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The electricity sector of Uganda – results of development assistance

by

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The electricity sector of Uganda
– results of development assistance

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Over the last decade, NORAD has spent almost 400 mill. NOK on the development of the electricity sector of Uganda. This note briefly discusses the background for the Norwegian support to this sector, describes the nature of the Norwegian aid, and reports some of the results that have been achieved.

This is not an evaluation report. This note is written as part of an internal NORAD project focussing on results management in development cooperation in general. The aim of the project is to improve NORAD's communication of results, in order to both enhance learning and to be better able to communicate results to the general public in Norway. Part of the project consisted of a field-visit to Uganda in January/February 2003, where the reporting systems related to the Norwegian support in the electricity sector were used as a case-study. Although the focus of the team was primarily with the systems of results management as such, an inevitable by-product was to gain insights into the actual achievements in this area of support. This report synthesises the results that the team came by during their visit, without digging too deeply into the subject matter.

The first two sections briefly describe the background for the Norwegian support to the electricity sector of Uganda and the projects that Norway has been involved in. Results are discussed in section 3, and our main conclusions are gathered in section 4.

[1] Comments from Hans Venvik and Geir Ynge Hermansen are gratefully acknowledged.

1. Background for the Norwegian support to the electricity sector of Uganda

The Norwegian support to the electricity sector of Uganda goes back to 1992. At that time, Uganda suffered from low electricity production and old, overloaded infrastructure. In 1991, a large power project (Third Power Project) was launched by the World Bank and the Ugandan government. Most of the Norwegian support has been used to finance various parts of this project.

Up to 2001, almost all electricity in Uganda was generated at the Owen Falls power station in Jinja (renamed to Nalubaale power station in 2000). The station was built in 1954 with a capacity of 180 MW. During the 1990s, the demand for electricity increased to levels that could no longer be generated at Owen Falls. Consequently, electricity was rationed through load shedding. Up to 85 MW were shedded at peak hours in 1998/1999. More generation capacity was urgently needed.

The transmission and distribution systems were also old and in poor condition with frequent outages due to breakdowns. An expansion of the capacity of the transmission and distribution systems was also needed in order to accommodate the planned increase in the generation capacity.

The problems caused by poor physical infrastructure were reinforced by an inefficient utility service. The parastatal monopoly supplier, the Uganda Electricity Board, showed low productivity and huge financial losses, and it did not collect money for more than 50-60% of the energy generated. During the 1990s, it became increasingly evident that institutional reform was needed in order to shape up the electricity sector.

Poor utility service and high electricity tariffs in the 1990s were also identified as the main impediments to private investment in Uganda. To develop the electricity sector therefore seemed essential for the stimulation of economic growth. Investments in the electricity sector thus clearly reflected some urgent needs.

Support to the electricity sector of Uganda also fitted nicely with needs and priorities on the Norwegian side. A sharp increase in the aid budget in the mid-1990s created a lot of money in search for projects. A task force was set down in 1996 in order to identify the possibilities of

spending more on aid, in particular in Africa. Large infrastructure projects are capital intensive and thus able to absorb a lot of funds.

On the Norwegian side there was also vacant capacity for hydropower development projects, as the investments in the electricity sector in Norway fell sharply from the early 1990s. Also on the institutional side, much expertise was available in Norway, as Norway went through a deregulation of the electricity sector in the early 1990s.

In addition to clearly defined needs on the Ugandan side and available financial and technical capacity on the Norwegian side, the power projects in Uganda appeared to be reasonably well founded in Uganda's own development plans. Hence, the conditions for a fruitful cooperation between Norway and Uganda on the development of the electricity sector of Uganda seemed to exist at the point of entry.

2. The nature of the Norwegian support

The Norwegian support to the Ugandan electricity sectors falls into three main categories; (1) generators to a new power station (Owen Falls Extension, renamed to Kiira power station in 2000), (2) rehabilitation and upgrading of nine substations[2], and (3) institutional development. The total disbursements for these three categories amounted to 380 mill. NOK in the period 1993-2001 (see Table 1).

Table 1. Disbursements to the energy sector of Uganda (1993-2001)

	Mill. NOK
Owen Falls Extension	175
Rehabilitation of substations	186
Institutional development	19
Other	4
Total	**384**

Source: Norwegian Embassy Kampala.

All Norwegian support, except the assistance to institutional development, was integral parts of the Third Power Project. Norway financed 13% of the total costs of the Third Power Project. Other financial sources were the World Bank (48%), Nordic Development

[2] There are twelve substations in Uganda. The three remaining substations will be refurbished and upgraded during 2003-2004.

Fund/SIDA (11%), African Development Bank (8%), DANIDA (6%), European Investment Bank (4%), Switzerland (1%), and the Uganda Electricity Board (9%).

The new power station in Victoria Nile, the Owen Falls Extension, has so far increased the power generating capacity of Uganda from 180MW to 300 MW. The three 40 MW generators were financed by NORAD and supplied by Kværner Energy.

The second large category of Norwegian support was the upgrading of nine substations in Uganda. These projects were undertaken in order to increase the reliability of the electricity supply and in order to be able to supply the increased power production from the Owen Falls Extension. The substations have been refurbished, and the capacity has been extended by the installation of a number of new transformers.

While most of the Norwegian financial resources to the electricity sector of Uganda have been put into physical infrastructure, Norway has also played an important role in the institutional development of the sector. Assistance from The Norwegian Water Resources and Energy Directorate (NVE) was important in the drafting of a new energy act, in the development of a regulatory framework, and in the establishment of the independent Electricity Regulation Agency (ERA).

3. Results

Methodological remarks

To ask for the results of Norwegian aid to the electricity sector of Uganda is at the same time to ask for a counterfactual: What would the situation have been without Norwegian support? What difference did we make? In order to answer the question properly, we need to compare the current situation with what the situation would have been at present without the Norwegian effort. Since such a baseline is difficult (or impossible) to define, it is common to resort to the more tractable issue of comparing the present with the past. This creates a new problem, though, because we then need to analyse whether observed changes come as a consequence of the actions taken, or whether they come as the result of external influences.

This note is based mainly on simple inspection of time series data. The scope of the study does not allow for a proper analysis of the reasons for the observed changes. Hence, the value of this study as a source of information on results of Norwegian development assistance is limited. Observed positive developments might have occurred without our involvement. Or perhaps even more likely, the electricity sector of Uganda could – without donor support – have slipped into even deeper problems as the physical infrastructure deteriorated over time.

Results can be reported at several levels. It is common to distinguish between *outputs*, *outcomes* and *impacts*.

The major *outputs* of the Norwegian support are that new power generators have been installed at the Owen Falls Extension, that substations have been refurbished, and that a new institutional framework for the electricity sector has been developed. To achieve outputs is normally a matter of project management; the number of external factors is usually so limited that the contractor can be held responsible for the failure to achieve outputs.

At higher levels in the results hierarchy, at the *outcome* and *impact* levels, the degree of control of the project management is more limited, due to an increasing number of external factors. Results at the *outcome* level are the immediate consequences of the outputs, for instance, the impact on the supply of electricity, load shedding, breakdowns etc. Asking for results at the *impact* level is to take it to the level of peoples livelihoods; what happened to people's quality of life? Did their incomes increase due to economic growth, or were their opportunities to lead a good life in any other way enhanced by increased supply of electricity?

This note focuses mainly on results at the *outcome* level. In general, *outputs* were achieved according to the project descriptions. Results at the impact level are more difficult to get at, due to data constraints. Nevertheless, we will reflect somewhat around impacts as well.

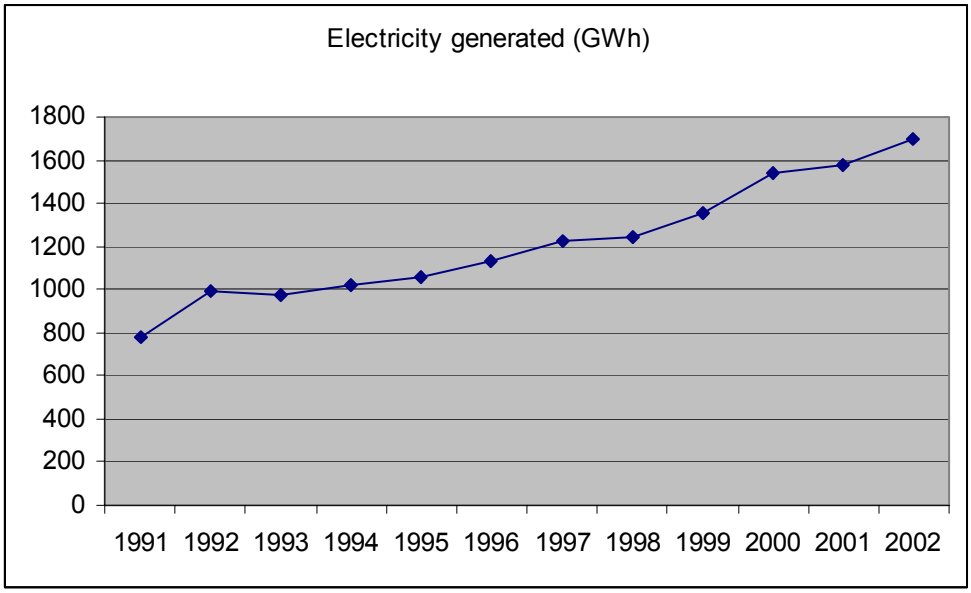
It goes without saying that results at the outcome level cannot be reported for the Norwegian assistance in isolation from the resources provided by other donors and finance institutions. Hence, the focus will be on the overall performance achieved in the electricity sector of Uganda, viewing the Norwegian support as complementary to the inputs provided by others.

Electricity supply

Over the last years, the power production capacity of Uganda has been increased from 180MW to 300MW through the installation of three new 40 MW generators at the Owen Falls Extension. The turbines were financed by Norway.

In general, the benefits of increased generating capacity can be measured along two different dimensions. First, increased generating capacity forms the basis for an expansion of the total supply of *energy*. Secondly, since electricity cannot be stored, increased production capacity implies that higher *effect* can be accommodated at any given point in time, and the need for rationing of effect at peak hours is thus reduced.

Total electricity generation has increased rapidly over the last few years in Uganda. In the period 1998-2002, the average annual growth rate in electricity generation was 8.2%, as compared to 3.8% in the period 1992-1998. The increase in electricity generation can be understood as a result of the interplay between a number of factors, such as 1) the underlying growth in electricity demand, 2) increased production capacity, leading to less rationing of effect in peak hours, and 3) the development of electricity prices.

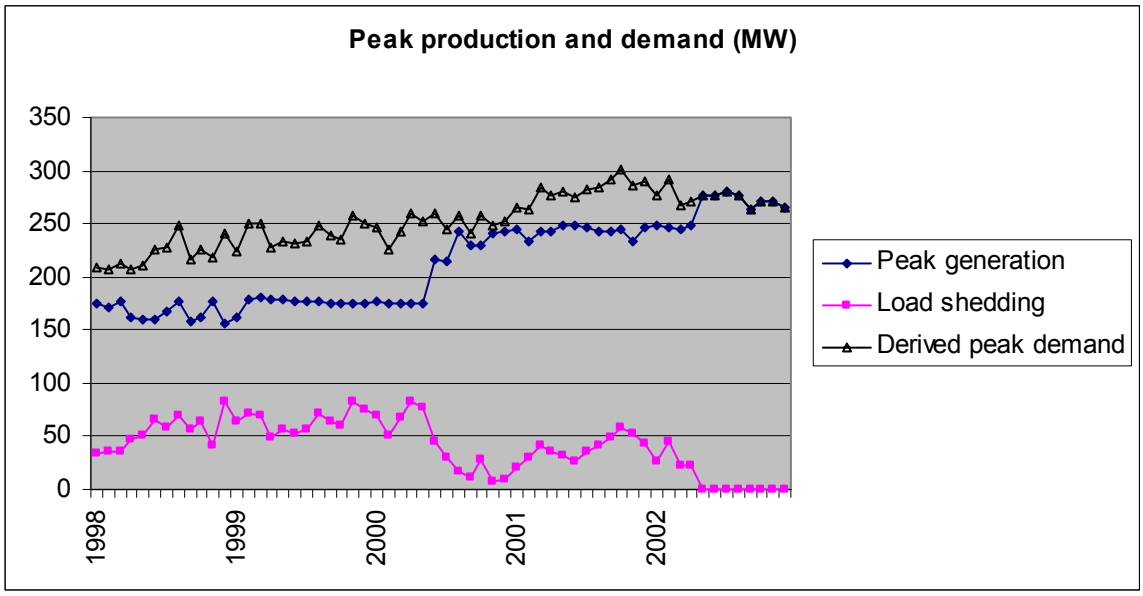


Source: World Bank (2002a) and UEDCL.

Consider fist the effect of reduced rationing. According to UEB (Uganda Electricity Board), the amount of rationed energy was at its highest level in 1998, when an estimated 85 GWh

were rationed. To simply do away with this rationing would increase power consumption and generation by 6.8%. New investments did indeed eliminate the need for rationing of electricity in the end of 2002. But from 1998 to 2002, total generation increased by as much as 37%. This suggests that there is far more to the picture than simply reduced rationing. Rather, the main effect of the new investments in generation capacity has probably been to accommodate a strong underlying growth trend in electricity demand. This conclusion is reinforced by the fact that electricity prices have increased sharply over the period under consideration (see below).[3]

It is quite evident that the observed increase in total electricity generation for domestic consumption over the last few years would have been impossible without an increase in the generation capacity. But the role of increased generation capacity for the reduction of rationing is perhaps even clearer, as illustrated by the following diagram.



Source: UEDCL.

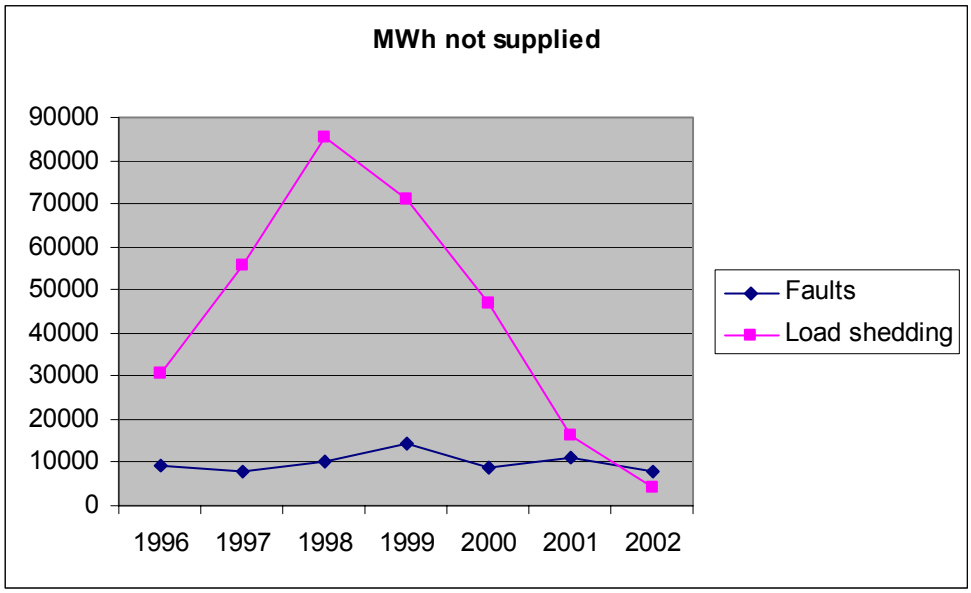
The two first 40MW generators in the Owen Falls Extension were installed in mid-2000, while the third one came on board in mid-2002. Their impact on the rationing of electricity (through load shedding) is quite striking.

[3] Uganda exports about 12-15% of its electricity production to Kenya and Tanzania. There has been no significant change in this pattern in the period 1997-2002.

System reliability

A reliable electricity system supplies its customers with the amount of electricity they demand at the time when they request it. The electricity system of Uganda has suffered from lack of reliability, both due to insufficient production capacity at peak hours, leading to rationing of electricity at certain times of the day, and because of poor infrastructure, causing irregular breakdowns of the system.

The following diagram shows the amount of energy not supplied due to faults and rationing (load shedding). A growing energy demand combined with stagnation in the production capacity increased the amount of load shedding up to 1998. Since then, new capacity has been installed more rapidly than the underlying demand growth, leading to an elimination of load shedding at the end of 2002.

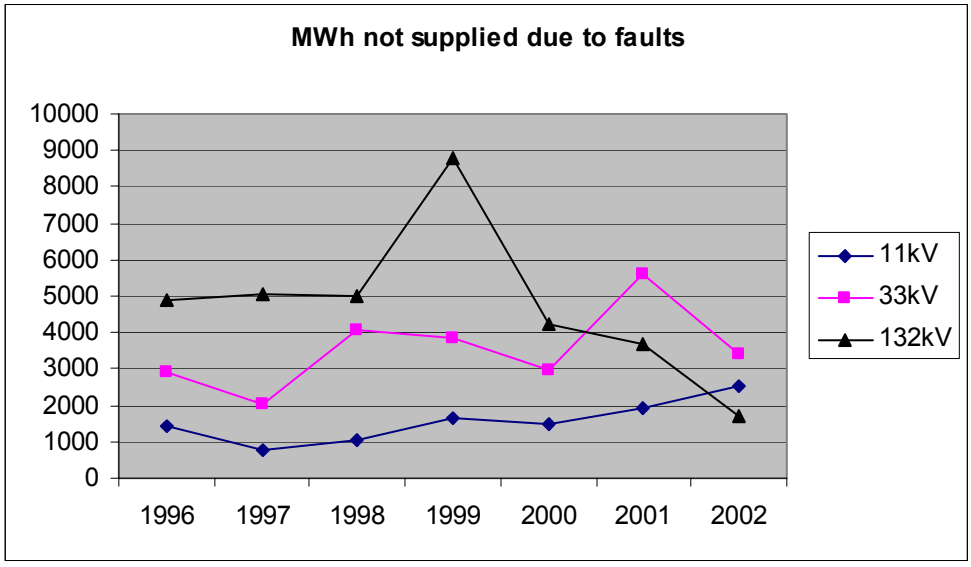


Source: UEDCL.

A similar improvement has not occurred with respect to system faults, though. Faults in the distribution and transmission networks are still causing about the same amount of energy not supplied as they did in the late 1990s. Looking behind the aggregate figures, one finds that faults in the distribution network (11 kV and 33 kV lines) are actually causing no-supply of a higher amount of energy than before. This negative trend is however counteracted by the

opposite development in the transmission network, where losses due to faults have been reduced significantly.[4]

The analysis above does not pay attention to the fact that the total amount of energy supplied by the system has increased by 50% since 1996. The amount of energy not supplied due to faults, measured as share of total electricity generation, decreased from 0.82% in 1996 to 0.45% in 2002. Hence, relatively speaking, there has been an improvement of system reliability also when it comes to faults.



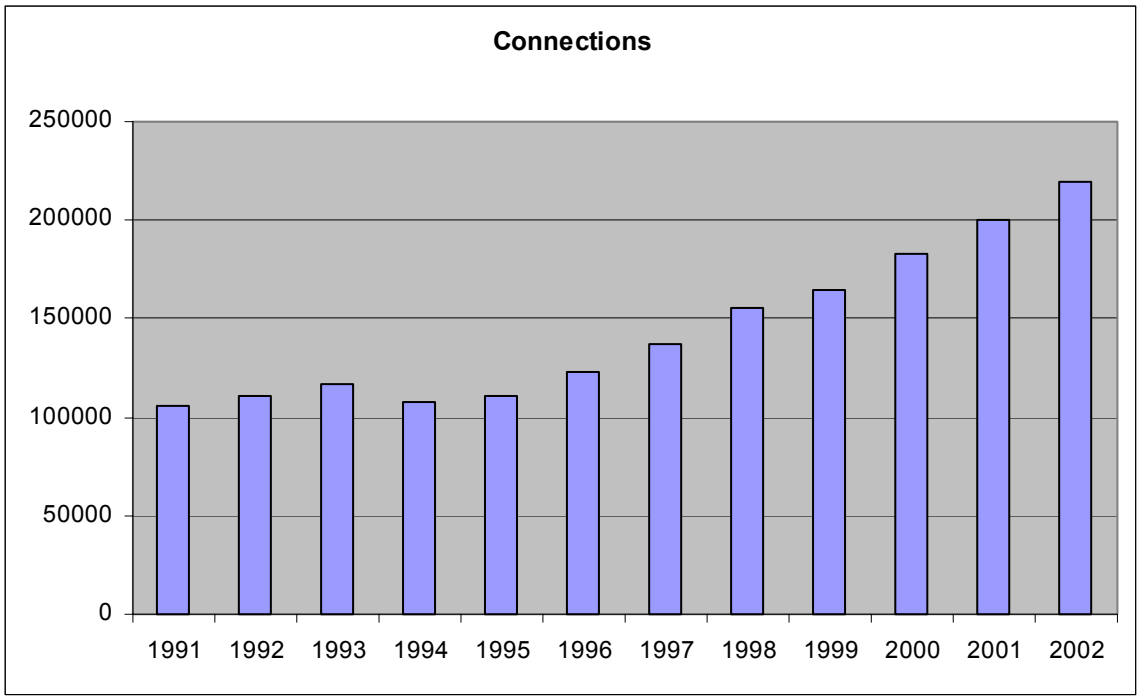
Source: UEDCL

New connections

At present, there are about 220.000 connections to the public grid in Uganda, up from 123.000 in 1996. Hence, the annual growth rate in connections has been 10% on average in this period.

Small consumers are over-represented among the new customers. In the period when the number of connections has grown by 10% annually, the growth rate of electricity generation has been only 7%. Taking into account that the consumption of existing customers has probably also increased (e.g., due to reduced load shedding), it is clear that most of the new users are small ones (in the sense that their consumption is smaller than the average consumption per connection).

[4] The rehabilitation of the distribution network is not finished yet. Parts of the network are shut down regularly in order to proceed with the work. The shutdowns can probably not explain the negative trend in the losses due to faults, because losses due to shutdown are reported as a separate category.



Source: World Bank (2002a) and UEDCL.

As can be inferred from Table 2, it is only in the domestic household sector that energy consumption per connection is lower than the average consumption. Hence, we may conclude that the growth in connections has been particularly large in the household sector.[5]

Table 2. Connections and energy consumption by customer group. July 2002.

	Share of connections (%)	Share of energy consumption (%)
Domestic	90.11	42.7
Commercial	9.43	13.7
Medium industrial	0.04	16.5
Large industrial	0.30	26.9
Street lighting	0.12	0.2

Source: UEDCL. (Figures for energy consumption are for January-July 2002)

It appears to be a general understanding that 5% of the population is connected to the public grid in Uganda. This figure appears both in quite recent documents and in documents dating back to the late 1990s. But given the observed increase in connections over the last years, it is probably time to revise this figure upwards. According to our estimates, the share of the

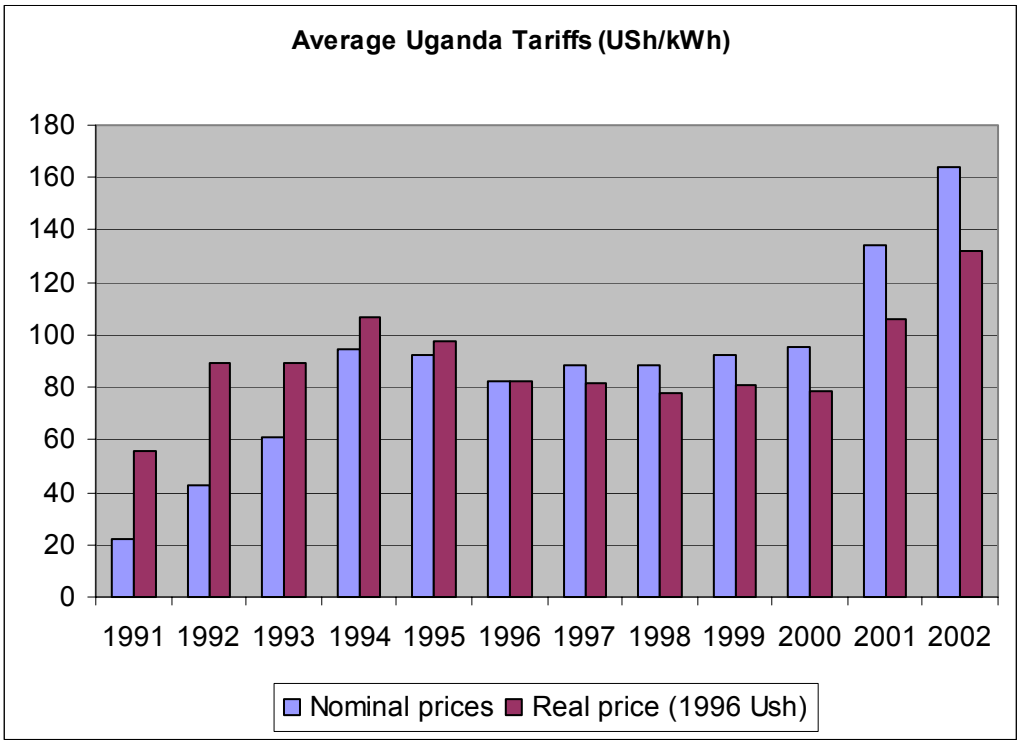
[5] This conclusion is confirmed by figures in Nordic Consulting Group (1999), where it is reported that 88% of connections (i.e., 132000 out of 150000 connections) in 1999 were domestic households.

population connected to the public grid has now increased to 6-7%.[6] Hence, there has been progress, albeit slow.

Prices

Increased availability of electricity does not contribute to improvements in people's livelihoods unless the electricity is supplied at affordable rates. Electricity tariffs in Uganda are high, even measured by Norwegian standards.[7]

Tariffs have increased sharply during the last couple of years. In June 2001, nominal end customer tariffs were raised by 69% on average. Tariffs were reduced again in September 2002 by 8%. Moreover, during 2001/2002 end consumers received an estimated 12.5% rebate due to debt relief in the electricity sector (World Bank, 2002b). The increase in tariffs has nevertheless been substantial.



Source: World Bank (2002a) and UEDCL. Price index from IMF homepage.

[6] According to Nordic Consulting Group (1999), the share of the population served by the public grid in 1999 was 5%, with a total number of domestic connections of 132000. Today the number of domestic connections has increased to around 200000. At the same time population has increased from 21.5 million to about 25 million. Simple extrapolation then suggests that the share of the population connected to the grid has increased to around 6.5%.

[7] The current price for residential consumers is almost 0.8 NOK/kWh (for consumption in excess of 30kWh/month).

Part of the increase in tariffs can be explained by the need to compensate for a reduction in the real price of electricity between 1994 and 2000. In order to bring real prices back to the 1993 level, nominal tariffs had to increase by 16 USh/kWh from 2000 to 2002. The actual price increase was 69 USh/kWh. Thus, the real electricity tariffs rose by almost 50% from 1993 to 2002.

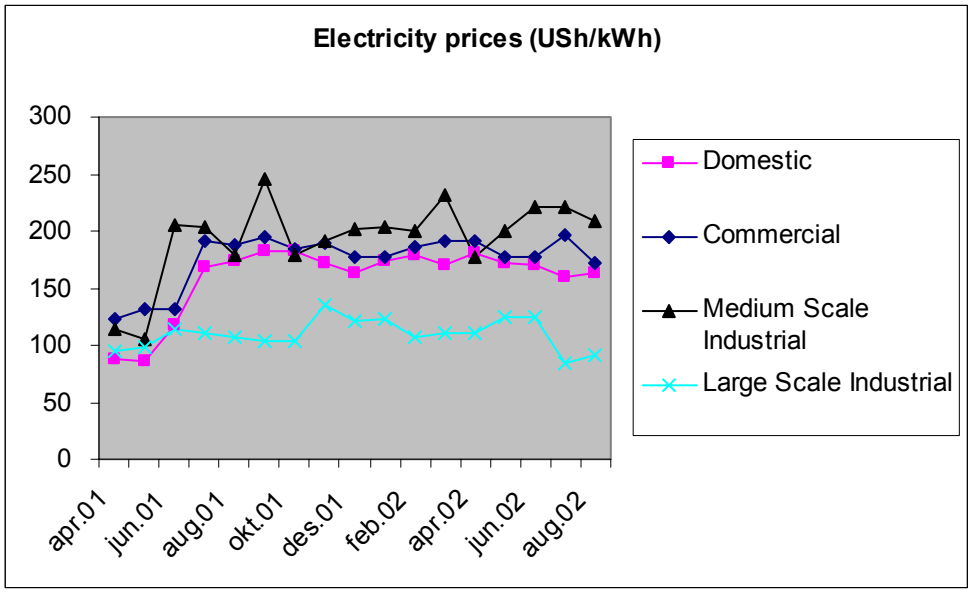
When electricity is priced at (long run) marginal costs, one would normally expect higher prices as production capacity is expanded by taking on board successively more costly power projects. Moreover, investments in the transmission and distribution infrastructure, leading to improved system reliability and thus higher quality of the service, will also drive costs and prices up. Hence, a certain increase in tariffs would be a normal consequence of the investments that have been made in the electricity system of Uganda.

However, the observed rise in the real price of electricity cannot be explained as a result of new investments alone. In the period under consideration, there has been a major restructuring of the energy sector of Uganda, implying inter alia that prices now have to reflect production costs (see below). In the late 90s, prices fell considerably short of costs, and the government of Uganda then financed the losses of the electricity company. Much of the observed price increase must therefore be understood as a consequence of the removal of state subsidies to the electricity sector.

According to Nordic Consulting Group (1999), the losses in the Ugandan electricity company amounted to 18 million USD (or some 33.3 billion USh) in 1998. The total amount of electricity sold in 1998 was 865 GWh (World Bank 2002a). Thus, according to these figures, the state subsidy may have been as large as 40 USh/kWh. But the state also contributed to the bad financial performance in the electricity sector by not paying its bills. The real subsidy element was therefore smaller than these figures suggest. Since average tariffs have increased by 69 USh/kWh on average and only 16 USh can be attributed to compensation for inflation, we may conclude that a significant part of the increased costs of electricity supply is a result of new investments.

Part of the reform of the tariff system in Uganda is the removal of cross-subsidies between different customer groups. In the past, large industries used to subsidise other sectors heavily.

Thus, large industries have not experienced the same increase in electricity tariffs as have other customers (see diagram).



Source: Own calculations, based on billing information from UEDCL.

For residential consumers, Uganda has implemented a two-tier price system that gives a rebate on the first units consumed. For consumption less than 30 kWh/month, the tariff rate is only 50 USh/kWh (i.e., about one third of the normal rate). 30 kWh is approximately the amount of energy needed to burn two 60W light bulbs for eight hours a day. Most of the families that have access to electricity use it for lightening only (see below).

Despite this "social profile" of the tariff system, the tariff reform in 2001 did in fact increase tariffs for the smallest consumers by more than the average 69%. In the period 1993-2001, the tariff for residential consumption below 30 kWh/month was only 20 Ush/kWh. Taking into account the monthly service fee of 1000 Ush (which did not change), the costs of 30 kWh/month thus increased by 94% in 2001.

Tariffs are only part of the costs of electricity; in addition comes the connection fee. Connection charges to residential customers vary according to distance from the nearest distribution pole. Currently the most common rates applicable to domestic households are as follows:

1. No pole service up to 35 metres USh 80.000 (ca. 320 NOK)
2. One pole service Ush 276.000 (ca. 1100 NOK)

Even though these charges cover only 25% and 40% of the actual costs, respectively, many households do not use electricity because they cannot afford the connection fee.

Institutional development

Institutional development has been an important part of the restructuring and renewal of the Ugandan electricity sector over the last years. Up to 2001, the electricity sector was run by the Uganda Electricity Board (UEB), a parastatal vertically integrated monopoly. The UEB suffered from poor financial performance and poor operating efficiency, low productivity, inadequate funds for required investments, low tariffs, poor collection rates, and high losses. During the 1990s, the government realised the need for a fundamental restructuring of the electricity sector.

A new Electricity Act was passed in 1999, opening the way for a restructuring of the sector, entailing the unbundling of UEB's generation, transmission and distribution businesses into separate companies, the establishment of a regulatory framework necessary for private sector involvement, and the creation of an independent power sector regulator.

Norway has actively supported the institutional development in the Ugandan electricity sector. Norwegian technical expertise was involved both in the drafting of the Energy Act and in the subsequent development of a regulatory framework. Currently, Norway is involved in capacity building within the Electricity Regulatory Authority (ERA), the independent power sector regulator set up by the government. Norway's expenses on institutional development are thus far between 20 and 25 mill. NOK.

As a result of the new regulatory framework, separate generation, transmission and distribution companies were established in March 2001. Generation was later on concessioned to a private enterprise, and there are ongoing negotiations about the concessioning of electricity distribution to a private company as well. Increased private sector involvement is thus one of the results of the institutional development in the sector.

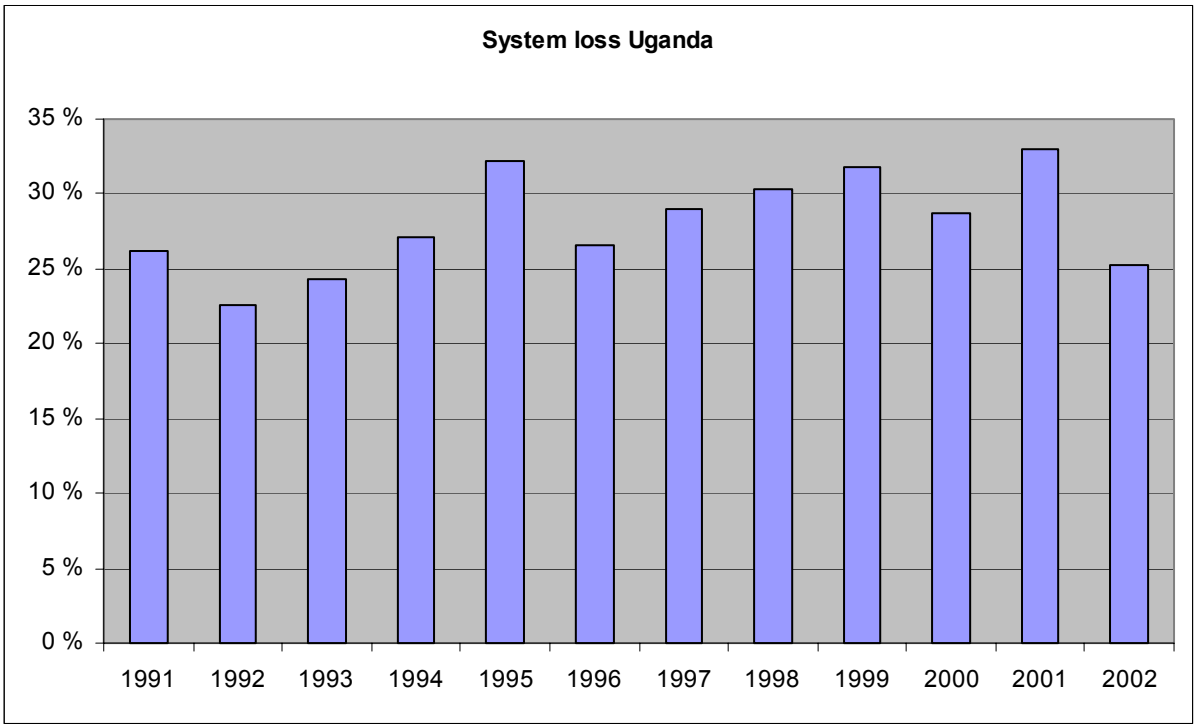
Another obvious result is the elimination of state subsidies to the electricity sector. Whether this in turn will improve budget discipline and improve efficiency remains to be seen. For the

citizens of Uganda, the reduction in state subsidies has no direct value, since they now have to pay for the costs of electricity directly through higher tariffs.

The new electricity sector of Uganda is still in its infancy, and the true effects of the reforms can only be judged in a long-term time perspective. We should therefore not expect big improvements in the fundamental problems of the sector at this point in time. Nevertheless, we will have a brief look at the recent development of two of the often mentioned weaknesses of the UEB; high losses and low collection rates.

Losses

Transmission and distribution of electricity inevitably cause some loss of energy. In Norway, system losses are 8% (WDI, 2001). In Uganda, system losses between 30 and 35 per cent have not been unusual. A large portion of these losses – maybe 15% – is non-technical losses (e.g., theft and incorrect metering).



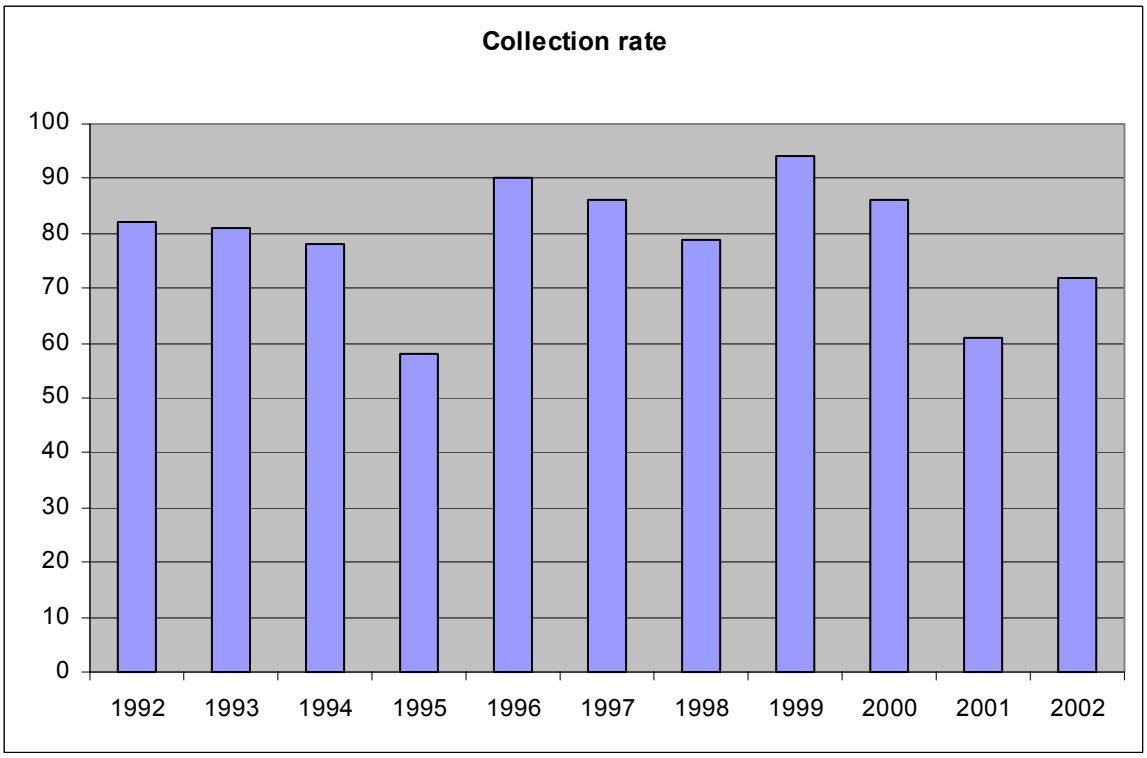
Sources: World Bank (2002a) and UEDCL.

Our data suggest that losses in the distribution net were reduced from 33% in 2001 to less than 20% in the first ten months of 2002. This is a remarkable improvement, which may indicate that the restructuring of the electricity sector may have stimulated to increased

attention on these underlying deficiencies of the system. It will be interesting to see whether or not the new private distribution company will be able to follow up on this trend.

Collection rates

The collection rate measures the amount of money actually collected relative to the amount billed. Prior to the unbundling of the UEB in 2001, the collection rate was between 80 and 90 per cent. It does not seem like the restructuring of the sector has lead to improvements in the collection rate to date. Quite contrary, the collection rate has been extremely low during the two last years (60-70%).



Source: World Bank (2002a) and UEDCL. Calculations for 2001 and 2002 are based on the nine last months of 2001 and the first ten months of 2002.

The main explanation of the reduction in collection rates over the last years is probably the strong increase in tariffs in mid-2001, coupled with the announcement by the government that people did not have to pay their bills (World Bank, 2002b). During the first four months after the tariff increase in 2001, the collection rate was down to 53%. Since then, there has been a gradual recovery, but there is still a long way to go to reach a satisfactory collection rate.

It is yet too early to conclude whether the concessioning of the distribution service to a private company will drive collection rates upwards. Several interview objects express hopes that a private actor will be able to reduce losses and increase collection rates, thus forming the basis

for reduced tariffs in the longer run. There is an inherent incentive problem in this way of reasoning, though. If the private company realises that efforts to improve performance will lead to lower tariffs in the next period, the incentives to perform are seriously weakened.[8]

A more intangible result of the Norwegian involvement in the institutional development appears to be a change in the way of thinking and the general understanding of the electricity sector. Also, the mode of cooperation between Norway and the local partners has facilitated local ownership to the new institutional set up. In the drafting of the new energy bill, Uganda faced the choice between a "package" from the World Bank and a more participatory approach where locals worked out their own solutions with inputs from Norwegian expertise. According to several sources, there seems to be great satisfaction on the Ugandan side with choosing the latter option.

The Norwegian support to physical infrastructure cannot be viewed in isolation from the new institutional set up. The refurbishment of substations and the accompanying reduction in losses is seen by several sources as a precondition for the unbundling of UEB and the later involvement of private companies in the sector.

Electricity and economic growth

The ultimate goal of the Norwegian support to the electricity sector is to improve the quality of life for the people of Uganda. This may occur directly through increased supply of affordable electricity to the household sector, or indirectly by stimulating to economic growth and increased incomes.

Are there any indications that the assistance to the electricity sector of Uganda has promoted economic growth? A survey by Reinikka and Svensson (2001) showed that in the period 1995-97, poor utility services and high electricity prices were considered respectively the most serious and the third most serious obstacle to private investment in Uganda. 94% of the firms in the survey were connected to the public grid, suggesting that there were major problems with the functioning of the existing system. On average, the firms in the survey did

[8] The seriousness of this incentive problem depends on the degree of asymmetric information between the regulator (ERA) and the private distribution company (for instance about the costs involved in making improvements in the performance criteria).

not receive electricity from the grid for 89 operating days (the sum of all part or full days) a year. As a result, the investments in back-up supply were significant. 77% of large firms, 44% of medium-sized firms, and 16% of small-sized firms owned generators. The costs of generators represented 16% of the value of total investment, and 25% of the value of investment in equipment and machinery in 1997. Moreover, the costs of own-generated electricity are about three times as high as the price at the public grid (Reinikka and Svensson, 2002).

Unfortunately, we have not been able to find a recent, comparable survey that might shed light on how this picture may have changed over the last years. We know, however, that real electricity prices in the public grid have increased significantly for most businesses, except for large industry. A rough calculation based on the figures above suggests that if the current system makes private generators superfluous, small- and medium-sized firms with a generator pay a higher average price for electricity today than they did before the reform, measured in real prices. The average price for large firms with a generator has been considerably reduced, though. In addition come benefits from reduced need to invest in generators. According to Reinikka and Svensson (2002), investments in private generators did indeed crowd out other investments. A stimulus to private investment must therefore be expected if generators are made more superfluous.

For firms without a generator, investments are also likely to increase. Reinikka and Svensson (2002) estimate that a reduction in the number of lost days of electricity supply from 70 days to 10 days will increase the investment (as share of the capital stock) from about 5% to 15%.

We have no data that can tell whether investments in generators have actually been reduced in Uganda. The elimination of load shedding has not had a big impact on most industries since load shedding used to take place primarily at night (between 6 and 11 p.m.), and most industries operate at daytime only. When it comes to other types of outages (irregular ones), there still seems to be a high number of faults in the system, particularly at the distribution level. Therefore, it does not seem unlikely that many firms still do maintain their back-up solutions.

In our interviews, it was claimed that the improvement in the electricity sector had made a big difference for certain industries. The tea industry was mentioned as an example. More reliable

electricity supply has made Ugandan tea competitive in the export market, at least in the East African market. We did not have the opportunity to verify these assertions, though.

Some private businesses have also benefited from being connected to the grid for the first time. The number of new business connections in the first year after the unbundling of UEB was almost 2500. In some places, like for instance in Kajunga, a remarkable increase in productivity and activity levels has been observed after the area was connected to the grid. This is an area with a quite high population density where people were engaged in productive and viable economic activities at the outset.

Case study: Steelmill in Jinja

The team visited the steel mill in Jinja in order to investigate how its operations were affected by the changes in the electricity sector. The steel mill produces scrap-based steel through an electric arc furnace process. The production volume per day is 70-80 tonnes steel. The steel mill uses around 5MW of electricity and is thus a major consumer in the Ugandan market.

Before the Owen Falls Extension became operative, the steel mill was load shedded four hours a day (from 6 to 10 p.m.). In addition, there were more irregular switch-offs once a week on average. The extended electricity generation capacity made it possible to run the mill for 24 hours a day and thus increase steel production by 20%. Although this in itself would increase employment, actual employment has not increased due to a recent change in production technology. There was no clear evidence as to whether the change in the technology was due to the changes in the electricity market.

A comparison of electricity bills between 1997 and 2002 showed that the nominal tariff for the steel mill had increased by only 8%, confirming that the rise in prices for large industry has been modest. The observed price level of around 150 USh/kWh (including taxes) was however considerably higher than the average prices reported for large industrial users in the official statistics. The price level is so high that a significant expansion of energy intensive industries in Uganda seems highly unlikely, independently of any further improvements in the reliability of the system.[9]

[9] The observed tariff was between 0.60 and 0.65 NOK/kWh.

Impacts on quality of life

Only a small share of the population of Uganda has access to electricity. According to our estimates, the share of the population connected to the public grid is between 6 and 7% (see above).

Data are sparse on the direct impact of electricity on people's quality of life. Figures reported in the Poverty Status Report 2001 suggest that the main use of electricity in ordinary households is for lighting. Only one percent of the population uses electricity for cooking. In urban areas, where the use of electricity is more common than in rural areas, the share of households using electricity for cooking was actually reduced from 5% in 1992/93 to 3% in 1999/2000.

On average, 7% of the population uses electricity for lighting (Table 3). But the share is much higher in urban areas. In 2000, 40% of urban households used electricity for lighting, up from 33% in 1996. In rural areas, however, there has actually been a reduction in the use of electricity for lighting in the same period. The majority of the population uses the "tadooba" that pollutes the air and exposes people to respiratory tract complications.

Table 3. Sources of lighting in households (%)

	1996			**2000**		
	Rural	Urban	**Total**	Rural	Urban	**Total**
Electricity	*2*	*33*	*7*	*1*	*40*	*7*
Tadooba	81	36	**74**	80	29	**72**
Paraffin lantern	11	30	**14**	11	30	**14**
Other	6	1	**5**	8	1	**7**

Source: Poverty Status Report 2001.

Unfortunately, we do not have data for the development in these variables after 2001, when the main changes in the electricity market took place. But given the significant increase in the number of connections after 2000, it is reasonable to believe that the trend towards more widespread use of electricity for lighting in urban areas has continued.

The main insight that can be drawn from these scattered observations is that the improvements in quality of life for people are related mainly to increased use of electricity for

lighting. More people have gained access to electricity for lighting due to increase in the number of connections, and those people who were already connected do no longer have to resort to other lighting sources during hours of load shedding. Some reduction in respiratory illnesses might therefore be expected, but given the low number of affected households any such improvements will only be of marginal importance for the overall health status of the population.

Improved reliability of the power supply implies that certain equipments, such as refrigerators, become much more useful. But since such equipments typically are not affordable for an average household, these are benefits that accrue mainly to the richer part of the population.

Some of our interviews also suggest some further improvements in the quality of life, e.g. through increased safety. Until increased production capacity was installed and the transmission system was refurbished, it was normal with regular or irregular outages 2-3 days a week in Kampala. Load shedding normally took place between 6 and 11 p.m. Covered by the dark, theft and other crime flourished. This pattern was perhaps reinforced by the tendency that husbands did not go home after work on days of load shedding, and rather spent the night out. Increased reliability of the electricity system may thus have made people more safe and made them able to move more freely at night. It is also worth mentioning that not all areas were equally affected by load shedding. In general, load shedding had a bias against the less well off areas of the city, due to the need to protect "vital functions". In this sense, it seems to be a certain positive distributional bias of the reforms, although the poorest households are not affected at all, of course, since they cannot afford a connection.

Despite an increase in the number of connections, welfare losses for the household sector are conceivable due to higher prices of electricity. Higher tariffs result in less money for other goods and services, or make one save on electricity. But, on the other hand, reduced rationing and increased reliability have improved the quality of the service, implying that the welfare effects of the households that already were connected are indeed ambiguous.

In general, there is poor documentation of the impact of the investments in the electricity sector on people's quality of life. Nor does there appear to be a good understanding of which variables that would be relevant to report on in this context. The need for a proper baseline

study that could be used both as an input in project appraisals and as a reference for future reporting of results is evident.

4. Summary of main findings

1. Installation of new power generating capacity at the Owen Falls Extension has been essential for accommodating the strong growth in the demand for electricity in Uganda.
2. Increased production capacity has eliminated rationing of electricity at peak hours. In the late 1990s, electricity demand sometimes exceeded actual generation by 40-50% at peak. Reduced rationing of electricity has in particular benefited the urban household sector.
3. Refurbishment of substations and installations of new transformers have been essential in order to supply increased amounts of electricity to end customers. The reliability of the transmission and distribution system has increased in the sense that the amount of energy not supplied due to faults has been reduced relative to the total supply (from 1.1% in 1999 to 0.5% in 2002). In absolute figures, however, the improvement is quite small, or negligible. Actually, there seems to have been an increase in the amount of energy not supplied due to faults in the distribution network (11 kV and 33 kV lines). This is however outweighed by improvements in the transmission network (132 kV lines).
4. Institutional development has been an important element of the renewal of the Ugandan electricity sector. A new Electricity Act, unbundling of the parastatal electricity monopoly, privatisation of the generation and distribution operations, and the establishment of an independent regulatory authority are important elements of the new institutional framework. It is yet too early too conclude whether the institutional reform will improve the functioning of the system. There are signs that losses in the distribution network are on their way down. Collection rates have been reduced, though, in particular after electricity tariffs were raised in 2001.
5. Electricity tariffs increased substantially in mid-2001 (up 69% on average). While nearly ¼ of the price increase reflects the need to compensate for a declining real price of electricity during the late 1990s and a large part of the increase is due to reduction in state subsidies to the electricity sector, a significant part also seems attributable to

higher costs of electricity supply. Tariffs increased more than average for small household consumers and less than average for large industrial users.

6. A survey from 1995-97 showed that poor utility services and high tariffs were among the strongest impediments to private investment in Uganda. Although the reliability of the electricity system has improved, the costs of electricity have not been reduced. Admittedly, there is presently less need to operate expensive private back-up solutions. But for most businesses this gain has probably been outweighed by the increase in electricity tariffs.

   Even though prices have not been reduced, it is expected that improved system reliability will increase investment rates. There is some scattered information that may support this conclusion. For instance, it is reported that improved electricity supply has enhanced the international competitiveness of the Ugandan tea industry. Also, the steel mill in Jinja was able to expand its production capacity by 20% when rationing of electricity ended.

7. The share of the population connected to the public grid has increased from 5% to 6-7% during the last three years. Data on the impact of increased electricity supply on people's livelihood are sparse. Any improvements in quality of life are probably related mainly to increased use of electricity for lighting. More people have gained access to electricity for lighting, and those people who were already connected do no longer have to resort to other lighting sources during hours of load shedding. Since alternative lighting is polluting, a reduction in respiratory illness in affected households can be expected. Interviews also suggest that security has improved in areas where load shedding previously took place at night.

References

Gildestad, B., L. Omulen, and R. Salomon (2001) *End review of the institutional co-operation for development and legislative reform project (ILRES)*. Oslo.

Nordic Consulting Group (1999) *Review of the Norwegian Input to the Energy Sector in Uganda.* Oslo, Stockholm, Copenhagen.

Poverty Status Report (2001) Ministry of Finance, Planning and Economic Development, Kampala.

Reinikka, R. and J. Svensson (2001) Confronting competition: investment, profit and risk. In: Reinikka, R. and P. Collier (eds.), *Uganda's Recovery: The Role of Farms, Firms, and Government.* The World Bank, Regional and Sectoral Studies, Washington, DC, pp. 207-232.

Reinikka, R. and J. Svensson (2002) Coping with poor public capital, *Journal of Development Economics 69*, 51-69.

WDI (2001) World Development Indicators. World Bank.

World Bank (2002a) *Implementation completion report for the third power project.* Report no: 24406.

World Bank (2002b) *Uganda power sector. Financial aspects concerning UEGCL, UETCL, UEDCL and UEB.* Power IV – World Bank Supervision Mission, October 7 to 19, 2002.

Annex 1. List of relevant institutions and persons visited

Institution	Persons interviewed
Norwegian Embassy	Tore Gjøs (Ambassador) Hans Venvik (First Secretary)
NVE	Espen Lier (Long term consultant)
Ministry of Energy and Mineral Development	Godfrey R. Turyahikayo (Commissioner) Watuwa Bwabi (Director) Henry Bidasala (Principal Energy Officer) Moses Muregezi (Assistant Commissioner)
Uganda Electricity Transmission Company	Willilam K. Kiryahika (Manager Engineering) Florence N. Musoke (Manager Finance, Accounts & Sales)
Uganda Electricity Distribution Company	Irene Muloni (Ag. Managing Director) Robert F.B. Mubiru (Ag. Manager Customer Service) Dison B. Okumu (Manager Pricing and Regulation) B.S. Balaba (Manager Customer Service)
DFID	Jonathan Beynon (Economic Adviser) Tim Williams (Governance Adviser)
World Bank	Robert Blake (Country Program Manager)
Uganda Bureau of Statistics	Male-Mukasa (Executive Director) Z.E.A. Kaija (Director)
Jinja Steel Rolling Mills	
NORPLAN	Steinar Grongstad