Urban poor livelihoods:
Understanding the role of energy services

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Table of Contents

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Abstract

This paper aims to:
(i) summarise current knowledge on poor urban livelihoods and energy;
(ii) review current approaches to energy services for the urban poor;
(iii) review the existing evidence on the impacts of commercialisation and privatisation in the energy sector on urban poor peoples' access to energy services and the sustainability of their livelihoods; and
(iv) map the impacts of fuel price increases on sustainable livelihoods of poor urban households.

The paper is based on a review of the literature (journals, newsletters, project reports and internet sites) related specifically to urban livelihoods and energy.

Urban households use a mix of purchased fuels, including woodfuels, and there are signs that even poor households use modern fuels. For urban households, energy costs can form a significant part of household budgets, with woman-headed households considered to be in a worse position than man-headed households.

The factors that influence switching to modern energy are both extra- and intra-household. For low-income households high "entry costs" (such as connection fees for electricity, LPG cylinder deposits and purchasing conversion equipment) are the most significant barrier to modern energy. Questions over supply reliability prevent a complete transition from wood or charcoal to modern fuels, as does the availability of appropriate and affordable conversion equipment.

The intra-household factors fall into two categories: the preference for one energy form over another and gender issues. Reasons for not switching from woodfuels include taste imparted to particular foodstuffs, pots not fitting new stoves and the stove's power output controllability. Although energy provision is women's responsibility, prioritisation of household purchases, including stoves is done by men.

The urban poor still appear not to be benefiting significantly from improved modern fuel supply availability. Oil products (kerosene, LPG and natural gas) are fairing better than grid based electricity. The way in which kerosene can be purchased, matching that of woodfuels, eases the transition away from the latter. The "up-front entry cost" for the other modern fuels remains a significant barrier for the urban poor.

There are few little micro-level data about the impact of energy sector reforms particularly on the urban poor. In the evidence available, the liberalisation of energy markets appears to be having a negative effect (reduction in quality of life and return to woodfuels) due to the significant price increases which appear to accompany liberalisation. Market sector reform alone is not sufficient to enable the transition to modern energy. While there is little support for blanket subsidies, there is support for the use of short term, targeted (so-called "smart") subsidies. Factors in other sectors are also influential, for example, enforced regulations on charcoal production.

Energy price rises lead to a reduction in the quality of life within poor households, such as a reduced number of cooked meals. There appears to be some return to woodfuels but the extent and the environmental impact on peri-urban areas has yet to be quantified. For the electricity sector, the increase in tariffs has seen a rise in the number of illegal connections.

Acronymns

DFID	Department for International Development
ESCO	Energy Service Company
GW(e)	Giga-Watt electric
ITDG	Intermediate Technology Development Group (now known as Practical Action)
KaR	Knowledge and Research
LPG	Liquid Propane Gas
NGO	Non-governmental organisation

Urban poor livelihoods: Understanding the role of energy services

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1 Introduction

Energy has both direct and indirect impacts on the livelihoods of the poor. Perhaps surprisingly, there has been little attention to energy within the livelihoods framework, despite its recognitions as a key aspect of physical capital. Barnett has made an initial attempt to assess how energy can reduce people's vulnerability (Barnett, 2001). Whilst there is a significant body of knowledge on how energy affects the rural poor, relatively little research has been undertaken into the relationship between energy and the livelihoods of the urban poor[2]. Existing research exploring urban household energy use has mainly taken a sectoral focus and not examined the links with household income generation, and has neglected gender aspects (particularly at the intra-household level) and the strategies poor urban households use to develop livelihoods, nor has it reflected the effects of privatisation and commercialisation in the energy sector on energy services[3] for the poor.

Empirical data on the urban poor and energy are lacking, and much policymaking is based on assumptions. For example, since commercial (modern) energy, such as LPG and electricity, is more readily available in urban than rural areas, it is *assumed*, that the urban poor have better access than the rural poor to the benefits of these cleaner forms of energy with their more efficient conversion technologies. This lack of a good understanding is of serious concern since urban poverty is considered to be increasing as a consequence of job growth lagging behind natural population growth, continued urban migration by the rural poor and loss of employment through structural adjustment policies.

The lack of knowledge about the role of energy services in the livelihoods of the urban poor is reflected in the lack of attention paid to their specific problems in energy policy. Karekezi and Marjoro (2004) consider that energy policy in the South is aimed at developing modern energy infrastructure that largely serves the needs of the urban-based formal industrial and commercial sectors and the medium and high income urban households. This policy is in turn supported by

[1] Formerly part of the Technology and Development Group (TDG).
[2] As part of the proposal for KaR project R8348, Clancy et al., (2002) analysed the linkages between urban livelihoods, gender and energy (see Appendix)
[3] There is no standard definition of "*energy services*". In this paper the term is taken to mean: the form (sometimes known as the *final form* or *energy carrier*) and manner in which energy is delivered to the end user (eg electricity via a grid connection, charcoal in bags sold in the market, LPG in cylinders delivered to the house), as well as the supply and maintenance of conversion technology technologies needed to convert the final form of energy into the *useful form* that the end-user requires to complete specific tasks (LPG needs a stove to produce heat to cook food).

international development aid.

1.1 *What are the issues?*

If urban poor people have access to modern energy services[4], what affect does this have on their livelihood strategies? How does energy influence income generation for poor people and how do changes in income feed back into the household? Does increased income lead to better well-being through the purchase of modern energy, for example, through reduced indoor air pollution, better cooked food, and more boiled water?

A key issue for policymaking related to fuel pricing and the need for fuel subsidies, is how the urban poor gain access to energy services. Are these always purchased, and if so what proportion of household income is used for energy? There is some evidence (O'Keefe, 1993) to suggest that the quantities of fuels purchased do not increase in line with income. However, the study unfortunately makes no reference to the quality of the fuels bought. How do poor households respond to energy shocks, such as price increases? This is a significant question in relation to the current policies of market liberalisation in the energy sector.

What are the gender aspects of urban energy and livelihoods? The evidence would suggest that the situation is little different to that which exists in rural households: energy is primarily the women of the household's responsibility. Urban women also face similar inequalities to their rural sisters: low capabilities, low rewards in the labour market, exclusion through social stigma and discrimination, a lack of productive assets and resources relative to men (Amis, 2002). How do these inequalities manifest themselves in women gaining access to energy services? Women are over-represented amongst the chronically poor (defined as those living in poverty for a considerable period of time). Therefore, if energy is a key factor in moving people out of poverty, through improved income generation, or is a significant contributor to well-being, addressing gender issues in energy will make an important contribution to reducing poverty. Gender and energy issues have not been explored in any systematic way in urban livelihoods.

It is against this background that this paper is written. The paper is part of the output of a Knowledge and Research Project (R8348) funded by the Department for International Development (DFID). Although the paper is a separate output, it also serves as a reference in which to imbed the empirical data gathered as part of the fieldwork and as an input into a Briefing Paper for decision-makers in the energy sector and for non-governmental organisations (NGOs) active in energy advocacy for the urban poor. The paper aims to:

(i) summarise current knowledge on poor urban livelihoods and energy;
(ii) review current approaches to energy services for the urban poor;
(iii) review the existing evidence of the impacts of commercialisation and

[4] Modern energy services are taken in the context of this paper to mean services related to electricity, refined oil products (LPG, and kerosene), and natural gas. A definition of energy services is given in footnote 3.

privatisation in the energy sector on urban poor peoples' access to energy services and the sustainability of their livelihoods; and

(v) map the impacts of fuel price increases on sustainable livelihoods of poor urban households.

The paper is based on a review of literature (journals, newsletters, project reports and internet sites) related specifically to urban livelihoods and energy.

2 Energy use patterns in poor urban households

The two dominant end-uses for energy in urban households are cooking and lighting. Households, irrespective of income, use a mix of fuels for both end-uses, although the fuel of preference does vary with household income. Lower-income households rely on biomass fuels[5] (or coal in some countries such as China and South Africa), whereas higher-income households will opt for electricity and LPG (Hosier and Kipondya, 1993; Future Energy Solutions et al., 2002). Kerosene is used both as a cooking and a lighting fuel, although electricity is the preferred option for lighting.

Urban size is also found to influence the use of traditional and modern fuels. A survey in Pakistan reported that 93% of households in towns of under 25,000 people depended on woodfuels for cooking and heating, 65 to 75% in medium sized cities and in the large cities (more than 250,000 inhabitants) the figure dropped to 25% (Government of Pakistan (1982) quoted in Leach and Mearns (1988)).

Electricity access in urban areas is better than in rural areas. However, there are still substantial number of urban households and enterprises without access to electricity. For example, even in South Africa where there is a progressive government policy in place to increase electricity access by the poor, around 30% of urban households are still waiting to be connected (ITDG, 1998). Some poor urban communities manage also to get an electricity connection through a combination of illegal hook-ups and private generators (Schutyser, 2003).

The available evidence suggests that urban poor people do buy their fuel even though there is little quantitative data on the use of non-purchased (scavenged) fuels (see below). Another little explored urban phenomenon in terms of its influence on urban household energy use is the purchase of food in informal restaurants. In Thailand, 20% of households eat most or all of their meals away from their homes or bring cooked food home to their workplace (ITDG, 1998). Is this an alternative to purchasing cooking fuels, a time saving strategy or an improved lifestyle associated with urban living?

At the beginning of the 1990s, the World Bank carried out a global survey of 45 cities and 20,000 households. This study found that poor urban households spend a significant portion (15 to 22%) of their cash incomes on energy (Barnes,1995). The poor are found to often spend a higher proportion of their income on fuels, than higher income households (ESMAP, 1999). This was attributed in part to the heat content of the fuels used and the conversion efficiency of the technologies influencing the amount of useful energy

[5] Wood, charcoal, agricultural residues and dung.

produced. The poorest 20% of households spend a higher proportion of their incomes than wealthier ones on lower-quality fuels (primarily biomass and kerosene) both for cooking and lighting.

Poor people prefer to purchase fuels in patterns that match their incomes: small amounts on a daily basis. This purchasing pattern influences the types of fuel they use. Wood, charcoal and kerosene can be bought in small amounts on a daily basis. A consequence is that they are paying a higher unit cost than for " bulk" purchases.[6]

In a detailed household survey in three cities (Dar es Salaam, Mbeya and Shinyanga) in a Tanzania study, it was found that woman-headed households use a higher average percentage of their income than man-headed households for purchasing energy (Hosier and Kipondya, 1993). The authors attributed this difference to woman-headed households having lower incomes than man-headed households, rather than using more energy. The implication of such a finding is that women-headed households will suffer more than men-headed households from rapid energy price rises.

Hosier and Kipondya (1993) found that household energy use responds to price and availability, with the patterns of use distorted by subsidies (the issue of subsidies is discussed in Section 3). It is not only the availability of the fuel but also of appropriate appliances which determines the fuel used. Hosier and Kipondya considered that the greater number of households using kerosene in Dar es Salaam (the largest city and port) compared to the number in the other two cities could in part be attributed to the greater availability of kerosene stoves and lamps. Likewise, an increase in cooking with electricity which occurred during a specific three-year period could be linked to the removal of import duties on electric stoves. The unreliability of supply was considered a significant barrier to more households switching to LPG, and the cause of a number stopping using it. Instead, charcoal was used as the main cooking fuel because of its reliability. An example of the private supplier satisfying customer needs while the public supplier fellshort (despite the social equity aspect of the energy policy in operation in Tanzania at that time). Inefficiencies in public supply can also lead to the development of black markets which raise the price of fuel and limit access by those on low incomes (for example, kerosene in India). In Peru, competitive private distribution of fuels has increased the number of outlets and led to greater access by all households (Doig et al., 1998).

Another example of the way in which availability influences the type of fuel used is that in some urban areas it is still possible for households to gather fuelwood. In the Tanzania survey referred to above, low-income households in Mbeya were able to find sufficient fuelwood and this significantly altered the household fuel purchase profile compared to the other two urban centres. Leach and Mearns (1988) consider that "free" wood, obtained from a variety of sources, such as timber yards, discarded packaging and the urban hinterland, is an

[6] However, it should not be forgotten that the provision of fuel in small quantities is often a service provided by other low-income, informal sector suppliers.

important energy source for low income households but one ignored by many energy planners. Time constraints and the availability of transport are limiting factors in access to these sources.

However, is the type of fuel used by households merely a question of price and availability, essentially economic arguments, or are there more complex issues involved? Hosier and Kipondya (1993) estimated that, at the time of their survey, electricity was the cheapest fuel for cooking (even when taking into account the cost of appliances and conversion efficiencies) yet connected households (which were usually in the higher-income groups) were not showing a significant switch to using a cleaner and safer fuel for cooking. It is possible to offer two non-economic explanations for these findings – one relates to cooking practices and the other to intra-household decision making. Long, slow simmering is required to cook two staples in Tanzania (ugali and beans) and without the use of specialised cookers (e.g. a slow cooker) the heat out put of electric cookers is difficult to regulate and it takes time to learn the skill. One also needs a degree of confidence in supply reliability to commit ones basic food to being cooked using electricity. Women (the cooks) may actively choose not to use an energy form they find impractical. For example, Leach and Mearns (1988) quote a World Bank study in Niger which found that despite cooking being cheaper with kerosene than wood, wood was still the preferred fuel. Three reasons were cited: (i) the power output of the kerosene stove was significantly lower than the traditional wood fire, and so cooking took longer; (ii) the kerosene stove did not support the round-bottomed cooking pots used in the area which tended to overbalance during the frequent stirring necessary with staple local foods; and (iii) the kerosene stoves were not robust. Kerosene stoves were used for rapid cooking and water boiling, while wood and charcoal were used with staples. A similar pattern with LPG and electricity was also found in Dar es Salaam, where these fuels were used when time was of the essence (at breakfast and for hot drinks in the evening).

A second alternative explanation for not switching to modern fuels for cooking rests on the fact that households have to make choices about expenditures. While economists tend to see households as a homogeneous entity making rational choices based only on price, social scientists using gender analysis consider this not to be the case. In households where there are adult men and women, the gendered division of labour generally allocates to women the responsibility for energy provision related to their spheres of influence in the household, in particular activities centred on the kitchen. However, when energy has to be purchased, men enter the decision-making process, for example men will often decide on the stove technology if it is to be purchased (Tucker, 1999). Men also make important decisions on other factors that influence cooking and kitchen comfort, for example material for kitchen walls and roofing (Dutta, 1997). In some households, recreational equipment, such as TVs and radios, was bought before labour-saving equipment for domestic chores (Makan, 1995).

Decisions (even well-meaning ones) in one sector can have negative outcomes for the urban poor and their access to energy. For example, in Cairo, buildings need an official certificate to prove they meet certain standards. This measure

was introduced in response to buildings collapsing as a result of poor construction. However, a building standards certificate is also required by the utility before it will connect homes to the electricity supply. Many poor people regard this certificate as too expensive. Conversely, in some areas, communities have mobilised themselves and through credit associations have been able to extend infrastructure to their homes (UNDP, 1999). There is no explanation of why these differences occurred. The poor construction of many informal settlements makes them prone to the theft of possessions, including items such as LPG cylinders. Lack of tenure can also make it less likely that utilities will be prepared to offer services to informal settlements.

3 Fuel Switching and energy efficiency

3.1 *Factors affecting fuel switching*

The energy ladder (see Figure 1) is a concept used to rank fuels based on consumer preferences for efficiency (with associated cost and time components) and cleanliness. Each rung on the ladder corresponds to the most commonly used fuel by a particular income group for a specific energy service. For example, for cooking, wood, dung and other biomass fuels are on the bottom rung, with charcoal, coal and kerosene on intermediate rungs, and LPG and electricity on the highest rungs. As one moves up the ladder, in other words switches fuel, the energy released in a useful form increases while the emission of particulates and other combustion by-products decreases (Reddy, 2000). The energy ladder concept is based loosely on the economic theory of household behaviour, and the assumption that modern fuels (electricity and gas) are normal economic goods and that traditional fuels (such as wood and residues) are inferior goods (Hosier and Kipondya, 1993). If this is the case then it can be expected that as a household's income increases, it will switch from relying on traditional fuels to modern fuels. By extension, higher-income households will make greater use of modern fuels than low-income households do.

Encouraging households to switch fuels so that they move up the ladder has a number of benefits both at the macro- and micro-levels. At the micro-level, making the transition up the ladder results in positive outcomes for the household: health gains (less indoor air pollution), time saving (from more convenient fuels) and potential cost savings for a particular activity (more efficient fuels)[7]. At the macro-level, there are environmental benefits to be gained from a reduction in woodfuel use through a reduction in deforestation. A comprehensive survey in Hyderabad, India on urban energy use (ESMAP, 1999*)* found that a substantial shift had occurred in household energy use: over a twenty-year period poor households have moved from wood to kerosene and LPG, while the middle-classes had moved to LPG reducing their competition with the poor for kerosene. The decline in fuelwood use in this city has been linked to a significant decrease in deforestation in the surrounding peri-urban

[7] It is possible that a household's *total* energy payments will not go down. The household may decide to use the particular equipment more often (for example, cook more meals) or invest the savings in bringing a quality of life improvement, for example, buy a fan or TV.

and rural areas (See Section 6).

Figure 1 Urban Fuel Preferences and Constraints
Source: Leach and Mearns (1988)

"IDEAL" GOALS	**Clean to use. Delivered to user. No storage. Versatile: e.g. good control of heat output. High efficiency holds down costs.**			
Fuel preference "ladder"		**Barriers to climbing the ladder**		
		Equipment Costs	**Fuel payments**	**Access**
ELECTRICITY		**Very high**	**Lumpy**	**Restricted**
Δ				
BOTTLED GAS (NATURAL GAS)		**High**	**Lumpy**	**Often restricted, bulky to transport**
Δ				
KEROSENE		**Medium-high**	**Small**	**Often restricted in low-income areas**
Δ				
CHARCOAL (may be higher in some cultures)		**Medium**	**Small**	**Good: dispersed markets and reliable supplies**
Δ				
FIREWOOD Δ **CROP RESIDUES ANIMAL WASSTES**	**Possible conversion to high-grade energy forms (e.g. biogas, electricity)**	**Low/zero**	**Small or zero**	**Good: dispersed markets and reliable supplies. Can usually be gathered "free"**

Leach and Mearns (1988) concluded, based on survey work in Dar es Salaam, that fuel price was not the single determining factor in encouraging fuel switching, unless the price difference was “very large”. They considered that there were two driving forces of fuel switching:

1. access to dependable supplies of modern fuels in sufficient quantities; and
2. sufficient income to invest in equipment to use modern fuels.

Both are poverty-related issues. The second issue is directly related to household income while the first is indirectly related.

The issue of equipment cost becomes more serious when moving up the energy ladder: the higher the rung the more expensive the equipment. Although, with the exception of electricity, the equipment costs are negligible when spread over their lifetime. If it is the cost of equipment rather than fuel that is the barrier to fuel switching, then new strategies are needed, for example, providing credit for equipment purchase. However, equipment costs are not the only up-front costs that can act as a barrier to fuel switching. The failure for the poor to switch to LPG has been attributed not only to the expensive stoves but also the purchase of the cylinder (von Molthe, McKee and Morgan, 2004).

However, upfront costs might only be part of the problem if the findings from research in rural India also apply in urban areas. Work by Sinha (forthcoming 2006) has found that even under schemes where the poor have assistance in overcoming these up-front costs that the cylinder falls into disuse due to the high cost of refilling it. Hosier and Kipondya (1993) found cylinder availability also a barrier to fuel switching.

The switch to electricity is hindered by high initial connection charges, the high cost of wiring and high standing charges. Utilities are often reluctant to provide a service where there are doubts about the legal tenure of property and where the dwelling is not considered to be a permanent construction. Many low-income households fall into one or both of these categories.

There are also non-financial factors which influence fuel switching. The insubstantial fabric of many low-income housing renders them more vulnerable to theft which can deter people from investing in equipment that is easily portable. The nature of the stove can also be a deterrent to fuel switching or at least to make a total transition. In Niger, urban households were found to still prefer wood to kerosene despite the latter being cheaper because the available stove for kerosene was not suitable for the long slow cooking of staples (Leach and Mearns, 1988). Kerosene was used for rapid cooking, particularly boiling water for tea. Urban households often seem to retain a mixture of fuels, not only to safeguard against supply uncertainties, but to match cooking styles and time constraints. In Dar es Salaam, urban households with LPG and electricity tend to use these energy forms for breakfast and for making hot drinks in the evening when time saving is a particular advantage and to use charcoal for cooking other meals (Leach and Mearns, 1988).

An energy transition within households reflects individual circumstances as well as events in the wider economy. For example, energy sector reforms seem to be. It can be concluded that, even in urban areas, there is no smooth transition up the energy ladder, with the fuel from the low rungs being abandoned in favour of more efficient, cleaner fuels. More complex factors are in play. Households retain the capacity to use a mixture of fuels for different needs and switch between fuels as circumstances dictate. Complex management decisions are made balancing preferences and cooking habits with flexibility (influenced by access and availability) and time constraints.

Understanding the motivations for making a transition up the ladder have been the subject of much discussion since this provides a key to developing appropriate mechanisms for stimulating fuel switching. Figure 1 summarises the barriers which act as a demotivation to climbing the ladder. If the motivation is non-economic (linked to preference or availability) the mechanisms have to concentrate on issues such as improved distribution services of the next fuel on the ladder rather than fuel efficient stoves of the current rung. If cost of energy services is the dominant factor in influencing fuel choice, then fuel efficient stoves are likely to be more attractive to consumers. However, it would appear that motivations are mixed and therefore it can be concluded that a mixture of financial and non-financial mechanisms will be needed.

Von Molthe, McKee and Morgan (2004), based on a successful programme in Senegal, have identified a number of key instruments for managing the transition from charcoal to LPG in urban areas:

- Establishment of an effective and reliable supply system
- Adoption of technology appropriate to local needs
- Introduction and enforcement of regulations to discourage deforestation
- Adoption of appropriate pricing and taxation policies
- Provision of attractive incentives for distributors and consumers
- Mounting effective information and awareness-raising campaigns.

One of the most common mechanisms for promoting fuel switching is the use of subsidies. This mechanism has been the subject of much debate and hence is discussed in more detail in next section.

3.2 *The role of subsidies in influencing fuel switching*

There is no standard definition of what constitutes a subsidy, and this can make discussion of the issue difficult. The International Energy Agency (IEA) provides a reasonably comprehensive definition of a subsidy in the energy sector as *any government action that concerns primarily the energy sector that lowers the cost of energy production, raises the price received by energy producers or lowers the price paid by* consumers (IEA, 1999 quoted in von Molthe, McKee and Morgan, 2004). A subsidy is an instrument for achieving policy goals. These goals, even within the energy sector, can have a social dimension (such as increasing employment) and increasingly an environmental dimension (such as promoting renewable energies to substitute for fossil fuels). A policy instrument can employ a number of different mechanisms to reach such goals. These mechanisms can directly affect prices (such as grants, tax exemptions, price controls) or work indirectly (such as regulations, research grants). Table 2 summarises the main types of energy subsidy mechanisms and classifies them, based on the IEA definition given above.

In the energy sector, subsidies are usually associated with kerosene and electricity, however, other fuels have also been subsidised, for example, petrol and diesel in Indonesia, and LPG in Senegal.

Table 2. Main types of energy subsidy

		How the subsidy usually works		
Government intervention	***Example***	**Lowers cost of production**	**Raises cost of production**	**Lowers price to consumer**
Direct financial transfer	Grants to producers	√		
	Grants to consumers			√
	Low-interest or preferential loans to producers	√		
Preferential tax treatment	Rebates or exemptions on royalties, sales taxes, producer levies and tariffs	√		
	Tax credit	√		√
	Accelerated depreciation allowances on energy supply equipment	√		
Trade restrictions	Quotas, technical restrictions and trade embargoes		√	
Energy-related services provided directly by government at less than full cost	Direct investment in energy infrastructure	√		
	Public research and development	√		
Regulation of the energy sector	Demand guarantees and mandated deployment rates	√	√	
	Price controls		√	√
	Market-access restrictions		√	

Source: UNEP/IEA 2002 (quoted in von Molthe, McKee and Morgan, 2004)

The role and effect of energy subsidies is hotly contested. Various arguments are advanced against subsidies: for example, that they distort markets or that they can lead to the development of "inappropriate" technology or the continued use of an outdated technology. Subsidies can also become a considerable drain on the economy. For example, in 2002, the cost of oil subsidies to the Indonesian Treasury was US$ 4 billion, which represented 10% of government spending (von Molthe, McKee and Morgan, 2004). However, subsidies were considered an essential factor in encouraging switching from charcoal to LPG in urban Senegal, although some authors consider that this switching would have taken place as part of the urbanisation of households and that the subsidies merely speeded-up the process (von Molthe, McKee and Morgan, 2004). The cost of subsidies then has to be offset against the environmental benefits of allowing the regeneration and further protection of natural forests as a result of decreased charcoal production. Although there is little quantitative evidence about the impact of the significant reduction in charcoal use, there is a general perception that there has been a positive impact on the forests

(Denton, 2002).

It is commonly argued that blanket subsidies on fuels should be removed since middle-income and better-off households are considered to reap a disproportionate share of the benefits (see for example Barnes, 1995). However, this is not a universal truth. In urban Zambia, poor urban households have managed to capture the bulk of the kerosene subsidy (87%) (Kalumiana, 2002).

Targeting, for example through ration cards, is an approach that avoids blanket subsides. However, this has not been a successful strategy for reaching poor households since retailers often divert fuels to more profitable outlets, as for example happened in Ecuador where kerosene intended as poor households cooking fuel was diverted to the transport sector. In India, subsidised kerosene is diverted to the black market. However, there are positive examples of smart subsidies. For example, in Thailand, the "lifeline rates" for enabling access by poor households to electricity ensure that they can enjoy the benefits of a higher quality light provided by electricity instead of candles and kerosene, the favoured options of the poor, which are also fire hazards (Barnes, 1995). Indeed, Hosier and Kipondya (1993) considered that in urban Tanzania there would have been no fuel switching without subsidies.

The impact of subsidies and incentives on urban poor household energy use formed part of a recent major study of energy services for the urban poor in East and Southern Africa (Mapako and Dube, 2002). The study focused primarily on commercial modern forms of energy and did not look at biomass[8]. Subsidies were found not to be decisive for the affordability of energy by the urban poor, but the removal of subsidies would impact more on the poor than on the non-poor. Other factors such as upfront costs, proximity and availability of energy sources were found to be more decisive in creating a barrier to access. The levels of expenditure on energy by the poor were considered to be sufficiently high that they could be taken as a proxy indicator that the poor could afford electricity and that the barrier to the poor using electricity is the high connection costs (Kebede et al., 2004). If electricity consumption in poor households is to move "beyond the light bulb", energy policy cannot be formulated on the basis of speculation. Given gender-based intra-household negotiations (see section 2) one cannot know *a priori* what the likely changes in energy expenditure patterns will be in response to households having to pay economic (for the utility) tariffs.

Again in East and Southern Africa, subsidies were not found to be beneficial for increasing the income generation of poor households but did benefit large-scale formal sector businesses and home-based income-generating activities by the non-poor (Mapako and Dube, 2002).

At the macro-level, removing subsidies is generally found to be beneficial, although the effects of continuing or removing subsidies depend on the type

[8] The subsidy given by society to urban woodfuel production, in terms of the costs of environmental degradation, does not seem to generate as much interest in the energy sector as that given to modern energy forms.

and size as well as the structure of the economy (von Molthe, McKee and Morgan, 2004). However, micro-level impacts cannot be ignored, including potential social impacts (for example, on health and employment) and environmental impacts (for example, stimulating a downward transition back to charcoal and wood). While economic effects can be quantified, social and environmental effects are more difficult and often contested.

3.3 *The impact of energy sector reforms on fuel switching*

Energy sector reforms which have resulted in the liberalisation of energy markets include both privatisation and commercialisation. Privatisation involves the sale of state energy companies, particularly the electricity utilities, to the private sector, as well as the opening up of the market for the private sector to provide other energy services. Commercialisation involves the removal of direct subsidies on fuels and appliances, and a shift towards market-based solutions in the provision of energy services. A number of arguments have been advanced for market liberalisation. The assumption is that the changes in ownership and management from the public to private will lead to technological advances, as well as to institutional and financial innovations, in providing improved energy services in terms of cost and reliability of supply. These improvements will also benefit the poor, with the implication that there will no longer be a need for subsidies. There is little empirical evidence, particularly at the micro-level, on the impacts of the reforms and, above all, as to whether or not the urban poor are benefiting from improved services. Most research to date has focused on electricity sector reforms (World Bank, 2000).

There are positive results reported in Bolivia of high levels of access by low-income households to electricity following the privatisation of the utilities (Barja and Urquiola, 2001). In urban areas, there was more than 95% access in the lowest income quantile. However, prior to privatisation, there was already an 86% access rate for this quantile. In another context, in the countries of the former Soviet Block prior to the political changes that removed the centrally-planned economy, urban households had enjoyed good access to modern energy. However, the transition to a market economy has, in some instances, led to a reduction in generating capacity with an accompanying fall in net consumption. For example, Batchelor (2003) quotes World Bank figures for Moldovia of a decline in generating capacity from 3.09 GW(e) in 1999 to 1.03 GW(e) in 1999. The effects of such reductions on urban household energy use, it is not unreasonable to assume, are likely to be negative[9].

Opening up markets and encouraging private sector involvement appears to have been successful with LPG in a number of countries. In Kenya, for example, the distribution system has expanded and a variety of outlets sells and refills cylinders. The market has also responded to the purchasing patterns of low-income households. Small cylinders are available and saving and loan schemes, which enable access to the cylinder and gas, are in operation (SPARKNET, 2004a). However, it would appear that it is not sufficient to "open up markets" and that other factors also influence whether or not the private

[9] Impact of the withdrawal of modern energy on the urban poor is the focus of a DFID KaR project (R8147).

sector is interested in or able to deliver fuels. For example, in Mozambique, distribution of LPG has been considerably hindered by the poor state of the roads (ITDG Zimbabwe, private communication). In Senegal, it was found that in order to promote a switch to LPG, it was necessary to manage the fuelwood and charcoal markets, for example by enforcing regulations, to reduce the ready availability of these fuels in urban centres (von Molthe, McKee and Morgan, 2004).

Sector reforms open up opportunities for other actors to enter the supply market. Does the opportunity extend to the small scale energy entrepreneur? Many goods and services for the urban poor are provided by informal sector entrepreneurs. Does this apply in the energy sector? A study in Lima, Peru found a thriving small-scale entrepreneurial system for supplying natural gas and kerosene to households (Wakelin et al., 2003). Competition helped provide customer-oriented services, for example, LPG cylinders could be delivered to households (heavy to carry) and kerosene could be bought in small quantities (matching low-income budgets). Unfortunately, the study did not mention how long it had taken to develop such services except to mention that some kerosene suppliers had been operating for twenty years. It is therefore difficult to draw conclusions as to whether or not market reforms had influenced the supply system.

The evidence about the effects of energy market liberalisation on prices is not so positive. Privatisation has generally been matched by price increases. Table 1 gives data for the petroleum sector in Nigeria where the government is pursuing a policy of commercialisation prior to privatisation. Price rises do produce a fuel transition but for the poor this appears in general to be downwards. In urban households, price rises have induced energy conservation measures which have resulted in potentially negative health effects and a reduction in the quality of life. A study in Ghana reported a reduction in the number of cooked meals and a switch to cheaper fuels (wood and low quality charcoal) as a result of energy price increases (Future Energy Solutions et al., 2002). To what extent this switching to biomass fuels will impact on peri-urban forests has yet to be determined.

Higher electricity tariffs lead to a significant loss of revenue by utilities through increased theft. For example, in Bahia State, Brazil, 11% of the electricity distributed goes to illegal connections (Andrade, 2004). Not all electricity used through illegal connections is with the explicit compliance of the end-user. Research in Ghana found poor urban households were the victims of deception with unscrupulous fellow residents making illegal connections but collecting the payments on the pretence of making the payment to the utility (Bannister, 2002). There are also concerns that the deregulation of energy markets has not been matched by a policy framework in which social objectives, such as equitable access, have been safeguarded (Maduka, 2004).

Table 1

Prices of Petroleum products in Nigeria (1990-2004)

Products	1990	1991	1993	1994	1998	2000	2002	2002	2003	2004
Gasoline	0.51	0.6	3.25	11	20	22	42.50	32/34	40.23	42.80
Diesel	0.35	0.5	3.0	9	19	8	42.00	32	38/39	40.50
Kerosene	0.15	0.4	2.75	6	17	19	32.00	32	32/53	41.25
Fuel oil	0.30	0.5	2.75	9	12.40	230	230	230	275	275

SOURCE: NNPC (Nigeria National Petroleum Corporation) (Maduka, 2004)

All prices are in naira ($1 = 130 naira at exchange rate January 2004).

3.4 *Energy Efficiency vs Fuel Switching*

It is a worthwhile question, in terms of policy options, to ask whether or not it is better to promote energy efficiency for low-income households than to stimulate fuel switching. Improved energy efficiency can also bring benefits to households such as health improvements and reduced expenditure on fuels. A desk study into urban household energy use in Pakistan suggested that, with improved fuelwood stoves, savings of up to 38% of fuel bills where possible (Dasgupta,1999). A programme promoting fuel-efficient stoves in urban areas of Madagascar is reported as bringing annual fuel savings equivalent to the minimum monthly salary (approximately US$ 24) to households which adopt the stoves (Bazile, 2002). This level of savings should have a significant impact in low-income households and may be of an order that households can begin to accumulate assets.

However, do people move up (or down) the energy ladder for financial (to reduce expenditure) or non-financial reasons (such as flexibility of use)? If it is the former, then fuel efficient stoves could be attractive. However, if it is the latter then a different set of mechanisms need to be used: such as addressing distribution issues or making low-cost conversion equipment for the next rung up the ladder rather than more efficient equipment for the current rung.

Low-income households often rely on second-hand equipment which is cheaper to purchase than new. However, the energy efficiency is generally lower (SPARKNET, 2004a). A lack of information for first time users about how to use electricity effectively and efficiently has been identified as a factor in the inefficient use of electricity (ITDG, 1998).

4 Energy, Urban Enterprises and Poverty

The urban poor are largely dependent on small-scale enterprises for generating income: street food vendors, small-scale manufacturing and repair services are common. The informal sector forms an important part of coping strategies particularly for women. UN statistics show that the informal sector is a larger

source of employment for women than for men (cited in BRIDGE, 2001). The number of informal sector enterprises is on the increase. For example, in the Philippines, a large number of factories and small businesses closed due to the financial crises in Asia, but this has been accompanied by a five-fold increase in street food vendors over the past three years (Lumampao, personal communication). These enterprises are often using process heat and since they operate in commercial markets they are vulnerable to shocks from energy price rises. The Intermediate Technology Development Group (ITDG), in Bangladesh, examined the role of energy in informal sector businesses, in particular the cooking activities of street food vendors. They found that any improvement in household energy would improve the livelihoods of street food vendors since the production of food for sale is a family-based activity and a large part of the food production takes place in the household (Tedd, 2001). These vendors are also serving urban low-income groups, possibly with their main meal of the day. Failure to store food at correct temperatures, or to sufficiently re-heat food, can have a significant impact on the health of customers.

Based on an extensive review of the literature, Meadows and her co-workers (2003) considered that the linkages between modern energy and micro-enterprises were:

a) Modern energy can, but does not necessarily, affect the emergence, development, productivity and efficiency of micro-enterprises.
b) While the lack of access to modern energy is often characterised as a barrier to micro-enterprise development, removing this barrier (through, for example, energy developments such as electrification) does not necessarily result in micro-enterprise development. Rather, modern energy should be viewed as one of a suite of critical enabling factors that act individually and/or in concert to create a suitable environment in which micro-enterprises can operate.
c) The linkages between modern energy and micro-enterprises, and the effects of the former on the latter, can have a gender-specific dimension (see Section 2.3.6).

Most of the literature reviewed by Meadows would appear to be linked to the effects of rural electrification on enterprises in rural areas. It is not clear, since there appears to be a lack of empirical data, whether urban enterprises have their own specific characteristics, challenges and better access to modern energy services than rural enterprises.

Urban small enterprises often use diesel or petrol generators for electricity or mechanical power generation (ITDG, 1998). Electricity use is linked to size and enterprise status. The larger the enterprise the more likely it is that electricity, where available, will be used. Formal sector enterprises are more likely than informal sector ones to have access to electricity. However, many urban enterprises are located in the household or its backyard/compound and use household energy resources for their processes. For example, in Zimbabwe, poor urban households are running welding, carpentry, and catering businesses from such locations (Mika, private communication, 2004). Such an arrangement can create methodological difficulties in assessing energy use.

Energy services can also be supplied by the poor. For example, fuelwood harvesting and charcoal production/distribution has become an important source of income for urban poor in Zimbabwe, Mozambique, Zambia and Malawi (Mika, private communication).

5 Gender, Energy and Urban Livelihoods

How can we define urban poor livelihoods? The urban poor are not easy to categorise because they are not homogeneous. The largest group, with fewest assets, is made up of women and children, the frail and the old. Then there are various categories of employment which are reflected in the different assets accumulated in the household. There are labourers (usually unskilled and often recent rural migrants), the self employed and small scale entrepreneurs who make up the informal sector. Not surprisingly, there are also unemployed people, particularly among the youth, who make their livelihoods by a variety of, sometimes precarious, means. The concept of a "household" also becomes blurred since there are large numbers of street dwellers (including children separated from their parents either due to bereavement or family conflict) as well as single parents. There can be multiple occupancies under a single roof. The manifestations of poverty vary with location and this also influences energy use. Not all the poor live in slums. In Latin America, for example, it is not unusual to find people living in brick houses in areas classified as poor. Not all the poor live in a permanent (or indeed any sort of) physical structure which can make service delivery unlikely. Poor urban areas are not always inadequately served by modern energy supplies. For example, in India, some slum areas are totally electrified (ITDG, 1998). Not everyone who lives in a slum is poor: some households will have sufficient income to purchase better quality fuels and appliances if available. Therefore, trying to analyse the energy needs of urban households can be methodologically challenging.

A Sustainable Urban Livelihoods Framework (SULF) has been used to explore the energy/ poverty linkages in poor urban households. The study examined how households respond to energy shocks and found that in order to stay as a family unit, households adopt a number of strategies to fulfil the short-term objectives of ensuring sufficient food, fuel and clothing. Households have three options: (i) shift to using cheaper options, (ii) reduce overall energy consumption (iii) reduce non-energy expenditure (for example, children are withdrawn from school)[10]. The study found that in Ghana, which had recently experienced significant energy price rises as well as other negative economic effects which made it more difficult for poor people to earn an income, that whichever option a household adopted there were negative consequences for household assets (Future Energy Solutions et al., 2002). People were eating fewer cooked meals (health), travel to home villages had become too expensive so they have less contact with family and kinship networks, and entertainment was reduced (quality of life and disruption of social networks). It is interesting to note that one of the last assets to be abandoned was that of

[10] A fourth option was suggested: switching to less energy intensive cooking foodstuffs (Lasten, private communication, 2004)

sending children to school.

Within the livelihoods framework, energy is seen as an enabling asset for reducing drudgery, saving time and improving the livelihood strategies. However, whether the men and women benefit equally from improving access to energy is not clear. A desk study for DFID found that the urban gender-energy-poverty nexus is under-researched (Clancy et al., 2003) and there is a lack of empirical data (Barnett, 2001).

Evidence would suggest that household energy in urban areas remains primarily a woman's responsibility. Based on evidence from other urban livelihoods research (Beall and Kanji, 1999), this responsibility can be extended to the provision of services for the community which, in the case of energy services, would include electricity. Urban women also face similar inequalities to their rural sisters: low capabilities, low rewards in the labour market, exclusion through social stigma and discrimination, a lack of productive assets and resources (Amis, 2002). They are over-represented amongst the chronically poor (defined as those living in poverty for a considerable period of time). It is not unreasonable to assume that women will face increased stress as a consequence of having to respond to the energy shocks referred to above.

It would appear that there is a gender division in the types of enterprises owned and operated by men and women. Women's enterprises tend to be home-based and use process heat. In this case, women could benefit from access to clean modern fuels as a substitute for the use of biomass in confined spaces.

Women's enterprise development is often advocated as a means for women's empowerment[11]. The role for energy in this context then becomes one of reducing drudgery and extending the working day (providing more flexible hours for work combined with other household duties) or enabling other opportunities such as education or relaxation. The study in Bangladesh referred to above (see Section 4) appears to be the only work to date which has explored gender and household energy issues in urban areas beyond health impacts. The study explored gender aspects in relation to income generation. Women were able to control the production process and hence keep the profits generated which, it was concluded (although no evidence was provided to support this statement) would lead to their empowerment).

There have been concerns expressed about lengthening the working day for women, adding to rather than reducing their burdens. Women are well aware of this, and women in male-headed households may not wish to increase their workload by becoming full-scale entrepreneurs. Perhaps it is better to envisage women as being empowered if they are able to act on energy choices open to them. A greater degree of self-confidence and making a significant contribution to household income may contribute to women's increased participation in, and influence over, decision-making within households. However, such more general empowerment may also require much wider social and political

[11] There is no standard definition of *women's empowerment* so it is defined here as the process of awareness and capacity building of women leading to a more equitable participation in decision-making and enabling them to exercise control over their own lives.

changes.

6 Urban Energy Use and Environmental Impacts

A DFID KaR-funded study into the environmental impacts of urban energy use found that the urban poor suffer disproportionately from the impacts of air pollution (Watkiss, undated). This is a consequence of the poor tending to live in areas with higher concentrations of roads and industry: areas which higher income groups tend to avoid. However, where solid fuels are used for space heating, indoor air pollution can be of greater significance than air traffic pollution for poor people's health.

In poor urban homes, biomass fuels and coal are typically burnt in open fires or poorly functioning stoves, often indoors due to a lack of space around the dwelling and with inadequate ventilation for the smoke. This leads to very high levels of pollution in the homes, and especially women and young children are exposed on a daily basis. Smoke from these fuels contains many pollutants which are capable of irritating the airways and lungs, reducing the resistance to infection, and increasing the risk of cancer, particularly in women due to their greater time of exposure to the pollution (Bruce, undated). Evidence has begun to emerge which suggests that indoor air pollution (IAP) in developing countries may also increase the risk of other important child health problems, such as low birth weight, perinatal mortality (stillbirths and deaths in the first week of life), asthma, and middle ear infection in children (Bruce et al. 2000).

However, even if food is cooked outdoors with solid fuels, the level of exposure to pollutants is likely to be damaging to health, although not as great as indoor use of the same fuel for the same exposure time. Other family members are more likely to benefit in terms of health than the cook if the stove is located outdoors (Smith, private communication).

The shift from fuelwood to kerosene in India (ESMAP, 1999; Dasgupta, 1999) has been accompanied by a shift to cooking indoors, into poorly ventilated rooms, which it is feared could increase the environmental health impacts on women and children. Nevertheless, a positive environmental impact from the shift to kerosene has been the reduction in deforestation in peri-urban and rural areas (ESMAP, 1999*)*, although this might have a negative effect on peri-urban and rural livelihoods through the loss of income from wood sales. However, in Africa, Leach and Mearns (1988) concluded that peri-urban deforestation is caused by land clearance for agriculture to produce crops for the growing urban markets, rather than specifically for charcoal production. Any charcoal is a by-product of clearance. There appears to be little empirical data on the environmental effects of a decline in urban charcoal use, for example, as in Senegal with the LPG programme. Has the cutting of wood declined in total as a consequence of the fall in urban demand, or has this merely freed up more wood for rural household use?

Alternatively, has the switching back to wood and charcoal, linked to energy price increases, had any negative environmental impacts in peri-urban areas?

The shortage of coal, and the high cost and intermittent availability of paraffin and electricity in Zimbabwe has seen fuelwood emerging as the cheapest and most easily accessible source of energy, and this is thought to be contributing to massive deforestation around cities (Mika, private communication, 2004).

Improvements in energy efficiency in the industrial and commercial sectors could bring significant health improvements for workers and the surrounding low-income housing. A study by the Natural Resources Institute noted that the direct linkage between poverty and the commercial sector was difficult to explore due to a lack of data (Dasgupta, 1999).

Renewable energy technologies, generally considered to be cleaner than fossil fuels and able to function well as small-scale decentralised energy systems, have not been so actively promoted in urban areas as they have in rural areas. Although up-front costs are likely to form a barrier for low-income households in both urban and rural areas, there maybe other practical considerations that make small-scale renewable energy systems less attractive in urban areas. For example, a lack of space surrounding dwellings can mean that there is no room for installing a household biogas digester or shading from surrounding buildings can make solar water heaters or PV panels inoperable. The possibility of theft in locations of greater anonymity could also be a barrier. A pilot project in South Africa tried to promote solar water heaters in low-income households but it was found that high initial costs and lack of awareness about the technology and its benefits were significant barriers to up-take of the heaters. Community involvement in such projects was considered a key factor in success by creating a sense of ownership and hence responsibility (ITDG, 1998).

Community systems might, under particular circumstances offer opportunities for renewables in urban settings, possibilities include, biogas digesters for treating urban market wastes and for communal latrines, and solar water heaters in hostels.

7 Conclusions

This paper has reviewed the available literature which is dedicated to urban livelihoods and energy. The documentary evidence is considerably less than for rural livelihoods and energy.

What can be said about urban fuel use is that it is complex, flexible and dynamic. As in rural households, household energy provision is primarily women's responsibility. Households use a mix of fuels and there are signs that even poor households use modern fuels. There appears still to be considerable use, by all income groups, of woodfuels. All fuel types are purchased, but not always. For urban households energy costs can form a significant part of household budgets, and the amount paid is in part influenced by the cash flow patterns of poor people (small amounts purchased frequently). In this context, woman-headed households are considered to be in a worse position than man-headed households.

The factors that influence switching to modern energy are both extra- and intra-household. Where there are no supply availability problems, the most significant factor for low-income households is the high "entry costs" (such as connection fees for electricity, LPG cylinder deposits and purchasing conversion equipment). Extra-household factors include the size of the urban area influencing biomass fuel availability. Legal issues such as tenure of the property can affect the possibility for an electricity connection or LPG delivery. Questions of supply reliability prevent a complete transition from wood or charcoal to modern fuels, as does the availability of appropriate and affordable conversion equipment.

The intra-household factors can be divided into two: the preference for one energy form over another and gender issues. Energy preferences are complex. The taste imparted to particular foodstuffs by wood or charcoal is a common reason for not switching away from these fuels. However, there are other pragmatic reasons such as pots not fitting new stoves, and the power output controllability of the stove. Although, energy provision is seen as the women's responsibility, decisions related to purchase are still made by men who determine household priorities.

In terms of energy services, the urban poor still appear to be underserved. Oil products (kerosene, LPG and natural gas) are fairing better than grid-based electricity. A possible explanation for this is that these fuels are easier to buy in small quantities, particularly kerosene which can be bought in cans or bottles to match cash flow patterns in poor households. This makes kerosene a direct competitor to wood and charcoal which are similarly available for purchase in small quantities. An additional benefit of kerosene, compared to the other modern fuels, is that it has no "up-front entry cost" (with the exception of owning an appropriate stove). The poor do buy electricity in small quantities, in the form of batteries, although the end-use is restricted mainly to entertainment and emergency lighting. Ironically batteries provide electricity at a much higher price per kWh than most grid tariffs. The pressure on governments to remove energy subsidies is likely to be detrimental to poor urban households, in particular in terms of them gaining access to grid electricity. LPG suppliers do appear to be responding to the need for small cylinders to reduce replacement costs.

But what of small, informal sector, entrepreneurs taking up the opportunities afforded under market sector reforms to establish ESCOs to serve the urban poor, such as those described in the study by Wakelin et al. (2003) in urban Peru? Based on the available literature, it is not possible to comment on the extent to which informal ESCOs are being established. However, based on the conclusions of the study by Wakelin and his colleagues, it will require more than a created opportunity to result in a service that matches poor people's needs. For example, start-up and working capital are often problematic for small entrepreneurs and hence form a barrier to establishing a business.

Market sector reforms are currently influencing the dynamics of urban energy availability. However, there are few micro-level data on the impact of these reforms particularly on the urban poor. In the evidence available the

liberalisation of energy markets does not appear, at least in the short term, to be promoting an urban fuel transition. In fact, it appears to be having the opposite effect due to the significant price increases which appear to accompany liberalisation.

In the move to commercialisation there has been some concern expressed over the fate of subsidies, particularly by those who regard this instrument as a key to enabling access by the urban poor to modern energy. Indeed, some authors consider that there would have been no fuel switching without subsidies, while others consider that they merely speed up a process that would have occurred as a "natural" result of urbanisation. If the latter is the case, the environmental costs, for example of deforestation or better urban air quality, have to be offset against the cost of the subsidies. While there is little support for blanket subsidies, being generally regarded as unsustainable in the long-term, there is support for the use of short-term, targeted (so-called "smart") subsidies. There is no universal law for subsidies. Each case, and the form of the subsidy, has to be determined on its merits.

In managing the urban transition up the fuel ladder, energy market reform alone is insufficient to produce a positive outcome. A number of other factors are also considered to play a role: for example, the cost of a stove or charcoal. This strategy requires good co-ordination between Ministries to ensure coherence in policies, for example, the Finance Ministry must be aware of the need to reduce the import tax on LPG stoves and/or the Forestry Department needs to enforce regulations on charcoal production. Fuel transition does not take place in isolation in the energy sector. Factors in other sectors are also influential. For example, although there are improvements in the availability of LPG in large urban centres, the poor quality of roads can hinder the distribution of cylinders.

The literature reviewed in this paper was written before the impacts of the 2004 oil price rises could have been felt by the subjects of studies. However, there are data related to the effects of the price rises linked to commercialisation in the energy sector. Not surprisingly, the impacts on the urban poor have not been positive. There has been a reduction in quality of life with households adopting energy conservation measures - but by "not using equipment" rather than switching to more energy-efficient devices. There appears to be some return to woodfuels but the extent and the environmental impact on peri-urban areas has yet to be quantified. For the electricity sector, the increase in tariffs has seen a rise in the number of illegal connections. It can only be surmised that the 2004 oil price rises will have exacerbated the situation in terms of access to modern energy by poor urban households.

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Appendix 1 Energy, poverty and gender links within an urban livelihoods framework

(Source: Clancy et al., 2002)

Livelihood Component	**General livelihood related aspects**	**Energy-Poverty-Gender links to be explored**
Household assets[12]		
Human	Skills; entrepreneurial ability; education level; ability to work (health); security of employment; income-earner dependency ratio	**Human energy** is an important asset for gaining employment in unskilled manual work, for example, portering. This clearly related to health and nutrition. **Energy-health** related issues (lung and eye disease from smoke – women household and productive related; men productive. Illnesses associated with unboiled water). **Access to education and skills** (who within the household?) for energy service delivery creating employment opportunities formal (utilities or entrepreneur) or informal (charcoal selling; providing illegal connections).
Social	Exchange of goods and services; assistance to or from extended family networks (rural, urban, abroad); membership of community groups; nature of interaction with other households; level of social isolation.	**Networks and social relations** often determine an individuals access to resources: who can scavenge for fuel at a particular location, access to energy conversion technology owned by others (eg portable generator, sewing machine), access to knowledge and skills of others (electrician to legal wire house or make illegal connection), information about technical alternatives. Women's networks will be important for household reproductive needs; women's and men's for productive needs. How do new migrants cope? (Gender differences? Young single men – eat outside the household, young women at home?) Rural relatives bring charcoal while those abroad provide access to energy conversion equipment and devices.

[12] It is assumed in an urban livelihoods that there are no natural assets.

Physical	Basic infrastructure for the supply of energy, shelter, water, transport and communications, production equipment and location for production and service provision (permanent structure/shop/stall/ pitch)	**Access to energy** of appropriate form and quantity at affordable price directly affects livelihoods and health. **Access to energy conversion technologies** affects efficiency (technical and economic), which in turn influences health (drudgery reduction; reduced emissions, more comfortable working conditions). **Provision of energy services** (direct provision, eg charcoal, or support eg electric wiring) can be an income generating opportunity. **Transport services** need reliable and affordable energy supplies – influences entrepreneurial and employment opportunities. **Communication technologies** allow social networks to be maintained and opportunities related to production and services. Energy enables the **provision of services (**also livelihood opportunity) (eg charcoal for roadside restaurants; electricity – music). Housing quality may influence connection chances as well as spaced heating/cooling requirements.
Financial	Savings, credit, remittances, ownership of disposable assets (home, animals, means of transport eg bicycle, cart)	Many poor people are unable to get together **enough cash to invest in more energy efficient conversion equipment or benefit from bulk purchase discounts** (kerosene by the can rather than the cup) denying them cash savings. Renewable energy technologies have high up front connection costs but cheaper running costs than fossil fuels. **Privatisation** of energy services will probably bring changes to costs. Do cost changes influence the choices households make about the types of fuels they use, or do other factors play a role? Direct savings on energy expenditure and improved productivity help improve savings and reduce vulnerability. Within the household who makes the decisions on what investment, who has the assets to enable investment and who decides on how to use any savings? What are savings used for?
Livelihood Context		
Location	Location of community with respect to topography. Access to transport and other services. Climate.	**Location** affects choice of energy services and costs of improving infrastructure. **Access to transport** affects livelihood chances in terms of employment or goods. **Climate** influences the need for space heating or cooling and biomass combustion (wet fuel produces more smoke than dry).

Cultural environment	Ethnicity; religion; gender; urbanisation patterns.	These factors influence social networks and access to energy and other assets.
Political environment	Political parties; feelings of insecurity/uncertainty; feelings of political unconnectedness. Informal control through gangs etc., harassment by state institutions. Impact of rules, regulations and policies; access to identification documents and legal registration; taxation; zoning; regulations on informal trading.	**Privatisation and commercialisation** of energy services are a consequence of political processes which directly impact on poor peoples' lives – processes over which they may have no voice due to lack of legal recognition of urban citizenship since the poor are often squatters or lack relevant documentation proving **right of abode**. This situation can influence a utilities decision to provide a service. **Zoning** on environmental emission grounds (eg smoke) can have negative impacts on the poor (removing income generating opportunities) or positive impacts (by creating conditions which improve occupational health). **Taxation and other economic instruments** influences the affordability of energy resources and efficient conversion technologies. **Feelings of insecurity** of right of abode or entrepreneurial location will **hinder investment decisions** in energy efficient technologies. Likewise similar reactions are likely, if state institutions have negative attitudes to, or overlook the consequences of legislation and policies on, the informal sector.
Economic Environment	Macro-economic environment; urban economic base; employment and inflation trends; policies and attitudes towards informal sector activities; micro-finance.	What are the linkages between changes in the energy sector, in particular **privatisation and commercialisation policies**, and the economy? These can influence opportunities for poor people to become involved in energy service delivery, promote or hinder new enterprises and affect existing enterprises' profitability. They outcomes of such policies can also impact on poor people in other ways, such as health and time. Do energy policies recognise specific **urban energy issues**, particularly those faced by poor people? If state institutions have negative attitudes to, or overlook the consequences of legislation and policies on, the informal sector it may **hinder investment decisions** in energy efficient technologies either due to the creation of feelings of insecurity or lack of access to credit.

Institutional environment	Presence and importance of community level institutions; interaction with external organisations; control of resources by organisations; formal vs. informal institutions	While central government is responsible for creating the enabling environment, **local government** is often responsible for planning of urban energy infrastructure. Their attitude towards informal settlements and informal sector activities can be crucial in the delivery of the energy services poor people need for livelihoods to move themselves out of poverty. They can be responsible for transport infrastructure which affects the availability, reliability and cost of energy delivery costs and access to income generation and employment opportunities. They are responsible for regulation and permits associated with small-scale energy retail business (eg sale of charcoal). Often important in mobilising, organising and developing schemes to help the poor are **community based organisations and NGOs**. They can play important role in interventions to improve energy services at the local level, by identifying community needs and providing a resource base of knowledge about technologies. The **private sector**, often in partnership with central government, at one level is the supplier of conventional energy services, eg petroleum fuels, and energy related infrastructure. What are their policies and attitudes towards meeting poor peoples' energy needs, in particular do they recognise their problems in meeting high up-front costs? At the other end of the scale many **small and micro firms** are likely to be the main actor in the supply and use of energy services that are used by poor people (eg illegal retailers of electricity, sellers of kerosene, candles and charcoal/wood) and understand their constraints. Can they be facilitated to deliver better quality, affordable services, and more energy efficient technologies, to improve poor peoples' livelihoods?
Livelihood Strategies	Activities undertaken by each household member, level of contribution to household finances, access to employment, income generating activities, access to credit; diversification vs. dependence on single earner; flows	Energy services can contribute to urban livelihoods in a variety of ways. **Gaining additional income** by selling energy services (fuels, such as charcoal, kerosene, LPG, and conversion technologies, such as stoves, lamps, batteries, electricity cards). **Gaining access to improved household energy services or fuel switching** (improved stoves; switching from candles to kerosene to electricity for lighting). Gaining access to improve energy services increasing production efficiency (eg through mechanisation) which in turn results in a greater ability to pay for improved energy services (who decides? Who benefits? In what way?). **Grouping with others to obtain access** to improved energy services for production, household consumption or community services (eg security lighting and communications technology) either by providing own services or lobbying utilities/govern-ment. Who makes the decisions within the household and who benefits from improved energy services in terms of health, timesaving and income are key gender issues in the urban energy-poverty nexus.

	of money, people and goods from rural areas and abroad.	
Nature of shocks	Occurrence, duration and nature of shocks; loss of assets due to shock; employment; illness.	The major energy related shocks have been associated with the availability and price of fuels, for example petroleum products due to commercialisation of prices, charcoal prices due to civil conflict, power cuts due to insufficient capacity. Rampant inflation also works against the urban poor more than rural poor since they are more integrated into a monetised economy – devaluing simultaneously their ability to buy commercial fuels and hiking fuel prices. All energy delivery systems are vulnerable to natural and man-made disasters, to war and conflict. These impact on income generation activities and have health impacts if people have to resort to lower quality fuels insufficient to meet their needs. Women are particularly vulnerable to these shocks since they are the main providers of household energy.
Livelihood outcomes.	Shelter, food, nutrition, health, water, education, community participation, personal safety.	Energy services can contribute to people achieving their livelihood goals in an number of ways: Increasing income (sale of energy services; energy related productivity gains; extending working day; access to liquid fuel based transport); increased well-being (improved street and household lighting; reduce indoor air pollution both in households and enterprises; reduced drudgery; improved information through radio, TV, telephone, internet; increased income generation opportunities through improved energy services).