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Energy Access theme results

Energy Services for the Poor in West Africa

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Energy Services for the Poor in West Africa
Sub-Regional "Energy Access" Study of West Africa

Final Draft

Prepared for

"Energy Access" Working Group

Global Network on Energy for Sustainable Development

by

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LIST OF ABBREVIATIONS AND ACRONYMS

AMADER:	Agence Malienne d'Energie Domestique et de l'Electrification Rurale (Malian Agency for Rural Electrification and Domestic Fuel)
ASER:	Agence Sénégalaise d'Electrification Rurale
CREE:	Commission de Régulation de l'Electricité et de l'Eau (Regulatory Commission of Electricity and Water of Mali)
CRSE:	Commission de Régulation du Secteur de l'Electricité (Regulatory Commission of Electricity Sector of Senegal)
ECOWAS	Economic Community of West African States
EMCES	Enquête Malienne de Conjoncture Economique et Sociale
EDM:	Energie Du Mali
ESAM	Enquête Sénégalaise Auprès des Ménages (Senegalese Household Survey)
EPPS	Etude sur la Perception de la Pauvreté au Sénégal (Study on the Perception of Poverty in Senegal)
GTI	Greenwich Turbine Inc.
GNESD	Global Network on Energy for Sustainable Development
GWh	Gigawatt hour
IPPs	Independent Power Producers
KWh	Kilowatt hour
NEPAD	New Partnership for Africa Development
MW	Megawatts
MV	Medium Voltage
OMVG	Organisation de Mise en Valeur du fleuve Gambie (the member states of the management of the River Gambia (Senegal, The Gambia)
OMVS	Organisation pour la Mise en Valeur du fleuve Sénégal (The Senegal River Basin Development Project)
ODHD	Observatoire du Développement Humain Durable
PRSP	Poverty Reduction Strategy Paper
LPG	Liquid Petroleum Gas
SOGEM	Société de Gestion et d'Exploitation de Manantaly
SENELEC	Société Nationale d'Electricité du Sénégal (National Electricity Company of Senegal)
LV	Low Voltage
UDS	Usage Domestique Spécial (Special Domestic Use)
UDG	Usage Domestique Général (General Domestic Use)
UP	Usage Professionnel (Professional Use)
WAPP	West African Power Pool

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Summary

The biggest challenge facing West African countries today is to reach a sustainable rate of positive economic growth that will enable them to cope with high poverty levels compounded by soaring demographic and urban growth. In a bid to stimulate a genuine dynamic of development and to rise above the economic, social, political, and environmental crises that have beset the sub-region more or less permanently since the late 1970s, the countries of the sub-region opted to subject themselves to the Structural Adjustment Programmes (SAPs) that have become the prerequisite of getting funding from multilateral co-operation donors. These SAPs were designed to be implemented in tandem with sectoral reforms.

The reforms relating to the electricity sector were adopted at different periods for different countries: Côte d'Ivoire was the first to adopt them in the early 1990s, followed by Senegal, Mali, The Gambia, and, finally in 2003, Benin. In all these cases, the objectives of the reforms were clearly technical (renovation and extension of the grid, improvement of the quality of electricity) and financial or management-related – none of them made explicit mention of tackling poverty, not even in terms of contributing to previous poverty reduction policies. This was in spite of the fact that many countries have listed poverty reduction as one of their main national priorities by adopting Poverty Reduction Strategy Papers (PRSPs). The bulk of PRSP's do not refer specifically to energy as being one of the factors necessary for effective poverty reduction, nor do they mention electricity as a strategic factor of production.

West Africa remains the sub-region with the lowest rate of electricity consumption not just in Africa but in the whole world. The annual per capita consumption varies between countries from almost 350 kWh in Ghana to 27 kWh in Burkina Faso. Access to electricity in the ECOWAS region as a whole is limited to about 20% of the population. In Côte d'Ivoire, Nigeria and Senegal it ranges from 30% to 40%, and it is as low as 4% in Niger and Guinea Bissau. In addition to these disparities between countries, a large disparity exists within individual countries between urban, peri-urban and rural populations in terms of access to electricity. For example, in Senegal, while the urban population has an access rate of 54%, in the rural areas this drops to just 8%; in Mali the rate is 32% in the urban area and less than 1% in rural areas (ECOWAS, 2000).

The low level of access of the poor to electricity, though due in part to the high level of poverty, can also be partly attributed to the underdevelopment of the electricity supply industry infrastructure in the sub-region. The countries with the highest electrification rates are those that have the most developed industrial infrastructure and equipment (Nigeria, Senegal, Côte d'Ivoire).

This study was conducted under the aegis of the Global Network on Energy for Sustainable Development (GNESD) and attempts to assess the impact of electricity sector reforms on poor people in West Africa. In order to do so, this report details the content of the reforms: the objectives, organisational formats, and technical and financial provisions. It also analyses their effects on electricity supply and their impact on the poor.

Because of the large size of West Africa and the limited resources means allocated to the study, we undertook two case studies. The countries were chosen so as to be

representative of the differing realities of the sub-region. Senegal and Mali were selected because each one is a member of one of the two groups into which the countries of the region can be placed according to the following criteria: rate of electrification (Senegal is among the best-off with a rate of over 30%, while the latter is one of the worst-off with a rate of just 10%); density of infrastructure and equipment; rate of urbanisation; and rate of industrialisation (Senegal being amongst the most advanced and Mali being amongst the least advanced). Other differences include the fact that Senegal is a coastal country while Mali is landlocked. They belong to different co-operation groupings: Senegal tends to look to Guinea, Guinea Bissau, and The Gambia, while Mali looks to Ghana and Côte d'Ivoire in the hope that it can export electricity from their hydroelectric power stations. Another similarity is that both countries have implemented electricity sector reforms.

The two countries do have some common attributes, and that allows us to establish some commonality between the countries of the sub-region. For example, they are both members of the regional power management framework: within the OMVS (Organisation pour la Mise en Valeur du fleuve Senegal), they co-operate to improve their electricity supply.

Despite the care that was taken when choosing the case studies, there are still some disparities in terms of the information it was possible to collect on each country. Additional studies will have to be conducted to identify more precisely the options to be recommended to policy makers. Nevertheless, some lessons can already be learned regarding the situation in West Africa.

The power sector reforms that have been undertaken have not been sufficiently implemented, or have not been implemented for long enough, to enable definitive conclusions to be drawn. What is certain is that reforms have resulted neither in a significant jump in electricity generation nor in improved quality of the supply (there are still frequent blackouts, fluctuations in current levels, etc); nor have they led to a decrease in the cost of electricity. The most visible effects have been the creation of new bodies to regulate the sector and to take responsibility for rural electrification. The poor, who would be the main beneficiaries of rural electrification programmes, have suffered from the delay in releasing specific funds supporting the pursuit of specific social and economic objectives.

In conclusion, the reforms have not been used by West African Governments in a way that would widen access to electricity and boost the capacity of economic operators. Governments must accompany their sectoral reforms with special measures to provide electricity access to the majority of the poor especially micro-entrepreneurs in the informal sector.

1.0 INTRODUCTION

The Economic Community of West African States (ECOWAS) is made up of fifteen countries,[1]of which twelve are classified as Least Developed Countries (LDCs). Improving living standards for the growing population and boosting economic development for the member States remain permanently challenging objectives. Poverty reduction is a major concern in the sub-region, as in the rest of sub-Saharan Africa. As in most of sub-Saharan Africa, in ECOWAS member States, it is possible to distinguish two types of supply system:

- Small interconnected grids covering the region surrounding the capital city plus a few relatively large power plants serving regional areas in the country, and many small diesel engines supplying isolated centres;
- Several sub-regional grids with many diesel engines supplying isolated centres.

The vast majority of the population of the sub-region have very limited access to modern energy services, and to electricity in particular. Widening access to electricity services can assist in reducing poverty.

Electricity consumption in the sub-region remains low. Access to electricity in the ECOWAS region as a whole is about 20%. Analysis of annual per capita consumption demonstrates the wide divergence between countries: it varies from almost 350 kWh in Ghana to 27 kWh in Burkina Faso. In Côte d'Ivoire, Nigeria, and Senegal, it ranges from 30% to 40%, while it is as low as 4% in Niger and Guinea Bissau. In addition to these disparities *between* countries, large disparities in access to electricity exist within individual countries between urban, peri-urban and rural populations. For example, in Senegal, while 54% of the urban population have access to electricity, only 8% of rural-dwellers do. In Mali, the rate of access to electricity is 32% in urban areas and less than 1% in rural areas.

The low level of access of the poor to electricity is due in part due to the high level of poverty of local communities. But another important factor is the underdevelopment of the electricity supply infrastructure in the sub-region. There is insufficient grid coverage in all the major load centres. Supply is unreliable; consequently, blackouts are frequent and many industrial consumers produce their own power. Some of these self-producers provide electricity to other consumers, thereby partly filling the gap where public utilities are unable to supply demand.

In the face of this situation, and under considerable pressure from the World Bank and the International Monetary Fund (IMF), most ECOWAS member States have, to a greater or lesser extent, engaged in reform processes in the electricity sector. Côte d'Ivoire initiated reforms in the early 1990s and was followed by Senegal, Mali, The Gambia, Benin, and other countries. These reforms appear to have been motivated mainly by constraints related to investments and poor management of Government-owned utilities. One of the major concerns is to improve the efficiency of the electricity systems in order to respond to the rapid increase in demand. In other words, the reforms are aimed at improving the overall situation of the utilities and the electricity sector in general. The reforms are also designed to improve the reliability

[1] The fifteen member countries of ECOWAS are Benin, Burkina Faso, Cape Verde, Cote d'Ivoire, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo. .

and availability of electricity supply and to guarantee the financial and economic viability of key actors in the industry.

This study deals with the impact of these reforms on energy access for the poor in the West African region. Undertaken within the framework of the Global Network on Energy for Sustainable Development (GNESD), the study seeks to determine whether reforms undertaken in the electricity supply sector are capable of providing large-scale electricity access for the poor in West Africa.

The recent redirection of national macro-economic policies, whereby fighting poverty has become a priority, has been demonstrated by the spread throughout West Africa of Poverty Reduction Strategy Papers (PRSPs). The PRSPs do not specifically mention electricity as one of the key factors in reducing poverty.

The scarcity of data required to provide a uniform overview of the national situation in each country in the sub-region is a natural consequence of the fact that a few years ago, the power utilities stopped the publication and circulation of annual reports including data on electricity use. Consequently, it is difficult to get a comprehensive picture of the sub-region and to collect information of the type and level of detail that was required for the two case-study countries.

1.1 Macro-economic reforms, poverty and energy access in West Africa

Over the past ten years, the regional gross domestic product (GDP) of ECOWAS has been on the decline. In macro-economic terms, the member States showed a 2.5% real GDP growth rate in 1999, down from 4% in 1996, 4.3% in 1997, 3.5% in 1995 and 5% in 1990. The implementation by West African countries of Economic Stabilisation Policies, followed by Structural Adjustment Programmes with their associated conditionalities, failed, over two decades, to produce any reduction in poverty; indeed in Sub-Saharan Africa it often had quite the opposite effect. Occasional improvements in economic performance rarely translated into sustained improvement of the standard of living for most African people. On the contrary, the trends towards greater poverty and social exclusion seem to be growing stronger, to the detriment of the overall socio-economic situation and the stability of the sub-region. This may explain why in recent years, all reform policies and programmes have been reoriented to give priority to the fight against poverty.

In Africa, about 340 million people – almost half of the continent's population – live on less than 1 US dollar per day. The under-five infant mortality rate is 140 per 1000; and life expectancy is only 54 years. Only 58% of the local population have access to potable water. The 2001 UN Global Report states that about two-thirds of ECOWAS member States are listed among the poorest in the world with 51% of the population living below the poverty line (with a poverty index average of 0.456). The Human Development Index (HDI) reflects the poor social conditions prevailing in the sub-region, caused by a combination of high population growth and low income.

These figures are alarming enough to justify the launch of continental and global initiatives to get the countries concerned onto the path to sustainable economic growth and enable them to neutralise the mechanisms responsible for propagating poverty. On the global level, the United Nations Millennium Declaration, adopted in September 2000, is an expression of a collective sense of awareness and commitment to support all the various efforts (notably in Africa) undertaken to combat social exclusion and to improve the social well-being of the poor.

In the same vein, the long-term objective of NEPAD (the New Partnership for Africa's Development) is to "eradicate poverty in Africa and place African countries (both individually and collectively) on the path to sustainable development and economic growth, thus ending the continent's marginalisation in the context of increasing globalisation". However, this objective demands concrete action. In strategic policies designed to combat poverty, such actions revolve around the creation of wealth (development of agriculture, local crafts and industries), capacity building and the enhancement of basic social services (such as water, education and health care), as well as the improvement of infrastructure services such as electricity to enhance living conditions for vulnerable population groups.

Poverty presents a daunting challenge in West Africa and the region has seen the number of very poor people increase steadily. The social challenge facing rural areas is particularly onerous. The quality of rural development is thus a basic determinant of the quality of future social development of these countries. Conditions for breaking out of the poverty cycle and lifting the rural poor out of penury are inextricably linked with increasing rural-urban interactions, the constraints of agricultural development, water scarcity, and the inaccessibility of modern energy. It must also be stressed that the high level of conflict in this region and in Africa as a whole has led to low incomes and poor growth, as well as low institutional capacity.

It should also be noted, however, that the approach taken by strategic policies has thus far been unsuitable. These policies are modelled on a sectoral approach, which leaves little room for the advantages that could emerge from an approach that is multisectoral (that is, an approach which places the emphasis on the development of synergies between the different strategic sectors promoting sustainable growth). A multisectoral approach would place energy issues, and electricity in particular, at the heart of the debate, thanks to the predominant role that electricity has in the development of economic sectors such as agriculture, small/medium-scale enterprises and industries as well as social sectors such as health, water and education.

Steps have already been taken towards developing regional links with a view to improving electricity access and supply to various population groups. The ECOWAS West African Power Pool (WAPP) and gas pipeline constitute two of the short-term initiatives; another is the NEPAD action plan for West Africa.

1.2 Background of the Electricity Sector in West Africa

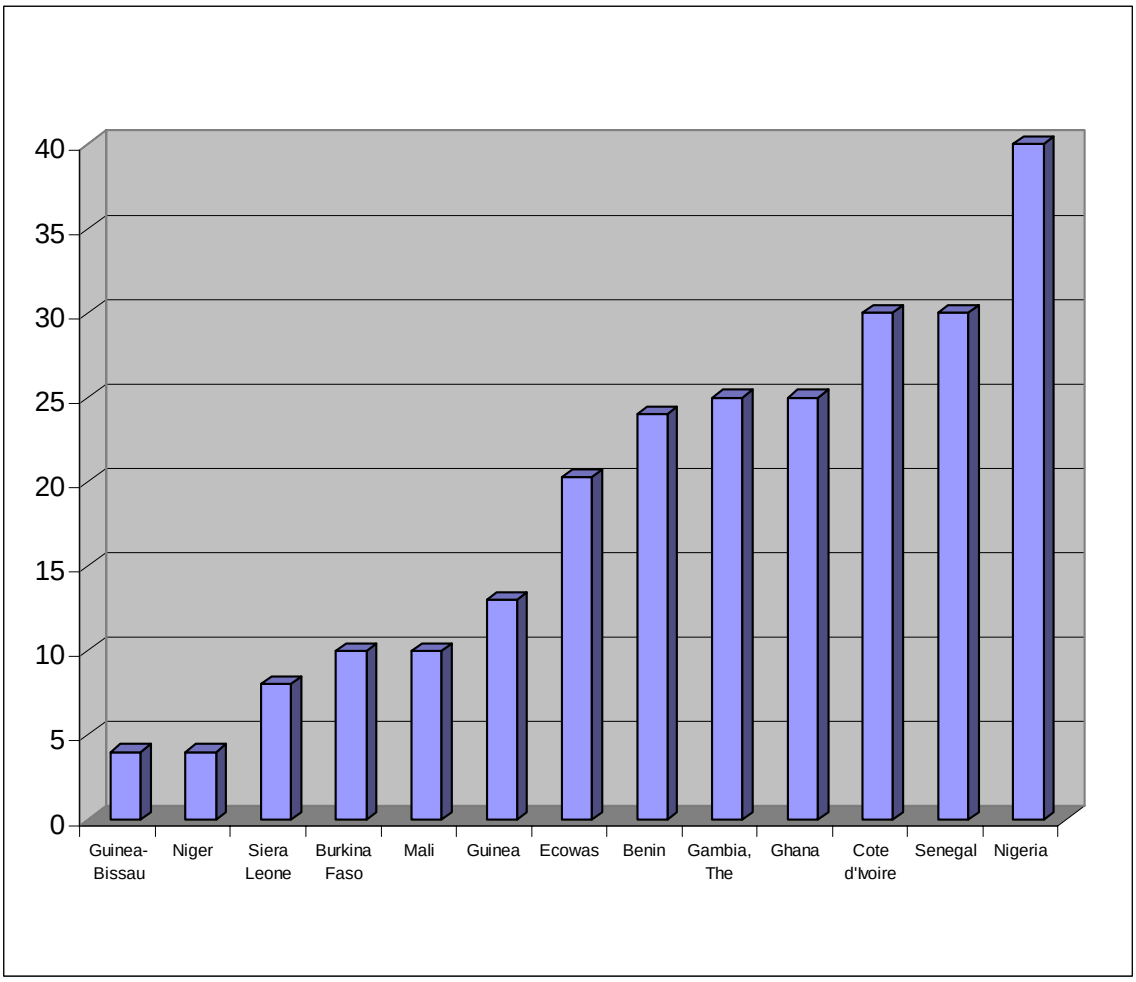
Electricity in West Africa is generated through thermal (58.8% of installed capacity) or hydro (41.2%) sources. The majority of power plants burn fuel oil, diesel oil, and natural gas. This poses considerable macro-economic problems because the majority of ECOWAS countries are not oil producers. Although the region has substantial hydroelectricity potential (estimated at 24 GW), hydroelectricity generation remains very low – only 4% of the potential capacity is currently tapped. This can be partly explained by the huge capital investments required for the exploitation of hydroelectric resources.

Table 1: Selected indicators of Electricity Sector of ECOWAS (2001)

Population (millions)	247.00
Installed electricity capacity (MW)	9,446.00
Electricity generated (GWh)	33.82
Electricity consumption (GWh)	31.78
Per capita electricity consumption (kWh)	129.00

Note: The data provided in this table was derived from SENELEC – the Senegalese national electricity utility - and is, therefore, taken to be the best possible data set.
Source: Compiled by the authors

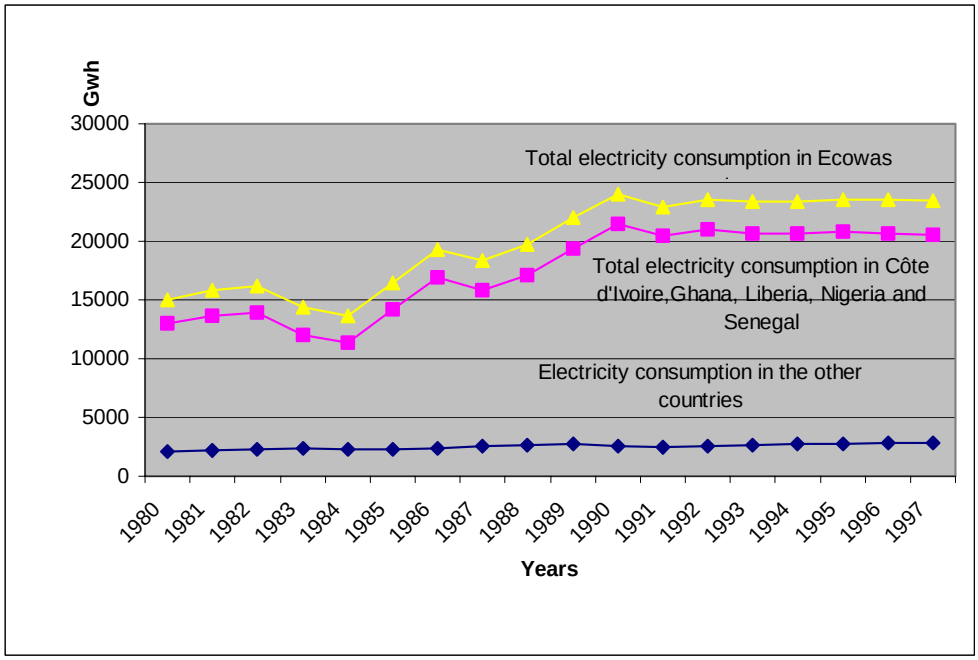
Figure 1: Access to Electricity, % of population in 2000



Source: Compiled by the authors, on the basis of ECOWAS data

The total amount of electricity generated in the sub-region in 2001 was 33.8 GWh. Of this, Nigeria generated more than half (15.7 GWh), followed by Ghana with 8.8 GWh and Côte d'Ivoire with 4.6 GWh. In 2001, regional electricity consumption was 31.8 GWh, led by Nigeria's 14.6 GWh (45.8%), Ghana's 8.8 GWh (27.8%), Côte d'Ivoire's 3.0 GWh (9.4%) and Senegal's 1.4 GWh (4.4%).

Figure 2: Electricity Consumption in ECOWAS Countries



Source: Compiled by the authors, on the basis of ECOWAS data

It is important to note that those countries that enjoy high potential for hydroelectricity generation are not necessarily those that have the most highly developed electricity supply. For example, Guinea with low electrification levels, is referred to as the ”water tower of West Africa” because it boasts a mighty hydroelectricity potential and because most of the sub-region’s waterways originate there – its hydroelectricity potential is estimated at 19.4 GWh per year, of which only a fraction is currently exploited through the main power station in Garafiri.

The so-called Southern Rivers States, among them Liberia, also have high hydroelectricity potential but low levels of electrification. However, the latter country’s electric power installations have been almost totally destroyed by long years of civil war. The Bumbuna hydroelectricity project, for example, had almost been completed when civil war broke out;the war interrupted its construction. The resumption of construction work will depend on the country’s success in mobilising the necessary finance. Although the African Development Bank has pledged 27.61% of the funds, the problem lies in finding investors to provide the rest.

In Ghana, hydroelectric power makes a far greater contribution than thermal energy in the generation of electricity, thanks to hydroelectric plants at Akosombo, Kpong and Pra. The country is also envisaging additional hydroelectricity projects, particularly on the Volta River, not only to meet the ever-increasing domestic demand, but also for export to neighbouring countries (Côte d’Ivoire, Mali, and Burkina Faso). Nevertheless, in order to reduce its dependence on hydro-power, and because of serious droughts observed in West Africa during 1997–98, Ghana also plans to diversify its sources of energy generation by increasing its imports of petroleum products, mainly through the importation of butane gas from neighbouring Nigeria.

As mentioned earlier, some of the countries in the sub-region began their reforms long after their neighbours did. For example, the Côte d’Ivoire kicked off in 1990, but Benin did not follow suit until 2003.

It has been generally observed that electrification rates are highest in countries that have a strong industrial base, endowed with substantial infrastructure services and equipment. In these countries, the implementation of reforms has been supported by private foreign investment.

In the case of countries with national electrification rates of less than 10%, the electric power networks and electricity generation are so weak that private investors are not interested. The State is therefore forced to appeal to either bilateral or multinational partners. The Gambia was successful in attracting South Africa's Eskom in June 2000 to invest in its reforms, with contribution of 50% of the required investment from the State-owned National Water and Electricity Company (NAWEC). This partnership, however, which included the participation of the World Bank, failed in just a couple of months. The intervention of the African Development Bank, which took over rural electrification, was not enough to attract the necessary private investment. Additional investment is needed to finance the construction of new power plants and to ensure the successful implementation of reforms at the national level.

The Republic of Niger has one of the lowest electrification rates (4%) in the sub-region and in the world. Due to the high cost of petroleum imports used for electricity generation, the country plans to explore hydroelectric options (to replace the predominance of thermally produced electricity), in line with integration strategies with its neighbours (Nigeria and more especially, Ghana). Niger wants its reform programme to be financed by international financial institutions, since its energy market is not sufficiently attractive to win the interest of private investors. One of the objectives of the reform package is to mobilise finance for the hydroelectricity project at Kandadji (on the river Niger), scheduled to be completed between 2004 and 2012. The complementary part of this project involves the construction of dams at Gamba and Dyodonga.

The electricity produced in Burkina Faso is also essentially of thermal origin, which has the serious disadvantage of being vulnerable to petroleum price increases. The country therefore wishes to embark on diversification of energy sources for electricity generation, with the emphasis on hydroelectricity, and notably the possibility of connecting to the electricity grids of Côte d'Ivoire and Ghana (connecting to Côte d'Ivoire via the grid running from Ferkessedougou to Ouagadougou).

Senegal's generation of electricity also largely depends on petroleum imports. Nevertheless, the country's strategy of diversifying its sources of energy for electricity generation has become very effective, with the completion of the Manantali hydroelectricity plant on the river Senegal, which has been producing electricity since 2002.

Projects involving the integration of electricity generation and distribution networks have been in the pipeline for years, with countries involved in various regional initiatives reflecting shared interests and geographical proximities. The OMVS sub-regional project, which brings together countries sharing the river Senegal, facilitated the construction of many important hydroelectricity installations towards the middle of the 1980s.

In 1986, the OMVS inaugurated the Diama dam to regulate the Senegal river flow; this was followed years later by the inauguration of the Manantali hydroelectricity dam. However the conflict between Senegal and Mauritania (the third partner in the

integration of hydroelectricity installations, under the OMVS framework) succeeded in placing the project on ice for quite a long time. The company managing the Manantali hydroelectric plant (the proprietor of infrastructure and equipment) is in partnership with the South African company Eskom (which is in charge of marketing and distribution). Senegal is integrated into a second regional interest group under the framework of the OMVG, which groups Senegal with countries sharing the river Gambia (The Gambia, Guinea, and Guinea Bissau).

There exist many such institutions, formed around river basin management programmes, which could be reactivated to serve as frameworks for defining or redefining policies on electricity for the benefit of small-country groups. Such frameworks include: the Niger Basin Authority (which has existed since 1963 and groups together Benin, Burkina Faso, Côte d'Ivoire, Cameroun, Mali, Niger, Nigeria and Chad), and the Volta River Development Authority (consisting of Burkina Faso, Côte d'Ivoire and Ghana).

For West Africa as a whole, the year 2000 was a very important turning point, in the sense that 14 of the ECOWAS countries signed an agreement aimed at launching a vast sub-regional project to provide electricity. The West African Power Pool (WAPP) was set up to foster the interconnection of national network grids and harmonise the regulatory frameworks existing in the different national electricity sectors. The power pool should operate in two phases, which should be completed by the year 2005. The first phase will involve Nigeria, Benin, Burkina Faso, Côte d'Ivoire, Ghana, Niger and Togo. The second phase will involve Guinea, Guinea Bissau, Cape Verde, Liberia, Mali, Senegal and the Gambia.

As already mentioned, the countries of the ECOWAS sub-region have the world's lowest rates of electrification with rates of access rarely exceeding 30% and as low as 1% in rural areas. The vast majority of poor households are without electricity. The widely distributed rural communities with their small populations are difficult to connect into an economically viable distribution network. Moreover, rural incomes are so low that families have little to spare to invest in wiring their dwellings and paying for electricity. Even when transmission lines pass close by a village, the expense of providing a step-down transformer makes connection too expensive.

In view of the size of West Africa and the limited resources allocated to the study, we undertook two case studies, in Senegal and Mali. These countries were perceived to be representative both of the differences and the uniformities of the trends observed. They were selected because each is a member of one of the two groups into which the countries of the region can be placed according to the following criteria: electrification rate (Senegal is among the best-off with a rate of more than 30%, while Mali is one of the worst-off with a rate of just 10%); the density of infrastructure and equipment; the rate of urbanisation; industrialisation rates (Senegal being amongst the most advanced and Mali being amongst the least advanced); and locational considerations (Senegal is a coastal country while Mali is landlocked). They belong to different co-operation groupings (diversification): Senegal tends to look towards Guinea, Guinea Bissau, and The Gambia, while Mali looks toward Ghana and Côte d'Ivoire in the hope that Mali can import electricity from their hydroelectric power stations.

The two countries do have some attributes in common, which allows us to establish some commonality between the countries of the sub-region. For example, they are

both members of shared regional power systems. Within the OMVS, for example, they co-operate to improve their electricity supply. They also share both a common power sector structure and also similar approaches to power sector reform.

2.0 METHODOLOGY

Using the case studies of Senegal and Mali, this study attempts to provide an empirical assessment of the impact of power sector reforms on the poor in West Africa by analysing available time series data. The key reform option assessed is the privatisation of the power utilities in Senegal and Mali which took place in 1999 and 2000, respectively.

Because of the lack of data on the electrification of the poor in both Senegal and Mali, this study uses proxies in its assessment of the indicators. In the case of Senegal the "poor" are considered to be customers in the category of Special Domestic Use (UDS). They are considered poor because their income is so low that they only use electricity for one purpose – lighting – and their low-set circuit breakers. These customers tend to live in low-income neighbourhoods and on the outskirts of the main urban areas, but they are also found in rural villages.

However, those in the UDS category are not the only poor customers. A segment of UDG (General Domestic Use) users are also poor, even though their limit exceeds the low-set circuit breakers and they may have some electrical appliances (usually gifts from parents or friends). The majority of customers in rural areas are poor, and tend to be concentrated in areas where the poverty levels are between 80% and 95%. In the case of Mali, where there is little available data on poor customers, this study considers the poor to be those customers living in rural and peri-urban areas.

Given the short period of time that has passed since the implementation of the reforms and given also the limited availability of data, the findings and conclusions of this study cannot be considered definitive. To determine the impact and effectiveness of electricity reform options, the following indicators were selected:

(i) Electrification level
(ii) Electrification rate
(iii) Electricity consumption (per capita)
(iv) Electricity tariffs
(v) Connection fees
(vi) Expenditure on electricity.

Electrification level is the proportion of households supplied by the electricity grid. It is calculated as: the total number of household customers multiplied by the average household size and then divided by the total population. This indicator provides a more accurate estimate of the proportion of the population that has physical access to electricity and avoids some of the flaws of other methods (for example, it does not assume that commercial and industrial customers are equivalent to household customers) and has consequently been adopted by many experts. This is probably the best and most simple indicator of the access to electricity of a population.

Electrification rate measures the pace of electrification for household customers (that is, the rate of new connections for household customers). It is estimated, for the year *n*, as the number of new connections of household customers for the year *n* divided by the total number of household customers for the previous year.

It should be borne in mind that electrification rates may not be entirely accurate. This is because this measure might not capture an increase in the number of households

with access to electricity through illegal connections. It is quite common in poor neighbourhoods for some households to connect to a neighbour's power supply after paying a lump sum according to the number of declared or observed appliances (TV, refrigerator, fans, etcetera) they have. One of the main reasons for this practice is that initial connection charges are too high for poor households.

Electricity consumption per capita is estimated by dividing the total amount of electricity consumed in the country by the population. It will be challenging, however, to determine whether households are satisfied, quantitatively or qualitatively, with their levels of electricity availability and consumption. The amount of electricity consumption simply reflects what these groups can afford to spend on electricity, but does not prove that their needs are met.

With respect to affordability of electricity services, the following indicators will be used to assess the impact of the reform options selected:

Average electricity tariffs: Changes in average tariffs could provide an indication of the extent to which a reform option makes electricity consumption cheaper or more expensive for the poor. The resulting impact on electricity prices will have consequences for domestic welfare.

Connection fees: Changes in connection fees could provide a proxy for increased or diminishing opportunities for new connections for the poor.

Electricity expenditure by the poor: The proportion of the household expenditure spent on electricity could shed some light on the possible ways of paying for the service.

3.0 Background on the Case Studies

3.1 Status of Poverty in Senegal and Mali

In Senegal, the poverty line defined in the "Poverty Reduction Strategy Paper – 2002" was estimated on the basis of the capacity to afford a food consumption of 2,400 kilocalories per person per day, which is equivalent to a daily expenditure of about 393 CFA francs per adult per day, or about US$0.65. Consequently, the poverty threshold is estimated at about US$239 per adult per year, as of 2001 rates. From the perspective of international poverty threshold definitions, in 1995 (World Bank, 2003) the percentage of the world's population living on less than $2 a day was 67.8%, and the percentage of the population living on less than $1 a day was 26.3%.

Three countrywide surveys were carried out in Senegal to estimate the percentage of households living below the poverty threshold. The first survey (ESAM I, or Household Budget/Consumption Survey, 1994) estimated the percentage of households living below the poverty threshold at 57.9% of the total population in 1994. The second (ESAM II,- Core Welfare Indicators Questionnaire, 2001) estimated the percentage of households living below the poverty threshold at 53.9% of the total population in 2001. The third (EPPS, Household Survey on Perception of Poverty in Senegal, 2001), carried out with the same sample as ESAM II (6,624 households living throughout the country), estimated the percentage of households living below the poverty threshold at 65% of the total population in 2001.

As can be seen from the results of the ESAM and EPPS Surveys of 2001, estimates of the proportion of the population living below the poverty threshold differ markedly. The differences are caused by differences in the criteria used for measuring poverty.

In Mali, the poverty line defined by the government in the "Strategic Framework to Fight against Poverty – July 2000" was estimated on the basis of the capacity to afford a daily food consumption of 2,450 kilocalories per capita, which is equivalent to a daily expenditure of US$0.47/adult /day. Consequently, the poverty threshold is estimated at US$171.5/year/adult. From the perspective of international poverty threshold definitions, in 1994 (World Bank, 2003) the percentage of the population living on less than $2 a day was 90.6%, and the percentage of the population on less than $1 a day was 72.8%.

Three main surveys were conducted on household consumption in Mali with a view to gaining an insight into the economic and social conditions of the population: the first survey, conducted in 1988/1989, focused on household budgets and consumption; the second (EMCES), in 1994, was concerned with economic and social trends, and the third, in 1996, focused on household expenditures.

These surveys provided the basis for a quantitative analysis of poverty by the *Observatoire du Développement Humain Durable* (ODHD). This analysis found that the poverty rate had dropped from 71.6% in 1996 to 69 % in 1998 and that poverty was much higher in rural areas – in 1998, 74% of poor people were rural-dwellers, with agricultural workers being the worst affected.

3.2 Status of Power Sector Reforms in Senegal and Mail

The State-owned electricity companies or national utilities of the two countries are facing multiple operational and development problems: poor management, lack of investment in the sector, poor quality of services, etc. This situation has not supported the development of the economy and the industries of these countries, or helped to improve the living standards of the majority of the population. Moreover, in these countries, electricity appears to be considered a luxury instead of a high priority basic service. Confronted with this situation, the Governments of Senegal and Mali have embarked on a review of their energy policy and/or strategy, which includes electricity reforms implemented after 1998 in the two countries. In spite of these reforms, the rate of electrification remains low. The urban poor and the rural populations remain marginalised (Table 2).

Table 2: Key indicators of the electricity sectors of Mali and Senegal (2001)

	Senegal	Mali
Population (million)	9.8	11.1
Installed capacity (MW)	422.3	186.1
Electricity generation (GWh)	1651.0	521.4
Electricity consumption (GWh)	1295.4	386.5
Number of customers	431,432.0	90,989.0
National electricity access rate (%)	31.4	9.3
Electricity average price (US$/kWh)	0.1205	
Electricity consumption per capita (kWh/capita)	132.5	35

Note: The data provided in this table was derived from the Senegalese national electricity utility (SENELEC) and the national electricity utility in Mali (EDM), and is, therefore, taken to be the best possible data set.
Sources: Compiled by the authors

In 1997, just before the introduction of the reforms, the Senegalese Government issued the following statement: “Measures introduced so far to increase electricity supply in Senegal have produced appreciable results. The rate of electricity access has risen to an average value of 27% (as against 23% for the whole of Africa), and per capita electricity consumption has also increased to about 115 kWh/year. However, this level of consumption is still low when compared to the average consumption of 660 kWh recorded by developing countries. Moreover, average consumption could drop even further, given the county’s rapid demographic growth rate, which is much higher than the rate of electricity penetration. This implies that the proportion of households without electricity could rise, particularly in rural areas.”

Senegal’s objective is to reach a national electrification level of 50% (60% for urban areas and 15% for rural areas) by 2005. This is also a general aim for Mali, since a poorly performing electricity industry could halt economic growth and jeopardise the objectives of sustainable development. Hence, one of the major challenges faced by the Governments of the two countries in terms of the electricity sector is to improve electricity access for local populations substantially and within a reasonable time. Substantial financial resources from the private sector are, therefore, needed to ensure the electric power sector’s development. However, the task of raising such

resources requires institutional changes in the organisation and regulation of the electric power sector.

Given this situation, Senegal in 1997[2] and Mali in 1999 embarked on a phase of restructuring their electricity industries in line with policy papers on the development of the energy sector prepared by each Government. The restructuring initiatives have the following objectives: (i) to guarantee adequate electricity supply for local populations and other groups of consumers, under the best possible tariffs, compatible with the country's economic situation; and (ii) to ensure the rational development of electricity supply, with a view to increasing substantially the country's levels of electricity access, particularly in rural areas.

The reform process for the two countries is very similar. Private sector participation will result from the changing of the two existing utilities – SENELEC (Senegal) and EDM (Mali) – from Government companies to privately held companies. The new companies created are expected to generate profits for their shareholders. The managers of the companies are accountable to the Board, which represents the shareholders. Other key characteristics are listed below.

- The new companies are regulated by an independent regulator;
- Private investment and participation are authorised in expanding the system (for example, development of independent power producers, IPPs);
- Existing and future assets will remain under government ownership, but will be leased to the private sector with associated investment obligations.

Since the implementation of the reforms required the backing of a legal and institutional framework adapted to the country's social, economic, political and cultural contexts, many new laws were enacted in the two countries. In both countries, this resulted in the creation of new bodies for regulating the sector (regulation commissions) and of electrification agencies responsible for promoting rural electrification (Table 3).

In Senegal, the following fundamental changes were made:

a) Rural electrification is no longer the responsibility of SENELEC; it remains a responsibility of the State;
b) Independent generation of electricity has now been introduced on the basis of the single buyer model;
c) Electricity, classified as a product, is no longer classified alongside transport, a service; this paves the way for competition in its distribution;
d) A regulatory body was created to protect consumers and to ensure equality in the treatment of competitors;
e) SENELEC was transformed into a "stock company with a majority public holding". The company's capital was split as follows: 51% to the State, 10% to employees, and 33.33% to strategic partners; the rest was open to the public to buy.

In Mali, the following changes were implemented:

a) All forms of monopoly over electricity and water supply were immediately abolished;

[2] Sectoral policy letter on the development of the energy sector (1997) – this led to the restructuring of the electricity sub-sector.

b) The EDM SA stock company was made responsible for providing the public with electricity in the zone in which it operates in accordance with its concession, which can be extended to cover an additional 73 localities;
c) A new regulatory body was set up to regulate the electricity and water sectors;
d) In those zones not covered by EDM SA, decentralised local authorities and independent operators (including EDM) were allowed to establish electricity systems such as local grids;
e) Electricity prices were subject to ceilings.

Table 3: Summary of key elements of the electricity industry reforms for each country

Key elements of reforms	MALI	Missions		SENEGAL	Missions
Development of a legal regulatory framework	Order no. 00019/RM, 15th March 2000	Liberalisation, clarification of the role of each sector, State withdrawal, creation of EDM SA, CREE, AMADER		Law no. 98-06 of 28th January 98 Law no. 98-29 of 14th April 98	Opening of capital of SENELEC, Creation of ASER and CRSE
Creation of a new institutional framework	Water and Electricity Regulation Commission (CREE)	To support the development of the public electricity service; To defend the interests of users and uphold the quality of the public service; To allocate concession and licences, determine price policy, and regulate organisations and competition		Electricity Sector Regulation Commission (CRSE)	To promote rational development of electricity supply; To ensure consumers' interests and rights are respected in terms of price, supply, and quality; To promote competition and monitor the smooth functioning of the sector by providing neutral and transparent regulation of the sector; To safeguard the conditions for the financial viability of the companies operating in the sector
	Creation of the Malian Agency for Rural Electrification and Domestic Fuel (AMADER)	To promote rural electrification and domestic energy supply		Senegalese Rural Electrification Agency (ASER)	To draw up priority rural electrification programmes; To select the operators and dossiers for concessions; To provide technical assistance and financial assistance; To monitor the execution of the priority rural electrification programmes
Geography of capital of electrical industries s	EDM SA: 40% for State 60% for the SAUR International /IPS WA group	Opening up of capital via a stock company		SENELEC capital split 51% to State and employees 34% to strategic partner 5% to local operators	Opening up of capital

Sources: Compiled by the authors

The ensuing reforms led to the creation of a new institutional framework more conducive to the implementation of a new vision of the electricity sub-sector. Table 4 encapsulates the similarities between the institutional frameworks of the two countries in the pre- and post-reform periods.

Table 4: Electricity key players prebefore- and after post-electricity reforms

	Senegal	Mali
Before electricity reforms	Ministry of Energy SENELEC	Ministry of Energy EDM.
After electricity reforms	Ministry of Energy Regulatory Commission of Electricity Sector (CRSE) Senegalese Rural Electrification Agency (ASER) SENELEC, Greenwich Turbine Inc. (IPP) Manantali Hydro-Power (SOGEM)	Ministry of Energy Regulatory Commission of Electricity and Water (CREE) Malian Agency for Rural Electrification and Domestic Fuel (AMADER) EDM SA Manantali Hydro-Power (SOGEM)

Sources: Compiled by the authors

4.0 ASSESSMENT OF THE IMPACT OF POWER SECTOR REFORM ON THE POOR: SENEGAL

4.1 Background on the Electricity Industry in Senegal

4.1.1 Structure of the electricity industry

The institutional context of Senegal's electricity industry has changed over four successive phases.[3]

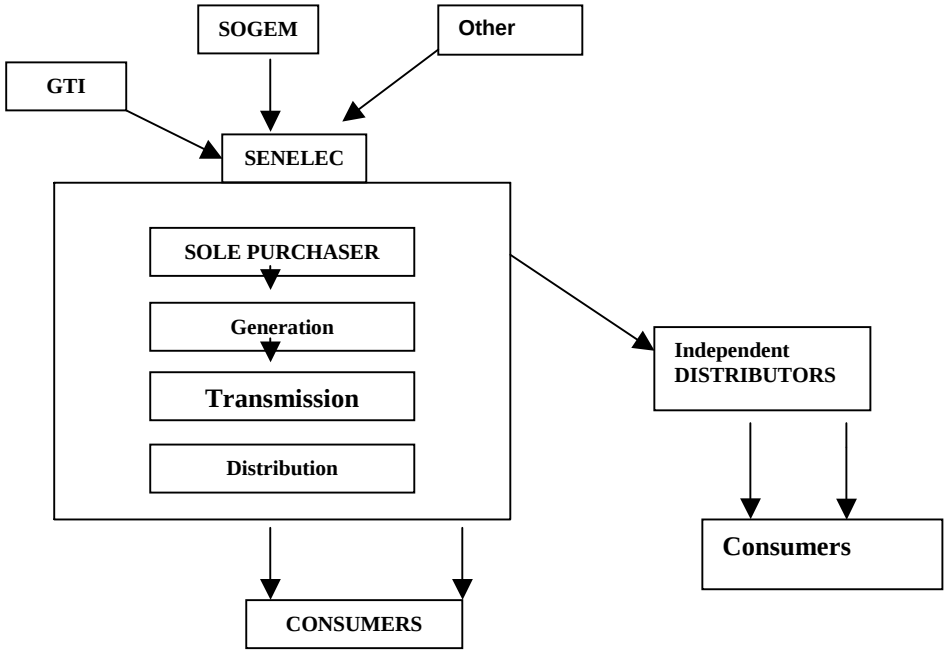
- Private management system (from before independence until 1966) – during this phase, electrification was carried out by private companies operating within concessions.
- Public management system, or nationalisation (1966–99) – this phase saw the foundation of SENELEC as the national company for producing and distributing electricity.
- Private management system (March 1999 – September 2000).
- Public management system – this is the current phase.

As we shall see, not only has Senegal's reform been incomplete in several aspects, but the reform process has also been rather confused. Privatisation only lasted for an extremely short period (from March 1999 to September 2000). Following this radical privatisation, the State has retreated from its own decisions, and denounced agreements concluded with a Franco-Canadian consortium which, following an international invitation for tenders, had taken over the State's majority shares in SENELEC. This is further explained in Appendix A4.

In the current post-reform phase, SENELEC has been given a nationwide monopoly over electricity transmission. It acts as the sole purchaser and buys electricity from the independent power producers Greenwich Turbine Inc. (GTI) and Manantali through the Société de Gestion et d'Exploitation de Manantali (SOGEM).

[3] Jean Philippe Thomas and Youba Sokona; *Regulation and Performance of the Electricity Sector: the Case of Senegal*, Enda; COPED 1992.

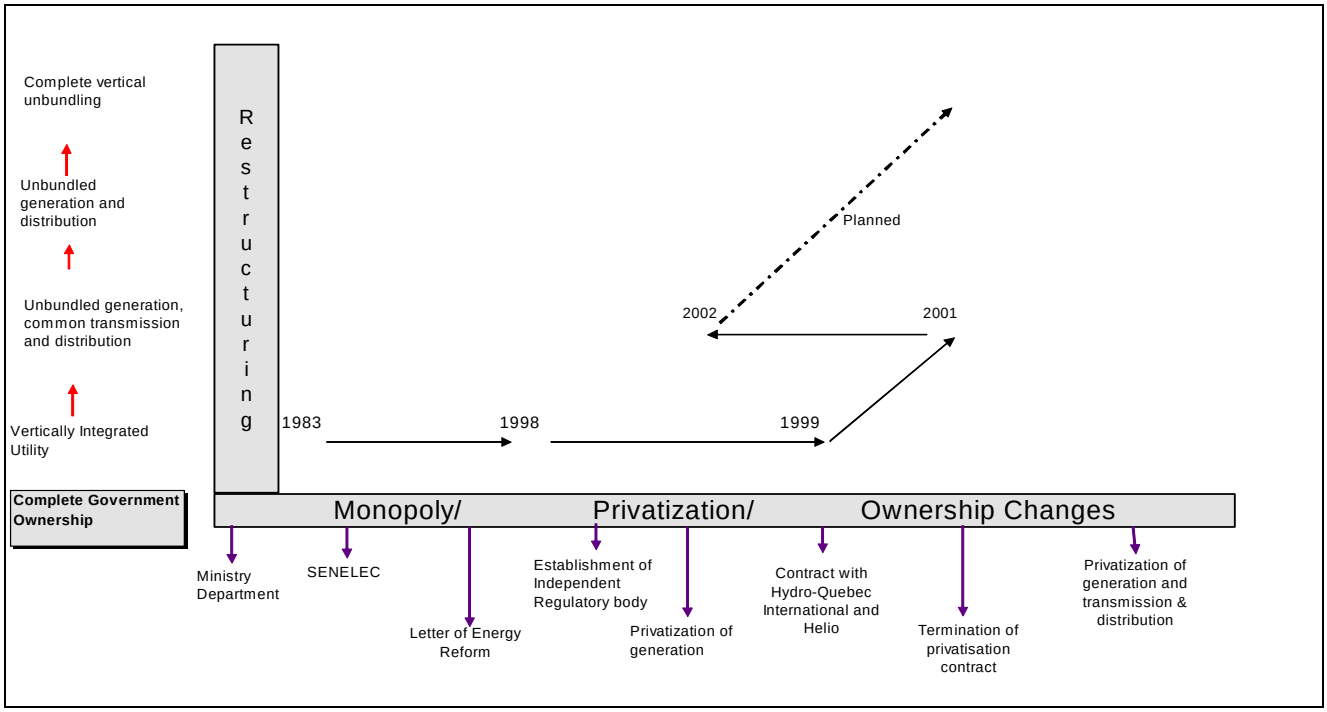
Figure 3: The structure of Senegal's electric power sector



Source: Fall, 2003

SENELEC has a monopoly on the distribution and sale of electricity within its concession zone. Electricity lines and power stations have been removed from direct State ownership, as stipulated in Law No. 76-66 of July 1976, and became the property of SENELEC. In the longer term, the strategy chosen by the Senegalese Government for restructuring the electricity industry focuses on more liberalisation of the sector through the gradual separation of generation activities from those of transmission and distribution. This means that the electricity industry's integrated structure is to be broken up and replaced by distinct activities, with generation entities on one side and distributors on the other (SENELEC and independent distributors in rural areas) (Figure 4).

Figure 4: Reform options for Senegal



Source: Compiled by the authors

4.1.2 The electricity generation system

Electricity generation in Senegal is mainly thermal. Indeed, up to 2001, all the electricity generated by SENELEC was produced by thermal power plants (see appendices). A hydroelectric power station with an installed capacity of 205 MW (5x 41 MW), recently erected at Manantali, Mali, under the aegis of the Senegal River Basin Development Project (Organisation pour la Mise en Valeur du Fleuve Sénégal, OMVS), provides Senegal with about 66 MW of its electricity capacity (see Appendix A5). Electricity generated from photovoltaic solar energy systems is still marginal: the total installed capacity is estimated to be only about 1 MW.

SENELEC's electricity generation can be grouped into two categories: the Interconnected Network (IN), (with an installed capacity of 407 MW in 2001) and the local regional power stations and isolated centres (with an installed capacity of 15.4 MW). The expansion of the IN was most significant during 1990–99, with an annual growth rate of about 6.1%, as against 3.0% during the period 2000–2001

Table 5: Capacity Evolution (MW)

Year	IN	Total capacity	Peak load (MW)
1990	196.4	242.1	138.1
1991	196.4	242.1	146.1
1992	225.2	277.0	154.7
1993	225.2	277.0	150.7
1994	225.2	277.3	159.6
1995	275.3	295.1	167.5
1996	275.3	295.1	180.5
1997	295.3	313.2	188.9
1998	315.5	341.5	194.7
1999	383.7	408.5	214.2
2000	399.7	422.3	234.4
2001	406.9	422.3	259.6

Note: The data provided in this table was derived from SENELEC – the Senegalese national electricity utility - and is, therefore, taken to be the best possible data set.

Source: SENELEC (1990 - 2001)

On the other hand, increases in the IN peak load were most significant during the implementation of reforms. While growth in the peak load was only 4.4% for the period 1990–98, it was 10.1% for the period 1999–2001, which is an indication of the huge demand recorded during this period.

4.1.3 Patterns of electricity consumption

Over the 1990 – 2001 period, SENELEC's generation of electricity has risen by an annual average of 5.6%, while its sales of electricity saw an average annual growth of 5.5%. During 1990 – 2001, the amount of generated electricity increased from 902 GWh to 1651 GWh, and the amount of energy sold climbed from 721.8 GWh to 1,295.4 GWh. Low voltage (LV) sales rose quickest of all, with an annual rate of increase of 8.6% compared to 3.4% for medium voltage (MV), and a relatively low 2.2 % for high voltage (HV) (see Table 6).

Table 6: The growth in electricity sales

	1990	2001	Average growth (%)
LV sales (GWh)	271.7	675.2	8.6
MV sales (GWh)	291.0	418.3	3.4
HV sales (GWh)	159.1	201.9	2.2
Total sales (GWh)	721.8	1295.4	5.5
Total generation (GWh)	902.01	1651.0	5.6

Source: SENELEC, 1990; SENELEC, 2001

Figure 5: Structure of Subscribers

Source: SENELEC, 1990; SENELEC, 2001

Since the implementation of reforms in the electricity sector in 1999, electricity consumption has seen an average annual growth rate of 10%. Its absolute value rose by 1063.4 GWh in 1999, by 1149.2 GWh in 2000 and by 1295.4 GWh in 2001.

This period also saw a significant amount of unsatisfied demand. This indicates that service quality is poor and characterised by frequent load shedding and numerous power cuts –due to generation deficits caused by delays in investments in capacity. Figures for 1999–2001 show that unsatisfied demand for this period was 105 GWh (of which 88 GWh was due to generation deficits). In 1999, the energy deficit was 51 GWh.

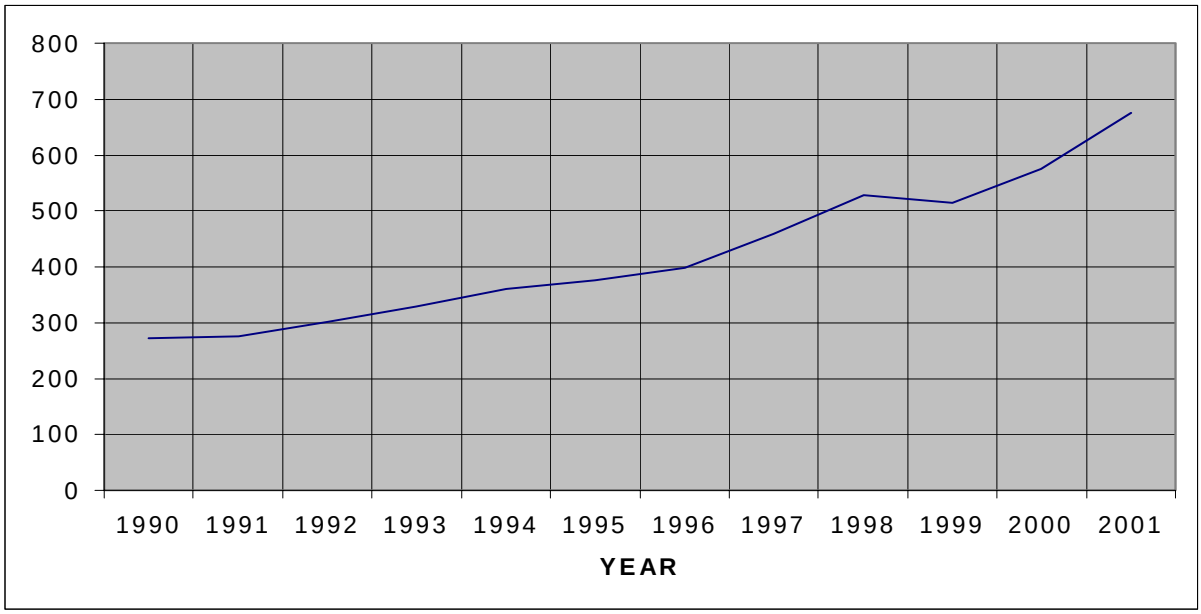
It is worth noting that SENELEC's specifications at the time of the reform stipulated that the maximum amount of unsatisfied demand should be 21 GWh; the actual deficit then, was 5 times the stipulated standard. The rise in the frequency of load shedding also highlights the poor quality of the service: from 1999 to 2001, there were 21,304 incidents of load shedding, an average of 19 per day.

In Senegal, the majority of electricity is consumed in the commercial and industrial sectors (about 64% of total consumption). Household consumption has been climbing steadily, with an annual growth rate of 8.5% from 1990 to 2001. Since the reform, the annual growth rate has been approximately 15%.

The access rate for households in urban and greater peri-urban areas is much higher than that for households in rural areas, where 55% to 60% of the population live. The Dakar region accounts for the lion's share of all types of electricity consumption. The statistics reveal that in 2001 LV sales in Dakar increased to 435.7 GWh or 64.5% of total LV sales in the country.

MV sales in the region accounted for 70.5% of the country's total. Dakar's high rate of electricity consumption, representing a little less than two-thirds of Senegal's total consumption, is explained by its very high electrification level (61.7%) as compared to the national average (32%), and also by the concentration of industrial facilities and economic and administrative activities in the region. Conversely, the low consumption of electricity in rural areas is due to the low population density (20 inhabitants/km^2) and a relatively low electrification level (about 8%).

Figure 6: Evolution curve of LV Consumption (GWh)



Sources: Compiled by the authors on the basis of SENELEC data (1990 – 2001)

Consumption rates can be used to estimate the minimum demand for electricity; where there are sufficient resources, consumption reflects demand fairly accurately. Therefore, in order to evaluate demand, non-distributed electricity must be factored in too. Working on this basis, we may say that demand for electricity has risen significantly since the reforms, especially when it comes to low voltage supply for domestic use. In the period 1990–2001, total demand, for all voltage categories, was 5.5%, whereas in 1999–2001, it jumped to 8.6%.

4.2 Assessment of the Indicators

4.2.1 Electrification level

Examination of the level of electrification during 1990–2001 reveals the following: SENELEC embarked on an extensive electrification exercise in 1994, increasing the national electrification rate from 23.8% to 25.1%. At the same time, the rural electrification level increased from 3.1% to 4.1%. This was mainly the result of a large investment outlay of 12.6 billion CFA francs (US$0.21 billion) through the World Bank-led Energy II project and other loans, which enabled a number of generation, transmission and distribution projects to be executed.

From 1994 to 1997, the electrification level remained fairly constant (Table 6). In 1998, the Government took charge of rural electrification, setting up electrification programmes defined by the electrification convention, with SENELEC as the main contracting authority. The programmes were financed by the National Energy Fund. These conventions continued following the creation of the Agence Sénégalaise d'Electrification Rurale (ASER) in 1999.

Table 7: Electrification level (%)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Rural	1.5	1.9	2.4	3.1	4.1	4.1	4.4	4.7	5.0	6.4	7.6	7.5
Urban	45.8	46.5	47.3	48.2	49.2	51.3	49.5	50.3	51.4	51.3	52.6	55.4
Total	21.2	22.0	22.9	23.8	25.1	26.3	25.8	26.6	26.9	28.3	29.8	31.4

Note: The data provided in this table was derived from SENELEC – the Senegalese national electricity utility - and is, therefore, taken to be the best possible data set.
Sources: Compiled by the authors

In the period following the reform (1998–2001), the national electrification level grew by 4.5% (reaching 31.4% in 2001), compared with 1.8% during 1994–1998; during this same period, the rural electrification level rose by 2.5% (reaching 7.5% in 2001), compared to only 0.9% during the period 1994–1998. This can be explained both by the Conventions guiding the Government's electrification programmes and also by projects conducted by SENELEC as part of its obligations stipulated in the specifications attached to its concession. As things stand, there are about 12,000 localities (villages) without any electricity supply, accounting for a population of some 4,688,000 rural people, or 541,340 rural households.

Various studies have found that the low household accessibility to electricity is due mainly to the difficulty households have in paying the subscription rates. We believe that when following up this work, it would be useful to explore further the question of bringing subscription costs more in line with income levels. One approach would be to conduct surveys of villages that have been electrified for at least 10 years.

4.2.2 Estimate of the number of poor households with access to electricity

Some 99% of subscribers use low voltage electricity – these are domestic users (UD), professional users (UP), and public users (public lighting). The number of subscribers at national level has evolved in accordance with the same trend as recorded for the number of domestic users (UD); this is because domestic users represent the majority (81%) of users. This figure has remained constant throughout the whole 1990 to 2001 period. The number of subscribers increased more sharply in the period following reform, when the growth rate was 8.0% compared to 5.8% in 1990–98.

Table 8: Structure of low voltage clientele

Subscriber category	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
UD	176112	187602	200382	214102	231605	249306	251449	266041	276951	299129	322888	348856
UDS*	*40199*	*39538*	*37255*	*37233*	*38152*	*40701*	*39232*	*40300*	*40922*	*41077*	*41592*	*40937*
UP	40190	42809	45234	48042	51143	55642	59676	62977	66098	69178	74833	81795
EP**	131	147	148	173	194	194	198	138	137	157	173	235
Total	216171	230264	245468	261971	282554	304754	310927	328880	342912	368150	397548	430419

* UDS is a sub-category of UD. The other sub-category of UD is UDG

** EP (éclairage Public) = public lighting
Note: The data provided in this table was derived from SENELEC – the Senegalese national electricity utility - and is, therefore, taken to be the best possible data set.
Sources: Compiled by the authors

However, the evolution in the number of UDS customers (poor people) follows the opposite trend to that of UD customers. While the number of domestic customers (UD) generally appears have been growing steadily, the number of UDS customers appears to have declined slightly (by 0.2%). This trend is, however, inconclusive given the limited data and time period.

UDS customers tend to be concentrated in low-income neighbourhoods and peri-urban areas, but there are also some in villages. However, UDS customers are not the only subscribers who are poor, since a sizeable section of UDG (General Domestic Use) subscribers, who have subscribed power in excess of low-set circuit breakers, are also impoverished. Most customers in rural zones are poor and are located in areas where poverty levels stand between 72% and 88% (compared to 44% and 59% in urban areas), according to ESAM. If we refer to EPPS's figures, the proportions are even higher.

4.2.3 Number of poor subscribers in urban areas

Table 7 shows that from 1995 to 2001, the number of UDS subscribers in urban areas represented less than 15% of domestic customers. Given that the incidence of poverty in urban areas is between 44% and 59%, it seems reasonable to estimate that at least 10% of UDG subscribers can be classified as poor subscribers. From discussion with the relevant SENELEC officials, we believe this figure to be realistic. Therefore, we can say that in addition to all the UDS subscribers in urban areas, 10% of urban UDG subscribers can be added to the ranks of poor people with access to electricity. The following table presents the changes in the number of poor subscribers to electricity services in urban centres.

Table 9: Access to electricity of the urban poor, before and after reforms[4]

YEAR	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Connected poor urban households	48221	48540	47505	48575	49938	52820	52648	54321	55254	56484	58426	61752
Poor urban population with access	380948	383462	375292	383745	394509	417275	415922	429134	436503	446224	461569	487837

Sources: Compiled by the authors

In the period after the reforms, the number of poor people with access to electricity in urban areas grew by 4.6% per year, compared to 1.7% in the period 1990-1998.

4.2.4 Number of poor customers in rural areas

[4] Note: The data provided in this table was derived from SENELEC - the Senegalese national electricity utility - and is, therefore, taken to be the best possible data set.

In view of the fact that the majority of people living in rural zones are poor (the incidence of poverty being estimated at between 72% and 88%), we estimate that 85% of domestic subscribers in these zones are impoverished. The following table portrays the evolution in the numbers of poor subscribers and of poor people with access to electricity in rural areas.

Table 10: Access to electricity of the rural poor, before and after reforms

YEARS	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Connected poor rural households	8814	10035	11426	13009	17591	17926	19520	22122	24575	30229	36232	36743
Poor rural population with access	83157	94681	107803	122742	165969	169129	184174	208722	231867	285206	341850	346670

Note: The data provided in this table was derived from SENELEC – the Senegalese national electricity utility - and is, therefore, taken to be the best possible data set.
Sources: Compiled by the authors

In the period after the reform, the numbers of poor people with access to electricity in rural areas grew marginally at an average rate of 14.7% compared to 13.9% in the period 1990 -1998.

4.2.5 Calculation of the total number of poor households with access to electricity

The following table depicts the evolution in the total number of poor households (urban and rural) with access to electricity.

Table 11: Total number of poor households with access to electricity[5]

YEAR	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Connected poor households	57035	58575	58931	61585	67529	70745	72169	76443	79829	86713	94659	98494
Poor population with access	464105	478144	483094	506487	560477	586403	600095	637856	668370	731431	803418	834507

Sources: Compiled by the authors

The number of poor households with access to electricity in 2001 was estimated at 98,494, equivalent to 834,507 people, or 8.5% of the country's total population. In 1990, the percentage of poor people with access to electricity was 6.4%.

Between 1999 and 2001, that is, the period during which the reforms were taking place, the annual growth rate of the poor population with access to electricity was 4.1%, compared to 1.9% during the pre-reform period of 1990–98. The percentage of poor people with access to electricity rose from 7.9% in 1999 to 8.5% in 2001.

[5] Note: The data provided in this table was derived from SENELEC - the Senegalese national electricity utility - and is, therefore, taken to be the best possible data set.

Table 12: Percentage of the poor population with access to electricity

YEAR	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Poor population with access (%)	6.4	6.4	6.3	6.4	6.9	7.0	7.0	7.2	7.4	7.9	8.4	8.5

Note: The data provided in this table was derived from SENELEC – the Senegalese national electricity utility - and is, therefore, taken to be the best possible data set.
Sources: Compiled by the authors

Table 12 clearly shows that the reforms had little impact on the access of the poor to electricity, with only a slight increase from the pre-reform period being recorded. Table 13 shows that the poor form a relatively small proportion of the electrified population. The table also appears to indicate that this proportion has been declining over time.

Table 13: Proportion of poor households in the overall electrified population[6]

YEAR	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Poor households . with access as % of total population with access	30.0	29.0	27.4	26.9	27.5	26.8	27.1	27.3	27.5	27.8	28.3	27.2

Sources: Compiled by the authors

4.2.6 Electrification rates

The electrification rates provided in Table 14 reflect electrification efforts made by SENELEC. The trends in electrification rates seem to indicate that during the pre-reform period, electrification rates in rural areas were relatively higher than those in urban areas. A record high of 26% was achieved in 1994 in the rural areas. This trend appeared to have been reversed after the reforms with urban electrification rates now being much higher than the rural ones.

Table 14: Rural, urban and national electrification rates (%)

[6] Note: The data provided in this table was derived from SENELEC – the Senegalese national electricity utility - and is, therefore, taken to be the best possible data set.

YEAR	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
RURAL	12.2	12.2	12.2	26.0	1.9	8.2	11.8	10.0	18.7	16.6	1.4
URBAN	5.7	6.0	6.0	5.7	7.6	0.1	4.8	3.2	5.9	6.0	8.3
Overall	6.1	6.4	6.4	7.6	7.1	0.9	5.5	3.9	7.4	7.4	7.4

Note: The data provided in this table was derived from SENELEC – the Senegalese national electricity utility - and is, therefore, taken to be the best possible data set.
Sources: Compiled by the authors

4.2.7 Per capita electricity consumption

Per capita consumption of electricity is a useful indicator of economic performance. Per capita consumption is relatively high (132.5 kWh/per capita in 2001) compared to countries such as Mali (37.2 kWh/per capita); but a lot of effort is still required for the country to create the conditions for sustainable economic growth. Per capita electricity consumption stagnated around 105–107 kWh during the period 1992–1996. It was only after 1997 that it started increasing significantly. Consumption rose quite rapidly, during the period following the reforms, with an annual average growth rate of 7.5% (corresponding to an annual consumption rate of 133 kWh/capita), compared with a rate of 2.3% during the period preceding reforms (1990–98).

Table 15: Evolution of per capita electricity consumption (KWh/capita)[7]

Year	1996	1997	1998	1999	2000	2001
kWh/ per capita	107.6	114.2	118.9	114.6	120.6	132.5

Sources: Compiled by the authors

4.2.8 Electricity tariffs

The tariff system applied by SENELEC is based on the subscriber's category, which in turn depends on the use to which the electricity is put and the voltage level of the electricity supply. The system is based on the principle of a single tariff for each category of consumers over the entire national territory, following a general standardisation or equalisation procedure.

The tariffs are determined on the basis of the generation cost of each voltage category, plus a fixed uniform charge (known as a "toll" charge). The latter ensures the continuation of self-financing at the rate of at least 30%. Recent studies on tariffs have led to the introduction of cross subsidies. Hence, part of the low-voltage domestic consumption is financed by the low- and medium-voltage professional users.

The "General Terms and Conditions" of Service of SENELEC contain an indexation formula for each voltage category, which is used to establish fixed electricity tariffs

[7] Note: The data provided in this table was derived from SENELEC – the Senegalese national electricity utility - and is, therefore, taken to be the best possible data set.

per kWh. In practice, only significant variations of the indices can bring about a modification of the tariffs. Three tariff modifications have been effected since 1990:

- July 1991: Following a 25% drop in the price of oil, the low and medium voltage prices were reduced by 5% and the high voltage price by 6%. This modest reduction was due to the fact that the total effect of the drop in the price of oil was not passed on to the final tariffs;

- January 1994: Following the devaluation of the CFA franc, electricity tariffs were increased by an average of 28% (low voltage by 25%; medium voltage by 27%; and high voltage by 35%);

- March 2002: Across-the-board increase of 10% followed the adjustment of the formula used to control concession contracts.

Analysis of the evolution of electricity tariffs during the period 1990-2001 shows a marked difference between the tariffs for the poor households (UDS) and those of the non-poor (UDG). The poor appear to pay higher tariffs than their non-poor counterparts.

Table 16: Electricity tariffs in CFA F/kWh

Tariff category	1990	1995	1996	1997	1998	1999	2000	2001
Low voltage	70.9	82.5	81.9	81.3	79.2	81.1	81.4	80.5
- Special tariff for domestic users			79.1	77.1	72.2	87.3		
- General tariff for domestic users			74.5	73.4	71.8	74.6		
- Professional users	84.9	101.5	98.5	99.2	96.9	99.0	99.7	98.4
- Public lighting	75.1	90.3	88.9	88.5	88.5	89.2	89.2	92.7
Medium voltage	60.6	70.7	69.9	70.4	71.0	72.0	72.2	70.5
High voltage	42.6	51.6	51.7	51.4	52.8	55.1	55.4	55.0
Average global price	60.5	72.3	71.8	72.1	72.3	73.8	74.1	73.3

Exchange rate: US$1 = 600 CFA francs
Note: The data provided in this table was derived from SENELEC – the Senegalese national electricity utility - and is, therefore, taken to be the best possible data set.
Sources: Compiled by the authors on the basis of SENELEC data

Box 1

The official average selling price of low voltage electricity is about 80.5 CFA francs/kWh (US$0.13/kWh). However, because it is common for customers to illegally connect a neighbour, some households (the illegally connected ones) end up spending much more on electricity. This is because the price of the electricity is arbitrarily set by the applying customer according to the number and type of declared or observed electrical appliances.

4.2.9 Cost of electricity connection and expenditure

To subscribe to UDS, the category designed for the poor, a customer must pay 19,361 CFA francs (US$32.3). This represents a two months' advance payment (calculated on the basis of a 5A supply) plus administrative costs and a charge for installing the meter. This is relatively expensive for poor people, and should be made more affordable, especially for domestic customers in rural areas, by basing the estimate of monthly consumption on the rural or UDS average instead of on the national average.

Box 2

The cost of subscription is a major barrier to poor people's access to electricity in areas reached by the grid. This was proved in two villages, Diaoulé and Ndiebel (in the regions of Fatick and Kaolack in Senegal), that were electrified with photovoltaic solar panels as part of a joint Senegal–Germany solar energy project.[8]

The subsidised connection price was set as a function of the income level of the three categories of consumers (plain farmers, farmers who received money transfers; wage-earners and traders). In the end, the rate of connection reached 90% of households, whereas SENELEC, under its pricing system, had only achieved 25%.

A recent study[9] (2002) of a very poor rural community in Senegal found that the average level of energy expenditure on lighting was 4,000 CFA francs (US$6.7) per month, that is, annual expenditure of 48,000 CFA francs (US$80). This spending accounts for up to 25% of the annual income of households in this community. Another factor to bear in mind is that it is known that poor families calculate how much they can afford to spend on a daily, rather than a monthly, basis. It is very difficult for low-income consumers to have the discipline and saving instinct to set aside money for a monthly outlay.

The Senegalese Government applies cross-cutting subsidies so that the same tariff can be applied to domestic users regardless of their location. But in the interests of equality and in order better to reflect poverty levels, this cross-cutting subsidy should be differentiated according to, firstly, the poverty zone, in order to reduce the size of the hole that energy expenditure leaves in the budget of poor households and, secondly, the types of use of electricity, with a view to encouraging productive uses through the promotion of motorisation in rural and urban areas as part of the fight against poverty. Decreasing the cost of electricity and of the other factors of generation will boost the wider distribution of limited investment capital that is available. Finally, poor people can be classified in terms of the amount of electrical equipment they have. This may be a useful indicator for the domestic sector, but is not of enormous benefit for the poor in general, since it only helps those who already have access to electricity.

[8] Masse Lo and Secou Sarr; *Suivi Socio-économique des centrales photovoltaïques de Diaoulé et Ndiebel*; Enda, December 1993.

[9] Sécou Sarr, Libasse Ba, Aby Dramé et al.; *Rural electrification rate: proposal for a pilot project to activities to be jointly executed in Senegal: socio-economic and energy study of the villages of Diarére and Diohine*, Enda, March 2002.

5.0 ASSESSMENT OF THE IMPACT OF POWER SECTOR REFORM ON THE POOR: MALI

5.1 Background of the Electricity Industry in Mali

5.1.1 Structure of the Malian electricity industry

The evolution of the Malian electricity industry is intimately linked with that of EDM (Energie du Mali). This company has gone through three phases: (i) EDM as a mixed investment company; (ii) EDM under a temporary new management contract; and (iii) EDM as a limited private company.

Box 3

The objectives of the Malian Government's policy in the electricity sector, are to ensure electricity and water supply for the vast majority of the country's population, under the best possible conditions in terms of quality and cost. The Malian Government is of the opinion that the achievement of these objectives should be based on the following:
(i) A substantial improvement of the sector's efficiency and productivity;
(ii) The State's disengagement from the running of the electricity industry; and
(iii) Greater and urgent participation of the private sector in the above activities.
In order to achieve these objectives, the following activities have been planned :

a) Opening up the electricity to competition;
b) Privatisation of EDM;
c) Restructuring of the electricity sector;
d) Execution of a rural electrification programme;

Source: Ministry of Mines and Energy of the Republic of Mali, 'Lettre de Politique sectorielle de l'electricité et de l'Eau potable'

EDM was created by the Malian state in the form of a mixed investment industrial and commercial company – the Malian state held 97.2% of the capital, with Electricité du France (EDF) holding the remaining 2.8%. This form meant that EDM was, in practice, a semi-State company; thus the majority of company decisions life of the company were taken by the Government of Mali. Considering the difficulties encountered by the company and the Malian Government's engagement in the reform of the electricity sector, it is necessary to make a comparative analysis of the company in its semi-State form and in the forms adopted thereafter.

EDM in the period operating under a new management sub-contract: The Government of Mali committed EDM to a process of reform to overcome management and operational difficulties that it was facing. The first phase of this reform was the total delegation of the management of EDM; this began in 1995 and lasted for four years and could be extended to a maximum of five years. The contract was signed on 20th October 1994 between the Government of Mali and a professional body made up of SAUR International, Hydro-Quebec International, Electricité de France International and CRC SOGEMA. The essential objectives of the new management sub-contract were to:

- Quickly improve management and operation of the company;
- Improve the quality of service and to increase water and electricity connection rates;
- Provide EDM with system, methods, tools and personnel necessary to ensure proper operation and management.

The company continued to operate as a mixed investment company, but the Malian State transferred decision-making power to the professional partner body. This phase of operating under a management sub-contract ended in 1998, with a mixed investment company management system continuing until 1999. During this stage, the process of privatising EDM began in earnest.

In 1999, EDM fell short of its contracted electrical energy generation by an estimated 46.5 GWh because of lack of power generation capacity. This failure represented a loss in the region of 23.26 billion CFA francs (US$38.7 million) to the Malian economy, calculated at the rate of 500 CFA francs (U $0.8) for each kilowatt hour of energy not generated (Ministère des mines et de l'energie du Mali).

EDM as a private company (EDM SA) EDM was opened up by the Malian State to an infusion of capital investment in 2000 and transformed into a limited company (*societé anonyme*). Its capital was increased from 2.5 billion CFA francs (US$4.1 million) to 20 billion CFA francs (US$33 million), and in 2001 to 32 billion CFA francs (US$53.3 million). The Malian State accounted for 40% of this, and the International SMOKED Grouping/IPS-WA (Industrial Promotion Service – West Africa) SA for the remaining 60%. The opening of EDM's capital followed the opening up of electricity sector to competition. The objective of the Malian state was to safeguard the quality of the public electricity utility in accordance with the provisions of the concession contract signed between the Malian state and EDM SA on 21st November 2000. These provisions are as follows:

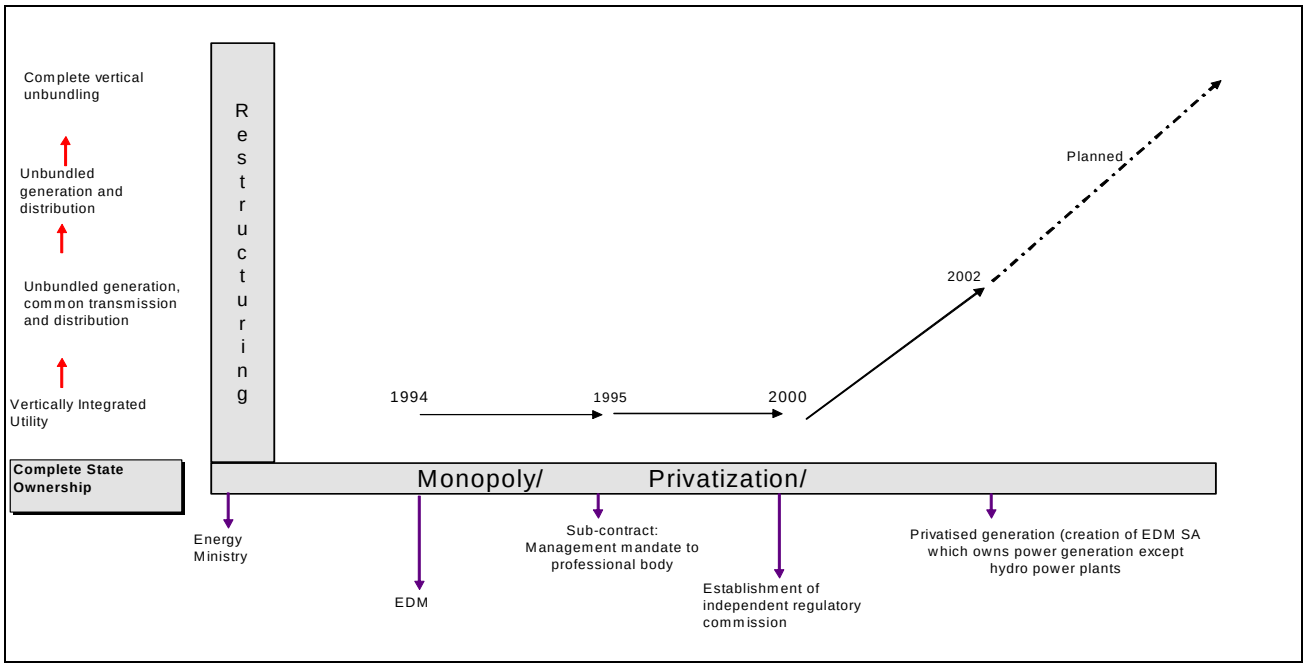
The public electricity utility is run by EDM SA within the framework of a concession agreement. This includes thermal and hydropower generation, the transmission and the distribution of electricity as well as the sale and purchase of electricity.
Any public electricity utility can be granted permission to operate through a concession or a licence for a well-defined concession zone.
Private operators must adhere to the regulations governing modes of concession and authorisation or auto-generation envisaged in the Bill regulating the electricity sector; and to conventions and specifications established with the State, the conceding authority.

For this reason, the new contracts prescribe for EDM SA include:

- A 20 years' concession, which can be extended to 25 years;
- A conceded zone comprising of 97 localities;
- An investment plan of 240 billion CFA francs (US$400 million) spread across generation, transmission and distribution.

EDM SA owns the distribution and transmission systems and the generating stations (apart from the hydroelectric power stations, which remain State property). The next diagram attempts to illustrate key reforms in the Malian electricity industry.

Figure 6: Mali's Reform options



Source: Compiled by the authors

5.1.2 The electricity generation system

Mali has a hydroelectric potential of some 1,050 GWh, of which almost 5% was being exploited before the reforms. Electricity generation in Mali was for a long time dominated by hydroelectricity, which represented 57% of EDM's total generation (385.92 GWh) in 1997 and 54% in 1998. By 2002, thermal generation had redressed the balance somewhat, despite the coming on-stream of Manantali hydropower plant.[10]

The strategy proposals of 1997[11] concerning reforms in both the electricity and the water sectors defined a number of specific objectives, which included, amongst others, an increase in the electrification rate from 7% in 1995 to 23% in 2007. This should satisfy the needs of the urban population and 3% of the rural population living in proximity to the national electricity grid. The remaining 97% of the rural population is expected to benefit from modern and renewable energy sources to meet their basic energy needs (home lighting, refrigeration; etc).

[10] According to the Ministry of the Economy, Planning and Integration's "Propositions pour une stratégie de croissance et developpement à l'horizon 2010" (published in November 1997): "the share of hydroelectricity is expected to increase from 55% in 1997 to 97% in 2007, while imported electric power is expected to represent 42% of total generation by 2007".

[11] Among the strategies proposed, particular mention is made of the social option (which is explicitly defined in the objectives and strategies of the reform): "to improve the conditions of access of local populations, particularly the most underprivileged classes of the population to the modern forms of energy" (see Ministère de l'economie , du Plan et de l'intégration / cellule (Croissance Accélérée et Développement, Propositions pour une stratégie de croissance et Développement à l'horizon 2010, Rapport de Synthèse, version préliminaire pour discussion, November 1997, p. 99).

Table 17: Installed capacity and market share of generated electricity among the key players in Mali, pre- and post-reforms

PRE- ELECTRICITY REFORMS (2000)			
	EDM SA	**PA**	**Total**
Installed capacity (MW)	124.2	99.7	223.9
Electricity generated (GWh)	470.2	229.5	699.7

POST- ELECTRICITY REFORMS (2002)		
	EDM	**PA**
Installed capacity (MW)	186.17	NA
Electricity generated (GWh)	590.2	NA

PA = auto-producers
Note: The data provided in this table was derived from EDM – the national electricity utility in Mali - and is, therefore, taken to be the best possible data set.
Sources: Compiled by the authors of EDM data

5.2 Assessment of the Indicators

5.2.1 Electrification level

The post-reform period has been marked by a sharp increase in the proportion of the population that has access to electricity. Most of those newly connected live in the urban areas. The electrification level has gone up by 3%: from 9% in 1999 to 12% in 2002. The increase in electrification in 2001 and 2002 can be attributed to promotional connection offers (these cover both the water and electricity networks) which encouraged many households in urban areas to connect.

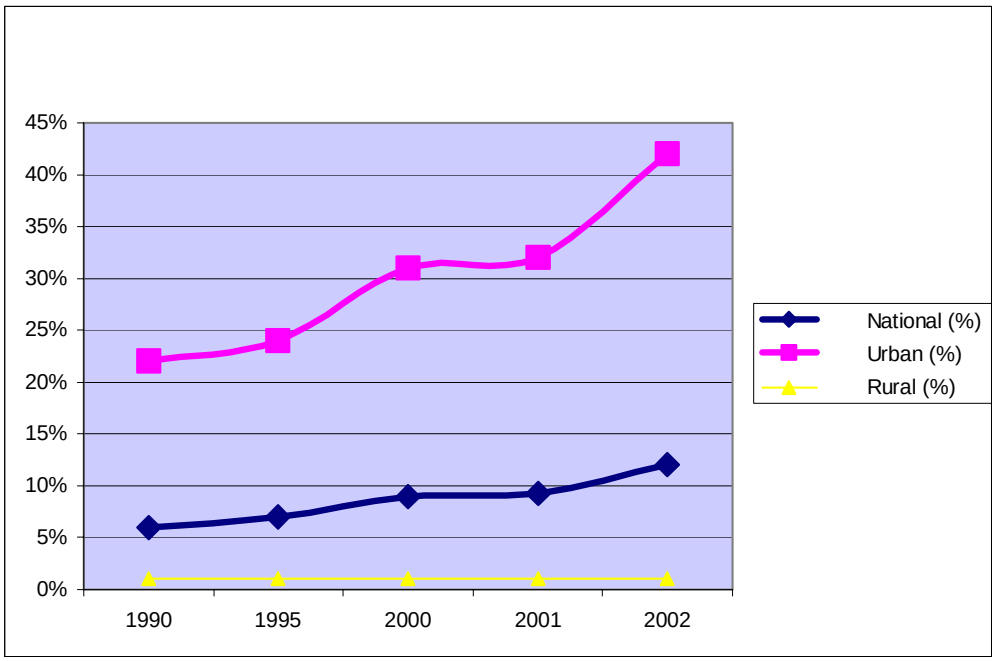
Table 18: Electrification levels in Mali (%)[14]

	1990	1995	1996	1997	1998	1999	2000	2001	2002
	6	7	8.4	8.3	9	9.2	9	9.3	12

Source: Compiled by the authors

[14] The data provided in this table was derived from EDM – the national electricity utility in Mali - and is, therefore, taken to be the best possible data set.

Figure 7: Evolution of electrification level



Sources: Compiled by the authors

Figure 7 shows that the electricity reforms have had little effect in increasing the electricity access of the rural population but instead have focused on the non-poor (urban) population.

5.2.2 The electrification rate

The electricity penetration rate rose substantially during the post-reform period. From 2.6% for low voltage consumers in 2000, the rate increased to 9.1% in 2001 and then to 23.5% in 2002, which is equivalent to an average annual increase of 12%. New low voltage subscribers totalled 2,142 in 2000, 8,751 in 2001, and 27,756 in 2002 (Authors, on the basis of EDM data).

Table 19: Evolution of number of subscribers

	1990	1995	2000	2001	2002
LV subscribers	40,700	66,5701	81,490	90,241	117,997
MV subscribers	362	473	693	748	809
Total subscribers	41,062	66,174	82,183	90,989	118,806
New LV subscribers	2,149	5,887	2,142	8,751	27,756

Note: The data provided in this table was derived from EDM – the national electricity utility in Mali - and is, therefore, taken to be the best possible data set.

Sources: Compiled by the authors

5.2.3 Electricity consumption

Mali's total electricity consumption remains far below the level required to lay the foundations for sustainable economic growth. Over an entire decade, national consumption only doubled, rising from 176.34 GWh in 1990 to 349.04 GWh in 2000. This low consumption is partially due to the country's low industrial base. In the period before the reforms, total consumption improved slightly thanks mainly to an

increase in electricity consumption by the household sector (Authors, on the basis of EDM data).

Per capita electricity consumption crept up between 1990 and 1995. It rose from 21.7 kWh per capita in 1990 to 34 kWh per capita in 2000, that is, an average annual increase of 5.6%. Per capita consumption stood at 37.1 kWh in 2001, then reached 40.3 kWh in 2002, reflecting an increase of 8.6% on the pre-reform year.

5.2.4 Electricity tariffs

Three tariff categories are applied to low voltage supply in Mali. The social tariff (for poor people) has four levels, depending on consumption: Band 1 for consumption lower than 50 kWh/month; Band 2 for 51–100 kWh; Band 3 for 101–200 kWh; and Band 4 for consumption of more than 201 kWh. The normal tariff system has two levels: Level 1 for consumption of less than 200 kWh and level 2 for consumption above 200 kWh. The public lighting tariff is a special one.

The electricity charges for the social tariff category vary according to consumption. The charge ranges from 67 CFA francs (11 cents) for the lowest band to 121 CFA francs (20 cents) for the highest band, per kWh. Table 20 shows that the price of electricity has been subject to slight increases since the reforms in 2000 (Authors, on the basis of EDM data).

Table 20: Evolution of social pricing

Social price (meter 2 5 A wires) (CFA francs/kWh)	April 1999	January 2000	June 2001	January 2002
Band 1	64	64	65	67
Band 2	99	99	100	103
Band 3	99	99	100	103
Band 4	115	115	117	121

Note: The data provided in this table was derived from EDM – the national electricity utility in Mali - and is, therefore, taken to be the best possible data set.
Sources: Compiled by the authors

Box 4

Future regulation of electricity tariffs is expected to be based on a price-capping approach to tariff setting, taking into account the following factors:

- In order to provide incentives for the rapid growth of business operators' efficiency and performance, the price ceiling will be maintained for a period of five years;
- Procedures for adjusting prices during the second and subsequent periods shall be specified in the terms set by the statutes of concession.
- In order to avoid arbitrary rulings by the regulation authorities, the principles of tariff setting shall be specified explicitly in the appropriate legal documents.

Source: Ministère des Mines et de l'Energie du Mali.

5.2.5 Cost of electricity connection

The cost of subscription includes an advance, connection charges, etc. (see table in appendices).

Indicator	Pre-reform, per year (kWh)	Post-reform, per year (kWh)
Average prices (US$/kWh) for the poor (consumption of 0–50 kWh per month)	10.00	10.16
Connection fees/charges (US$)	6.43	7.80
Lifeline price charges (fixed US$ per month)	27.00	41.89

Source: Compiled by the authors

The total electricity connection cost is in the region of about 100,000 CFA francs about US$166.60; see below) and, as such, is beyond the means of the poor. The national poverty line (defined as the income required to procure a minimum daily food consumption equivalent to 2,450 kilo calories) is only US$ 171.5/year/adult. Thus, the connection cost is equivalent to 97.1% of the maximum income of the poor. Any effort to boost poor people's access to electricity should focus on reducing the connection costs by bringing it more in line with their income levels (the average annual income in Mali is 183,217 CFA francs, around US$305 and the national poverty line is set at US$ 171.5/year/adult.

Box 5

Mali has one of the highest electricity tariffs in West Africa, notably for the Band 1 bracket (0–50 kWh per month), while the Band 2 and 3 brackets (51–100 kWh) are exempted from VAT and other regulatory royalties. The normal connection fee depends on the type of meter, the power supplied and electrical consumption. For a single-cable, 5-amperes meter, the subscription fee should have been US$8.50 in 2002. In reality, however, the actual fee demanded from a customer is of the order of US$166.60, irrespective of the customer's consumption bracket. This can be explained by the fact that, in addition to the subscription fee for drawing electricity from the electrical grid, the customer (who receives no subsidy whatsoever) also has to pay for the materials used in connecting him or her to the electric grid. When one compares these fees with income and poverty levels in Mali, which has a net annual national per capita income of around US$305 and a national poverty line of US$ 171.5/year/adult. It would appear to support the fact that ongoing power sector reforms have marginalized the poor.

6.0 CONCLUSIONS AND THE WAY FORWARD

6.1 Conclusions

Data on the electrification of the poor in both Senegal and Mali appears to be inadequate; hence this study was obliged to use proxies. In the case of Mali, generic data on the power sector was also limited. Moreover, the two countries undertook major reforms only recently and, therefore it might be too soon to make a comprehensive assessment of the impact of reforms on the poor. The abovementioned limitations make the findings and conclusions provided in this study provisional. However, based on the available data and information, it is possible to provide some tentative conclusions.

First and foremost, this study indicates that the Governments of Mali and Senegal appear to have no explicit policies for increasing poor people's access to electricity within a reforming power sector. Indeed, all the signs seem to indicate that the poor have not been specifically considered, and are expected to become "goorgorlou"[9] in order to pay the same relatively high connection costs and monthly bills as their better-off compatriots. In both countries, the connection fees are totally out of tune with poor people's level of income.

Essentially, the policies and measures that have had a positive impact on poor people's access to electricity have been those that have seen control of the electricity sector remain with the Government. The privatised SENELEC and EDM have no policy for, and apparently, no particular interest in increasing the access of poor people to electricity – both are much more concerned with ensuring their activities are profitable. The main objective of the privatisation of SENELEC as well as EDM was to enhance the efficiency of the electricity system and to safeguard the stability of power supply in a competitive market.

Second, preliminary assessment of some of the indicators reveals that the poor could have been negatively impacted by reforms. For example, electrification rates in Senegal indicate that during the period prior to reforms, electrification rates of the poor (that is, rural areas) were higher than those of the non-poor (urban areas). This trend appears to have been reversed following the reforms. Another worrying negative impact on the poor is the declining proportion of electrified households that are poor in Senegal.

This study highlights the fact that reforms appear to have done little to make the cost of electricity connection and consumption more affordable to the poor. In both Senegal and Mali, the study clearly demonstrates that the poor face difficulty in paying for the higher connection fees.

With respect to electricity tariffs, in Senegal it appears that the poor pay significantly higher than the non-poor. On average, expenditure on electricity by the poor is estimated to account for 25% of their annual income. In Mali, a comparison between the pre- and post-reform period reveals that tariffs for the poor have gone up slightly.

Conversely, reforms also appear to have had some positive impacts on the poor. In both countries, rural electrification agencies have been established by the Electricity

[15] "Scrimp and scrap".

Act and could potentially be an effective instrument for reaching the poor. However, the benefits of increased electrification may not be realised in the foreseeable future given that the rural electrification agencies in both countries are not yet fully operational.

It should be stated that the reforms never had explicitly and comprehensively designed social objectives. Instead, their priorities were technical, institutional, managerial, and financial. So what we have now are non-indigenous models of reform that reflect only the concerns of international institutions and the big financial groups that peddle the same standard reform model. This observation holds for the entire sub-region, irrespective of the countries considered, or their electrification rates.

6.2 The Way Forward

Mechanisms should be put in place to facilitate the access of the poor to electricity. In Senegal and, especially in Mali, the cost of connection remains out of the range of poor people's potential to pay. This encourages the urban poor to seek illegal connections. Several avenues should be explored when it comes to increasing poor people's access to the electricity grid:

- The connection cost should be set to reflect the amperage level.
- Small generation activities should be identified and their connection costs should be subsidised in a bid to increase the amount of added-value-generating activity in the country;
- Collective connections should be performed in certain rural zones (villages). This means installing a single meter for the entire rural community (with no individual meters, circuit-breakers, or bills).

It is important to understand the prevailing patterns of domestic energy consumption, in order to appreciate the role that electricity is likely to play in improving living conditions and productivity. The consumption of energy (obtained predominantly from biomass) is largely aimed at satisfying basic domestic needs (cooking). In urban areas, such as in Ghana and Senegal, experience has demonstrated that when an institutional policy of butanisation is carried out to subsidise LPG and make it available to the poorest segment of the population, consumption patterns change markedly – the amount of biomass gathered for cooking purposes drops significantly. On the other hand, increasing electricity connection rates does not significantly change the amount of electricity used for cooking (because it is still too costly in terms of equipment and consumption). The main use that households make of electricity is for lighting and, more generally, to make life more comfortable (with refrigerators, televisions, and small household appliances).

Nonetheless, many households use electricity to fuel small income-generating activities (selling ice, ice-cream, etc.) that generate badly needed revenue in a situation where poverty is rising fast and beginning to engulf the middle classes.

As in the urban zones, the main need for electricity in rural zones is not, in the short term, to replace biomass as a source of domestic fuel (where the principal need is cooking). For rural zones, the low levels of income and standards of living mean that access to electricity (in terms of both physical proximity to the grid and of the possibility of connecting to it) would not fundamentally change people's conditions,

since few own any electric end-use appliances. What access to electricity means to most rural dwellers is lighting. Electricity only makes a small difference to the factors of generation and income levels (as a result of the small-scale nature of domestic income-generating activities). Farmers can barely afford animal-powered equipment (ploughs, and carts for transporting the harvest) in order to boost agricultural yields or stimulate processing activities. There is, therefore, the need for additional research on how electricity services could assist in increasing the incomes of the poor.

The gender/energy/poverty nexus is another issue that requires further study. Because of the lack of segmented gender/energy/poverty data, it is very difficult to analyse energy access according to gender and incomes. Many studies have deduced that poverty generally leads to increasing urbanisation. It would be useful to study energy and gender in order to get a clear understanding of how women's access to electricity is progressing, especially in the small-scale commercial generation sector. This is particularly important given the fact that in Africa women are the dominant players in a country's economic fabric. Such a study would make it possible to provide forecasts relating to urban transition in West Africa and its relationship with energy and poverty trends.

A comprehensive energy/poverty assessment initiative should launched in order to direct subsidies towards the most deprived zones and towards productive use. This will provide impetus to the motorisation of agricultural production and artisan activities in rural and peri-urban areas.

Additional effort is also needed in the following:

(i) Conduct more in-depth studies of the level of user satisfaction to establish the ratio of needs that are currently met to expressed or felt needs. The absence of any qualitative indicators has made it difficult for this study to gauge the level of consumer satisfaction. To determine satisfaction levels, it is necessary to identify energy needs, particularly electricity needs, and to evaluate their cost, including expenditure both on consumption and on electrical equipment both for productive and domestic uses.

(ii) Conduct more in-depth studies of the extent of illegal connections. It is common in some neighbourhoods for households to connect to their neighbour's electricity supply in return for a payment that reflects their declared or observed number of electrical appliances (TV, refrigerator, fan, etc). In such cases, the sub-contractor's bill is higher than usual. One reason for the existence of this practice is the very high cost of subscribing to the electricity service compared to the low incomes of poor households. Consequently, a single subscription may, in fact, be supplying electricity to several households. This reality makes indicators of electrification and penetration rates somewhat inaccurate when it comes to measuring poverty. It would be useful, in a subsequent step, to undertake physical surveys in order to obtain a more accurate estimate of the proportion of households with access to electricity.

(iii) Carry out more case studies in order to validate the findings of this study at the West African level and so that meaningful and widely applicable results can be gleaned for the entire sub-region. Preferably, countries with different reform experiences to those outlined in this study, should be selected. Côte d'Ivoire would be worth studying because of its economic importance to the ECOWAS region, while Ghana would provide insights into the experience of English-speaking countries.

(iv) Establish and monitor indicators for measuring the relationship between access to electricity and poverty; this will provide a better idea of the impact of reforms on the poor;

(v) Take into account the different levels of poverty in the region by attempting to study very poor households who cannot afford electricity and who rely on traditional fuels to satisfy their energy needs. For that reason, access to other energy sub-sectors (petroleum and gas, biomass, new and renewable energy sources) should be studied.

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APPENDICES

A1 Some macroeconomic indicators of a selection of ECOWAS countries (2001)

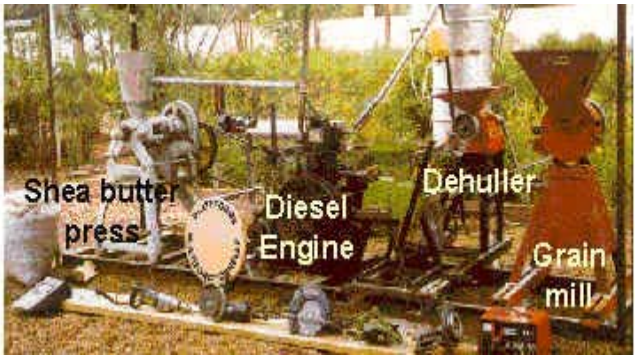
	Population (million)	Demographic. growth %	Infant mortality per 1000	GDP (billon dollars)	Development aid (million dollars)
Senegal	9.4	2.7	80	4.4	423.5
Mali	11.4	2.4	142	2.3	359.7
Niger	10.8	3.2	159	1.8	211.0
Côte d'Ivoire	16.0	3.5	102	9.4	351.8
Nigeria	113.9	2.9	86	41.1	184.8
Togo	4.5	2.8	80	1.2	69.8
Benin	6.3	2.9	98	2.2	238.6
Guinea-Bissau	1.2	2.5	132	0.2	80.4
Guinea	8.2	2.8	112	3.0	152.7
Gambia	1.3	3.5	92	0.4	49.1
Sierra Leone	4.4	1.6	180	0.6	182.4
Ghana	19.3	2.7	58	5.2	609.4

Source: *World Report on Human Development*; UNDP 2002

A2 Multifunctional Platforms

DESCRIPTION OF THE PLATFORM

Essentially, the platform comprises a 10 hp diesel engine, capable of driving up to a dozen different ancillary modules. These include a grain mill, a de-huller, a shea butter press and even an electric alternator. This alternator can drive modules such as a water pump, provide power for up to 250 light bulbs, charge batteries, drive a sawmill or weld metal. The platform employs simple and appropriate technology and is an economic, practical and sustainable solution for many of the problems faced by rural communities. Local artisans are trained to master all aspects of this simple and appropriate technology.



More information on the diesel engine

- It is a simple, inexpensive energy source at the village level.
- It provides energy for milling, dehulling, charging batteries, welding, food processing, pumping water, lighting.
- It reduces many of the women's burdensome, exhausting and unproductive tasks (fetching water, grinding cereals...), offers women income-generating opportunities and management experience and increases women's social status as they become more economically independent.
- It is paid for (60% = US$2,500), owned and managed by rural women, through the women management committee.
- It is made of locally available equipment and is installed and maintained by local private artisans.
- It stimulates the creation, development and/or modernisation of other artisan activities in the villages (e.g. blacksmiths, mechanics, carpentry, etc…).
- It can run on oil pressed from pourgher nuts (jatropha curcas).

A3 Background to the reforms of the electricity sector in Senegal

The institutional context of the Senegalese electricity sector has evolved over four phases:[16]

- Private management system (from before independence until 1966) – during this phase, electrification was carried out by private companies operating within concessions.

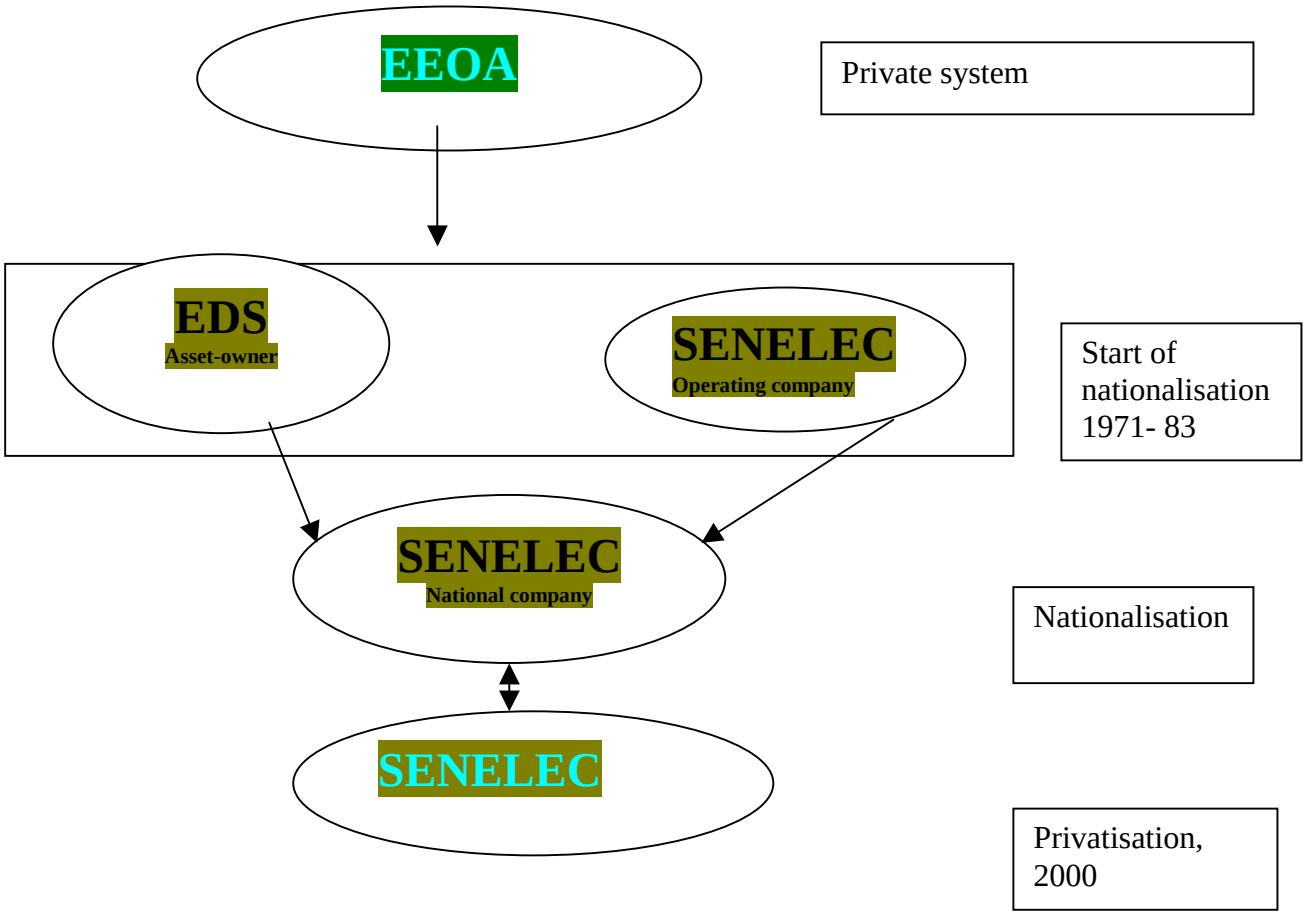
- Public management system, or nationalisation (1966–99) – this phase saw the foundation of SENELEC as the national company for producing and distributing electricity.

- Private management system (March 1999 – September 2000)

- Public management system – this is the current phase

[16] Regulation and performance of the electricity sector: the case of Senegal; Jean Philippe Thomas, Youba Sokona, Enda, COPED 1992.

Institutional evolution of the Senegalese electricity sector



i) Before independence, electrification was the responsibility of decentralised private companies who each operated concessions around the country. CES (Compagnie d'Electricité du Sénégal) was a limited private company that operated such concessions, as was Compagnie Africaine d'Electricité (CAE) – these two companies later merged to form Compagnie des Eaux et de l'Electrcité de l'Ouest Africain (CEEOA – West African Water and Electricity Company). This company exploited energy according to market demand, and this is the model the young Senegalese State encouraged until 1966. Installations were decentralised around the country, and there was little inter-connectivity on the grid.

ii) After 1966, in a bid to make better provision for economic and social development, the Government decided to become involved in the exploitation of electricity and took charge of concessions. This heralded the beginning of **nationalisation** and, in 1971, the Government bought the CEEOA's electricity generation and distribution facilities. In its early phase as it learned to manage the electricity sector, it applied a system of farming out by founding two mixed investment companies: EDS (Electricité du Sénégal), the company that owned the facilities and was responsible for investments, and SENELEC (Société Sénégalaise de Distribution d'Energie Electrique), which took charge of operations.

iii) The nationalisation[17] process continued and, in 1983, led to the merger of these two companies, thereby creating SENELEC (Société Nationale d'électricité)[18] whose only shareholder was the State**.** This new company was supposed to obey classical commercial rules, and enjoyed a complete monopoly on the generation, transmission, and distribution of electricity**.** However, despite its status as a commercial and industrial company with financial independence, SENELEC's autonomy eventually proved illusory, since many decisions were taken through Government, and these decisions were not always economically or financially viable. This situation was partly to blame for the problems and poor performance of the electricity industry. In 1997, the national electrification rate was 26.6%, while the rate of electrification in rural areas was just 4.6%

iv) Very recently, in 1997, the State set out a new energy policy in its *Lettre de politique de développement du secteur de l'énergie* (LPDSE, January 1997). This aims to guarantee electricity supply to consumers in the best conditions and at prices compatible with the country's economic reality. The new institutional structure saw the opening of the company's capital to private enterprises. The State has withdrawn, and has been replaced by other operators; at the same time, it has delegated management to a strategic investor.

[17] Law no. 65-69 of 19-07-1965, regarding the generation, transmission, distribution of water and electric energy.

[18] Law 83-72 of 05 07 1983

A4 The main steps to privatisation in Senegal

In 1999, Law no. 98-06 of 28 January 1998 enshrined the privatisation of SENELEC. 34% of shares were yielded to a Strategic Partner (a consortium made up of Hydro-Québec International/Élyo). This took effect on 31January 1999.

The objectives that had been set were not attained by the Strategic Partner, in particular those objectives relating to the absorption of the generation deficit and improvement in the quality of the electricity supply (there were delays in fulfilling the conditions of the concession contract relating to the enhancement of generation facilities, persistent load shedding and power cuts, etc.). Therefore, on 2 January 2001, 18 months after the arrival of this Strategic Partner, the Senegalese Government effectively ended their partnership by buying back all the shares through a share disposal contract.

On 10 January 2002, Law no. 2002-01 abrogated and replaced Article 19, paragraphs 4 and 5 of Law no. 98-29, and in so doing enshrined the following changes:

- Electricity lines and power stations became the property of the State, which could make them available to the concession-holders, i.e. SENELEC. If the concession contract is not renewed, they will revert back to the State when the concession expires.

- SENELEC was given the right to compete with independent producers and respond to invitations to tender to develop new electricity power stations as part of BOO (Build, own and operate) projects or electricity imports. The CRSE would be responsible for implementing these invitations to tender processes.

On 10 January 2001, after reiterating its support of liberalisation and the increased involvement of private bodies in the electricity sector, the State, through CRSE, published an international invitation to tender for the second privatisation of SENELEC. This featured the following new options:

- Disposal of 51% of shares to the Strategic Partner;
- Modification of the structure of the transaction, by combining share sale with an increase of capital (with the result that the Strategic Partner's 51% holding of SENELEC's social capital would be made up of a capital increase of 30% of the total sum to be paid, and a share sale equivalent to 70% of this amount).
- A contractual commitment from the Strategic Partner to carry out a minimum investment programme and to raise the necessary finance for this.

Two candidates – VIVENDI Environnement-Office National d'Électricité du Maroc Group, and AES Frontier Ltd – tendered bids. However, after evaluating these bids and engaging in discussion with both candidates, neither candidate was selected; the invitation to tender was therefore deemed a failure. What this experience demonstrated was that the main obstacle to a partnership agreement between the State and private candidates was the difficulty in raising investment finances for the portfolio. It was also observed that the formula for selling assets posed two related problems: firstly, the sheer size of the investment required for acquiring the assets, and secondly, the high electricity tariffs in Senegal and the impact of asset sales on

these tariffs, which are supposed to recover the costs of the portfolio and the physical investments.

Finally, in April 2003, following the deliberations of a task force comprising the World Bank, the International Monetary Fund, and the Senegalese Government, it was decided that SENELEC would be privatised by 31 December 2004 at the latest, with the new Strategic Partner taking a majority shareholding and offering concessions in the new SENELEC.

According to the authorities, this new option will save the new Strategic Partner from having to make significant financial outlays when it first enters the market. As part of the accompanying measures for this process, the donors (WB and IMF) will provide substantial support to the Senegalese Government in order to facilitate the restoration of SENELEC's technical, economic, and financial equilibrium during the first five years. This support will mainly concern funding through concession of SENELEC's investment programme over the next five years, which will amount to 212 billion CFA francs.

A5 Installed capacity and electricity generated market share among the key players, pre- and post-reforms (Senegal)

PRE- ELECTRICITY REFORMS (1998)

	SENELEC
Installed capacity (MW)	341.5
Electricity generated (GWh)	1304.3

POST- ELECTRICITY REFORMS (2002)

	SENELEC	**GTI**	**Manantali (Hydro)**	**Total**
Installed capacity (MW)	354.9	52	66	472.9
Electricity generated (GWh)	1177.2	353.3	193.9	1724.4

A6 Evolution of total electricity consumption (GWh), Senegal

VOLTAGE	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
LV	271.7	275.1	302.1	329.7	359.9	375.8	397.9	458.9	527.9	514.3	575.1	675.2
MV	291.0	301.6	320.5	304.5	344.8	347.8	360.0	375.5	383.7	384.1	388.9	418.3
HV	159.1	159.8	186.1	159.7	160.1	160.3	164.5	171.4	162.8	165.0	185.2	201.9
TOTAL	721.8	736.5	808.8	793.9	864.8	883.8	922.4	1005.8	1074.4	1063.4	1149.2	1295.4

Note: The data provided in this table was derived from SENELEC – the Senegalese national electricity utility - and is, therefore, taken to be the best possible data set.

Sources: Compiled by the authors

Some comparative figures[19]

A7 Annual generation (GWH)

Country	1990	1995	2000	2001	2002
Senegal	902.2	1085.5	1476.3	1651.3	1724.4
Mali	233.5	312.7	470.2	521.4	590.2

Sources: Compiled by the authors

A8 Evolution of the electrification level (%)

	1990	1995	1996	1997	1998	1999	2000	2001	2002
Senegal	22.0	26.3	25.8	21.6	26.9	28.3	29.8	31.4	33.2
Mali	6	7	8.4	8.3	9	9.2	9	9.3	12

Sources: Compiled by the authors

A9 Evolution of household electricity consumption (GWh)

	1991	1995	1996	1997	1998	1999	2000	2001	2002
Senegal	195.1	262.3	271.5	312.7	364.8	355.0	396.5	468.6	515.4
Mali	87.43	120.25	133.9	151	166.1	165.8	188	204.3	231.6

Sources: Compiled by the authors

A10 Evolution of electricity consumption per capita (kWh/capita)

	1990	1995	2000	2001	2002
Senegal	98.9	105.9	120.6	132.5	134.7
Mali	21.7	26.9	34	37.1	40.3

Sources: Compiled by the authors

A11 Evolution of the number of LV subscribers

	1990	1995	1996	1997	1998	1999	2000	2001
Senegal	216171	304754	310927	328880	342912	368150	397548	340419
Mali	40700	66174	69345	74845	82234	75279	82183	90989

Sources: Compiled by the authors

[19] Note: The data provided in these tables were derived from EDM and SENELEC and are, therefore, taken to be the best possible data sets.

A12 Energy access in Senegal

	1990	1995	2000	2001	2002
Total installed capacities (MW) - Thermal - Hydraulic - Solar	242.1	295.1	422.3	422.3	518.3 452.3 66
Annual generation in GWh	902.0	1085.5	1476.3	1651.3	1724.4
Annual electricity consumption in GWh	721.8	883.9	1149.2	1295.4	1351.7
Electricity consumption per sector - Industry - Households (rural and urban) - Others	 450.1 191.4	 508.1 262.3	 574.1 396.5	 620.2 468.6	 612.7 515.4
Number of subscribers	217042	305673	398533	431432	469995
Electrification rate % - National - Urban - Rural	 21.2 44.8 2.2	 26.3 51.3 4.1	 29.8 52.6 7.6	 31.4 55.4 7.5	 33.2
Rural population	4374335	4833417	5321153	5420975	5520705
Urban population	2924248	3514559	4205492	4356293	4510896
Annual electricity consumption per capita (kWh)	98.9	105.9	120.6	132.5	134.7
HV income levels	43671	63896	85154	94950	108146
Average price of electricity (CFA)	60.50	72.29	74.10	73.30	80.0

Note: The data provided in this table was derived from SENELEC and is, therefore, taken to be the best possible data set.

Sources: Compiled by the authors

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