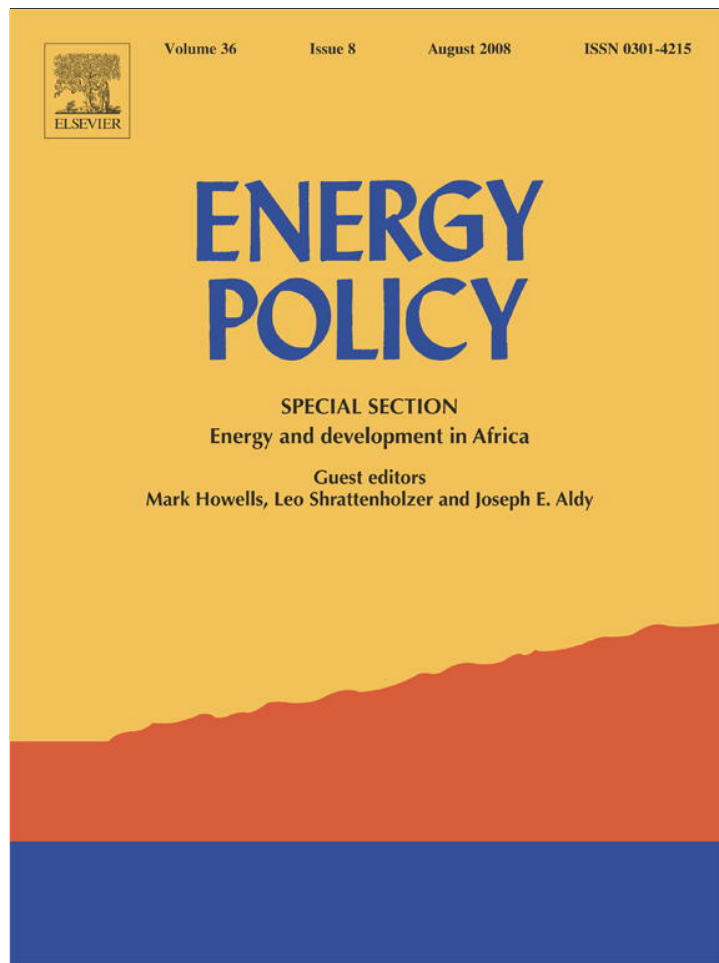


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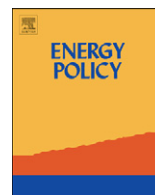
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# Energy sector reform, energy transitions and the poor in Africa

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## ABSTRACT

There is little systematic information about the impact of energy sector reform on all sources and methods of energy utilised or potentially utilised by the poor. It is not sufficiently known what fuels the poor use, if a larger range of fuels becomes available and affordable and if barriers to access and consumption are reduced. A detailed assessment is presented for four countries, three in Africa (Botswana, Ghana and Senegal) and for comparison one in Latin America (Honduras), of steps taken to reform the energy sector and their effect on various groups of poor households. The paper analyses the pattern of energy supply to, and use by, poor households and explores the link—or its absence—to energy policy. We investigate what works for the poor and which type of reforms and implementation are effective and lead to a transition to more efficient and clean fuels from which the poor benefit.

Energy sector reforms when adjusted to the specific conditions of the poor have a positive impact on access and use of clean, safe and efficient fuels. The poor are using gradually less wood as cooking fuel. Gas and kerosene are made more widely available through market liberalisation and subsidy in the particular case of Senegal. Electricity access and use is generally promoted or subsidised through changes in payment conditions and lifeline tariffs.

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## 1. Background

A major objective of energy sector reform was to improve the livelihoods of people in poor countries. Many countries in Africa have initiated some sector reform but none has completely restructured its energy sector, and power utilities remain government-owned monopolies. The petroleum sector has been liberalised in most of Africa, however, and petroleum products have become more widely available, with households having easier access to commonly used household fuels such as kerosene and gas.

Households in Africa have traditionally used biomass fuels for cooking, most commonly wood and charcoal. Extensive harvesting of tree resources for the commercial urban market has been found to be unsustainable, and has led to vegetation and soil degradation around many urban centres. Natural wood resources are declining and will not be able to meet the growing demand. Governments have generally become aware of these problems and have enacted policies to increase household access to fuels such as kerosene, gas and electricity.

Many poor households cannot, however, afford these fuels and the majority of the poorest ones continue to use fuelwood for their most intensive energy use cooking. Since poverty is wide-

spread, at least 40% of the populations of Botswana, Ghana (and Honduras in Latin America, used in this study for comparative purposes) use fuelwood as their major cooking fuel, as Fig. 1 shows. In Senegal, policy interventions including subsidies resulted in over 85% of households, including the poorest, using gas for cooking. Rural electrification in Botswana is another case where there was an attempt to meet the income constraints of poor households. This example is of particular interest because strategies included cost recovery from the outset. In both Senegal and Botswana implementation of programmes took many years before the conditions for large-scale take-up were adequate.

## 2. Method

This paper is based on collaborative work on power sector reform and its impact on the poor (Prasad, 2006) in four countries: Botswana (EECG, 2004a, b), Ghana (KITE, 2003, 2004), Senegal (Ba, 2005; ENDA, 2003, 2004) and Honduras (ESA, 2003, 2005). The work included a 2004/2005 household survey on energy supply, energy use, energy cost and appliances. The sample was biased towards the poor. Households were divided into five income groups and their energy supply and use data were tabulated and the impact of policy reforms on fuel/energy source uptake was analysed for the five income groups in each country. Earlier household surveys supplied data for the analysis of energy transitions.

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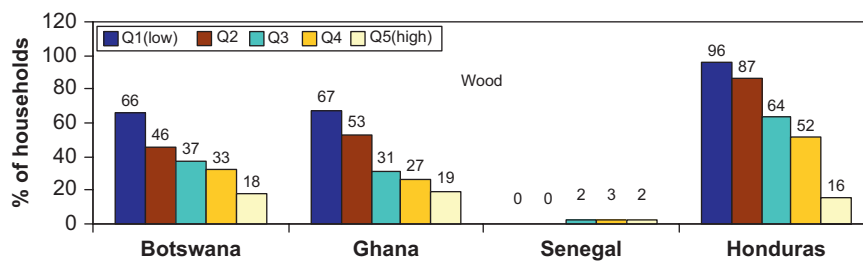


Fig. 1. Proportion of households in Botswana, Ghana, Senegal and Honduras using fuelwood for cooking by income quintile.

### 3. Reforms in the energy sector

The most important fuels used by the poor in the countries studied here are electricity, petroleum products such as kerosene and candles, charcoal and fuelwood; reforms intended to facilitate the access of these fuels are described here.

Botswana, Ghana, Senegal and Honduras have taken some steps towards power sector reform, though none have completed structural reforms and the electricity companies remain state-owned monopolies. Botswana has not implemented any structural reform. Ghana has reform plans in place but implementation is slow. Senegal has tried to privatise its electricity company without success. Honduras has advanced most towards structural reform, and independent power producers generate 37% of electricity. Coverage increased from 33% in 1989 to 75% in 2001. The reforms in Honduras have improved the financial performance of the utility but still 7.5% of current income is paid by the government as a consumption subsidy.

All four countries have implemented some low-level reforms in the electricity sector, including subsidies, stepped tariffs or lifeline tariffs, changes in technology, price setting, loan schemes or community involvement. Senegal, Ghana and Honduras introduced stepped tariffs for low-consumption customers, with the latter two having lifeline tariffs intended to benefit the poor. In Senegal, the rate for customers using only up to 20 kWh per month is almost double (23 US¢/kWh) what it is for those who use more than 50 kWh: thus effectively penalising the poor since most low-consumption customers are poor households. Botswana has just one domestic tariff and no concessionary tariffs.

The petroleum sector was liberalised in all four countries and private companies took over the import, distribution and sale of petroleum products. The private companies expanded the distribution network and petroleum products such as kerosene and gas became more widely available. The charcoal industry is private, and almost unregulated in Ghana and regulated in Senegal. Fuelwood is generally unregulated and it is largely self-collected, particularly in rural areas, though in urban areas it is widely sold by private entrepreneurs.

### 4. Examples of successful low-level reforms

Two examples of successful energy reform to increase access and affordability for the poor are rural electrification in Botswana and Senegal's butanisation programme, through which charcoal and fuelwood, the most important cooking fuels of the poor, are replaced by butane gas.

Botswana's rural electrification was introduced by the Botswana Power Corporation (BPC), which developed policies on technology, price setting and community involvement. The electricity delivery and the mode of payment were adjusted to be affordable to the poor and this led to a five-fold rise in rural

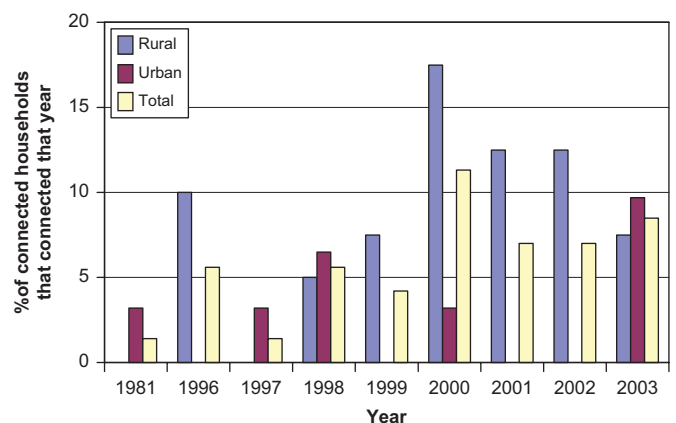


Fig. 2. Rate of household connections by year for rural and urban Households in Botswana.

connections from 1996 to 2003 (see Fig. 2). The country's Rural Electrification Collective Scheme was started in 1988 and went through several phases and adaptations. In the most recent phase potential customers form groups of four or more to share the cost of extending the grid to their premises. A 5% payment is required before connection work begins. The balance of 95% is a loan from BPC and repayable, with interest, over 18, 60 or 180 months, depending on the customers' choice. Full cost recovery for the connection is insisted upon, to sustain the electrification programme. The government pays for extending the grid into the village.

In 1993 it was found that many poor could not afford the connection and an additional scheme, standard costing, was introduced as part of rural electrification. The objective was to decrease the initial down-payment, and customers were to pay a standard amount (P5000–P6000) for a connection. Those within 500 m of the reticulation corridors were eligible. In this scheme the subsidy is greater because government pays for the grid extension deeper into the rural areas.

The effect of the Rural Electrification Collective Scheme can be summarised as follows:

- 80% of the beneficiaries could not have connected without the scheme.
- Groupings increased affordability.
- Reticulation initially installed by those who could afford it benefits poor customers who can only connect when the grid is sufficiently close to their houses.
- Low-income households are able to afford the loans because the BPC does not require income guarantee and security and sometimes the loans have lower interest rates than commercial loans.

- The implementation of the Rural Electrification Collective Scheme accelerated connections when repayment rates became affordable for many rural households in 1999 (Fig. 2).

There are two further challenges for rural electrification in Botswana. The very poor households who have low and irregular incomes cannot yet afford the connection fee and the monthly payments, and some customers who had connected to the grid have defaulted on repayment. A comprehensive policy review is required to address the situation of very poor households.

The butanisation programme in Senegal was first introduced in 1974 when the government became alarmed by the high rates of deforestation and environmental degradation because trees were extensively harvested for making charcoal for household use. Charcoal and wood were the major cooking fuels. The butanisation programme offered and subsidised small stoves with attached gas cylinders: in 1974 a stove with a 2.7 kg gas cylinder, then in 1983 a more solid cooking stove, better adapted to the cooking habits and income levels of the poor, was also subsidised.

In 1988, 14 years after the introduction of the subsidy, the government realised that charcoal continued to be widely used and poor households could not afford the stoves and the gas cylinders. The retail price was further subsidised by about 38% and the uptake increased significantly. In the 10 years from 1988, demand for gas grew by 15% annually, while the demographic growth rate was 2.9% and urbanisation was growing by 5%.

In 1999, as part of a wider energy sector reform the Senegalese government gradually withdrew the gas subsidy. From 1999 to 2001 the subsidy was reduced by 20% each year and the last 20% of subsidy was retained to combat deforestation. The withdrawal of subsidies combined with the devaluation of the Senegalese currency to depress the demand for gas. In the early 1990s the local currency was devalued and gas prices rose by 31%, but the growth of demand for gas decreased only from 15% to 13%, and returned to 15% in 1995. Demand for gas slowed down again when the subsidies were cut in 1999, decreasing from 15% to 6% in 2001.

The gas and stove subsidy achieved the following:

- Over 85% of households of all income groups, including the poorest, use gas for cooking (Fig. 3).
- The objective of the butanisation programme, to substantially reduce the use of charcoal and fuelwood, was achieved.
- Selling gas appears to be profitable, and gas has become commercially available in remote areas of Senegal.
- The exit strategy for the subsidy depressed the growth of demand from 15% to 6%, but demand continues to grow, although at a lower rate
- After using gas for some time households appreciated its greater convenience and cleaner burning compared to charcoal and wood.

- Some poor households who could not afford the gas without the full subsidy switched back to charcoal and wood when the subsidies were withdrawn.

When comparing Senegal with the other countries in this study, it is clear that the initial subsidy helped households of all income groups to accept gas for cooking. Fig. 3 shows the success of the Senegalese gas policy, particularly for the very poor who cannot generally afford to buy gas. More than 85% of Senegalese households in all income groups use gas for cooking while in Botswana only 23% of the lowest income households (Q1 in Fig. 3) can afford it. With rising income more and more households use gas and 71% of the highest income households (Q5) in Botswana use gas. This trend, of the proportion of households using gas with rising income, is also found in Ghana and Honduras (Fig. 3) but the level of use is relatively low. The two most common cooking fuels in Ghana are charcoal and wood, in Honduras, wood and electricity.

There are some similarities in the policy approaches of Botswana and Senegal, and some differences. The major differences are the motivations for the policies and the use or not of subsidies. The major motivation in Botswana was poverty alleviation and deforestation was secondary. The primary concern in Senegal was environmental degradation and deforestation in particular; the policy addressed the needs of the poor when establishing the cooking habits of the poor and what they could afford to pay for gas.

In Botswana cost recovery was insisted upon from the beginning and in Senegal the gas and the stove were subsidised and the subsidy was only later reduced by 80% after over 85% of the households had switched to gas.

Despite differences, both policies achieved their objectives because there was political will to implement them—and to make the necessary adjustments when the objectives were not achieved. Initially the incentive levels were too low and few households could access the gas or the electricity. The implementation process was monitored and gradually the payments were adjusted until the poor were able to afford the more efficient fuel/energy sources.

The poorest of the poor remain excluded because they have irregular or no incomes. They were also the first to revert to wood when the subsidy on gas was reduced to 20%. In the case of rural electrification in Botswana, some very poor households defaulted on repayment of the loan.

## 5. Fuel sources, supply and use

The surveys indicate that households in Botswana, Ghana, Senegal and Honduras use a great variety of fuels or energy

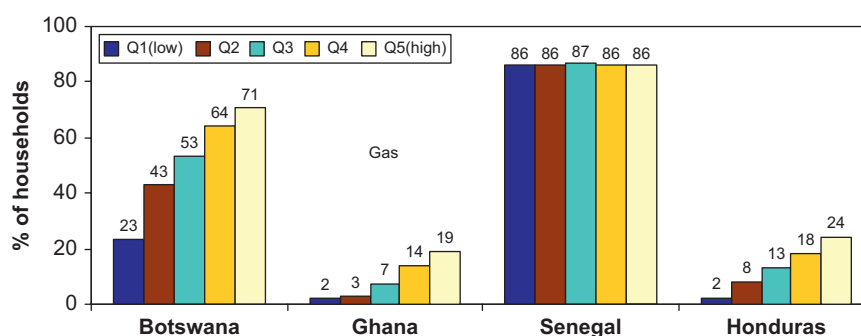


Fig. 3. Proportion of households in Botswana, Ghana, Senegal and Honduras using gas for cooking by income quintile.

sources—eleven different ones are listed, with fuelwood, charcoal, kerosene, LPGas, and electricity the most common. Fuelwood remains very important in all these countries except Senegal, but its use is declining compared to earlier surveys 2–4 years ago (Prasad, 2006). Kerosene and electricity are widely used for lighting, and gas is gaining importance and, as we have seen, widely used in Senegal.

Fuelwood is mostly self-collected in rural areas and sold by private wood sellers or in shops in urban areas. Households, which switch to new fuels such as gas and electricity for cooking, continue to heat water with fuelwood. Gas is increasingly used for cooking, and it is much more widely used in urban than in rural areas.

Charcoal is produced and sold by private charcoal sellers or in shops. It is widely used in Ghana and to some extent in Senegal but very little in Botswana and Honduras. In Ghana 51% of households cook with it—an increase of 20% from 4 years earlier before the present survey—and 50% use it for water heating. In Senegal 3% use it for cooking and 3% for water heating; 26% of urban and no rural households use it for space heating.

After market liberalisation, kerosene and gas became widely available. Kerosene is a minor cooking and water heating fuel in Botswana (<8%), Ghana (1%) and Honduras (<6%) but not used for these purposes in Senegal. Kerosene is the lighting fuel of choice when there is no access to electricity (Senegal again excepted), though more common in rural than urban areas, and the pattern of usage varying greatly from country to country: 57% in Botswana, 25% in Ghana, 13% in Honduras, and 3% in Senegal.

In the electricity sector structural reform has been very slow in all four countries and the electricity companies continue to be government owned. It appears that some governments are not convinced that structural reform and privatisation are the best paths to performance improvements and it explains the reluctance of the Botswana electricity utility to start structural reforms. One of the goals of sector reform in the four countries was to increase electricity connections to households, and connection rates did advance. Ghana and Senegal extended coverage by less than 4% in 3 years, mainly because of generation constraints. Honduras increased connections by 42% in 15 years; generation constraints were overcome by facilitating private investment in new generation. Botswana increased connections by 18% in 7 years, importing more electricity from South Africa.

Electricity is mainly used for lighting and media and the proportion of households using electricity for lighting corresponds closely to the connection rate. Electricity use for cooking remains low because of high service and appliance costs, and ranges from almost 0% in Ghana and Senegal to 21% in Honduras. Reforms did facilitate access to electricity for the poor, with concessionary tariffs facilitating basic use.

## 6. Patterns of fuel transitions

Patterns of fuel transitions vary between countries, but certain general trends can be identified. To compare fuel transition over time, data from the 2004 and earlier surveys in 2001 and 2000 are used. The questionnaires of the earlier surveys are not identical to those of 2004, and the comparison therefore indicates trends rather than exact proportions.

In Botswana the transition is from wood to gas, in Ghana from wood to charcoal and gas, in Senegal from wood and charcoal to gas, and in Honduras from wood to electricity and gas. Although the specific fuel transitions are different, a few general trends apply to all four countries:

- All show a switch from wood to a more energy-intensive fuel: gas, charcoal or electricity.
- Households increasingly use gas for cooking, though gas is much more widely used in urban than in rural areas.

The trend of switching from fuelwood to gas is illustrated in Fig. 4. In Botswana at the national level 51% of households cooked with gas in 2004, compared with 41% in 2001 (46% using fuelwood). Gas use is much more common in urban than in rural areas, but has been increasing in both rural and urban households, with a higher rate of increase in rural households where the change from 2001 to 2004 is from 17% to 41%. Fuelwood use decreased concomitantly in that period: in rural households from 77% to 54%, and in urban households from 23% to 13%. Fuelwood is getting scarcer and women have to spend more time and walk longer distances to gather it—adding to the motives for the switch from fuelwood to gas.

How does a household choose which fuel to use for which end use in a fuel transition phase? Fig. 5 shows end uses for gas and wood in Botswana. Households prioritise the end use for which the new fuel, gas is used and the transition is gradual. Gas is first used for cooking, and wood remains the more common fuel for space heating and water heating. This trend is found in both urban and rural households, but in the latter the transition is much less advanced: 83% of rural households still use wood for space heating and 73% use it for water heating, while only 40% of urban households use wood for space heating and 30% for water heating. Very little space heating is done by gas anywhere, but 41% of urban households use gas for water heating, compared to 17% of rural households.

The use of wood declined (Fig. 7) and the use of charcoal increased in both urban and rural areas. But a much higher proportion of urban households (69%) use charcoal in 2004 than rural households (19%). Gas is not widely used and only a small proportion of households use gas for cooking (Fig. 6) but

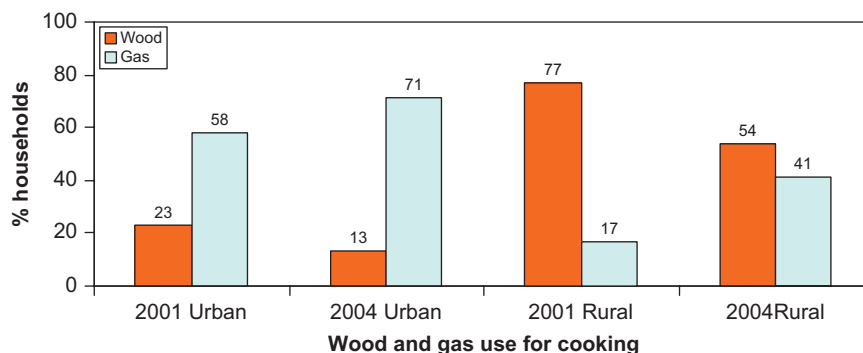


Fig. 4. Transition from fuelwood to gas for cooking in rural and urban Botswana in 2001 and 2004.

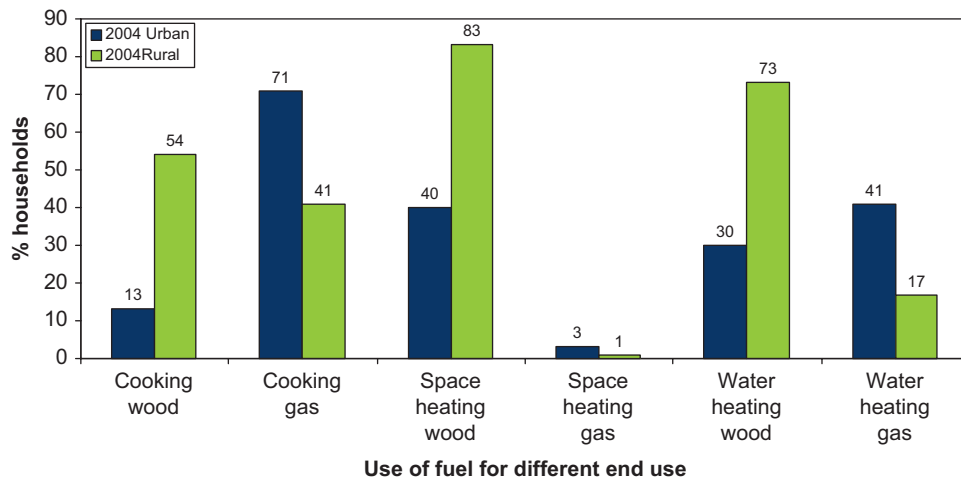


Fig. 5. Proportion of urban and rural households using wood and gas for cooking, space heating and water heating in Botswana.

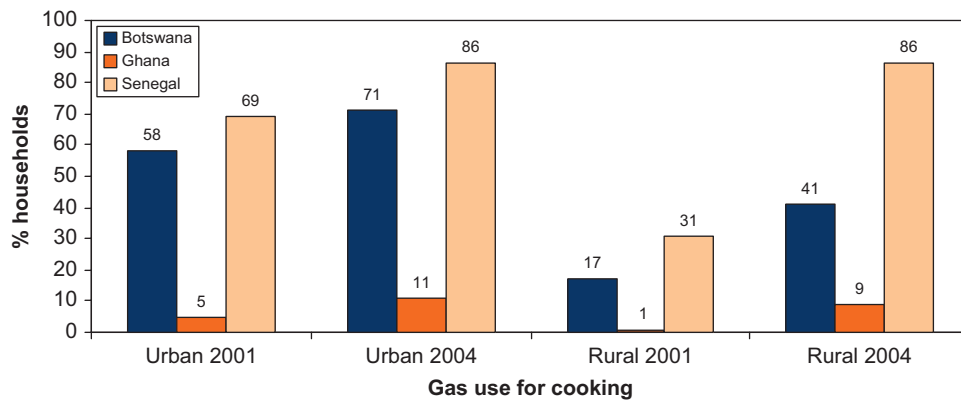


Fig. 6. Transition to gas for cooking in Botswana, Ghana and Senegal.

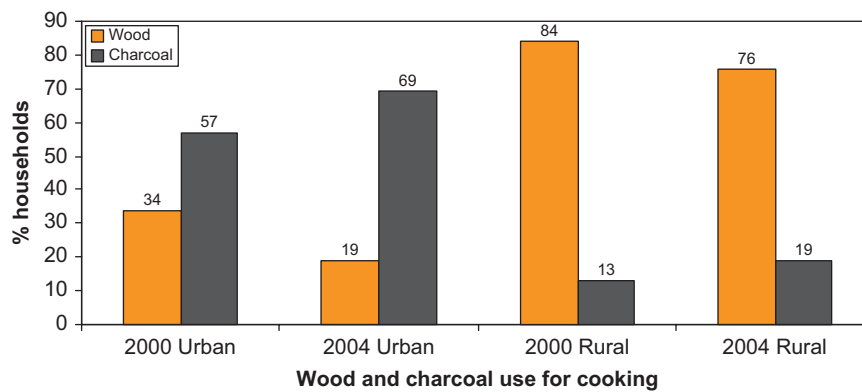


Fig. 7. Transition from fuelwood to charcoal in urban and rural households in Ghana.

comparable to Botswana and Senegal gas use is rising from 5% in 2001 to 11% in 2004 in urban areas and from 1% in 2001 to 9% in 2004 in rural areas. In Ghana, households switched from fuelwood to charcoal. Ghana, with extensive forests and woodlands, is a much more humid country than Botswana of which large parts are desert. Fuelwood and charcoal are still widely available and regrowth rates are much higher there than in Botswana.

### 6.1. Comparing the transition trends between countries

Most poor households, when first connected to electricity, use it for lighting, TV and radio and few other appliances (Fig. 8), and

not for the most energy-intensive uses such as cooking, water heating and space heating. They remain multiple-fuel users because they cannot afford electricity even if they would prefer to use it more extensively. For the very poor, particularly in rural areas, fuelwood remains the major cooking fuel simply because it can often be collected free, with the expenditure only of their own time and labour.

## 7. What works for the poor?

Energy sector reforms are generally promoted at the highest levels of government, far removed from ordinary people.

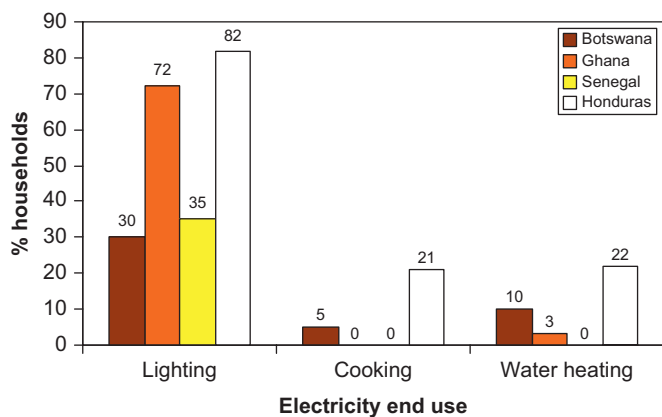


Fig. 8. Proportion of households using electricity for lighting, cooking and water heating.

Implementation depends on many institutions through which the potential benefits are supposed to 'trickle down', and in developing countries regional and local institutions often have insufficient capacities to implement new policies.

If reforms improve the efficiency of a sector the entire country, including the poor, should benefit. Energy sector reform can affect the poor in any or all of the following ways: access to energy services; cost; quality of supply; improvement in other services such as health, education and communications; and stimulation of economic development and public sector finances (Davies et al., 2003). When reforms are located and effectively implemented as closely as possible to where the poor households require the service they are most likely to succeed. It is also necessary for people to be well informed, and empowered to demand these services. Not only the content of the policy is important but also the way the policy is implemented.

Information about energy programmes must be clearly and repeatedly communicated to communities and households well in advance of implementation. Community support and participation is important, particularly in large and capital-intensive projects, such as electrification, where theft can undermine any success: the community must feel itself the owner of its electrification programme.

At the household level, members need to be well informed about the opportunities, limitations, obligations and payments of their energy services. Many households have been disappointed, and defaulted on payment requirements because their expectations did not match the service they got from even well-intentioned energy projects.

There are some useful lessons to be drawn from the butanisation programme in Senegal. The government successfully promoted gas for cooking through its subsidy, which increased over 14 years until over 80% of households in all income groups were using it for this purpose. The subsidy was effective in introducing a new cooking fuel to even remote parts of the country. Although an exit strategy was not initially planned, when the subsidy was withdrawn, few households reverted to fuelwood or charcoal. The initial subsidy should be weighed against long-term environmental benefits and maintaining agricultural production and water resources when deforestation for commercial wood harvesting and charcoal production was reduced. Rising oil prices may threaten the sustainability of gas use. In future the poor may not be able to afford the gas.

Why did rural electrification in Botswana work? Supply could be imported and the utility had the capacity to implement the rural electrification project. There was political will to extend the

grid to poor rural areas. The BPC introduced low-level reforms focusing directly on the conditions of the poor. Impacts were monitored and evaluated, and payment conditions were made easier, leading to a substantial increase in grid connections. Conditions for granting credit enabled the poor to receive it and to afford repayment. Recovery of the connection cost and cost-reflective tariffs ensured sustainability.

## 8. Conclusion

Many countries in Africa have started energy sector reform. Such reforms do not necessarily benefit poor people, but when they cater to their conditions and affordability, there can be a positive impact on access to and use of clean, safe and efficient fuels.

Overall policies encouraging the use of more efficient and cleaner fuels are successful. The increasing scarcity of fuelwood and charcoal support this trend. Wood is declining as a cooking fuel and this will have a positive impact on health. Gas and kerosene are made more widely available through market liberalisation (and subsidy in the case of Senegal) and gas is increasingly used for cooking, particularly in Botswana and in Senegal. The rising oil prices may make the use of gas unsustainable in the future. Electricity access and use is promoted or subsidised through changes in payment conditions and lifeline tariffs. Electricity is used mainly for lighting, radio and TV, although it is widely unaffordable for cooking.

Information and education on energy policies and projects must be clearly and repeatedly communicated to households and communities. False expectations lead to disappointments and defaulting on payments. Community participation is essential; the community must participate in decision-making and become the guardian and owner of its energy programme.

## Acknowledgements

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