports. The difference is total losses, and it is expressed in %.

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[35] A review of the Electricity Sector in Mozambique and the Support to the Sector by Norway and Sweden, Norplan, April 1995

Data/**Indicator**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
GWh available	908	965	1032	1112	1202	1328	1395	1472	1696	1829	1923	2098
GWh invoiced	637	697	680	779	883	996	1013	1065	1209	1340	1413	1629
GWh Losses	271	268	352	333	319	332	382	407	487	489	510	469
% Losses	**30%**	**28%**	**34%**	**30%**	**27%**	**25%**	**27%**	**28%**	**29%**	**27%**	**27%**	**22%**

Table A4- 29: EDM – Total Losses 1994 – 2005

The result is contrary to expectations. In the long run, there is little change in percentage reduction, and in absolute amounts, losses are generally increasing.

A4.9.4.2 Access Rate To Electricity

This indicator is of socio-economic nature. It is a reflection on how much progress is being made in increasing access for the people of the country. The method used to calculate the access rate is to take the absolute number of costumers of EDM at the end of the year, multiply this with the statistical average family size of 4.2 persons per family, and divide the result by the total population figure for that year, calculated from official growth rates. The problem here is that data quality is uncertain.

Numbers x 1000	**1987**	**1991**	**1993**	**1995**	**2000**	**2003**	**2004**	**2005**	**2006**
Population	13,190	13,724	14,455	15,224	16,574	18,862	19,302	19,730	20,152
Customers	106	127	136	159	202	246	285	339	416
Households el.	446	534	573	669	848	1,033	1,195	1,424	1,746
% access	**3.4%**	**3.9%**	**4.0%**	**4.4%**	**5.1%**	**5.5%**	**6.2%**	**7.2%**	**8.6%**

Table A4- 30: EDM – Increase of Access Rate 1987 to 2006

The increase of access has been marginal for many years. It has almost stagnated during the war, and was insignificant up to 2003, with yearly growth rates of 0.2% per year on average. Only from 2004 onwards is progress significant.

A4.9.4.3 Ratio of Customers per Employee

The indicator is a measure of efficiency of the utility. If fewer staff are needed per customer, the efficiency is considered increased, assuming that service quality remains the same. The method to calculate the ratio is simply to divide the number of customers by the number of employees. (see Table A4- 31 (next page).

Data/Indicator	**1987**	**1991**	**1993**	**1995**	**2000**	**2003**	**2004**	**2005**	**2006**
Employees	3,556	3,086	2,839	2,895	3,271	3,219	3,183	3,194	3,233
Customers	106,228	127,260	136,328	159,169	202,001	245,859	284,562	338,951	415,667
Ratio	**30**	**41**	**48**	**55**	**62**	**76**	**89**	**106**	**129**

Table A4- 31: EDM – Customer to Employee Ratio 1987 to 2006

An increase of the customer ratio by a factor of more than 4 over twenty years indicates a significant increase in staff efficiency and productivity.

A4.9.4.4 Ratio of Sales per Employee

Similar to the customer ratio, the amount of sales is calculated per staff. Table A4- 32 shows a modest increase over a period of 12 years

	1993	**1995**	**2000**	**2003**	**2004**	**2005**
Employees	2.839	2.895	3.271	3.219	3.183	3.194
GWh invoiced	777	697	1.013	1.340	1.413	1.629
GWh/Employee	0.27	0.24	0.31	0.42	0.44	0.51

Table A4- 32: EDM Electricity Sales per Employee 1993 to 2005

A4.9.4.5 EDM Earning Capacity and Cost Structure

To analyze EDM cost development has the purpose of identifying the impacts of institutional development and to what extent the utility is able to take advantage over time of an improving business environment. Towards this end, the following calculations were done with data from EDM annual reports.

- The gross surplus from operation was calculated by deducting energy procurement cost from gross revenue from energy sales for every year (the blue line "surplus" in the graph Fig. A4- 12). Energy procurement cost is largely payments to HCB from where most of EDM's power comes, but it also includes the cost of producing energy with EDMs' own generation and power purchase from South Africa.
- The major cost components are shown as a stacked column for each year.
- The stacked column does not represent the totality of cost, but only the major cost positions. Hence diagram does not show net profit as a difference between the amount of surplus and the amount of cost.

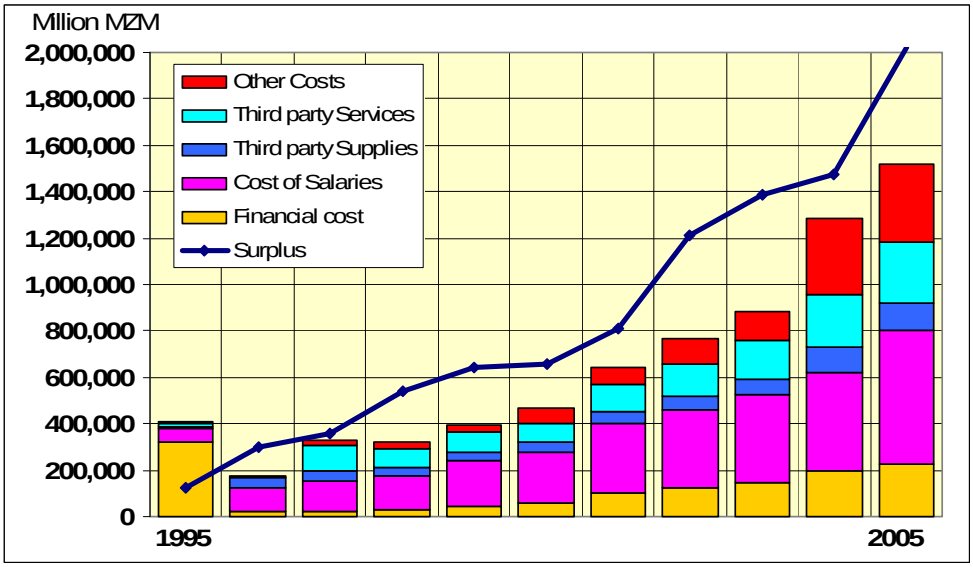

Fig. A4- 12: EDM Revenue Surplus and Major Cost Drivers 1995 to 2005

However, the diagram clearly shows that:

- The revenue surplus increases dramatically between 1995 and 2005. The reasons for this are that the sales volume is increasing continually, and tariffs increase also. At the same time, power from HCB has become cheaper. EDM could finally benefit from the original Eskom-HCB agreement, when the transmission line to RSA was fully rehabilitated (about 1998).
- The major cost components develop in parallel with the surplus, despite the fact that financial cost have been reduced drastically after 1995 restructuring. Surprisingly, despite growing sales volumes and higher staff efficiency, no economies of scale become visible.

A4.9.4.6 Conclusion

While the business of EDM is growing, and the earning capacity increases considerably, the development of costs is contrary to what one would expect from increased staff efficiency, higher tariffs, lower energy procurement cost, and growing business volume. If this trend continues, the expectation of achieving profitability and financial sustainability remains elusive. It appears that EDM requires more rigorous cost management and more effective loss management.

A4.10 Mozambique's benefit from SAPP

Norway's regional support to the power sector – the case of SAPP

The Southern African Power Pool (SAPP) is a loose association of national electric utilities in the region, with the purpose of creating a fully integrated regional power market. Norway and other donors have supported the SAPP since its beginnings as one of the components of assistance to SADC.

A4.10.1 SAPP – Present Status

A4.10.1.1 Creation

SAPP was created in August 1995 at the SADC summit when member governments of SADC (excluding Mauritius) signed an Inter-Governmental Memorandum of Understanding (IGMU) for the formation of an electricity power pool in the region under the name of the Southern African Power Pool (SAPP). It was the first formal international pool to be set up outside North America and Western Europe. Although small in terms of overall trade at the present time the pool has considerable potential covering about 9 million square kilometres and 240 million people. The number of customers of the interconnected national systems is well over 6 5 million[36]

A4.10.1.2 Vision and Objectives

The vision of SAPP is to become a facilitator of the development of a competitive electricity market in the SADC region, serve to give end users a choice of electricity supplier, make Southern Africa a region of choice for investment by energy intensive industries and ensure sustainable energy developments through sound economic, environmental and social practices.

SAPP attempts to realize the vision through its objectives of providing a forum for the development of a good interconnected electrical system in the southern African region; coordinating and enforcing common regional standards; harmonising relationships between member utilities; developing regional expertise; increasing power accessibility in rural communities and implementing strategies in support of sustainable development priorities.

A4.10.1.3 Membership

Members of SAPP, according to the IGMU, were to be *one* national utility from any country which was a member of SADC in September 1994. The utility would have to be appointed by the government under which it served. New country utilities were subject to approval by a two thirds majority of the SAPP Executive Committee and ratification of SADC Energy Ministers' Committee.

There were two categories of membership:

- *Operating Members* would have their system interconnected internationally with at least one other member. These were Botswana Power Corporation, Electricidade de Mocambique, Eskom South Africa, Lesotho Electricity Corporation, NAMPOWER Namibia, Societe Nationale d'Electricité (DRC), Swaziland Electricity Board, ZESCO and Zimbabwe Electricity Supply Authority (ZESA).
- *Non-Operating Members* are signatories to the Inter-Utility Memorandum of Understanding. These are at present the Electricity Supply Corporation of Malawi, Empresa Nacional de Electricidade Angola and Tanzania Electricity Supply Company Ltd.

A4.10.1.4 Relation to regional organisations

The SADC protocol on energy makes reference to the SAPP IGMU. SAPP's intergovernmental affairs are governed by the SADC Ministerial Committee. The organisation is linked to the SADC

[36] Likely to understate the true number of retail customers since some are distribution companies.

Directorate of Infrastructure and Services. At the SAPP level the Executive Committee has overall responsibility over a Management Committee with three sub branches: the Planning Sub-Committee, the Operating Sub-Committee and the Environment Sub-Committee. The operating Sub-Committee supervises the Coordination Centre located in Harare which has a small staff of eight and is led by the Coordination Center Manager Dr. Lawrence Musaba.

In February 2006 the SADC Council of Ministers Committee the Ministers responsible for energy in the SADC region signed a revised IGMU taking into account the restructuring of the SADC Secretariat an consequent changes in the reporting structure for the SAPP. Also it adjusted the IGMU for electricity sector reforms, in particular the introduction of Electricity Regulators in many SADC countries and notably the need to include Independent Power Producers (such as HCB, Kariba North Bank Company, and Zimbabwe Power Company) in SAPP. The restructuring process was concluded in April 2007 with the signature of a new Inter-Utility Memorandum of Understanding (SAPP 2007) and a Memorandum of Understanding between Regional Electricity Regulators Association (RERA) and SAPP (SAPP and RERA 2007).

A4.10.1.5 SAPP activities and Development

The SAPP is at present a "loose pool" along the lines of former NORDEL/NordPool focusing exchange of information to maximize economic and reliability benefits from trading and system autonomy, relying on long-term bilateral contracts for electricity supply between generators and customers. SAPP also may provide central services, including producing continuous, real-time data to match generation and demand, developing indicative expansion plans, and implementing emergency procedures. Common design and operational standards are also designed to ensure system security and reliability and to facilitate trades.

Most of the energy trade among SAPP members still takes place by way of bilateral contracts. Energy trading via bilateral contracts grew from just over 10 TWh in 2002 to 16-TWh in 2004 and further to 19-TWh in 2005. The trade is spurred on by the change in the regional energy balance where the dominant producer and consumer South Africa[37] has an increasing production deficit pressing prices upwards.

In 2001 SAPP started operating a regional Short Term Energy Market (STEM) and now utilizes the Internet to conduct trade. The STEM is a spot market of non-firm[38] electricity contracts. Quantities traded are minuscule compared to the bilateral contract market. In 2002, the peak year of STEM trade, it was only some 8.5% of the volume (GWh) of bilateral trade and declined to just under 1% in 2005. This was mainly because Mozambique and Zambia implemented major power generation rehabilitation and maintenance works and did not participate in the STEM. In terms of *value* trade has however held up well as the STEM energy prices roughly tripled from 2001 to 2006.

The next steps in development of trade mechanisms are under way. Development plans include VSAT communication and in the longer term a fibre network. ZESA, ZESCO and Eskom are presently connected via VSAT. Capacity building via Traders and Operators for a more sophisticated system has started.

The installation of a so called day-ahead market system will introduce cutting edge technology to power trading in Southern Africa. The system manages the auctioning of physical electricity contracts**.** It was first implemented by Nord Pool in the Nordic market and has become the common standard for European market places. This is the first implementation outside Europe and is installed by Nord Pool partners with Enerweb, a daughter company of the South African TSO (Eskom). The delivery of the SAPP day-ahead market system will enable competitive trade of electricity in the SADC region. Trials with the system started on 10 April 2007.

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[37] With well over 80% of the regions generating capacity and peak demand

[38] Non firm contracts are subject to the continued flow of firm contracts and can only be cut commiserate with load shedding.

In view of the diminishing production surplus in the region SAPP identifies and supports projects such as rehabilitation projects and generation projects. Projects include interconnect of the SAPP non-operating members namely Angola, Malawi and Tanzania.

To further power trade and cooperation in the region WESTCOR (Pty) Ltd, has been formed under the auspices of SAPP. WESTCOR's task is to develop the Western Power Corridor and is expected to move 3.500-4.000MW of power from Inga-3 in the DRC to southern Africa and to pick up 6.500MW of generation at Kwanza River in Angola. The organisation was officially launched in Gaborone in September 2005 and a project office set up.

Within the framework of NEPAD, SAPP works with similar organisations in other regions of Africa. Cooperation framework protocols have been signed between SAPP, the Central African Power Pool, (CAPP), COMELEC of North Africa, East African Power Pool (EAPP) and West African Power Pool (WAPP)

The team visited the SAPP headquarters in Harare and interviewed the Coordinator and two key staff members. Information from the literature and media together with the interviews in Harare supports the view that SAPP is a small and well run organisation which has a tremendous potential for developing the regional electricity market. As part of SADC it is a concrete manifestation of regional cooperation and serves to build physical links that may be said to "lock in" regional cooperation. A CMI study on the restructuring and emerging policies of SADC argues that among the regional institutions which develop and implement regional programmes and projects under the subsidiarity principle of SADC the (probably) strongest are SAPP and RERA. (Tjønneland, Isaksen et al. 2005)

A4.10.2 Mozambique's benefits from SAPP

Mozambique has over time been supporting the SAPP initiative and clearly has an interest in the organisation since it is the third biggest exporter (after SA and DRC), has the second largest generating capacity in the region and has enormous potential. Mozambique appears to be the most active member of SAPP and the head of EDM is the (rotating) Chairperson of the SAPP Executive board. An examination of EDM's annual reports over the years leaves no one in doubt that SAPP is a force to reckon with in the regional power picture and is actively used and participated in by EDM.

Interviews with Government officials as well as EDM staff in Maputo brought up a number of advantages as well as the absence of disadvantages.

An obvious advantage is that short term market surpluses via STEM can be sold to other pool countries when it arises. Mozambique's earnings from this trade at the present were estimated at USD 5-7 million per year.

The establishment of a regional market also helps establish a set of real market prices. This will become an even greater advantage in the future as it is expected that a smaller share of total supply is traded via bilateral agreements. A real competitive market in the region is however much dependent on the break up or unbundling of Eskom for which there at present seems little hope (Scanteam 2005).

It can also be argued that without some form of regional agreements, power trade would be inhibited and at least transmission costs very high because of the need for having direct lines between trading countries. Mozambique would then for example have to build a direct line to Botswana to sell power to that country whereas the SAPP cooperation enables EDM to use other regional routes to transfer power to Botswana.

The attraction for investors to invest in a *regional* power market would be much greater than the prospect of investing national markets of single countries.

The SAPP has improved the access to information in several ways. Firstly, there is better access to information on regional supply and demand balances for electricity. There is also more information about *plans* of the various operators in the longer run. Also, officials in Maputo stressed the effect of SAPP in improving and transferring knowledge and awareness about international development of regional power markets and power technology in general.

It is clear that the regular meetings of the various committees of the SAPP gives Mozambican members (as other members) a better contact interface with colleagues in the region, builds personal

and professional relations and thus helps cement regional cooperation. The contacts between people at the operating "coal face" are said to be particularly helpful for exchange of information and thus furthers capacity building in a very specialized area. By using costly expertise brought in from outside Southern Africa in a regional, rather then in a national setting, costs can be cut.

Comparing SAPP to the development of the Nordic market it may appear that the countries of Southern Africa have leapfrogged and that trade over the national borders in the region has started before domestic trade and coordination have been properly organized. Although this may to a certain extent be true, the Mozambican officials pointed out that SAPP and regional cooperation also has a positive effect in bringing out more clearly the need to concentrate on domestic organisation and coordination.

An example of a power sector investment undertaken by two countries in the region where support from SAPP has been important is the Mozambique - Malawi interconnector, a 200 km 220 kV double-circuit line, fitted with a fiber-optic cable,

between Matambo in Mozambique and Phombeya in Malawi. Although it is possible that the project would have emerged without a SAPP, the World Bank loan for the investment is clear that the objectives of the project are to: (i) strengthen regional power integration by connecting Malawi, one of the few remaining unconnected members of SAPP, thus allowing Malawi to receive and contribute to benefits of the regional power market; (ii) enable Mozambique to earn export revenues from wheeling charges and expand opportunities for power trading.

Finally, despite all the good things that could be said about regional power cooperation, the question of alternative use of resources has to be raised. Although it is not possible to point out alternatives a good example of possible advantages of greater focus on domestic issues should be mentioned: "Sweden provided massive support to enable EDM to make USD 2 million through Southern Africa Power Pool (SAPP) related activities, while alternatively Swedish aid could have enabled EDM to make an additional USD 15-20 million by curbing non-technical losses and getting the metering problems and billing issues in order." (Hansen 2006)

A4.10.3 Origins and formative period of SAPP – the Role of Norway

At the start in 1995 SAPP reported to the SADC energy Technical Administrative Unit (TAU) sub committee on Electricity. The utilities in 1997 proposed to set up a coordination centre and in 2000 the centre moved into its premises in Harare. William Ballet, a former manager of the New York power pool became the manager of the centre under a USAID contract. Dr. Musabi was first an "understudy" and took over centre management in 2002.

The USAID project arranged a travel to US and Norway in 2001. Dr. Musabi feels that the visit to Nordpool was a kind of "watershed". Whereas the US trip was instructive the example of Nordpool was relevant because the SADC situation was also to deal with several countries, several currencies different regulations etc. The delegation received several presentations by Nordpool, which also prepared a document on how a similar system might work in Southern Africa. Soon after STEM was set up and worked.

A4.10.3.1 Donors

A number of donors have supported SAPP since the beginning. **Table A4- 33** on the next page gives rough amounts and project descriptions for each donor in approximate chronological order.

Donor	Approx donor input USD mill	Description
Danida	1	Study of Tsonga- Bindula (Moz-Zam) interconnection 400MW to stabilize the line which was unstable
DfID	1	Study on Transmission. The recommendations implemented with good result in use at present
WB/JICA	0.7	SAPP telecoms study 1999-2000. Suggested satellite connection in the short term and fiber optics in the longer term
USAID	1-2	Finance for TA and 2001 travels, to New York, New England to Oslo and contact with Nordpool
WB	1-2	Zambia - Tanzania interconnection study
Norway	5-6	Supply, installation and implementation of the SAPP trading Platform
Sweden	1.5	Consultancy for development of long-term transmission pricing policy, Implementation procedures and ancillary services market development
WB	1	SAPP pool plan, US company.
DBSA	0.15	SAPP tariff study

Table A4- 33: **SAPP Conducted Projects 2001 to Date**

A4.10.3.2 Role of Norway

It appears that although Norway was a relative latecomer to support of the centre, its financial contribution now amounts to about half of the donor support for the centre since its start. The project on Cooperation between Southern African Power Pool (SAPP) and NORAD Regarding the Development of Competitive Electricity Markets 2003-2007 (SAPP and Norad 2003) has, according to SAPP, been very successful. The purpose of the project is the development of a competitive electricity market in the SADC-region. It represents a move from the cooperative pool using a cost based pricing system to a competitive pool using a bid-based pricing mechanism. The end result for SAPP would be the creation of a spot market for the SADC region.

There has clearly been a good relation between Norwegian project staff and SAPP. Both SAPP staff and the Executive Board have visited Norway often.

At present, South Africa, Zimbabwe, Namibia, Swaziland, Mozambique and Botswana are ready to adopt the system. Zambia is rehabilitating, DRC has severe communication problems and in Lesotho the utility has no generation since the Lesotho Highland scheme is not owned by the utility.

Although the Norwegian support to SAPP has been considerable it is still too early to evaluate the impact of the particular project on competitive trading. All reports however indicate that it is promising and will bring SAPP and regional power trading a huge step forward. Our impression from interviews with SAPP is that financial support has been important. However, probably more important that that has been the transfer of Norwegian experience which has greatly helped SAPP in avoiding the mistakes done in the Nordic cooperation thus increased the speed with which the new trade system seems to be built up.

An assessment of regional power cooperation and Norway's role should also include RERA which is an association of Regulators in the SADC region. The objective of RERA is to develop the electricity supply industry in the region through enhanced regional integration and trade, and to harmonise and develop a regulatory framework. A RERA/NVE contract was signed February 2004, and includes assistance in establishing a RERA secretariat, coordinating and harmonising the regulatory framework in the region and coordinating the legal framework. (NVE 2004)

Collaboration in electricity regulation through RERA enables gains to be made from increased co-operation and trade through SAPP. The gains emanate from utilization of shared system reserves, each country using a larger (regional) set of generators which creates cost savings and price reductions to end customers. Also, RERA will put in place a regulatory framework to oversee market liberalization

and facilitate investment in the region by encouraging the countries to use “common rules of the game” and promoting certainty for investors. (Isaksen, 2002)

A4.10.3.3 The role of Norwegian support to TAU

Apart from the direct support to SAPP it is also likely that Norwegian aid has had a positive influence on regional power cooperation in a more fundamental or perhaps seminal sense through its support for the Technical Administrative Unit (TAU), which SADCC set up in 1982 in Angola to lead the organisation’s energy sector work.

Through its inputs to TAU as a main donor, it is likely that Norway played a key role in shaping SAPP. The general idea of a pool is clearly linked to the start of SADCC in 1980. Regional governments as well as donors at the time were all enthusiastic to regional cooperation. As early as 1983 NORAD financed a study on the set up of the SADCC energy secretariat (Norconsult 1983). Secretariat activities commenced soon after and in 1986 a new agreement covering 1987-1990 was signed (Ystgaard, Simoes et al. 1986). TAU at an early stage took initiatives to meetings with leaders of the power utilities in the region (GICON A/S 1989, 2-32). In 1991 TAU raised the option of cooperation and power exchange with Eskom and SNEL but the move was barred for obvious political reasons (TAU 1993, 2-23).

A Norwegian / Swedish Review of the Electricity sector in Mozambique gives the following account of SAPP’s origins, clearly linking it to ideas from the Nordic power market organisation: “The idea for a pool had been taken up in SADCC in 1984 during a seminar in which the Nordel model was presented, and was further emphasized in a presentation to the SADCC Energy Ministers' Seminar in 1991 on the SADCC Project AAA 3.8. "Inter-Utility Power Exchange". The idea was now (1994) taken up by the four SADC utilities most immediately concerned, from South Africa, Botswana, Zimbabwe and Zambia, and also SNEL of Zaire, on the basis that these utilities will shortly have a strong North-South HV linkage with each other. A series of meetings were held during 1994 to work out the modalities of the Pool arrangement, resulting in drafts of an Inter-Governmental Memorandum of Understanding an Inter-Utility Memorandum of Understanding, and an Operating agreement”.

The TAU annual report 96/97 cites the completion of the establishment and making operational of SAPP as the most important development in the electricity sub-sector and as a significant step towards the integration within the SADC electricity sector. (Technical and Administrative Unit (TAU) Energy Sector 1993).

Outside TAU, other Norwegian supported interventions contributed to the recent changes in SAPP. The UTIP work plan for 2003 contains mention of the importance to allow IPPs to become members of SAPP (Norwegian Embassy Maputo 2002)

A4.10.3.4 Norwegian benefits from SAPP

Although the support to TAU and SAPP was aimed at supporting regional power cooperation there were also benefits flowing to Norway although these are hard to quantify. Norwegian companies landed contracts for consultancies in the region. The regional cooperation led to higher investment volumes in the region and (Norad 1997) therefore benefited as a major supplier of material and technical inputs and capital goods to the sector.

Nordpool later used its experience gained and track record to develop business in Asia.

A4.10.4 Conclusion

SADC’s task from which SAPP rose, was to further regional cooperation. In the early eighties the member states and donors alike were all keen to further the aim of regional cooperation. The new South Africa was interested in power cooperation to mend broken fences with the neighbouring states and Eskom wanted to preserve hegemony. The setting in the early eighties was clearly strongly pro regional cooperation and it is not likely that Norway’s attitude towards regional cooperation in the power sector would other than marginally influence the decision in principle to build a Southern African power pool.

However, leadership of Norway and the Nordic countries in international pooling of power trade made the Nordic system a very relevant “role model” for a SADCC power pool”. The Nordel model was presented for the relevant countries as early as in 1984. In addition the clear Norwegian leadership in cooperation with the TAU over time built knowledge and trust in Norwegian expertise. Both through Norwegian assistance through TAU and outside, the Nordel/Nordpool became a role model. Cooperation in the regional power sector would have taken place without Norway’s influence but perhaps using different forms, making mistakes that now could be avoided on the basis of the Nordic experience and thus speeding up the development of the pool.

It could be argued that to a certain extent leapfrogging has taken place and that with the installation of the new trading platform the present professional and technical state of the Southern African pool is approaching that of the Nordic/European markets. This bodes well for a style of cooperation in the future which has much greater emphasis on mutuality and takes place increasingly on a commercial basis. On the basis of the past gains in business opportunities it is likely that the Norwegian companies and organisations involved will be interested in such cooperation.