Energy in Low-Income Urban Communities

(Contract Number R8146 – Barriers to access to modern energy in slums)

FINAL TECHNICAL REPORT

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Contents

Acronyms

A	amp
ADB	Asian Development Bank
BOT	Build Operate Transfer
BS	British standards
CC	Competition Commission (South Africa)
CEA	Central Electricity Authority (India)
CERC	Central Electricity Regulatory Commission (India)
CFL	compact fluorescent lamp
DAEP	Depressed Area Electrification Programme
DFID	Department for International Development (UK)
DME	Department of Minerals and Energy (South Africa)
DOE	Department of Energy (Philippines)
EDRC	Energy and Development Research Centre (University of Cape Town)
ERC	Energy Regulatory Commission (Philippines)
FBE	Free basic electricity (South Africa)
GWh	gigawatt hour (10^6 kWh)
h/h	household
IEC	International Electrotechnical Commission
IPP	Independent Power Producers
kW	kilowatt
kWh	kilowatt hour
LPG	liquid petroleum gas
MDG	Millennium Development Goals
MW	Mann Whitney U-test
MWh	megawatt hour (10^3 kWh)
N	number of responses
NEA	National Electrification Administration (Philippines)
NER	National Electricity Regulator (South Africa)
NGO	Non-governmental organisation
NNR	National Nuclear Regulator (South Africa)
NPC	Napocor (National Power Corporation) (Philippines)
p	confidence level, probability that differences between groupings have occurred by chance
PPM	Pre-payment Meters
PPP	Public Private Partnership
PPP	Purchasing power parity
PSP	private sector participation
RDP	Reconstruction and development plan (South Africa)
RED	regional electricity distributors (South Africa)
SEB	State Electricity Boards (India)
SERC	State Electricity Regulatory Commissions (India)
UPAO	Urban Poor Affairs Office

Currency conversion rates

Rs	Rupees (India)	48 Rs/$
P	Peso (Philippines)	55 P/$
R	Rand (South Africa);	7 R/$US

1 Executive Summary

1.1 Description of project

The research sought to identify barriers preventing low income urban households from accessing electricity, and preventing them making formal connection in particular.

The project gathered data from both households (demand side), and from local supply utilities (supply side). The aim of the project was to gather data on the use of electricity amongst the urban poor in order to inform future policy decisions on power sector reform; the Purpose statement was:

> *'to promote a pro-poor policy in private sector participation (PSP) to improve the access and affordability of electricity services to the urban poor'.*

A series of key informant interviews in each country were used to identify the factors influencing access to electricity and constraints to use. Based on the key informant responses, the survey methodology and questionnaire was adapted for use in each country. Samples of over 200 households were drawn from a number of communities representing various types of dwellings and types of electricity connections. A statistical analysis was made of the responses, including non parametric linkages between variables. The results were the subject of an extended analysis process that included consultation activities in each country. These activities, along with input from expert members of the team, served to identify the policy recommendations.

The research was designed by Gamos Ltd. in conjunction with the Indcare Trust (India), Philrads (the Philippines), and the Energy Research Centre (South Africa); expert analysis was provided by Halcrow Business Solutions and by the Electrical Energy and Power Systems groups at Manchester University.

1.2 Headline conclusions

Governments can be reluctant to permit the supply of electricity to unauthorised settlements as it may confer certain legitimacy on the settlement[1]. Nevertheless, policy needs to permit utilities to supply informal settlements, otherwise residents will have no option than to steal electricity. With privatisation and the growth of innovative utility provision, there is a growing body of evidence that electricity can successfully be supplied to informal settlements. The household surveys showed a strong willingness to pay for metered supplies among all groups, including those in informal settlements. Their use of illegal and flying connections are predominantly due to an inability to access metered supplies (due to current regulations and documentation requirements). The research indicates that if innovative "official" solutions are put in place for electricity provision to informal settlements, the poor will respond.

Conventional wisdom maintains that the high cost of connection acts as a significant barrier to the poor getting access to energy[2]. Whilst evidence from the research supports this view to some extent, it seems to suggest that, within the urban context, this is not the major barrier. The majority of those with access to legal supplies had made a metered connection. While

[1] This view is also expressed in 'Innovative approaches to slum electrification', USAID, 2004.
[2] Energy for the poor: underpinning the Millennium Development Goals. DFID. August 2002.

high cost was a drain on the household finances of the poor, the willingness to pay was so strong that, within the communities sampled, cost did not appear to act as a barrier that would prevent connection. However, the households, being willing to pay for a connection, are influenced by the fact that flying connections are cheaper than individually metered supplies, and will opt for the flying connection. Nevertheless, although cost remains a significant factor, it was the legality of land title combined with utility connection policy to restrict availability of legal supplies that presented the principal barrier.

1.3 Utility electricity supplies

In each of the countries considered, governments have taken a similar approach to improving operational efficiency by shifting towards rationalisation and private sector involvement. Each of the communities surveyed under the research had some innovative features of electricity distribution at a local level (see box).

> ***Electricity utilities go Local***
>
> A particularly interesting model was observed in Delhi (India), where a small, local company was sub-contracted to install and manage a small network supplying an informal community of 500 dwellings, where theft had previously been widespread. PN Energy, which operates only in Khayelitsha (South Africa), was set up as a joint venture company, and has been successful in overcoming low revenue recovery problems through the use of prepayment technology.

Although the cost to the household of a metered connection was similar in all countries (roughly $20 - $30), there were considerable differences in electricity unit costs; this was highest in the Philippines (8 cents/kWh), then 6 cents/kWh in Khayelitsha, and lowest in areas of Delhi supplied by a sub-contractor at 3 cents/kWh.

1.4 Summary of findings from household surveys

Electricity was only used extensively for thermal applications (notably cooking) amongst households in the South African sample, where kerosene (paraffin) was the main alternative. LPG and kerosene were mostly used in India and the Philippines. Low status households tended to make greater use of kerosene and charcoal. Most households in all samples had electrical connections. The Philippines was the only country in which almost all urban households had access to electricity. In India and the Philippines these were primarily used for lighting, cooling and entertainment.

In both the Philippines and South Africa there has been recent migration from low grade fuels (kerosene and wood) to higher grade fuels – notably LPG in the Philippines and electricity in South Africa.

Khayelitsha "Clean Air" Campaign

The negligible use of woodfuel in Khayelitsha identified by the research served to inform the ongoing 'clean air' campaign that had been initiated in response to high levels of measured air pollution. Local authorities had assumed that household energy practices were a major contributory factor. The research contributed to a greater understanding of the situation and attention will now be focused on non-domestic combustion including traffic, street vendors, and the effects of wind-blown particles.

People generally hold strongly positive attitudes towards electricity as a fuel. It's main attractive features are ease of use (convenience) and accessibility (a flick of a switch). In India, attitudes towards LPG were more positive than towards electricity, principally because most households in this sample were unable to get a metered connection. In the Philippines and India electricity was regarded as more expensive than low grade alternatives but similar to LPG; only in South Africa, where electricity is subsidised, were economy ratings similar to those for kerosene. Note also that safety was rated as the most important issue in all samples. Electricity was, therefore, attractive in the Philippines and especially in South Africa where LPG was perceived as potentially dangerous and paraffin is a well recognised cause of catastrophic fires, but not in India where most electricity users had illegal supplies. Electricity also has the advantage of contributing to improved lifestyles, principally through health (space cooling fans) and entertainment (e.g. TV, video, music systems).

Residents in low income communities were highly motivated to connect to electricity, and whilst the vast majority were willing to take metered supplies, significant numbers of households from all samples made informal connections where this had not been possible.

Among the communities chosen for the surveys, lack of availability of electricity was clearly the main barrier to access. In Delhi, it is clear that households are highly motivated to access electricity, and will resort to illegal connections if metered connections are not available. Almost all households sampled in the Philippines had electricity, so physical access is not a barrier; flying connections were, however, a feature of poverty and housing vulnerability. In Khayelitsha, the main barrier to access to electricity was the planning process – only households situated on approved land could obtain a metered connection. The ranking of barriers, and subsequent electricity supply options (observed within the sampled communities) is summarised in Figure 1.

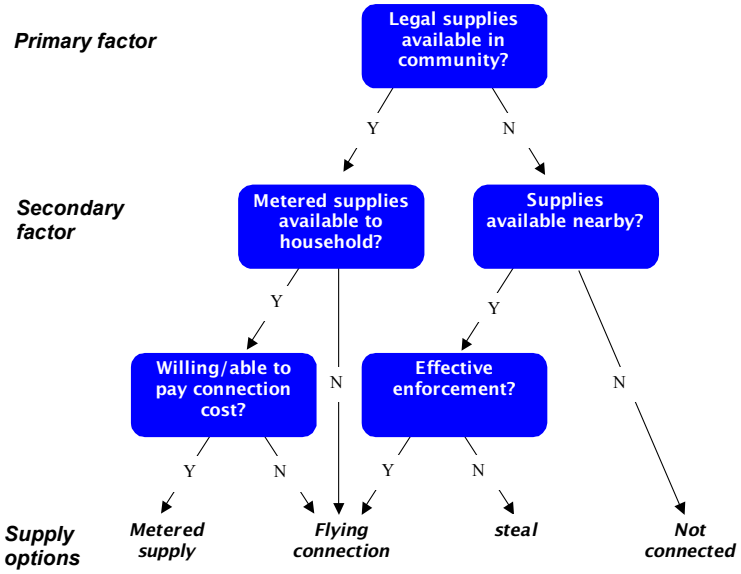


Figure 1 electricity supply options in low income households

The research shows that there is a near universal willingness to pay for metered supplies amongst low income communities, and that households are prepared to pay for a good quality supply. In Delhi, willingness to pay for a legal connection was strongest amongst those with illegal connections, where the cost of illegal connections can be similar to that of metered connections. Willingness to pay was only weakly linked to wealth indicators, despite the fact that the most commonly reported difficulty with obtaining legal supplies was the cost. Households in the Philippines with flying connections generally expressed a strong willingness to pay for a metered connection, however, some stated they were unwilling to pay the current high cost and a significant proportion stated they were constrained by the required documentation. Households in Khayelitsha without a metered connection expressed an almost universally strong willingness to pay for this service.

1.5 Conclusions and Recommendations

In order to address the main research concern of providing access to electricity amongst low income communities, attention needs to be focused on communities where supplies are not available i.e. those outside of planning processes on illegal settlements.

Where these settlements are well established, there exists a precedent to permit the provision of formal electricity connections (as in the Philippines). However, households in unstable settlements tend not to be attractive to a utility. There is high degree of risk associated with investing in a distribution network to serve a community that may well be subject to eviction. Utilisation of the network will be low amongst low income households - revenue is low and demand is peaky. On the other hand, where illegal communities are located in urban centres and steal electricity, utilities have a real interest in providing metered connections as a means of reducing theft - converting non-technical losses into metered supplies.

The challenge remains to design mechanisms that can address the needs of these target communities, and to muster the political will to provide access to electricity in these communities. To this end, the research has identified some examples of ways in which utilities have developed a local presence in order to work effectively in low income communities (see box above).

A number of disadvantages associated with decentralised approaches are evident:

- local operators will seek to minimise capital cost by sourcing lowest cost equipment, leading to higher life cycle costs;
- the cost of capital for financing network development is higher for small, local institutions;
- provision needs to be made for ownership and maintenance of assets in the event that the local implementing agency ceases to exist;
- all stakeholders endeavour to shift risk, with the result that low income consumers tend to pay up front (deep connection charges).

The solution lies in allowing the utility to recover the cost of investment in network in a high risk environment. Additional costs (including losses from lost assets) could be recovered through tariffs, if permitted by the regulator. Alternatively, extraordinary costs can be guaranteed by a third party such as the government, or a donor (through an aid programme).

The principal recommendations can be summarised as follows:·

- Political will is needed to make supplies available to illegal communities;
- Electrification should be a development goal as it offers safety and health benefits;
- Provision of formal supplies can convert losses to revenue;
- Regularise the status of illegal communities (formally or informally);
- Supplies to informal settlements need to include shallow connection charges;
- Use the private sector to supply informal settlements;
- Finance network expansion through the utility;
- Standards and enforcement procedures need to be in place;
- Extend duration of licences;
- Utilities should work with community credit schemes;
- Public awareness campaigns on fuel costs and safety.

2 Introduction

2.1 background

The substitution of clean fuels, and electricity in particular, for traditional household fuels has health and environmental benefits. Electricity can introduce new services such as light, mass media and refrigeration, bringing positive impacts to education and health. The research is, therefore, based on the premise that access to electricity contributes to improving livelihoods amongst low income urban households.

However, high connection costs have been identified as a major barrier to improved access to and affordability of electricity supplies (e.g. DFID Guidance note "Energy for the Rural Poor"). Within the urban context, with high user density, there should be scope for reducing connection costs. Nevertheless, high costs may be due to circumstances at any level of the industry e.g. limited generation or transmission capacity, dilapidated local distribution infrastructure, lack of investment in efficient equipment etc. These, in turn, may be attributable to players throughout the vertical structure of the industry e.g. lack of political will to liberalise markets, inability to attract investment, inflexible utility attitudes to customer requirements, irresponsible behaviour of customers etc. Where utility companies (and

governments) have little incentive to increase the number of connections, national electricity utility policy can, indeed, be in direct conflict with poverty eradication goals.

Ongoing power sector reform brings opportunities for improved services, new investment, and increased flexibility, but at the same time the emphasis on cost recovery means that prices tend to rise, especially where previously subsidised. As the poor spend a higher proportion of their income on energy than the wealthy, it is the poor who will be most severely affected by this trend. Cost barriers will become greater still. In urban contexts, those who live in slum areas tend to lack physical capital, and utilities will often refuse to make connections to premises without land title. In this case, people are forced to make informal connections which may be unsafe and illegal. One of the priority areas for power sector reform regarding making efficiency savings is reducing leakage (including illegal connections); again it is the poor who will suffer most.

The research seeks to identify barriers preventing people accessing electricity, and preventing them making formal connection in particular. It has taken a broad view, focusing on factors influencing choice of fuels, and including the role of social capital. The project has considered ways in which utilities approach low income communities, and highlighted examples of innovative practice. The key stakeholders are low income households (demand), and local utility companies (supply). The aim of the project was to gather data on the use of electricity amongst the urban poor in order to inform future policy decisions on power sector reform.

2.2 Objectives of project

Goal: Improved access to clean energy in poorer households

Purpose: to promote a pro-poor policy in private sector participation (PSP) to improve the access and affordability of electricity services to the urban poor.

Outputs *Phase 1 – proof of concept*

1. Review of electricity industries and pro-poor policy instruments, drawing on other utilities and key players in partner countries.
2. Consolidation workshop (India); partners compare results from Output 1, consultation with local supplier(s).
3. First country survey (India); detailed data on barriers to access gathered from key stakeholder interviews and household surveys; preliminary analysis of barriers to access.

Phase 2 – Comparative analysis

4. 2 country surveys; detailed data on barriers to access gathered from key stakeholder interviews and household surveys; analysis of barriers and identification of possible options, including cross country comparison (i.e. a range of policy options to improve access)
5. set of policy reports tailored to each of major stakeholder groups (see Appendix 1 to Appendix 3).

The research hypothesis, developed from the literature[3], was that there are emerging opportunities for providing electricity to the very poor, but that data on household priorities

[3] e.g. Brook, P & Besant-Jones, J 2000 Reaching the poor in the age of energy reform**,** Chapter 1 ESMAP Energy Report 2000

and practices was in short supply. The research was designed to generate data on practical issues encountered at the client / supplier interface in slum communities. To this end, the research use a combination of participatory discussions and non parametric statistical analysis of household level data to create a clearer picture of the priorities and practices of the poor in "modern energy use" in three countries (India, South Africa and Philippines). It was intended that this data should inform policy options.

2.3 Literature review (summary)

A report on a World Bank sponsored Workshop on Global Coalitions of Voices of the Poor (Narayan and Shah, 2000) opens with a quote from a participant from Brazil:

> *"Sometimes they do not even let you talk. They say they already know the problem and that they will solve it."*

Whilst this comment was made in the context of emerging information technology, and its potential to redress imbalances of power in decision –making processes that affects the lives of the poor, it may also be applicable to the provision of electricity services. The project has, therefore, sought **to explore the opinions and priorities of the poor themselves**.

Privatisation policies have been implemented with a view to attracting investment, but attention has been paid more recently to the impact on the poor, and the literature highlights a recognition that little empirical data exists. It is also pointed out that little data on energy demand exists to inform energy sector projects, and it is recognised that the demand amongst poor communities will have its own, unique characteristics.

The literature highlights a number of problems faced both by the poor when securing an electrical supply (such as affordability and access), and by distribution companies in making supplies available on a sustainable basis (such as cost recovery and cost of infrastructure). The research was, therefore, designed to gather data on a range of issues concerning the distributor–customer interface:

- Constraints to access to electricity supplies – there seems to be debate in the literature as to whether principle constraints are economic i.e. people can't afford electricity, or access i.e. they simply aren't able to get the utility to provide a supply;
- Payment mechanisms – utilities experience problems with non-payment (and theft);
- Participation of consumers and community representatives have been involved in utility service provision;
- Customer priorities – identify issues of concern, such as quality of supply.

Details are available in the full text of the literature review, presented in Appendix 12, which was submitted to DFID in January 2003 as a special contract condition.

3 Methodology

3.1 Research Framework

The project considered only one aspect of infrastructure required for development in slum communities, namely electricity supply, although it considers this within a wider development

context. It considered constraints to access to electricity by the urban poor, and constraints on the use of electricity amongst those with access. At the start of the programme, the framework illustrated in Figure 2 was proposed as representing the context in which the research was to take place.

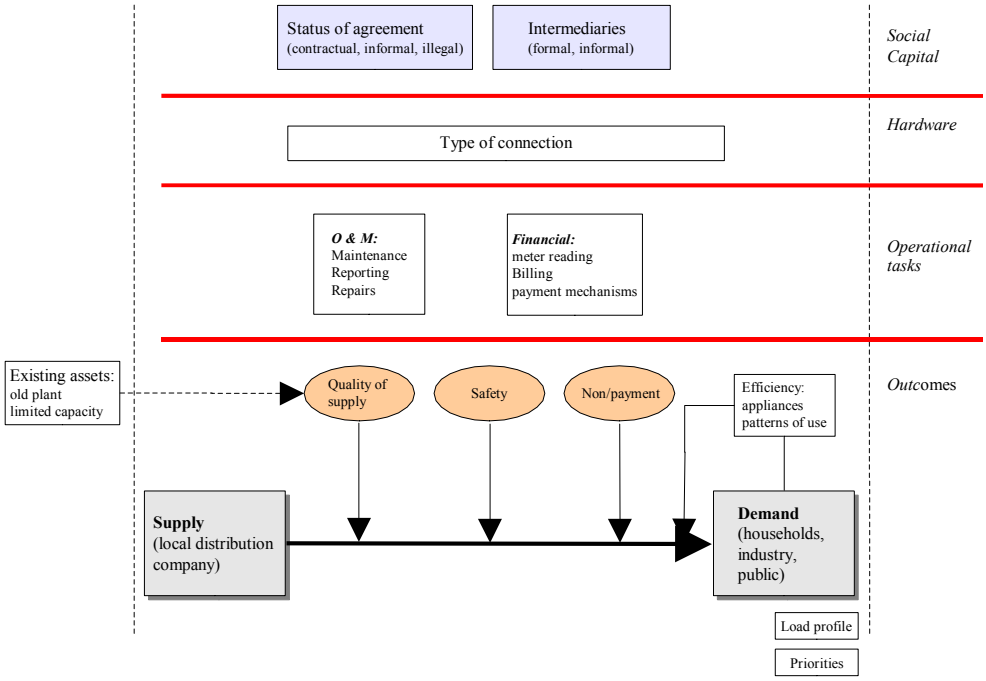


Figure 2 Supplier - Demand context

This shows that the supply of electricity to households is affected by a range of factors. These factors (or outcomes) are in turn determined by the manner in which various operational tasks are carried out, which depends on the physical nature of the connection. When drawing up this framework, it had been assumed that the type of connection adopted by a household would depend on a range of social factors including, for example, ability to pay for a legal connection and social relationships with local entrepreneurs (intermediaries).

It became evident during the initial field visits that, within the research communities, the role of social capital in determining the type of electrical connection adopted by a household was limited. The household survey questionnaire was, therefore, designed to focus more on issues surrounding choice of fuels, in order to gain an understanding of demand for electricity in low income communities. This approach also enabled the research to address some of the issues concerning the distributor–customer interface that arose from a review of the literature.

3.2 Project process

The research methodology was designed by Gamos Ltd., in conjunction with the Indcare Trust (India), Philrads (the Philippines), and the Energy Research Centre (South Africa); expert analysis was provided by Halcrow Business Solutions and by the Electrical Energy and Power Systems groups at Manchester University.

As indicated in Section 2.2, the project was divided into two phases:

- Phase 1 - proof of concept. Preliminary activities in each country, resulting in the detailed design of field survey instruments; the field surveys were carried out in India along with a preliminary analysis of the data gathered.
- Phase 2 - Comparative analysis. Field surveys carried out in Philippines and South Africa, along with final reporting and dissemination.

The views of utilities and policy makers were gathered through stakeholder interviews, which were conducted mostly during the Phase 1 field visits. Data on patterns of household energy use and factors affecting this (as illustrated in Figure 2) were gathered through detailed household surveys. The sequence of activities is presented in Figure 3.

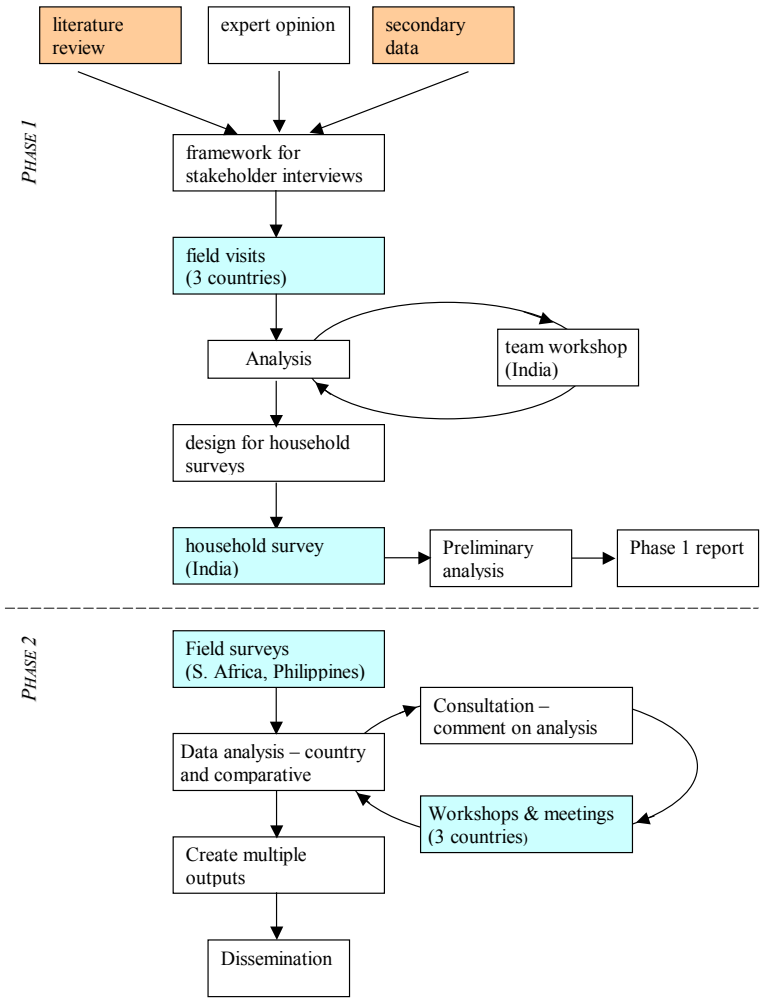


Figure 3 Research process

Initial field visits were made to all three countries to work with local partners in gathering background information and identifying salient issues through a series of key informant interviews and focus group discussions. Experience from each country was collated at a team workshop held in Delhi. The objective of the workshop was to design a detailed questionnaire which could be used in all three country contexts. This exercise was of particular value in promoting ownership of the research process by each of the partners, and

in ensuring that the instrument was applicable (with minor modifications) to each national context. The questionnaire comprised the following sections:

- Household descriptors, including eviction and moving house
- Electricity supplies including costs, opinions, and social aspects regarding supplies
- Household energy use and changes in fuels
- Fuel preferences
- Household financial.

The questionnaire used in the Philippines is presented in Appendix 4 as an example.

Research partners in each country adapted the questionnaire as necessary, and piloted it before carrying out the household surveys. The random, clustered sampling process was stratified according to types of community, chosen to include households of different electrical connection status.

Findings from the data analysis were tested through stakeholder consultation activities in each country (workshops and key meetings). These also served to solicit policy recommendations, to complement input from expert members of the team (see papers presented in Appendix 5 and Appendix 6).

3.3 Data analysis

It was initially proposed to use sample sizes of around 100 households (see Logical Framework – Appendix 11), but initial field visits showed that communities are far from homogeneous, so sample sizes needed to be increased significantly in order to enable comparison between households with different types of electrical connections.

The analysis uses non parametric statistical tests when looking for linkages that highlight factors acting as barriers to getting electrical connections (metered or illegal as appropriate). When looking at the influence of groupings, the Mann-Whitney U test has been used. Tables present the probability (p value) that differences between the two groupings have occurred by chance. Generally, only differences with a probability of less than 0.05 have been taken to indicate a relationship. Similarly, when considering correlations between two variables, only where the p value associated with a Spearman Rank Order Correlation Coefficient is less than 0.05, and the correlation coefficient itself is greater than 0.2, has it been assumed that a valid relationship exists.

4 Country Contexts

4.1 Electricity industries – at a national level

In each of the case studies considered, governments have taken a similar approach to improving operational efficiency by shifting towards rationalisation and private sector involvement. Details of the structure of the industry and the measures taken in each country are presented, along with an overall paper on power sector reforms, in Appendix 7 (prepared by Halcrow).

The situation in India is complex due to the federal nature of the country, where each state has its own electricity board. As of 2001, 7 of the 35 states and Union Territories had unbundled

their industries into separate generation, transmission and distribution companies. In Delhi, for example, the entire industry was split into a generating company, a transmission company, and three distribution companies, each serving different geographical parts of the city. The industry was characterised by high losses and low revenue collection rates. In 2002 the Minister of Power stated that by 2012 all households would have access to electricity (at the time 60% were electrified), although it is not clear that any policy for achieving this has been carried forward into recent privatisation arrangements. Electricity tariffs have steadily increased since reforms were introduced around 10 years ago.

The National Power Corporation of the Philippines (NAPCOR) was due for privatisation in 2003, and has already been split into two companies dealing with generation and transmission. There is a history of international investment in the Philippines electricity industry. Distribution of electricity to consumers is performed by a number of utilities, the biggest of which is the partly state-owned Manila Electric Company (Meralco), and others include a small number of local government-owned utilities, some private companies, and some electric cooperatives. The Department of Energy is responsible for long-term planning, strategy formulation and the monitoring of the country's national energy programme. It's aims include achieving "affordable and reasonable" prices. In addition, the regulator holds the power to specify a lifeline tariff to protect low income consumers. The Government has committed itself to electrifying all villages/barangays by 2006, and by the end of 2002 100% electrification had been achieved in cities.

In South Africa, Eskom generates almost all electricity in the country, and handles the transmission, but there are over 400 local companies (mostly municipal corporations) which distribute to customers. The government is proposing to separate generation and transmission, to privatise Eskom, and to rationalise the distribution industry into 6 regional distributors. The Government has approved the *Eskom Conversion Bill*, which will enable Eskom to become a limited liability company, open to private sector investment, possibly through a public offering. In 1994 Nelson Mandela stated, "by 2010 no community in South Africa will be without electricity", and the government' white paper on housing included electricity services in a commitment to provide basic services. The Reconstruction and Development Programme (RDP) set a target of electrifying 2.5 million households, 72% of the total, by the year 2000, which has been met. Removal of cross-subsidies has meant that domestic tariffs have increased whilst commercial consumers have experienced a cut in costs.

4.2 Innovative practice in local distribution

4.2.1 India

Although Bombay based BSES Ltd. is the licensed distribution company for the areas of Delhi where the Indcare Trust surveyed, they have developed a policy of using local companies as sub-contractors to provide services to low income communities. BSES provide power directly to established customers, but their general preference is to use a single point of delivery system whereby the sub-contractor buys power through a bulk meter. It is the sub-contractor who then installs low voltage networks to dwellings, installs meters, issues bills and collects payments.

A building company had experience of managing loans to house buyers, so they responded to an advert in the paper inviting tenders to supply the Banjara Camp slum area. They have installed the entire low voltage network including meters in each house for an average cost of

1,500Rs per connection ($30), although people can buy on credit. The technical specification provided by the company was analysed by Manchester University (see Appendix 5).

The community used to steal electricity, so the company has experienced problems with acceptance by the community, but things have settled down now. The key to their success in reducing theft is regular spot checks. They read meters to check on the meter readers they employ, and they look for illegal connections. They also have a 3 phase supply to pole mounted distribution boxes, which makes it more difficult to steal. This is a slum area, and potentially subject to eviction; in this event the company would endeavour to remove their equipment in the hope of using it in another location.

4.2.2 Philippines

The big cities and urban areas, like Metro Manila, Cebu, and Davao, are served by privately owned or managed corporation, whilst the smaller cities and towns, which also have their share of squatter communities, tend to be served by electricity cooperatives[4]. The cooperatives have generally been active over the last four years in promoting community action, and deal with local groups on connection and payment issues. In Tacloban, for example, the cooperative has a unit that organises villages into Barangay Power Associations specifically for this purpose. The coops, which also serve poor areas, are generally more efficient and have lower rates of pilferage and payment delinquency.

The requirements needed for formal connections are stipulated mostly by local government, although the utilities may review the building and electrical requirements, mainly for safety considerations. In Metro Manila, each city or town has its own programmes for low-income groups. Quezon City, for example, has the Urban Poor Affairs Office (UPAO) which, if needed, actively organised communities to expedite the delivery of basic services, including electricity. In such cases the utilities, which are sensitive to relations with the government, have to accept this arrangement (which is mostly to their benefit anyway). This approach to community organisation also eases the burden on individual households of connection costs, as the total cost become considerably lower if the applications are handled by the association in a single transaction.

Local governments do not normally subsidise costs, but through the associations they can find sponsors such as NGOs, international organisations, or even local politicians (with their 'pork barrel') to provide funding assistance to help low income communities. One of the research areas, Payatas, was a beneficiary of one such programme called the Depressed Area Electrification Programme (DAEP), funded by the Asian Development Bank.

The area of Davao was off limits to settlements according to the zoning laws, so houses in this community have no legal permits. However, the government has been tolerating their stay for several years and regularly extends basic services to the people, and the community also has its own local government (barangay) which is recognised by the city. Despite its illegal status, the utility companies remain able to supply electricity to households.

The Leyte Electric Coop (Leyeco) in Tacloban is a successful user of prepayment meters, and promotes their use amongst other utilities. The technology (Siemens) was introduced four years ago in response to problems with overdue payments. This has been widely accepted by consumers for a variety of reasons:

[4] Cooperatives have a board, which is elected by the members (the consumers), that recommends to the government electrification agency their choice for top management.

- buying electricity has been made easy;
- no more disconnection hassles; besides the penalty, disconnection is a social embarrassment;
- no more standing charges – people pay for what they consume;
- low minimum payment denomination (P100 ($2)), can be purchased at any time;
- ability to monitor their consumption.

Leyeco also benefits from the prepayment and saves meter reading and billing costs; pilferage has been practically eliminated.

The main concern of the programme is the high cost of the meters, which at P8,000 ($145) are three to four times higher than conventional meters. Leyeco has implemented an instalment programme than enables customers to pay up front only half of the cost, and rest within one year. However, the recently enacted 'Magna Carta for electric consumers' stipulates that the entire cost of meters should be recovered through tariffs i.e. no up front charge; it is currently making an appeal to the regulator for an exemption.

4.2.3 South Africa

In South Africa, Khayelitsha township was chosen as the case study community, as this is a large community which caused particular problems for the municipal utility. This was partly due to the history of non-cooperation with government bodies as part of the campaigns of civil disobedience during apartheid. The licence was switched to Eskom, but this was also seen as closely associated with the government at the time (early 1990s), so PN Energy was set up and presented as independent company – this was a joint venture between Eskom and two European companies. PN Energy only serves customers in this one township.

The company uses prepayment meters exclusively. They are now standardising on the voucher system (customers punch in a 20 digit number) as these meters are proving to be more reliable than the magnetic card reader type. With this technology, customers make payments at appointed vendors, who issue them with the vouchers. Some vendors are installed at residential premises within the community, whilst others are located in strategic places e.g. shopping mall. In this way customers can buy electricity as and when they can afford it.

Photo: Nigel Scott

Figure 4 Local residents are given equipment and training to sell prepayment vouchers

4.2.4 Comparative costs

The cost of connecting a household depends not only on the type of meter used, but also on the type of installation e.g. above ground or underground. The prepayment meters used in Khayelitsha are more expensive, and the connection cost is of order $300, although the connection fee that the household pays is only $20. Connection costs in the Philippines and India (using credit meters) are around $30, and customers pay the full cost in the connection fee (the cost of the meters used in India is around $12). Note that subcontractors in India have flexibility on specification of installation and fees they can charge, so connection costs in other areas was up to $70 – again, paid in full by the customer.

Although the average cost of getting connected in the Philippines (including meters, fees, wiring and fixtures) is around $70, the cost can rise to around $100 when an agent is use to make all the necessary arrangements.

The unit cost is highest in the Philippines (8 cents/kWh), where consumption appears to be slightly lower, then 6 cents/kWh in Khayelitsha, and lowest in areas of Delhi supplied by a sub-contractor at 3 cents/kWh.

4.3 Country context observations from Phase 1 survey activities

The preliminary surveys identified a number of issues that affect the ability of the poor to connect to electricity, and to make good use of supplies.

Delhi:

- formal documentation is needed before customers can get a legal supply;
- safety of electrical connections is a problem, and is exacerbated by frequent cutting of wires;
- people need to get into the habit of paying for electricity;
- Delhi administration is fragmented, making it a complex process of lobbying for a utility company to make supplies available;
- utility companies are under no obligation to make supplies available in low income communities.

Philippines:

- losses and pilferage have been virtually eliminated by "waiving" the requirements for a legal connection and placing the electric meters in high boards along the roads in front of slum communities, not in individual homes. Meralco sources said there is still pilferage, but minimized to 2 to 3%;
- almost all households have electricity, however, 30% do not have their own electric meters (as required by law) and illegally connect with their neighbours. They also pay more than they probably would do with a metered supply.
- Access to a legal connection is hampered by bureaucratic requirements of city hall. People are unable to meet these, so they resorted to "fixers" who demand high fees.
- The issue of land ownership is usually the biggest hindrance amongst those who cannot afford to pay the fixers.

Khayelitsha (Cape Town):

- As people continue to migrate to Cape Town, they are, therefore, engaged in a continuous process of upgrading informal, unstructured shacks into planned settlements with services
- Local leaders negotiate with households on who wants electricity, and appear to act as liaison with PN Energy. There appears to be consensus that when an area is to be electrified, everybody wants to be connected.
- Eskom and Municipalities have different standards leading to different connection costs e.g. 2,500R in Khayelitsha, 4,000 R in Cape Town.
- One of the main problems is tripping at distribution boards – tendency for people to try to connect too high capacity appliances; current policy is for PN Energy to install 20A supplies.
- Customers have complaints with the system of vendors e.g. queues, insecurity, unreliable.
- The policy of providing 'free electricity' was causing some problems at the time of the survey, as it was not available through PN Energy.
- Despite ambitious electrification targets, there remains a proportion of residents in this low income settlement that do not have access to electricity.

5 Household surveys

5.1 Description of samples

5.1.1 Description of sample - India

The three communities in the Delhi sample were:

- Inderpuri: slum – spontaneous, illegal settlements, often well established over time, tend to arise in developed areas
- Holumbi Kalan: resettlement – planned settlements, tend to be on the outskirts of the city
- Vikas Nagar: unauthorised – people buy plots of land from original landowners.

Both household earning index[5] and sum of household expenditures is highest amongst slum dwellers, and respondents in unauthorised communities have the lowest reported levels of expenditure.

The characteristics of type of community are quite distinct - the Resettlement community is legal, permanent, home owners; the unauthorized community is illegal, temporary, mostly owned; only in the slum community is there diversity of intention to stay and rental status. People have stayed longest in the slum community (mean = 12.1 years), and have only recently arrived in the resettlement community (mean length of stay = 1.8 years).

Earned income for most households is estimated to be around the 3,000 Rs/month range and less than 10% are over 6,000 Rs/month ($60 and $125/month respectively).

[5] number of working adults in household weighted according to their employment status (full time, part time or occasional)

The mean proportion of household expenditure spent on energy is 14%, but there is an even degree of spread within the responses – 15% of households spend less than 9% on energy, and 16% spend more than 19% on energy (14% $^{+}$/- 5%).

5.1.2 Description of sample - Philippines

Rodriguez is regarded as a resettlement area, and residents in both Davao and Payatas regard their settlements as recognised by the authorities. Note that the community in Davao occupies a public (foreshore) areas which should have been off limits to settlements according to the zoning laws, so the houses have no legal permits, but the government has been tolerating their stay for several years and regularly extends basic services to the people, so the residents consider their community is authorised; the community also has its own local government (barangay) which is recognised by the city.

The average size of all households included in this survey is 5.23 members. This figure basically follows national trends. In the 2000 national census of households (last official counting), the average size is 5.5 members, but the trend has been decreasing - it was 6.0 in 1990 and 5.7 in 1995.

The majority of the respondents are Female (78%), most being spouses of household heads (57%); it should be noted that the sample does not target household heads, as 82% of heads are male, and only 18% female (mostly widows or single parents, or eldest daughters of elderly parents). Most of the respondents have finished Secondary education (52%); 23% have finished only Elementary education. Only about 18% have taken up some college studies or finished a College degree (6%). Interestingly, these figures closely match the education levels of household heads.

88% of household heads are employed, with 62% in full time employment; only 12% of households claimed the head was unemployed. The number one occupation listed among household heads is Unskilled/Labour (31%), closely followed by Semi-skilled (21%), while 17% have Skilled or Technical jobs and 12.5% are into Small businesses, mostly trading of food products and basic household goods.

The average age of all respondents is 39.7 years old. In Davao, it is 43.6; Payatas, 39.7 and Rodriguez, 35.9 years old.

Overall, 29% of the households have family members living abroad. The number is generally higher for Metro Manila and the main island of Luzon (where Rodriguez and Payatas are located) than the rest of the country, especially Mindanao (where Davao is located). The economic importance of overseas family members is evident in the fact that the average value of gifts received from family members is 3,600 P/month, compared with an average of 2,000 P/month amongst those without family members abroad ($65 and $35/month respectively).

Most houses are concrete, and almost all houses in the resettlement community (Rodriguez) are concrete. Poorer construction techniques are found in ‘authorised’ communities - 20% of the sample are wood, and 16% are semi-concrete. 13% of the sample lives in rented accommodation, but the proportion is higher in the resettlement community (20%). Resettlement community is also characterised by involuntary settlement, and relatively recent settlement (compared with authorised settlements where 28% of residents have ‘always lived there’). Overall, the sample is stable - 50% of the sample having lived in their current accommodation for over 5 years (mean = 13 years), and 94% of the sample believe they will

be permitted to stay in their house for over five years. Only 7.5% believe they will be evicted from their house (mostly in Rodriguez and Davao).

5.1.3 Description of sample – South Africa

Khayelitsha is a township of up to 1 million residents, located about 30 km from the centre of Cape Town, which was established in 1984. There is a variety of dwellings and the following categories were identified:

- informal shacks with no services, situated in unauthorised areas;
- informal shacks in planned settlements with services (water, sanitation and electricity);
- brick houses built under the Reconstruction and Development (RDP) programme;
- higher quality brick houses for private purchase (housing bonds).

The majority of residents in Khayelitsha had access to regular, legal electricity services (estimated at over 80% of households), and only a minority were without. The issue of access to electricity was, therefore, less of an issue than constraints to use. Nevertheless, there are households without electricity, most of which are in unplanned settlements in unauthorised areas.

The sample of 226 was drawn from four neighbourhoods, designed to represent various of the poorer sections of the community, particularly those with no access to electricity:

Monwabisi Park – informal settlement of shacks made from corrugated iron and wood, without services other than some communal water points. There is no formal electricity supply but some households take a supply using extension cords.
Site C – an informal settlement of shacks, but provided with basic services. Security of tenure enables people to build with bricks, but most use corrugated iron and wood.
Kuyasa – RDP houses with services. Residents moved from informal unauthorised settlements.
Makhaya – a community of 'core houses' which were amongst the first to be built in the area; provided with services in the same way as RDP houses.

Electricity supply in the township is unusual within South Africa as it is operated by an intermediary energy supply company, PN Energy. Distribution is usually the responsibility of Eskom (state owned company) or local municipalities. PN Energy was set up in 1994, and has expanded the customer base from 6,000 to 60,000 households, and reduced non-technical losses from around 80% to nearer 5%. They use prepayment technology exclusively, and the connection fee for a household is 150 R.

The sample is split evenly between households with brick / concrete dwellings (45%) and those made of wood and corrugated iron (54%). As described above, the former are found in the RDP and core housing areas, whilst the latter are found in the informal communities.

98% of households said they owned their house - even those in unauthorised settlements. Other measures of security include how long people feel they will be able to stay in their home, and how likely it is they will be forced to leave their home. Both indicators confirm that those in informal settlements are less secure – 60% of those in unserviced shacks don't know how long they will be able to stay (compared with 47% in serviced shacks, and 14% in core housing); 60% of those in unserviced shacks feel it is likely they will be forced to leave (compared with 33% in serviced shacks and 4% in core housing).

The average household size is 4.1, and the average number of children is 1.4. Household sizes are smallest in Monwabisi Park (mean = 3.1), as is the number of children (mean = 0.9). Monwabisi Park has the highest proportion of young adults (18 – 39 years), and the smallest proportion of older people.

5.1.4 Comparison of poverty figures

The figures presented in Table 1 indicate that the sample from South Africa was the poorest, and most marginalised within the national context. Samples from India and the Philippines appear to be similar in terms of position of samples within national context i.e. the per capita income (PPP) is around 40% of national per capita GDP (PPP).

Table 1 Household incomes (samples) and national statistics

	India	***Philippines***	***South Africa***
Mean monthly household income (sample)	3,500 Rs	10,100 P	250
Household size (sample)	4.1	5.2	4
PPP[6] conversion (2002)[7]	8.8 (Rs/$)	12.1 (P/$)	2.4 (R/$)
Per capita annual income PPP (sample)	$1,164	$1,926	$312.5
National per capita GDP PPP (2003)[8]	$2,892	$4,321	$10,346
Sample per capita income PPP as proportion of National	40%	45%	3%
HDI rank	127	84	120
Per capita annual income (sample)	$213	$424	$107

However, at the exchange rates prevailing at the time of the surveys, the per capita income of only the Philippines sample is above $1 a day. Income data from the sample should be treated with caution as the focus of the survey was on energy behaviour rather than economic status.

5.1.5 Choice of electrical connections

The samples offered some distinct characteristics in terms of electricity supply policy and practice (see Table 2):

- In Khayelitsha and Delhi the samples included a mixture of households in planned and unplanned settlements, however, in Delhi the unplanned settlements tended to be located in the midst of authorised dwellings so there was ready access to electricity networks, making it easy for people to steal electricity.
- In Khayelitsha the utility is effective in disconnecting illegal connections, so there were no illegal connections.
- Although some settlements in the Philippines sample are officially unauthorised, utilities are free to operate in them, so there were no illegal connections and almost no households without a supply.

[6] purchasing power parity
[7] Relative prices and exchange rates, World Development Indicators Report. World Bank International Comparison Programme. http://siteresources.worldbank.org/ICPINT/Resources/Table5_7.pdf
[8] UNDP Human Development Report, 2005.

Table 2 Types of electricity connections in each country sample

	India	*Philippines*	*South Africa*
Not connected	14%	1%	17%
Illegal	47%	-	-
Flying connection	5%	16%	16%
Metered	33%	82%	67%

Figure 5 extension cords laid across road from served to unserved areas (Khayelitsha)

The choices of electricity connections made by households in the sampled communities is summarised in Figure 6.

- Where legal supplies were available to the household, most households in all samples tended to pay for a metered connection. Exceptions were found in the Philippines where some claimed to be unable to pay the connection charges, and in Khayelitsha where backyard shacks, for example, are not eligible for metered supplies; these types of households tended to make flying connections.
- Where electricity was not provided in the community (e.g. unplanned settlements in Khayelitsha (Monwabisi), Holumbi Kalan resettlement area in Delhi), and there was no electricity nearby then people had no choice but to do without electricity.
- However, where a distribution network ran close to the community then people were able to get an informal supply. In Khayelitsha, where PN Energy have patrols looking for illegal connections, households made flying connections; typically, an extension cord was laid across a road that constituted the boundary between planned and unplanned settlements (Figure 5). In contrast, slum communities in Delhi simply stole electricity. In most communities individual households made their own illegal connections to networks supplying neighbouring (authorised) communities; where the distribution network was some distance from the community a number of 'fixers' ran businesses providing illegal connections and maintaining a distribution cable from the nearest point where they could tap into the network.

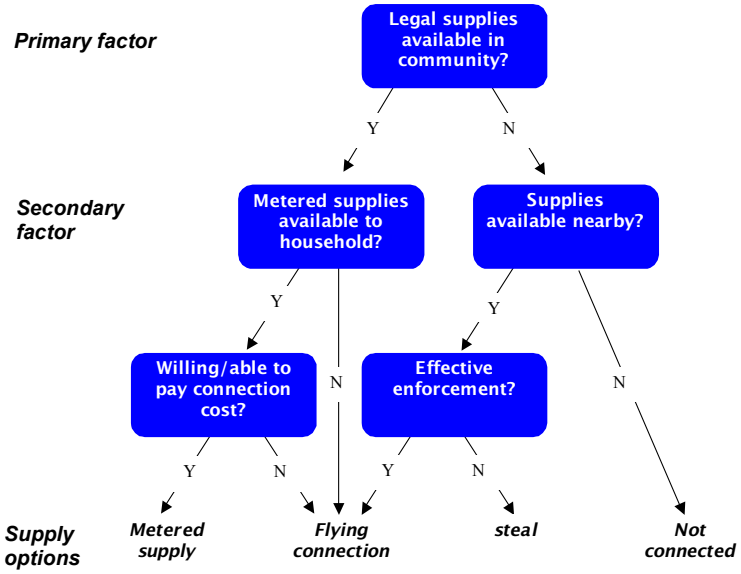


Figure 6 electricity supply options in low income households

5.2 Findings from household surveys

5.2.1 Findings - India

The Delhi sample is characterised by a high proportion (approaching a half) of households with illegal connections (stealing). Their main concern is related to power cuts, which affects the activities for which they use electricity, and there is also a regular experience of shocks.

There is a wide variety in choice of fuels, depending on dwelling (and economic) status. Gas is the fuel of choice for cooking amongst those with legal electricity connections. Where people have access to kerosene on ration cards, it tends to be kerosene. Those without electricity tend to use wood and kerosene. There is a clear pattern of fuel choice with gas at the top, then kerosene, followed by wood, and some households using dung at the bottom. People using electricity for cooking are an anomaly, as they do not pay – only households with illegal supplies use electricity as their main cooking fuel. There is a universal desire to use gas for cooking and electricity for water heating. The priority uses of electricity are cooling in hot seasons in order to control mosquitoes (health and good sleep), and lighting at other times of the year.

Contrary to what might be expected, the economic status of slum dwellers was highest, and respondents in unauthorised communities had the lowest reported levels of expenditure. The mean proportion of household expenditure spent on energy is 14%.

Respondents are most positively disposed towards gas, and least keen on kerosene. Safety and access are regarded as the most important characteristics of fuels – economy is near the bottom of the list.

Relationships are an important factor in securing an electrical supply, especially amongst those with illegal connections. Local political and community leaders are regarded as key figures amongst those with illegal connections, indicating that these offer some form of sanction. Those with no connection regard utilities and community groups as influential in

securing a legal supply. Note that amongst those with legal supplies, relatives and neighbours are important as a means of financial support to pay for connections.

Willingness to pay for a legal connection is strongest amongst those with illegal connections. An illegal connection is not necessarily a free connection; the cost can be similar to that for a metered connection. Willingness to pay is only weakly linked to wealth indicators, despite the fact that the most commonly reported difficulty with legal supplies is the cost. It is clear that households are highly motivated to access electricity, and will resort to illegal connections if metered connections are not available. The issue of safety is influential in encouraging people to make metered connections.

Further detail is presented in the data analysis summary included as Appendix 8.

5.2.2 Findings – the Philippines

Social networking has a direct impact on the financial position of a household – over 20% of households receive regular gifts from family members, and these make up a quarter of household income. Remittances will, therefore, have an impact on ability to pay for household items (including energy). It is somewhat surprising that the data indicate that households do not call upon social networks to access capital needed to make an electricity connection.

Energy is a priority household expenditure item, but is less than food, debt payments (on household items), and transport. The mean proportion of income spent on energy is 11%, but this increases amongst poorer households.

LPG and kerosene are the dominant fuels for cooking and water heating. The use of charcoal and kerosene is more common amongst poorer households. Choice of fuels for these tasks is closely linked to poverty. There has been an impressive migration from low grade fuels (kerosene, wood and charcoal) towards LPG, especially in the low income neighbourhood of Davao. It is interesting to note that this is driven not by cost, but rather by convenience. Almost all households have an electricity connection, used for lighting and cooling (fans); there is also a high penetration of TVs.

Safety is an important issue influencing choice of fuels, and there is a perception that gas is safer than electricity. Safe wiring installation is regarded as one of the benefits of a legal connection.

Almost all have electricity, so physical access is not a barrier. Flying connections are a feature of poverty and housing vulnerability (where households rent, and feel they are likely to move on). People with flying connections have a positive view of electricity as a fuel, and exhibit a strong willingness to pay. However, people with flying connections find it difficult to get a legal connection, mainly due to the cost of the connection (which appears to be about twice the cost of a flying connection), but also the required documentation.

Flying connections also occur in cases where families just rent rooms or extensions of existing houses but have separate economic arrangement from the rest of the house occupants; therefore they are considered separate households. Here, electric utilities do not allow the installation of separate meters, even if the households are willing to pay.

All social referents have a positive attitude towards legal connections, so vested interests does not appear to be a barrier to legal connections. The main constraint is financial. Family members are the strongest referents amongst those with flying connections, whereas those with metered connections have stronger links to local institutions (e.g. community groups and political leaders). The importance of links to local institutions may be evident in the fact that many households (one-third) have accessed cash through community credit schemes to pay for metered connections. It may seem contradictory that those with flying connections would tend not to approach a relative in order to get a legal supply; this may reflect two things – firstly, many people take their flying connection from a relative who benefits from their financial contribution and then has a vested interest in keeping the illegal connection; secondly, where people have migrated into cities, their family networks will be weak within the urban community.

Further detail is presented in the data analysis summary included as Appendix 9.

5.2.3 Findings - South Africa

PN Energy should not be regarded as a privatised alternative to utility service provision, but more as an innovative approach to providing a 'localised' presence on behalf of the utility. It has proved successful in electrifying the township and reducing non-technical losses.

The price structure on the ground has been successful in extending the benefits of electrification to the poor. However, if future investment in generating plant (and environmental cost internalisation) and removal of subsidies lead to electricity price rises, it is possible that the poor may suffer from exposure and dependency on electricity.

With regard to fuel choices amongst sampled households, the dominant fuels are electricity and paraffin; most households use electricity for cooking and water heating, but paraffin remains more commonly used than electricity for space heating. Although electricity is the preferred fuel for all activities, amongst those who use paraffin this choice appears to be driven by costs or perceived costs. There are mixed opinions on which fuel is cheapest, which reflects the situation where electricity is only marginally cheaper. However, externalities such as health and safety issues would justify more intensive use of electricity.

The fact that two-thirds of households with a metered electricity supply indicate that they mainly use electricity for cooking is considered one of the most important findings of the survey. Over previous years, there has been a conventional viewpoint that low-income electrified households tend not to use electricity for their main cooking tasks, and reserve it for lower-power applications like lighting and media appliances. The proportion of households using multiple cooking fuels was considered surprisingly low, compared with conventional views that multiple fuel use among low-income households is widespread. A quarter of the sample has changed cooking fuels, mostly from paraffin to electricity, but not primarily for reasons of cost (reflecting the marginal difference in cost).

Whilst household expenditure on energy is linked to household income, per capita expenditure is not. On the face of it this indicates that energy demand is inelastic, but it may also conceal higher per unit prices paid by the poor for energy; for example, low income households using extension cords do not benefit from Free Basic Electricity. The proportion of household income spent on energy is moderate (mean for whole sample = 9%), although the proportion is higher amongst poorer households.

The recent introduction of Free Basic Electricity allowance has resulted in the consumption of more electricity for more purposes. However, this support mechanism does not reach those without electricity or with extension cords.

The main barrier to access to electricity is the settlement planning process – only households situated on approved land can obtain a metered connection. Khayelitsha experiences in-migration pressure, and some people settle on land considered dangerous for habitation. Whilst the authorities face the challenge of housing people safely and sustainably, the provision of services (including electricity) can help reduce poverty and dangers amongst people in unapproved settlements. It was not possible to analyse data for factors influencing intention to connect to metered supplies because almost all households without a metered connection expressed a very strong willingness to pay for, and intention to connect to a metered supply. This is despite a widespread view that electricity is a public good (not only for those who can afford it). The following characteristics regarding extension cords connections are noted:

- security status is lowest;
- making rational use of electricity;
- pay similar monthly electricity charges to those with meters (although are likely to use less electricity);
- experience poorer quality of supply;
- informal connections are driven by perceptions of cost (and accessibility) of electricity;
- Local relationships are essential to getting an extension cord connection.

Further detail is presented in the data analysis summary included as Appendix 10.

5.2.4 Cross country comparisons

Amongst those who can afford it, LPG is the fuel of choice (for cooking) in the Indian and Philippines samples – the South African sample is different because electricity is subsidised and LPG is not widely available in Khayelitsha, with the result that LPG is almost twice the price of electricity (indeed, kerosene is marginally more expensive than electricity). This is also reflected in the positive attitude towards electricity amongst the South African sample, although it is the cleanliness (non polluting) and ease of use that make it attractive rather than cost. It is interesting to note that in the Indian sample, the characteristics of LPG that make it the most attractive fuel are the same – cleanliness and convenience (tied with safety).

The proportion of declared income spent on energy is consistent across all three countries at around 10%.

The ability to get an informal connection depends primarily on physical location – it is not possible to get a supply if there is no network nearby. Across all samples, it was friends and relatives that were regarded as most important in securing an informal connection, rather than local or political leaders.

Table 3 Comparisons across samples

	India	Philippines	South Africa
Fuels			
Cooking fuels (metered connections)	LPG, kerosene	LPG	Electricity
(no electricity)	Wood, kerosene	N/a	Kerosene
Attitudes – most positive	LPG	Electricity (and LPG)	Electricity
Proportion of sample to have changed cooking fuel	10%	40% kerosene, wood & charcoal to LPG	26% kerosene to electricity
Reason for change	-	convenience	Availability of electricity
Proportion of income spent on energy	12% (mean)	11% (mean)	9% (mean)
Social capital – getting an informal connection	Most important for getting an illegal connection (neighbours). Community leaders most important in getting legal connections	Important for getting a flying connection (relatives). Community groups active in promoting legal connections (finance)	Depends mostly on location, but also on knowing friend / relative to approach for an extension cord connection
Electrical appliances			
TV	61%	86%	63%
fridge	18%	48%	58%
fan	78%	92%	8%

6 Conclusions

6.1 Uses and benefits of electricity

Electricity is only used extensively for thermal applications (notably cooking) amongst households in the South African sample, where kerosene (paraffin) is the main alternative. LPG and kerosene are mostly used in India and the Philippines. Low status households tend to make greater use of kerosene and charcoal. Most households in all samples have electrical connections. In India and the Philippines these are primarily used for lighting, cooling and entertainment.

In both the Philippines and South Africa there has been recent migration from low grade fuels (kerosene and wood) to higher grade fuels – notably LPG in the Philippines and electricity in South Africa.

People generally hold strongly positive attitudes towards electricity as a fuel[9]. It's main attractive features are ease of use (convenience) and accessibility (a flick of a switch). In India, attitudes towards LPG were more positive than towards electricity, principally because most of this sample were unable to get a metered connection. In the Philippines and India, electricity is regarded as more expensive than low grade alternatives but similar to LPG; only in South Africa, where electricity is subsidised, are economy ratings similar to those for kerosene. Note also that safety is rated as the most important issue in all samples. This makes electricity attractive in the Philippines and especially in South Africa where LPG is

[9] Based on the following characteristics: access, efficiency, cost, pollution, convenience, and safety

perceived as potentially dangerous and paraffin is a well recognised cause of catastrophic fires, but not in India where most electricity users have illegal supplies. Electricity also has the advantage of contributing to improved lifestyles, principally through health (space cooling fans) and entertainment (e.g. TV, video, music systems).

Whilst urban electrification holds the promise of benefits in terms of health, safety, and quality of life, there are environmental implications (at a national level) associated with substituting local combustion of fuels with conversion to electricity (at relatively low efficiency) in centralised generating plant.

However, this does not play a part in household decision making. Residents in low income communities are highly motivated to connect to electricity, and whilst the vast majority are willing to take metered supplies, significant numbers of households from all samples have made informal connections where this has not been possible.

6.2 The nature of informal connections

Amongst the communities chosen for the surveys, lack of availability of electricity is clearly the main barrier to access. In South Africa, all of those without metered supplies resided in unserviced areas i.e. unauthorised settlements; conversely, all of those in planned settlements had metered connections. Almost all households with informal connections (both illegal and flying connections) in the Indian sample were located in areas where the utility had not made supplies available - infrastructure had not been installed in the resettlement community, and the utility connection policy prevented them making connections to slum (illegal) dwellings. Metered supplies were available in all areas within the Philippines sample, both authorised and unauthorised settlements, but in each there was a small proportion of households that had flying connections.

In South Africa, availability is tied closely to the urban planning process, and the utility can only make connections to authorised settlements. In Delhi, the licensed utility can only make connections to registered dwellings, which excludes the many informal slum communities arising throughout the city[10]. In the Philippines, the authorities have taken a more liberal approach in one area where residences are not officially authorised and dwellings have no permits, but the government has been tolerating the community for several years and regularly extends basic services to the people, with the result that 80% of residents have metered supplies and the remainder have flying connections.

Flying connections are of minor concern to utilities as electricity consumed is metered and paid for. They raise concerns for residents in terms of safety and cost – they tend to pay a flat fee. Reasons for choosing a flying connection include:

- Difficult to meet formal requirements for a metered connection (especially in illegal settlements in the Philippines);
- High cost of formal connection (utility costs and 'fixers' fees);
- Multiple dwellings – utilities may be unable or unwilling to provide multiple meters within one building or registered site (e.g. backyard shacks in South Africa);

[10] supplies are made available to unregistered dwellings using a bulk metered sub contract arrangement described in Section 6.3.2.

In order to address the main research concern of providing access to electricity amongst low income communities, attention needs, therefore, to be focused on communities where supplies are not available i.e. outside of planning processes on illegal settlements. The research shows that there is a universal willingness to pay for metered supplies, and that households are prepared to pay for a good quality supply. The field work has identified some innovative examples of ways in which utilities have worked with these communities.

From the supply side point of view, whilst there are undoubtedly problems associated with providing service to customers in informal settlements, problems can only be exacerbated if a utility is not permitted to provide service at all. The regulatory authorities in Delhi recognised that legislation preventing the utility from supply electricity to unauthorised dwellings left potential customers with no option but to steal electricity[11]. This is a growing problem (not only in Delhi) as the rate at which people migrate to the cities tends to exceed the rate at which authorities can provide them with planned settlements.

6.3 Local service provision

6.3.1 Authorised settlements

Households within authorised settlements can make illegal connections or not pay their bills (e.g. see research into electricity industry restructuring in Eastern Europe and Central Asia[12]), although this was not common practice amongst the households sampled. In Khayelitsha, however, this had been a major problem for the utility as it faced the legacy of the civil disobedience campaign – in 1994 non-technical losses amounted to 80%. PN Energy was set up as a means of overcoming these problems, and appears to have been largely successful – the customer base has been expanded from 6,000 to 60,000 households, and losses have been reduced to nearer 5%. There are a number of reasons behind this:

- As a private company, it is clearly independent of the state;
- Local presence – it has local offices and employs local people;
- Local solutions - widespread adoption of prepayment technology has proven to be appropriate, and the appointment of local traders as retail outlets has improved availability of vouchers.

6.3.2 Unauthorised settlements

Samples in both the Philippines and India included households that, although on land that is not officially approved for dwellings, are well established and recognised by the authorities and to which utilities are able to provide metered supplies. Nevertheless, in the Philippines, one of the main obstacles to getting a metered supply is meeting the documentation requirements. This demonstrates how requirements can be relaxed to permit utilities to make supplies available to unplanned settlements.

On the other hand, households in unstable settlements are not attractive to a utility. There is high degree of risk associated with investing in a distribution network to serve a community which may well be subject to eviction. Utilisation of the network will be low amongst low income households - revenue is low and demand is peaky. In the absence of any incentives or statutory requirements there is, therefore, little reason why a utility should want to provide

[11] 'The unbundling and privatisation of DVB', Jagdish Sagar. TERI workshop.
[12] Gamos KaR 'Impact of the withdrawal of modern energy on the urban poor'. R8147.

service to informal settlements. One exception is where supplies are available nearby (see) and households steal electricity, as in slum areas of Delhi. In this instance, utilities have a real interest in providing metered connections as a means of reducing theft - converting non-technical losses into metered supplies.

BSES in Delhi have recently developed a policy of using sub-contractors to supply local neighbourhoods, and the research found an example of a sub-contractor taking responsibility for installing metered supplies throughout an informal (slum) community. This mechanism offers a number of advantages, such as local presence that ensures good recovery rates and no theft, and local solutions offer the potential for community participation (the coops in the Philippines provide examples of how this can be achieved, although they are a different model). However, a feature of the mechanism is that investment risk is eliminated by recovering the cost of the (local) network through the connection charge, resulting in a deep connection charge – this presents a major barrier to low income households.

Models for participation of the private sector, especially at local level, are emerging as liberalised markets evolve. And so many of the obstacles preventing the supply of electricity to informal communities can be overcome. With the advent of local, private electricity companies, local authorities and government structures can become disassociated from electricity service provision, and there need no longer be any contradiction in the supply of electricity to illegal settlements. Unlike local authorities which have to be risk averse in their management of public money, private sector companies can take risk, and this puts them in a position to enter into informal communities, like the Banjara Camp example given in Section 4.2.1.

6.3.3 Disadvantages associated with decentralised approaches

There is a view that technical issues associated with the industry should remain the responsibility of the utility (design, installation and operation), whilst commercial activities can be managed by through private sector participation (billing and collection). At worst, local operators could install systems that are unsafe, although no evidence of this was encountered by the research. It is quite likely, however, that local operators will seek to minimise capital cost by sourcing lowest cost equipment. This will lead to higher life cycle costs and sub-optimal pricing; for example, cheap transformers have higher losses. There is, therefore, a need to establish technical standards and to provide a mechanism for enforcing these standards.

The more decentralised a mechanism is, the smaller the implementing agency will be. The cost of capital for financing network installation is higher for small organisations (poor credit rating, small deal size), which leads to higher costs to consumers. Costs could, therefore, be reduced if mechanisms were found to finance network expansion through the utility.

A characteristic of the private sector is that companies cease to trade, for a number of reasons. Any decentralised approach involving the private sector will need to make provision for ownership and maintenance of assets in this event.

In the Delhi sub-contractor example above, the risk of network investment is shifted from the licensed utility to the sub-contractor through the sub-contract arrangement; it is then shifted from the sub-contractor to the consumers through the connection charge. In order to make affordable supplies available to low income communities it is necessary to find viable ways of distributing this risk, and some suggestions are outlined below. In the PN Energy example,

risk is minimised because they only install infrastructure in planned settlements, and they can recover investment through the tariff structure.

6.4 Possible solutions

Utilities generally recover the cost of investment through tariffs. Due to the relatively high degree of risk associated with insecure informal settlements, the net cost of investment is likely to be relatively high e.g. assets will be lost if a community is evicted. In principle, utilities could equally well recover the cost of investment in informal communities in the same way, if permitted to do so by the regulator, but there are political implications associated with this.

An alternative is to treat the investment in insecure areas as a separate cost item, the potential loss of which can be mitigated through some means of guarantee. This cost can be underwritten for example by the government, or a donor, or as part of an aid programme as in the ADB example given in Section 4.2.2.

All of these rely on there being the political will to make services available to informal settlements. This can be argued for on the basis of the benefits to low income households; although strictly outside of the scope of this study, the data does indicate that the principal benefits of the provision of electricity are improved safety and health.

6.5 Impact on the Millennium Development Goals

The research presents household level data on patterns of fuel use amongst low income communities, and provides an understanding of factors that lie behind their choice of fuels. Although the positive impact of electrification on low income households was taken as a premise in the project design, the data confirm that access to electricity does indeed bring a number of benefits.

- Amongst the poorest households, electricity is primarily used for lighting and entertainment. Lighting can make a valuable contribution towards the education of children by enabling them to work in the evenings. (MDG2 – achieve universal primary education).

- In both India and the Philippines, most households had an electric fan. In Delhi, fans were regarded as the most important use of electricity, especially in the hot season, as they helped combat mosquitoes, and provided comfort for a good night's sleep. (MDG 6 – combat HIV/AIDS, malaria, and other diseases).

- The electrification of slum households offers the potential of improved safety and health, along with other improvements in quality of life (MDG 7 – ensure environmental sustainability).

The poor spend a significant proportion of their household budget on energy (ranging from a mean of 9% amongst the South African sample to 14% amongst the sample from India). Illegal connections can cost the consumer more than legal connections and have implications on safety and health. Metered legal connections will in many cases save the poor household expenditures (on energy, medical bills, etc), and enable them to make improved livelihood

choices (MDG1). Livelihood strategies are built on the various capital assets available to households. The research interviews and surveys clearly show that those with illegal connections favour legal connections if possible, thus improving their standing in the community (social capital) and their linkages to institutional frameworks. The innovative use of prepaid meters also enables a greater control of household finances (economic capital).

The heart of the MDGs is about empowering the poor and reducing their vulnerability. The research shows that informal communities outside of planning processes are most vulnerable, as households in these areas are denied access to electricity. The challenge to conventional wisdom is that there are now cost recovery mechanisms that can address the needs of these target communities, and there is a need to muster the political will to provide access to electricity in these communities. The report draws on recent experience of liberalisation of electricity markets to make suggestions on how this can be done. This is supported by some examples identified by the field research of ways in which utilities have developed a local presence in order to work in low income communities.

"Clean air" Campaign in Khayelitsha

Khayelitsha is located in a rather barren portion of the Cape Peninsula. The ground is sandy, and the area is wind-swept and exposed. The City of Cape Town has been monitoring air quality in Khayelitsha and as a result of disturbingly high levels of measured air pollution, is embarking on a large-scale "clean air" campaign. There is uncertainty at this stage about the causes of pollution, but it had been assumed that household energy practices were a major contributory factor. However, only one household reported using wood as a fuel. Even allowing for a reluctance to 'admit' to using a fuel that is generally regarded as 'backward', it is clear that household use of firewood is not significant. Findings from the research have, therefore, suggested that the campaign examines other factors such as non-domestic combustion including traffic, street vendors (who commonly use wood), the burning of tyres to recover metals, and the effects of dangerously small wind-blown particles created by high winds and sand.

7 Policy recommendations

- Lack of availability of metered supplies is the main barrier to access. This is most commonly linked to the planning status of communities – utilities do not generally provide connections in settlements that are not formally recognised. The poor can only gain access to electricity if the **political will to provide services** exist, and appropriate instruments are implemented.

- The provision of electricity as a fuel to low income households offers advantages in terms of safety and health – it offers reduced risk of fire, and elimination of hazardous products of combustion (especially when compared with kerosene as an alternative). It also offers additional improvements in quality of life, principally in terms of lighting and entertainment. On these grounds, the **electrification of low income communities** should be pursued as a **development goal**.

Figure 8 Cardboard and newspaper (for insulation) combine with kerosene stoves to create fire risks

- In terms of **environmental policy**, there are, however, negative implications of electrification, especially when promoted for thermal uses (e.g. cooking and space heating). Substituting local combustion of fuels with conversion to electricity in centralised generating plant leads to higher emissions.

- Where informal communities are located adjacent to areas where electricity is available, residents tend to steal electricity. Adopting policies that promote the electrification of informal settlements are an effective means of **converting these non-technical losses** to revenue. There is a strong willingness to pay for metered electricity amongst those without electricity and those with illegal supplies.

- One means of overcoming the barrier of availability of metered supplies is to **regularise the status of informal communities**, thereby permitting the introduction of metered connections. This can be done either formally (as in South Africa, although the number of people settling in Khayelitsha continues to exceed planned capacity) or informally (as in the Davao settlement in the Philippines).

- The electrification of informal settlements should be stimulated through **statutory requirements** on utilities (e.g. as part of licence conditions). However, it is important that these requirements contain a mechanism for achieving shallow connection charges. The cost of investment (expected to be relatively high for installing network in unstable communities) could be recovered from all consumers through tariffs, or could underwritten by guarantees from government. An alternative approach would be to oblige utilities to work with donor programmes concerned with urban and infrastructure development, where donors would underwrite the cost of investment.

- Although flying connections present no loss to the utility, they tend to present higher costs to poor households. **Relaxing the requirements** for metered connections will reduce barriers – this is especially true in unauthorised settlements where dwellings are not registered.

- **Use the private sector** to provide electricity in informal communities. Were government utilities or state authorities to provide electricity to an informal settlement that is officially regarded as illegal, a conflict would arise as provision of electricity would confer a degree of legitimacy on the settlement. A private sector provider dissociates service provision to an area from its political status. The private sector is also better suited to provide service in high risk situations, as government authorities are risk averse.

- Network extension should be **financed through the utility**, as it presents a low risk borrower compared with the private sector (especially local, small enterprises). Lower perceived risk to the lender and higher deal sizes result in lower costs of borrowing, which in turn translate into lower cost to the customer.

- **Technical standards** need to be established, and enforcement procedures and authorities put in place. This is needed to ensure that local distribution networks meet minimum standards of safety and of technical performance.

- Licences should have a **long duration** in order to promote a long term view when making investment decisions. This would permit utilities to use life cycle cost analysis, and to lower the cost of capital, resulting in lower overall costs.

- Community **credit schemes** are an important means of helping low income customers overcome the high capital cost of connecting to electricity (both connection charge and domestic wiring plus appliances). Local distribution companies should work in partnership with local credit organisations to ensure that all customers have access to credit facilities. Community credit schemes can also be effective in spreading the cost of energy efficient appliances, notably energy saving lamps.

- Initiate **public awareness campaigns** aimed at informing consumers on the relative costs and safety implications of fuels. This should help consumers make informed fuel choices. There is also a need to inform consumers of their rights when entering into contracts with private sector utility companies, and to encourage willingness to pay by explaining cost structures within the industry.

- **Prepayment technology** has proven itself to be effective in reducing losses in the context of South Africa (and the Philippines). The high incidence of mobile phone use throughout developing countries demonstrates that consumers are comfortable with the principles involved. It is, however, relatively expensive and will only yield benefits where problems exist with conventional credit metering. The high willingness to pay expressed by people in informal communities indicates that revenue recovery is unlikely be a problem if they are offered connections, but prepayment technology remains an option if problems become evident.

- **Energy conservation measures** will help the poor reduce their energy costs. The poorest households tend to use electricity mainly for lighting and entertainment. A campaign to disseminate low energy lamps in particular would have the greatest proportional impact on these households.

- The experience from the countries surveyed is that private sector utilities have been effective in reducing losses and extending connectivity. Establishing a **local utility presence** (through decentralised companies) has been effective in addressing local

solutions to address local conditions. These examples show ways in which the private sector has devised innovative ways of meeting local demand.

8 Follow-up and Dissemination

8.1 Activities to date

Findings were tested through consultation activities in each country. In India and South Africa these were based around workshops, supported by individual interviews. However, experience showed that it was difficult to get senior people to attend workshops, so the partner in the Philippines arranged a series of individual meetings instead, which proved to be an effective alternative.

Based on the research activities, Indcare have since engaged with a USAID project in Delhi, and are currently involved in community mobilization for an electrification programme in two slums of Delhi. They run awareness raising activities within neighbourhoods, and negotiate with both the community and the utility. In the Philippines, Philrads also plans to incorporate issues concerning energy supply into ongoing work on advocacy for resettlement rights.

The unexpected indications of a fairly comprehensive switch to electricity use in a low-income residential area such as Khayelitsha have highlighted the benefits of South Africa's electrification programme and householders' response to a 50 kWh/month free basic electricity allowance. The research results have also helped to inform a Khayelitsha Air Pollution strategy, currently under development by the City of Cape Town.

EDRC have presented findings from the research at conferences in South Africa on the domestic use of energy[13] and on improving access to modern energy services[14]. Indcare presented research findings at an ESMAP convened workshop on the energy needs of the urban poor[15], and EDRC presented at a workshop on energy transitions[16].

Project output and supporting documents have been made available on the internet:
http://www.gamos.org.uk/urbanenergy/
Content will also be disseminated on CD by all research partners.

8.2 Future work

The key conclusion from the research is that the principal barrier facing the urban poor is lack of supplies to illegal settlements. The proposal quoted DFID publications that state that high

[13] Lloyd, PJ and B Cowan (2005). Improving access to electricity; lessons from Khayelitsha. 13th Domestic Use of Energy Conference, Cape Peninsula University of Technology, Cape Town, 29-31 March 2005.
[14] Lloyd PJ, B Cowan and N Mohlakoana (2004). Improving access to electricity and stimulation of economic growth and social upliftment. Conference on "Improving Access to Modern Energy Services through CDM and Technology Transfer," Eskom Conference Centre, Midrand, 27-29 July 2004.
[15] "Steps towards slum upgrading by overcoming the barriers to access to electricity" presented by Indcare Trust at the ESMAP workshop on "Meeting the energy needs of the urban poor: the case of electrification", September 12-14, 2005; Salvador do Bahia, Brazil.
[16] Workshop on "Energy Transitions", jointly convened by the Programme for Energy and Sustainable Development, Stanford University, and Energy Research Centre, University of Cape Town, 18-20 August 2004, Cape Town.

connection costs are the principle barrier for rural electricity supplies. While this may be true for rural areas, the study shows a high willingness to pay in urban areas.

This conclusion should be integrated into future DFID publications on energy, urban development, and energy sector restructuring. Further research should be commissioned across a wider range of contexts to confirm the findings, as this potentially has an important influence on policy decisions (as evidenced by the differences between the samples' access to electricity in India, South Africa and the Philippines). Materials need to be collated from recent experience (e.g. this research, experience in Orissa, guidance from USAID survey etc.) as part of an initiative to raise awareness and inform electricity sector reform processes (e.g. present knowledge to bilateral donor fora such as OECD DAC Povnet Infrastructure group).

In addition to these, a number of areas for further work have been identified:

- Innovative approaches to credit worthiness in order to simplify connection procedures;
- Gather evidence from additional countries;
- In depth analysis of risk sharing strategies (utility, consumer and government or agency) to promote shallow connection charges;
- Design guidance for installation standards in informal communities;
- Develop advocacy approaches and materials to justify intervention in private sector distribution.

Appendix 1

Policy Paper – Ministries and Regulators

Barriers to access to electricity

Amongst Low-income Urban Communities

– with Recommendations for Policy Makers

This paper presents some conclusions and policy recommendations arising from DFID funded research into factors preventing poor, urban households from accessing electricity.

The project gathered data from both households (*demand*) through **household surveys**, and from **local supply utilities** (*supply*) that had developed innovative approaches. Surveys were conducted by local partners in low income communities in Delhi (India), Manilla and Cebu (Philippines), and Khayelitsha township (South Africa).

Electricity and poverty reduction

To achieve the MDG of reducing the proportion of people living in extreme poverty by half, commensurate decreases in the number of people without access to electricity and clean cooking fuels are required.
A Framework for Action on Energy. UN WEHAB Working Group (Water, Energy, Health, Agriculture, and biodiversity). 2002.

The greatest barrier facing the poorest is lack of availability of legal connections, especially in illegal settlements. In order to reach these households, utilities need to be encouraged to serve illegal communities - but this requires political commitment. The private sector has demonstrated that it can work with low income communities, and even unstable communities.

Barriers to access to electricity

The conventional view is that the high cost of connecting to infrastructure services presents the most significant barrier to access. The research confirms that connection costs do indeed present a barrier, but it shows that the ***lack of availability of formal connections is much more important*** (see Figure 1, based on survey locations). Where households were entitled to metered supplies, almost all were connected.

Households can be denied legal access for a number of reasons, mostly related to the illegal nature of settlements. In order to extend the benefits of urban electrification to the poorest in society ***it will, therefore, be necessary to find ways of supplying illegal settlements.*** Commercial solutions can be found, but they will ***only be possible where political will exists.***

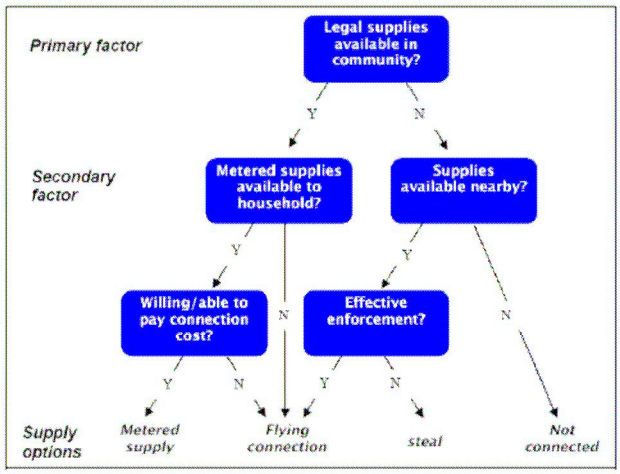


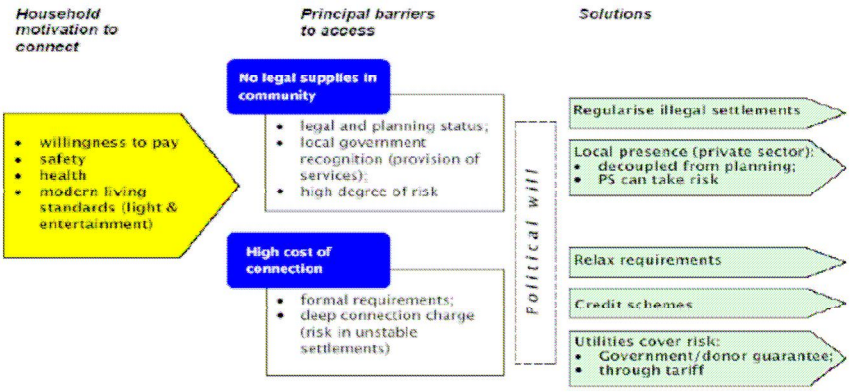
Figure 1 Electricity supply options in low income households

The role of private sector participation (PSP)

Electricity sector liberalisation, in conjunction with the involvement of the private sector, has proven an effective way of improving efficiencies, and reducing subsidies required - key principles are presented in a series of case studies carried out for USAID ('Innovative approaches to slum electrification', 2004). The involvement of the private sector can effectively '***decouple***' the provision of electricity from the legal or planning status of a community. Unlike the public sector, the private sector can take risks associated with dealing with settlements that may be subject to eviction, and the research identified examples of local private sector participation. However, there are a number of disadvantages associated with decentralised approaches e.g. efforts to minimise risk associated with network investment result in deep connection charges.

Document produced as an output of a Gamos research project funded by DFID (UK) 2005, KaR R8146

Figure 2 Options for making supplies available in illegal settlements



Recommendations

The following recommendations address how to provide metered supplies in illegal settlements, and how to do so at minimum cost; the main points are summarised in Figure 2.

- Lack of availability of legal supplies is the main barrier to access. The poorest can only gain access to electricity if the **political will to provide services** exist, and appropriate instruments are implemented.
- electricity offers advantages in terms of safety and health – reduced risk of fire, and elimination of hazardous products of combustion (compared with kerosene). It also offers additional improvements in quality of life, principally in terms of lighting and entertainment. On these grounds, the **electrification of low income communities** should be pursued as a **development goal**. In terms of environmental policy, there are, however, negative implications of substituting local combustion of fuels with conversion to electricity in centralised generating plant
- Where households steal electricity, electrification is a means of **converting non-technical losses** to revenue. There is a general willingness to pay for metered electricity amongst those without electricity and those with illegal supplies.
- **regularising the status of informal communities** can permit the introduction of metered connections; this can be done either formally or informally (e.g. through tacit recognition of community).
- The electrification of informal settlements should be stimulated through **statutory requirements** on utilities. However, it is important that these requirements contain a mechanism for achieving shallow connection charges. The cost of investment could be recovered through tariffs, or could underwritten by **guarantees** from government or donors.
- **Relaxing the requirements** for entitlement to metered connections.
- **Use the private sector** to provide electricity in informal communities. This dissociates service provision to an area from its political status, and the private sector is better suited to provide service in high risk situations.
- Network extension should be **financed through the utility**, as it presents a low risk borrower compared with the private sector (especially local, small enterprises), resulting in lower costs.
- **Technical standards** need to be established and enforced to ensure that local distribution networks meet minimum standards of safety and of technical performance (and lower costs).
- Licences should be of **long duration** in order to reduce costs, through use of life cycle cost analysis and lower cost of capital.
- Initiate **public awareness campaigns** aimed at informing consumers on the relative costs and safety implications of fuels, and on raising 'legal awareness' when entering into contracts.
- **Energy conservation measures e.g.** a campaign to disseminate low energy lamps in particular would have the greatest proportional impact on low income households.
- Establishing a **local utility presence** (through decentralised companies) has been effective in devising local solutions to address local conditions.

Study countries and PSP

Since 1994, PN Energy in Khayelitsha has reduced non-payment from around 80% to roughly 5%, and has extended the number of customers from 6,000 to 60,000. The international private sector has a long history of investment in the power sector of the Philippines, resulting in an impressive investment in extending infrastructure. Electricity distribution in Delhi was recently licensed, primarily on the basis of commitments to reduce losses.

DFID

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The research project 'Barriers to access to modern energy in slums' (R8146) was carried out by the following partners:

- Indcare Trust (India)
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- Energy Research Centre (South Africa)
- Halcrow (UK)
- Manchester University (UK)

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Appendix 2

Policy Paper – Utilities

Barriers to access to electricity

Amongst Low-income Urban Communities

– with Recommendations for Utility operators

This paper presents some conclusions and policy recommendations arising from DFID funded research into factors preventing poor, urban households from accessing electricity.

The project gathered data from both households (*demand*) through **household surveys**, and from **local supply utilities** (*supply*) that had developed innovative approaches. Surveys were conducted by local partners in low income communities in Delhi (India), Manilla and Cebu (Philippines), and Khayelitsha township (South Africa).

Electricity and poverty reduction

"Recognising the needs of bottom-of-the-pyramid markets and creating innovative solutions to meet these needs are vital actions from the private sector, both domestic and international".
Unleashing entrepreneurship: making business work for the poor'. Commission on the private sector and development. UNDP 2004.

The greatest barrier facing the poorest is lack of availability of legal connections, especially in illegal settlements. In order to reach these vulnerable households, utilities need to be given the ability to serve illegal communities, and to develop innovative solutions through partnerships .

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Barriers to access to electricity

The conventional view is that the high cost of connecting to infrastructure services presents the most significant barrier to access. The research confirms that connection costs do indeed present a barrier, but it shows that the ***lack of availability of formal connections is much more important*** (see Figure 1, based on survey locations). Where households were entitled to metered supplies, almost all were connected.

Households can be denied legal access for a number of reasons, mostly related to the illegal nature of settlements. In order to extend the benefits of urban electrification to the poorest in society ***it will, therefore, be necessary to find ways of supplying illegal settlements.*** Commercial solutions can be found, but they will ***only be possible where political will exists.***

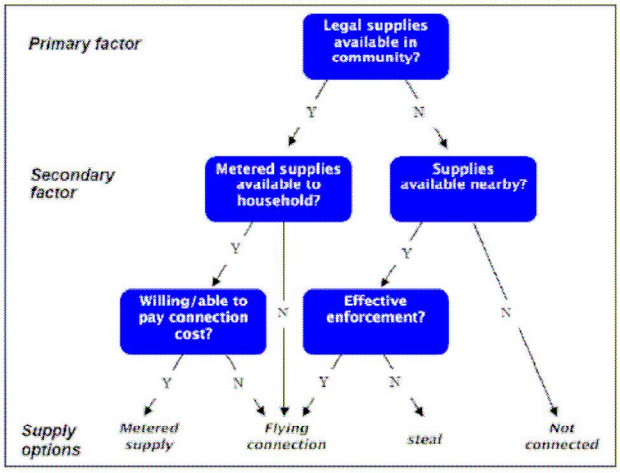

Figure 1 Electricity supply options in low income households

The role of electricity utilities

Opportunities exist for utilities to serve low income customers on a commercial basis. Much work is being done on developing business models to serve '***bottom-of-the-pyramid***' markets, and the research identified high willingness to pay amongst illegal communities. The research highlights a number of ways in which utilities can meet the needs of illegal communities – but only if permitted to do so. Utilities need to lobby regulators to give them a mandate to serve low income communities. Where ability to pay is weak, ***public-private partnerships*** can provide a means of extending services to the poor. Approaches to corporate social responsibility (CSR) are evolving, and multinational companies are developing ways of ***engaging with social development goals.*** Note that although the language of initiatives is targeted at the private sector, most of the principles can also be applied to government owned utilities.

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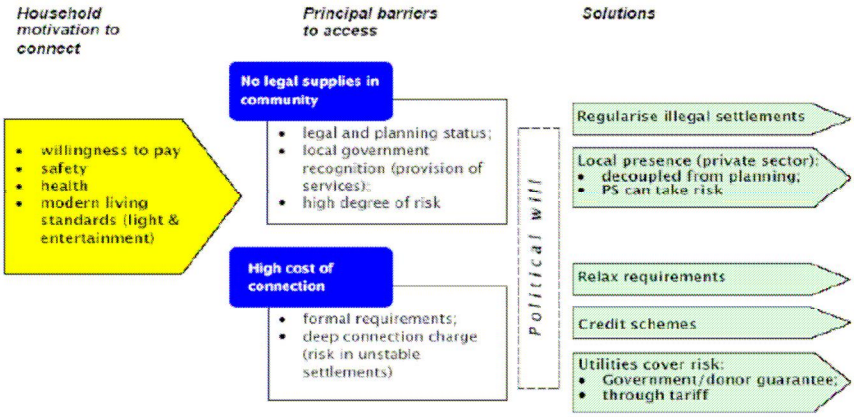
Figure 2 Options for making supplies available in illegal settlements



Recommendations

The following recommendations address how legal supplies can be provided in illegal settlements, and at minimum cost; the main points are summarised in Figure 2.

Lobby government and authorities:

- Where households steal electricity, electrification is a means of **converting non-technical losses** to revenue. There is a general willingness to pay for metered electricity amongst those without electricity and those with illegal supplies.
- Where utilities supply informal settlements (either where obliged to do so, or by commercial choice), there should be provision for achieving shallow connection charges (low initial cost). The cost of investment could be recovered through tariffs, or risk could be underwritten by **guarantees** from government or donors.
- **Relaxing the requirements** for entitlement to metered connections e.g. informally regularising the status of illegal communities.
- Licences should be of **long duration** in order to reduce costs, through use of life cycle cost analysis and lower cost of capital.

Partnerships:

- **Use the private sector** to provide electricity in informal communities. This dissociates service provision to an area from its political status, and the private sector is better suited to provide service in high risk situations.
- Establishing a **local utility presence** (through decentralised companies) has been effective in devising local solutions to address local conditions.
- Community **credit schemes** help customers overcome the high capital cost of connecting to electricity. Local distribution companies should work in partnership with local credit organisations to ensure that customers have access to credit facilities.
- Initiate **public awareness campaigns** aimed at informing consumers on the relative costs and safety implications of fuels, and on raising 'legal awareness' when entering into contracts.

Study countries and PSP

Since 1994, PN Energy in Khayelitsha has reduced non-payment from around 80% to roughly 5%, and has extended the number of customers from 6,000 to 60,000. The international private sector has a long history of investment in the power sector of the Philippines, resulting in an impressive investment in extending infrastructure. Electricity distribution in Delhi was recently licensed, primarily on the basis of commitments to reduce losses.

Utility operation:

- Network extension should be **financed through the utility**, as it presents a low risk borrower compared with the private sector (especially local, small enterprises), resulting in lower costs.
- **Technical standards** need to be established and enforced to ensure that local distribution networks meet minimum standards of safety and of technical performance (and lower costs).

Although the language of initiatives is targeted at the private sector, the principles can also be applied to government utilities.

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Appendix 3

Policy Paper – Civil Society Organisations

Barriers to access to electricity

Amongst Low-income Urban Communities

– with Recommendations for Civil Society Organisations

This paper presents some conclusions and policy recommendations arising from DFID funded research into factors preventing poor, urban households from accessing electricity

The project gathered data from both households (*demand*) through **household surveys**, and from **local supply utilities** (*supply*) that had developed innovative approaches. Surveys were conducted by local partners in low income communities in Delhi (India), Manilla and Cebu (Philippines), and Khayelitsha township (South Africa).

Civil society and electricity service provision

Section IV C. Sustainable human settlements development in an urbanizing world
6. Sustainable energy use
"In order to promote efficient and sustainable energy use, Governments at the appropriate levels, in partnership with the private sector, non-governmental organizations, community-based organizations and consumer groups, should, as appropriate," (etc.)
The Istanbul Declaration and The Habitat Agenda (1996)

The greatest barrier facing the poorest is lack of availability of legal connections, especially in illegal settlements. Civil society organisations can play a role in helping extend services to these households - by lobbying for service, and by working in partnership with utilities to develop innovative solutions.

The role of civil society

One of the greatest challenges facing governments and local authorities is rapid urbanisation. Key issues in sustainable urbanisation in developing countries are poverty alleviation and good governance. Priorities for action are participation of citizens, and capacity building – areas where civil society organisations (CSOs) play a vital role, especially in the current context of decentralisation and strengthening of local authorities. Access to electricity plays a part in lifting the urban poor out of poverty - CSOs can represent the interests of the poor, they can hold service providers to account, and they can play a part in service delivery (private sector – CSO collaborations).

Barriers to access to electricity

The conventional view is that the high cost of connecting to infrastructure services presents the most significant barrier to access. The research confirms that connection costs do indeed present a barrier, but it shows that the *lack of availability of formal connections is much more important* (see Figure 1, based on survey locations). Where households were entitled to metered supplies, almost all were connected.

Households can be denied legal access for a number of reasons, mostly related to the illegal nature of settlements. In order to extend the benefits of urban electrification to the poorest in society *it will, therefore, be necessary to find ways of supplying illegal settlements.* Commercial solutions can be found, but they will *only be possible where political will exists*.

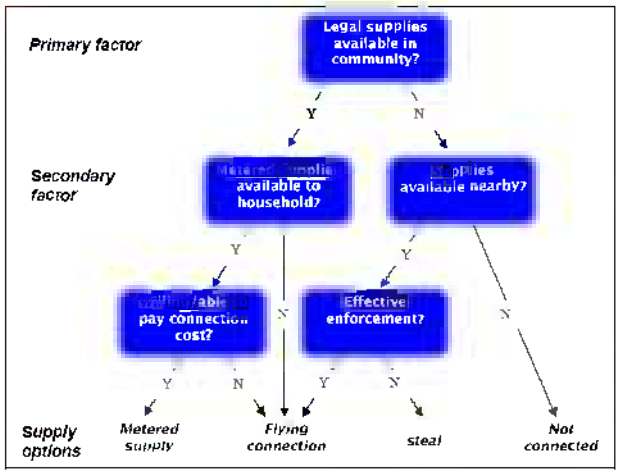
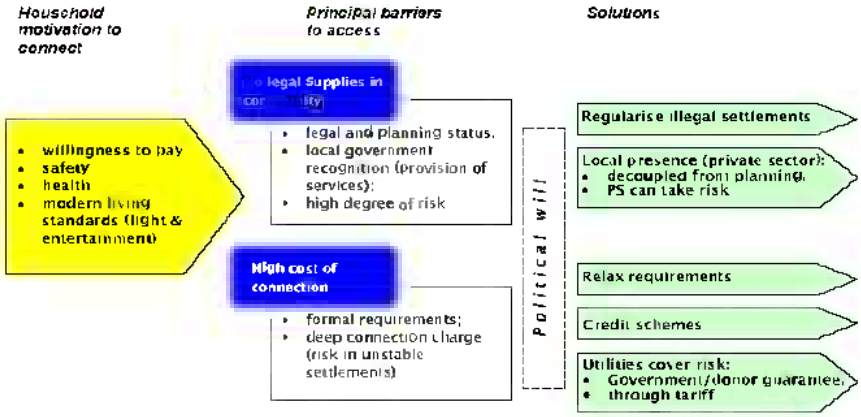


Figure 1 Electricity supply options in low income households

Document produced as an output of a Gamos research project funded by DFID (UK) 2005, KaR R8146

Figure 2 Options for making supplies available in illegal settlements



Recommendations

The following recommendations highlight how CSOs can work with national government (regulators), local authorities, and utilities (including the private sector) to provide access to legal supplies in illegal communities, and at minimum cost, the main points are summarised in Figure 2

Lobby government and authorities

- Lack of availability of legal supplies is the main barrier to access. Utilities need to be permitted to serve illegal areas, and disincentives to serving unstable communities (high risk) need to be removed. This requires political will – CSOs can mobilise communities to apply political pressure.
- Electricity offers safety and health benefits – reduced risk of fire, and elimination of hazardous products of combustion (especially when compared with kerosene). It also offers improved quality of life, principally in terms of lighting and entertainment. The electrification of low income communities should be pursued as a development goal.
- Where households steal electricity, electrification is an effective means of converting these non-technical losses to revenue. There is a general willingness to pay for metered electricity amongst those without electricity and those with illegal supplies.
- regularising the status of informal communities can permit the introduction of metered connections; this can be done either formally or informally (e.g. through tacit recognition of community);
- Establishing a local utility presence (through decentralised private sector companies) has been effective in devising local solutions to local conditions. In the context of evolving liberalisation processes, CSOs need to assess whether the poor are better served by government utilities (often viewed as corrupt) or by the private sector (likely to raise prices), and lobby accordingly.

Study countries and PSP

Since 1994, PN Energy in Khayelitsha has reduced non-payment from around 80% to roughly 5%, and has extended the number of customers from 6,000 to 60,000. The international private sector has a long history of investment in the power sector of the Philippines, resulting in an impressive investment in extending infrastructure. Electricity distribution in Delhi was recently licensed, primarily on the basis of commitments to reduce losses.

Working in Partnerships:

- The electrification of informal settlements needs to include a mechanism for achieving shallow connection charges (low initial cost). CSOs can work with government or donor programmes in the design of mechanisms that minimise risk .
- Community credit schemes help low income customers overcome the high capital cost of connecting to electricity. CSOs and local credit organisations should work in partnership with utilities to ensure that customers have access to credit.
- Initiate public awareness campaigns aimed at informing consumers on the relative costs and safety implications of fuels, and on specific issues (e.g. legal literacy – when entering into contracts); this can be done in partnership with utilities.
- Energy conservation measures e.g. a campaign to disseminate low energy lamps in particular would have the greatest proportional impact on low income households (e.g. in partnership with donors, local authorities, manufacturers etc.).

DFID

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- Indcare Trust (India)
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Appendix 4

Example Questionnaire - Philippines

Energy in Low-Income Urban Communities - PHILIPPINES
R8146 2003

Questionnaire Entry No. _____

I. SURVEY INFORMATION

1. Date of Interview: _____
2. Name of Interviewer: _____
3. Name of Supervisor: _____
4. Name of Respondent: _____
5. Name of Community/Barangay: _____
6. Name of District/City: _____
7. Type of Community (Check one only):
   a) Authorized (Recognized by government): *(1)* _____
   b) Unauthorized (Not recognized by government): *(2)* _____
   c) Resettlement: *(3)* _____

II. HOUSEHOLD INFORMATION:

8. Information on all persons currently living in the household:
   (Fill in each column with the appropriate code for each HH member)

ID	Gender	Relationship to HH Head	Age	Educational Attainment	Main Occupation	Employment	Mark X HH Head	Mark X Respndnt
	Male: 1 Female: 2	Head: 1 Spouse: 2 Son/Daughter: 3 S/D-in-law: 4 Grandchild: 5 Parent: 6 Brother/Sister: 7 Parent-in-law: 8 B/S-in-law: 9 Others: 10		None/Non-formal: 1 Elementary: 2 Secondary: 3 Some College: 4 College Grad: 5	Professional: 1 Teaching: 2 Business: 3 Admin/Mgmt: 4 Skilled/Tech'l: 5 Semi-skilled: 6 Unskilled/Labor: 7 Student: 8 Housewife: 9 Unemployed: 10 Pre-school: 11	Full: 1 Part-time: 2 Occasional: 3		
01								
02								
03								
04								
05								
06								
07								
08								
09								
10								
11								
12								

9. Do members of your immediate family live abroad (parents/siblings/children/grandchildren)?
   a) Yes: ***(1)*** _____
   b) No: ***(2)*** _____

III. HOUSING:

10. What type of house do you have? *(Do not ask; just observe and check box.)*

Wood ***(1)***	Semi-concrete ***(2)***	Concrete ***(3)***	Others ***(99)***
			(Describe: _____)

11. How many rooms are in your house? (Separated by solid walls, not by curtains): _____

12. What is the size of the house? *(Do not ask, observe and check box representing your observation.)*

Small (3x3 m) ***(1)***	Medium (4x4 m) ***(2)***	Large (5x5 m & above) ***(3)***

13. Is your house rented or owned? *(Check one only)*

Rented ***(1)***	Owned ***(2)***

14. Is your house recognized by the government or not?

Recognized (legal) ***(1)***	Not recognized (illegal) ***(2)***

15. How long have you lived in this house? (no. of years): _____

16. Under what circumstances did you move to this site? *(Check one only)*

Voluntary Choice ***(1)***	Involuntary resettlement ***(2)***	Eviction ***(3)***	Marriage ***(4)***	Always lived here ***(5)***	Other reason ***(6)*** (specify)

Other specified reason: _____

17. Have you experienced demolition or attempted eviction in this site?

Yes ***(1)***	No ***(2)***

If yes, indicate how many times have they been evicted from their current home: _____

18. How long do you think you will be permitted to stay in this house? *(Check one only)*

Less than one year ***(1)***	1-2 years ***(2)***	3-5 years ***(3)***	More than 5 years ***(4)***

19. How likely is it that you will be forced to leave this house? *(Check one only.)*

Very unlikely ***(-2)***	Unlikely ***(-1)***	No opinion ***(0)***	Likely ***(+1)***	Very likely ***(+2)***

IV. ELECTRICITY CONNECTION

20. Is it possible to get a metered supply of electricity in this neighborhood? (*Check one only*.)

Yes ***(1)***	No ***(2)***	Don't Know ***(3)***

21. How easy or difficult is it for you to meet the requirements to get a legal electricity
connection? *(Check one only.)*

Very difficult ***(-2)***	Difficult ***(-1)***	Don't know ***(0)***	Easy ***(+1)***	Very easy ***(+2)***

22. How easy or difficult are these requirements to overcome? *(Check one only.)*

Very difficult ***(-2)***	Difficult ***(-1)***	Don't know ***(0)***	Easy ***(+1)***	Very easy ***(+2)***

23. If difficult, please explain what are the most difficult issues?
(List maximum of 3 – in order of importance)
1. _____
2. _____
3. _____

24. How willing would you be to pay for the legal supply? *(Check one only.)*

Very opposed ***(-2)***	Opposed ***(-1)***	No opinion ***(0)***	Willing ***(+1)***	Very willing ***(+2)***

25. What are the disadvantages of a legal supply?
(List maximum of 3 – in order of importance)
1. _____

2. _____
3. _____

26. What are the advantages of a legal supply?
(List maximum of 3 – in order of importance)
1. _____
2. _____
3. _____

27. Who do you think is the better provider of electricity supply – private company or government? (Check one only)

Private Company (1) _____
Government (2) _____

27.a. Please state reasons. *(List maximum of 3 – in order of importance)*
1. _____
2. _____
3. _____

28. Do you agree that access to electricity should be only for those who can afford it? *(Check one only.)*

Strongly disagree (-2)	Disagree (-1)	No opinion (0)	Agree (+1)	Strongly agree (+2)

29. Do you agree that getting a connection to your house is your responsibility rather than a community responsibility? *(Check one only)*

Strongly disagree (-2)	Disagree (-1)	No opinion (0)	Agree (+1)	Strongly agree (+2)

30. Who would you approach to get a supply of electricity for your house (legal or illegal)?

Get an illegal supply: _____

Get a legal supply: _____

31. How strongly do you agree or disagree that having strong relationships with the community is essential to get an electricity connection? *(Check one only)*

Strongly disagree ***(-2)***	Disagree ***(-1)***	No opinion ***(0)***	Agree ***(+1)***	Strongly agree ***(+2)***

32. Which of the following personalities are the most effective in getting an electrical connection to your household? *(Indicate the 3 most effective – i.e., 1 = most effective, 2 = second, 3 = third)*

Personality	Rank
Relative (incl. family mbr)	
Neighbor	
Community organization	
Political/Community leader	
City official	
Utility/Company	

33. For each of the following personalities, could you indicate:

a) How supportive would each be toward you making a legal connection?

(Ask the question for each personality and fill in the code (Code a) which represents the degree of support.)

b) How motivated would you be to take the advice of each regarding electricity connections? *(Ask the question for each personality and fill in the code (Code b) which represents the degree of motivation.)*

Code a			***Code b***		
Very opposed	=	*1*	*Very opposed*	=	*1*
Opposed	=	*2*	*Opposed*	=	*2*
Undecided	=	*3*	*Undecided*	=	*3*
Supportive	=	*4*	*Supportive*	=	*4*
Very supportive	=	*5*	*Very supportive*	=	*5*

Personality	***a) supportive***	***b) motivation***
Relative		
Neighbour		
Community organisation		
Community leader		
Political leader		
City official		
Utility / Company		

34. What type of electricity connection do you have? *(Check one only)*

Not connected ***(0)***	Illegal ***(1)***	Flying ***(2)*** (fed from another meter)	Metered ***(3)***

If <u>not</u> connected

35. How strongly do you intend to connect your house to an electrical supply in the next year? *(Check one only.)*

Very weak ***(-2)***	Weak ***(-1)***	No opinion ***(0)***	Strong ***(+1)***	Very strong ***(+2)***

If <u>not</u> connected to any electrical supply, skip to Question 44.

If connected to an illegal or flying connection, answer Question 36.

36. How strongly do you intend to connect your house to a metered electrical supply in the next year? *(Check one only)*

Very weak ***(-2)***	Weak ***(-1)***	No opinion ***(0)***	Strong ***(+1)***	Very strong ***(+2)***

If connected (metered or flying), answer Questions 37-43.

37. For how long have you had electricity in your home? No. of years: _____

38. Who in the household made the decision to get the connection (Table 1)?
_____

39. How much did you pay to get a connection (NOT including internal wiring)?
_____

40. How much did the household wiring cost? _____

41. Where did you get the money to get a connection? *(Check appropriate <u>box or boxes</u>)*

Relative	
Neighbour	
Community credit scheme	
Money lender	
Bank	
Own savings	

42. Who installed the wiring INSIDE your house? *(Check appropriate <u>box or boxes</u>)*

HH member ***(1)***	*Unskilled other* ***(2)***	*Professional* ***(3)***	*Don't know* ***(4)***

43. How many households (including yours) are supplied from your supply?
_____

V. HOUSEHOLD ENERGY USE

44. For each of the following household activities which is your main source of energy / fuel and
where appropriate, which is your secondary source of energy / fuel?
(Note in each column the main and second fuels used)
(Code: main source of energy / fuel = 1, second source of energy / fuel = 2)

	ACTIVITY	Cooking	Room heating	Water heating	Room cooling	Lighting	Entertain-ment	Ironing	Clothes washing	Refrige-ration	Home business
1	Electricity										
2	Gas										
3	Kerosene										
4	Wood										
5	Cow dung										
6	Coal										
7	Charcoal										
8	Candles										
9	Dry cells										

If other, please specify: _____

45. Have you changed your main fuel for cooking while you have been in your present house?

(Write in each response box the appropriate coded response)

(a) Changed main fuel for cooking?	(b) What fuel did you use before?
Code: *Yes = 1* *No = 2*	*Code:* *1 electricity* *6 coal* *2 gas* *7 charcoal* *3 kerosene* *8 candles* *4 wood* *9 dry cells* *5 cow dung*
Response:	Response:

Ask question 46 only if they have changed their main cooking fuel

46. If you changed type of fuel, why did you change from what you were using before for cooking?

You have changed because it is?	
Code:	
1 More efficient	*5 Accessible*
2 Economical	*6 Affordable*
3 Less polluting	*7 Other reason*
4 Convenient	*(Specify)*
Response: _____ Other reason: _____	

47. Given the choice, which would be your preferred choice of fuel for each activity? (*Enter only one fuel code for each activity*)?

Code:

1 Electricity	*6 coal*
2 gas	*7 charcoal*
3 kerosene	*8 candles*
4 wood	*9 dry cells*
5 cow dung	

Cooking	Space heating	Water heating	Space cooling	Lighting	Entertain-ment	Ironing	Clothes washing	Refrige-ration	Home scale business

48. Consumption and cost of most important fuels:
(Ask questions a, b, and c and note the responses against each type of fuel)

	(a) How much do you use in a month on average of each fuel type? (e.g. kwhs)	(b) How much do you spend in a month on average for each type of fuel? (in Pesos)	(c) Who do you pay for fuel? *Code:* *Company…… 1* *Local shop / merchant... 2* *Neighbour…… 3* *Payment Center …. …… 4* *No payment…… 5*
Electricity	Kwhs:		
Gas	Kilograms:		
Kerosene	Liters:		
Wood	Kilograms:		
Cow dung	Cakes:		

49. Who is the main decision maker regarding purchase of fuels in your household?
(See Table 1: Household Information for codes) _____

50. What appliances do you have in your house?

(Ask questions a, b, and c and note the responses against each type of appliance)

	(a) How many do you have?	(b) Is it regularly used?	(c) Working or broken?
		Yes = 1; No = 2	*working = 1, broken = 2*
Electric stove – 4 plate			
Electric stove – 2 plate			
Electric stove – 1 plate			
Electric oven			
Rice Cooker			

Gas stove			
Kerosene stove			
Kerosene stove - pressurized			
Wood stove			
Light tubes			
Light bulbs			
Compact fluorescent lamps			
Radio			
TV			
Video (VHS/VCD/DVD)			
Music system/Karaoke			
Cooler			
Fan			
Air conditioning			
Refrigerator			
Iron			
Washing machine			
Immersion rods (water heaters)			
Space heater			
Gas lamps			
Kerosene lamps			
Other appliances – domestic (*specify*)_____			
Other appliances – for business use (*specify*)_____			

51. Business activities in the house. *(Ask questions b and c if they have business in their homes - write in the appropriate code or responses in each box)*

(a) Do you run any business activities in your house? *Code:* *Yes = 1* *No = 2*	(b) Type of business, if yes?	(c) Types of fuel used in business? *Code:* *1 Electricity* *6 coal* *2 gas* *7 charcoal* *3 kerosene* *8 candles* *4 wood* *9 dry cells* *5 cow dung*
Response (a):	Response (b):	Response (c):

52. How would you reduce the cost of cooking? *(Indicate the methods mentioned)*
1

_____

2

_____

3

_____

53. How would you reduce the cost of lighting? *(Indicate the methods mentioned)*
1
._____
2
_____
3
_____

VI. FUEL PREFERENCES

(Ask these questions of all respondents, whether they use the fuel or not)

54. What is the main advantage of using electricity? *(List in order of importance)*
1 _____
2 _____
3 _____

55. What is the main disadvantage of using electricity*? (List in order of importance)*
1 _____
2 _____
3 _____

56. What are the main problems faced regarding getting connected? (List in order of importance)
1 _____
2 _____
3 _____

57. What is the main advantage of using gas? (List in order of importance)
1 _____
2 _____
3 _____

58. What is the main disadvantage of using gas? (List in order of importance)
1 _____
2 _____
3 _____

59. What is the main advantage of using kerosene? (List in order of importance)
1 _____
2 _____
3 _____

60. What is the main disadvantage of using kerosene? (List in order of importance)
1 _____
2 _____
3 _____

61. What is the main advantage of using wood? (List in order of importance)
1 _____

2 _____
3 _____

62. What is the main disadvantage of using wood? (List in order of importance)
1 _____
2 _____
3 _____

63. What is the main advantage of using cow dung? (List in order of importance)
1 _____
2 _____
3 _____

64. What is the main disadvantage of using cow dung? (List in order of importance)
1 _____
2 _____
3 _____

In the following scales, Questions 65 to 91, check only one box on each

Electricity

65. How would you rate the accessibility of electricity? (e.g. how easy it is to buy, is it available locally, when you want it etc.)

Very poor ***(-2)***	Poor ***(-1)***	No opinion ***(0)***	Good ***(+1)***	Very good ***(+2)***

66. How efficient do you feel electricity is?

Very inefficient ***(-2)***	Inefficient ***(-1)***	No opinion ***(0)***	Efficient ***(+1)***	Very efficient ***(+2)***

67. How economical is it to use electricity?

Very expensive ***(-2)***	Expensive ***(-1)***	No opinion ***(0)***	Cheap ***(+1)***	Very cheap ***(+2)***

68. How polluting is electricity?

Very polluting ***(-2)***	Polluting ***(-1)***	No opinion ***(0)***	Clean ***(+1)***	Very clean ***(+2)***

69. How convenient is it to use electricity?

Very inconvenient ***(-2)***	Inconvenient ***(-1)***	No opinion ***(0)***	Convenient (+***1)***	Very convenient ***(+2)***

70. How safe is it to use electricity?

Very dangerous ***(-2)***	Dangerous ***(-1)***	No opinion ***(0)***	Safe ***(+1)***	Very safe ***(+2)***

71. How satisfied are you with your electricity supply to power all the equipment you need to use?

Very unsatisfactory ***(-2)***	Unsatisfactory ***(-1)***	No opinion ***(0)***	Satisfactory ***(+1)***	Very satisfactory ***(+2)***

72. How reliable is your electricity supply?

Very unreliable ***(-2)***	Unreliable ***(-1)***	No opinion ***(0)***	Reliable ***(+1)***	Very reliable ***(+2)***

73. How would you rate the procedures for paying for your electricity? (both legal and illegal)

Very unsatisfactory ***(-2)***	Unsatisfactory ***(-1)***	No opinion ***(0)***	Satisfactory ***(+1)***	Very satisfactory ***(+2)***

Gas

74. How would you rate the accessibility of gas? (e.g. how easy it is to buy, is it available locally, when you want it etc.) *(Check one only)*

Very poor ***(-2)***	Poor ***(-1)***	No opinion ***(0)***	Good ***(+1)***	Very good ***(+2)***

75. How efficient do you feel gas is?

Very inefficient ***(-2)***	Inefficient ***(-1)***	No opinion ***(0)***	Efficient ***(+1)***	Very efficient ***(+2)***

76. How economical is it to use gas?

Very expensive ***(-2)***	Expensive ***(-1)***	No opinion ***(0)***	Cheap ***(+1)***	Very cheap ***(+2)***

77. How polluting is gas?

Very polluting ***(-2)***	Polluting ***(-1)***	No opinion ***(0)***	Clean ***(+1)***	Very clean ***(+2)***

78. How convenient is it to use gas?

Very inconvenient ***(-2)***	Inconvenient ***(-1)***	No opinion ***(0)***	Convenient (+***1)***	Very convenient ***(+2)***

79. How safe is it to use gas?

Very dangerous ***(-2)***	Dangerous ***(-1)***	No opinion ***(0)***	Safe ***(+1)***	Very safe ***(+2)***

Kerosene

80. How would you rate the accessibility of kerosene? (e.g. how easy it is to buy, is it available locally, when you want it etc.) *(Check one only)*

Very poor ***(-2)***	Poor ***(-1)***	No opinion ***(0)***	Good ***(+1)***	Very good ***(+2)***

81. How efficient do you feel kerosene is?

Very inefficient ***(-2)***	Inefficient ***(-1)***	No opinion ***(0)***	Efficient ***(+1)***	Very efficient ***(+2)***

82. How economical is it to use kerosene?

Very expensive ***(-2)***	Expensive ***(-1)***	No opinion ***(0)***	Cheap ***(+1)***	Very cheap ***(+2)***

83. How polluting is kerosene?

Very polluting ***(-2)***	Polluting ***(-1)***	No opinion ***(0)***	Clean ***(+1)***	Very clean ***(+2)***

84. How convenient is it to use kerosene?

Very inconvenient ***(-2)***	Inconvenient ***(-1)***	No opinion ***(0)***	Convenient (+***1)***	Very convenient ***(+2)***

85. How safe is it to use kerosene?

Very dangerous ***(-2)***	Dangerous ***(-1)***	No opinion ***(0)***	Safe ***(+1)***	Very safe ***(+2)***

Wood

86. How would you rate the accessibility of wood? (e.g. how easy it is to buy, is it available locally, when you want it etc.) *(Check one only)*

Very poor ***(-2)***	Poor ***(-1)***	No opinion ***(0)***	Good ***(+1)***	Very good ***(+2)***

87. How efficient do you feel wood is?

Very inefficient ***(-2)***	Inefficient ***(-1)***	No opinion ***(0)***	Efficient ***(+1)***	Very efficient ***(+2)***

88. How economical is it to use wood?

Very expensive ***(-2)***	Expensive ***(-1)***	No opinion ***(0)***	Cheap ***(+1)***	Very cheap ***(+2)***

89. How polluting is wood?

Very polluting ***(-2)***	Polluting ***(-1)***	No opinion ***(0)***	Clean ***(+1)***	Very clean ***(+2)***

90. How convenient is it to use wood?

Very inconvenient ***(-2)***	Inconvenient ***(-1)***	No opinion ***(0)***	Convenient (***+1)***	Very convenient ***(+2)***

91. How safe is it to use wood?

Very dangerous ***(-2)***	Dangerous ***(-1)***	No opinion ***(0)***	Safe ***(+1)***	Very safe ***(+2)***

92. Indicate how important to you are the following issues when thinking about the type of energy / fuel to use:

(Read each issue and ask the responded to indicate the importance, check one box per issue)

Issues	Not at all important ***(1)***	Not important ***(2)***	Important ***(3)***	Very important ***(4)***	No opinion ***(0)***
Accessibility					
Efficiency					
Cost					
Pollution					
Convenience					
Safety					

VII. PROBLEMS WITH ELECTRICAL SUPPLIES

93. Of the following list of problems could you indicate if any of these have occurred in your house in the past 6 months, the frequency of that occurrence and which of these are the three biggest problems to you?

(Ask questions a, and then questions b and c if the problem has occurred. Place the appropriate codes against each problem)

Problems	(a) Has the problem occurred in the past 6 months? *Code:* *Yes = 1* *No = 2*	(b) How often has it occurred? *Code:* *Once or twice = 1* *Frequently = 2* *Very frequently = 3* *All the time = 4*	(c) Which are the three biggest problems of these? *(Read list of problems and note which ones in order of importance)* *Code:* *Biggest = 1* *Second = 2* *Third = 3*
1. Only have power part of the time			
2. The supply becomes too weak to run the appliances (e.g. fans)			
3. Appliances have fused due to surges in the electrical supply			
4. Connecting wires have been stolen			
5. Officials have cut the wires			
6. Officials have asked for bribes so as not to cut the supply			
7. Members of the household have had electrical shocks			
8. Have had a fire in the house due to electricity			

VIII. EXPENDITURE AND INCOME

94. ***Household expenditure****: How much do you spend in a month on average on each of the following?*

Expenditures	Average monthly spending (In Pesos)
Housing (e.g. rent, repairs, improvements)	
Food	
Transport	
Debt payments (e.g. paying back loans, credit payments)	
Education	
Clothing	
Entertainment (movies/video rentals/music tapes/discs, park, etc.)	
Electricity/Gas/Fuel	
Religious/Charity contributions	
Telephone	
Water & sanitation	
Other major expenditure: _____	

95. **Earned income**: Which household members contribute to household income, and what is the total average monthly amount that they contribute?
(Indicate who are the main income earners contributing to the household income, the average monthly income of each and frequency of payment)

(a) Income earners: (State who they are)	(a) How much per month? (In Pesos) *Less than 1,000 ……..1* *1,000 – 2,000 ……..2* *2,001 – 4,000 ……..3* *4,001 – 6,000……..4* *6,001 – 10,000……..5* *More than 10,000 …….6*	(c) Frequency of payment? *Monthly ……..1* *Semi-monthly….2* *Weekly……..3* *Irregular ……..4*
1		
2		
3		
4		
5		

96. What is the average monthly income received from the following sources by the household?

Types of income	How much? (In Pesos) *None……..0* *Less than 1,000……1* *1,000 – 2,000 ……2* *2,001 – 4,000……3* *4,001 – 6,000……4* *6,001 – 10,000……5* *More than 10,000……6*
Senior citizens pension	
Widows pension	
Grants (e.g. caste / tribes)	
Disability grants	
Rental income	
Gifts from family members	
Other (specify): _____	

Ask Questions 97 and 98 if relevant to the household context

97. Have you received any information on electricity use e.g. leaflets, visit from official.

(Yes = 1, No = 2) _____

98. If you have received information on how to use electricity (e.g. management and safety) from whom or where did you receive it?

_____
_____

THANK THE RESPONDENT.

Any other observations:

Appendix 5

Electricity supply to unplanned settlements: an analysis of associated financial risks and alternative risk management strategies

(by Dr. Jospeh Mutale, and Prof. Goran Strbac)

1 Background

This paper explores alternative approaches to making electricity supply available to unplanned settlements clustered around urban areas in developing countries in a sustainable and cost effective manner. The rationale for striving to electrify these communities which invariably tend to be poor is the widely acknowledged fact that electricity plays an important role in the general development of such communities and hence in reducing poverty. There are many well documented challenges in bringing development to poor people in unplanned settlements where there tends to be a general lack of services be it clean water, waste management, roads, healthcare or schools. Often the standard of shelter is also poor having been constructed without reference to any formal standards or approval process. The uncertainty often associated with these communities is an added complication to planning for service delivery.

In this paper we focus on the financial risks associated with electricity supply to unplanned settlements in urban areas and discuss innovative ways of spreading the risk associated with such undertakings. We use as an example the case of supply to 500 hutments in Delhi to discuss some of the issues concerning alternative arrangements for cost effective supply of electricity to these areas. The paper concludes with a list of general recommendations and suggestions for further work.

2 Review of financial risks associated with electricity supply to unplanned settlements

The many challenges associated with electricity supply to unplanned settlements are well documented. Some of the critical ones include the following:

- Lack of order (complicates service delivery, debt collection due to absence of proper streets/street names and convenient access by truck)
- Safety - poor standard of structures and lack of awareness of dangers of electricity
- Theft of electricity and non-payment of bills
- Limited degrees of freedom for service delivery – supply by under ground cable may not practical due to lack of space
- Risk of demolition of settlement and uncertain customer base could lead to stranded assets

In many ways the issues concerning supply to slum dwellers are related to the allocation of financial risk between the slum dweller, the electricity supplier and the Government. The level of risk carried by the developer or utility has an impact on the ultimate cost of supply to the customer as do the nature of arrangements for extending supply. It is therefore important to understand the nature of these risks and how they may be allocated so as to minimise the cost of electricity supply to the customer. It is also equally important to appreciate the consequences of policy decisions on matters such as the party responsible for borrowing the

capital to finance the required infrastructure, ownership of the infrastructure as well as long-term operation and maintenance responsibility. To start with we examine the perceptions of risk from customer and utility perspectives and also from the point of view of Governments. We then go on to discuss in the following section alternative propositions for allocating the risk under different arrangements for provision of supply to unplanned dwellings.

The customer perspective

The customer is primarily interested in receiving a good quality electricity supply at an affordable price and to pay a low connection charge. This implies that the risk for investment in the electricity delivery infrastructure would be carried primarily by the utility/developer. It should be noted however that customers in unplanned settlements are generally perceived to be high risk and not credit worthy by utilities. The reasons for this perception include the fact these customers are generally poor with low disposable incomes and furthermore they tend to be difficult to pursue for debt recovery. This is in contrast to customers in developed countries or in well-planned areas in developing countries who are regarded in a much more favourable light because they are easier to deal with and are credit worthy (low risk customers). Fewer numbers of customers in this latter category would default on bill settlement. These issues and how they impact connection charges are discussed further below under utility/developer perspectives.

The Utility/developer perspectives

The developer or the utility would wish to minimise financial risk exposure when extending supply to an unplanned settlement. This is in a way understandable given the risks involved as set out above. The tendency therefore would be for the utility to recover the investment in the supply infrastructure upfront. This is clearly a problem for customers as they may not be able to afford the full cost as a single lump sum payment. This approach to charging for access or connection is commonly referred to as a deep connection charge policy as it recovers all elements of costs from the main cable right up to the cable supplying the individual house.

An alternative charging structure could be applied in which the customer only pays for the cable supplying their house with the rest of the capital investment being converted into a use of system charge, which can be recovered as part of the ongoing electricity charge. This approach is referred to as a shallow connection charge policy.

In general a deep connection charge policy is a barrier to access whereas a shallow connection charge would encourage more connections purely from the point of view of affordability.

The role of Government

In terms of risk, it is obvious that a shallow connection charge policy transfers the risk from the customer to the utility or developer. The Government could mitigate this risk (through appropriate regulation) by undertaking to allow revenue recovery from other customers should the slum customer disappear. This underscores the need for Government involvement in the issues related to service delivery to unplanned settlements. Without appropriate guarantees for revenue recovery, it is extremely difficult to expect the utility let alone the private sector developers to accept a shallow connection charge policy because the risks would be too high; the ultimate risk being that of demolition of the unplanned settlement.

3 Alternative risk allocation strategies under different arrangements for electricity supply to unplanned settlements

It is now generally accepted that involving the private sector in the provision of electricity could accelerate the rate of electrification. The level of involvement can vary from construction to operation and maintenance. In order to meet the requirement for private sector participation or indeed other forms of arrangement other than through the utility innovative ways of managing the risk would be needed. In general it would be desirable to retain the technical responsibility for design, installation and operation under the utility (or other independent regional/national agency) as this safeguards the public interest and ensures consistency of standards. Appropriate regulation and standards enforcement would have to be instituted as well. Of course appropriate standards would have to be developed as these can have an impact on cost of supply. For example international standards (BS or IEC) would be more costly to adhere to than local ones and could even be inappropriate for the local environment.

Commercial responsibility for billing and debt collection can be delegated to any entity that is best placed to perform the task. This could include local civic organisations such as co-operatives.

The following issues would be pertinent when contemplating the involvement of the private sector and other non-utility entities in the supply of electricity to unplanned settlements:

- Cost of borrowing would be higher for non-utility organisations due to lower credit worthiness compared to the utility. This leads to high cost of electricity in general and the connection charge in particular.
- Private sector has short-term focus and looks for a quick return (say in 5 years). This leads to higher costs in general and hence high cost of electricity.
- Life cycle cost analysis should be the preferred method for assessing project cost. However this tends to produce higher initial costs which private enterprises with a short-term focus are not keen on.
- In the absence of strict standards, the private sector may seek inexpensive solutions that may not be cost effective in the long term (from life cycle cost perspective). For example preference for cheap transformers producing high losses instead of more expensive transformers with lower losses but with lower life cycle cost.
- Trust – communities might not trust non-utility companies to supply them with electricity
- Who owns and operates the infrastructure and what happens if the private company collapses/moves on? Experience in the UK where some housing associations and developers provide electrical services to new housing estates without the involvement of the utility have proved to be fraught with difficulties after the contractor moves as no one is left to attend to electrical problems inside the housing estate. The utility maintains clear demarcation, which excludes problems in the compound. It is therefore important to define upfront the areas of responsibility and any recourse in the event of problems.

It is clear that the involvement of the private sector in supply of electricity to unplanned settlements would have to be accompanied by strong Regulation and standards so as to guard against the adoption of least cost designs that are likely to be costly in the long-term.

At the same time it will be important to come up with innovative financing schemes to minimise the overall cost of borrowing which is certain to be higher for non-utility players whose risk profile is likely to be perceived as being higher by Bankers.

4 Review of specification for the 500 dwelling installation in Delhi (done by private contractor)

Review of technical specification

The schematic diagram shown in Figure 9 depicts the supply arrangements for the 500 hutments in a part of Delhi derived from the bill of quantities provided by the Contractor. It should be noted that this is our best guess of how the supply would be configured on the basis of available information.

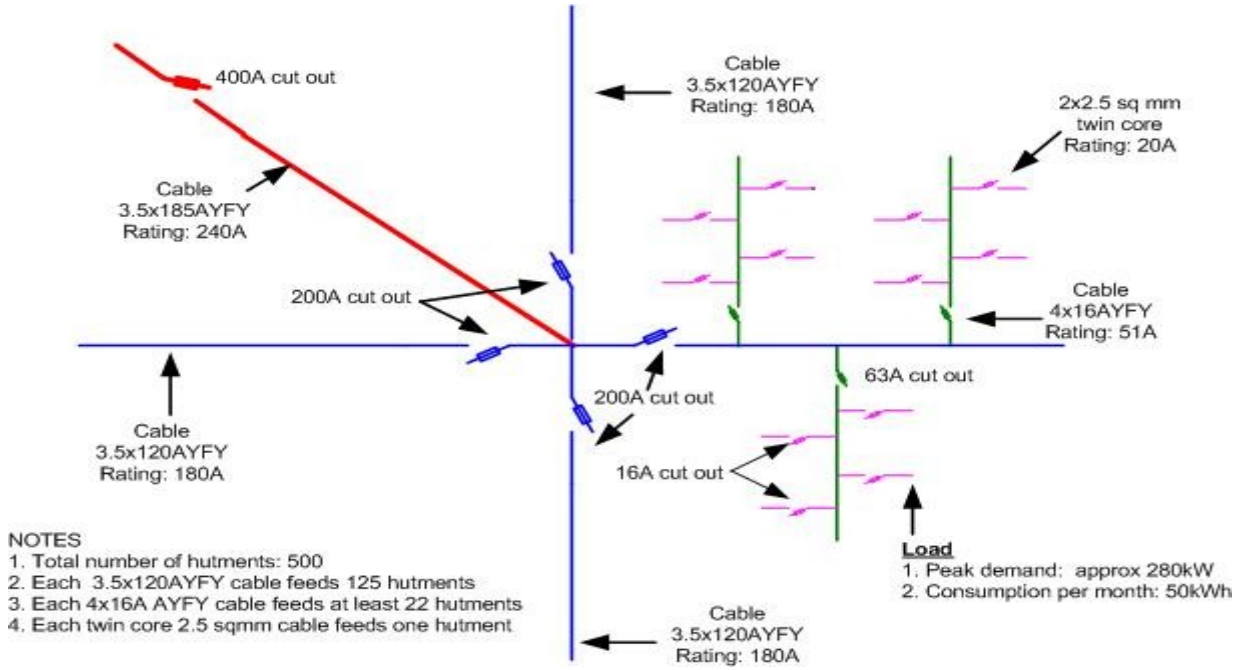


Figure 9 Schematic diagram of supply to 500 hutments in Delhi

The cable ratings are have been obtained from manufacturers data sheets assuming the cables are all strung in air at an ambient temperature of 40°C.

In the absence of definite load data we have assumed a very low initial consumption equal to an average of approximately 50kWh per month. The loads assumed for each household are given in Table 1 and consist of a fan and a fridge (due to very hot weather), lighting, a radio and a television set (TV). The associated hours of use for each appliance are also shown. The appliances chosen should reflect the likely energy use patterns in a given environment. In this example cooking and water heating are not considered priorities for electrical energy use. This is borne out by the conclusions of the study of load profiles obtained from slum, resettlement and unauthorised communities in Delhi. The study draws the following key conclusions:

1. *In slum areas, where people have access to readily available electricity supply, albeit illegal, there is significant use of electricity for cooking. Note electricity is dominant energy source for water heating and for space heating (although the heating season is short).*

2. *Analysis of the unauthorised community will show most reliably how people will manage electricity when metered i.e. no use for cooking and only minimal use for water and space heating.*

As expected in slum areas where electricity is not metered and theft is prevalent there is less judicious use of electricity.

It is important to note that in other countries or even regions in the same country energy use patterns could be very different.

In a normal planning process it is important to take seasonal variations in demand into account. In this example seasonal variations have been neglected. The justification for this is simply that Delhi is located in an equatorial area where the climate is almost unchanging resulting in fairly constant electricity demand throughout the year.

Table 4 Power consumption of expected loads

Type	Appliance Typical rating (W)	Current (A)	Diversified Maximum Demand (W)	Current (A)	Hours of use per day	Monthly Consumption (kWh)
Fan	60	0.25	40	0.17	10	12.00
Fridge	200	0.83	25	0.10	24	18.00
Lighting	150	0.63	90	0.38	5	13.50
Radio	10	0.04	5	0.02	10	1.50
TV	60	0.25	35	0.15	5	5.25
Total	**480**	**2.00**	**195**	**0.81**		**50.25**

The information in Table 4 was used to derive the group hourly peak load data in Table 5 and the group daily load profile shown in Figure 10. Note that the group hourly peak demand was obtained by multiplying the sum of diversified maximum demand for each hour by 500, the total number of hutments.

Table 5 Hutment daily load profile

Time of day	Diversified demand (W)					Group Hourly Peak
(hr)	Fridge	Fan	Lighting	Radio	TV	Demand (kW)
1	25	0	0	0	0	12.5
2	25	0	0	0	0	12.5
3	25	0	0	0	0	12.5
4	25	0	0	0	0	12.5
5	25	0	0	0	0	12.5
6	25	0	0	7.5	0	16.25
7	25	0	0	7.5	0	16.25
8	25	0	0	7.5	0	16.25
9	25	0	0	7.5	0	16.25
10	25	0	0	7.5	0	16.25
11	25	40	0	7.5	0	36.25
12	25	40	0	0	0	32.5
13	25	40	0	0	0	32.5
14	25	40	0	0	0	32.5
15	25	40	0	0	0	32.5
16	25	40	0	7.5	0	36.25
17	25	40	0	7.5	40	56.25
18	25	40	90	7.5	40	101.25
19	25	40	90	0	40	97.5
20	25	40	90	0	40	97.5
21	25	0	90	0	40	77.5
22	25	0	90	0	40	77.5
23	25	0	90	7.5	0	61.25
24	25	0	0	0	0	12.5

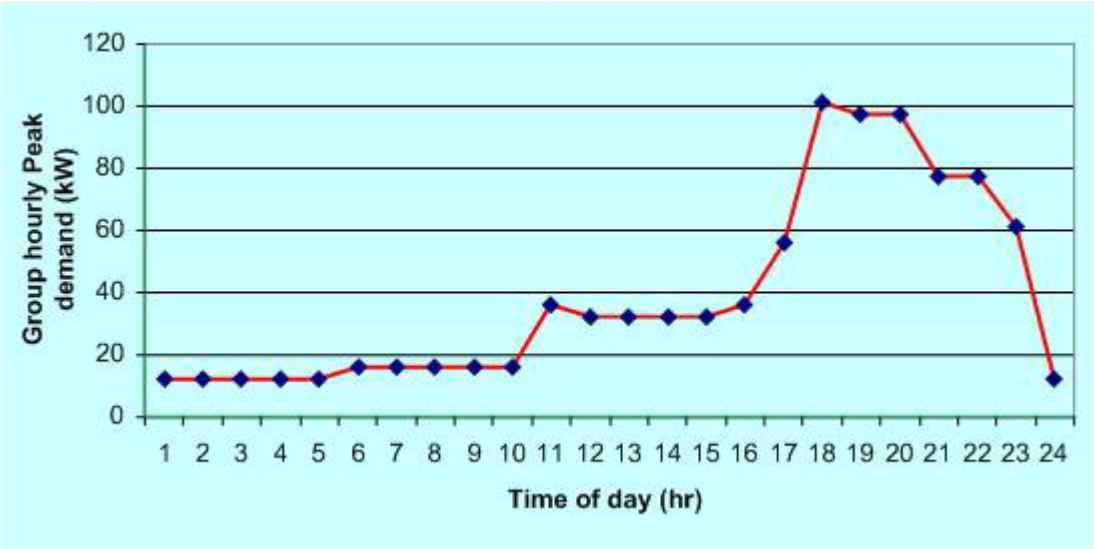


Figure 10 Daily load curve for each hutment

The main supply cable rating of 240A is equivalent to a power rating of 172.5kW assuming unity power factor and a line voltage of 415V (N.B. $P = \sqrt{3}V_L I_L Cos\phi$ for a three phase supply and $P = VpIpCos\phi$ for single phase supply where the subscripts L and P denote line and phase quantities respectively). Comparing the rating of the main supply cable (172.5kW) to the diversified peak demand for the group (101.25kW – from Table 4) confirms that the cable is adequately rated for this load. Neglecting technical losses, there is a margin of 71.25kW for

load growth before the cable becomes overloaded. However looking at the rating of protective cut outs (400A) the cable would be able to carry up to 287kW, which is more than two and half times the total simultaneous peak load. The rest of the cable ratings are well above the assumed loads. For example, the 2.5sqmm cable supplying individual units can support 20A, which is significantly above the peak current of 2.0 A (see Table 4). Note that the undiversified demand is used to calculate the load supplied by the 2.5sqmm cable supplying individual households, as it is quite possible for all the loads in the house to be on at the same time. With regard to sizing of the cables, it is interesting to note that the optimal size of cable that balances the cost of losses and investment should be about 5 times that needed for pure transport of electricity especially at lower voltages (11kV and below) [1], [2], [3]. While this ratio of optimal cable capacity to the capacity needed for transport of electricity is based on UK data, its validity is considered to be universal because it is valid for wide variations in cable capacity (and hence cost). This is particularly important in this example where cable costs in India appear to be lower than those obtaining in the UK. In this example the main cable is only 1.7 times larger than the peak power flow. In the context of the recommended ratio of optimal capacity to cable utilisation alluded to above this is an inefficient design from a losses point of view. The ratios for the other remaining cables are all satisfactory. For the 3.5x120AYFY cable the ratio is 5.11 and for the 4x16AYFY cables and the 2.5sqmm cables this ratio is 7.97 and 9.98 respectively. The cable capacities, the number of customers served by each cable type and associated reserve margins on ratings are shown in Table 6. It is important to note that the margins shown in Table 6 ignore the impact of distribution losses. If losses are taken into account the margins would be lower. For example if we assume 10% losses, the main cable would carry 111kW (101kW plus 10% of 101kW), which would reduce the margin from 71.25kW to about 61.5kW.

Table 6 Data on cable ratings and usage

Cable type	3.5x185 AYFY	3.5x120 AYFY	4x16AYFY	2x2.5 sqmm
Rating of cut out (A)	400	200	63	16
Equivalent power (kW)	287.52	143.76	45.28	3.83
Cable rating (A) - X	240.00	180.00	51.00	20.00
Equivalent power (kW) - Y	172.51	129.38	36.66	4.79
No. of customers	500	125	23	1
Capacity use per cable (kW) - Z	101.25	25.31	4.60	0.48
Margin on cable rating = (Y/Z)	**1.70**	**5.11**	**7.97**	**9.98**

N.B. 1. Diversity for the house load supplied by the 2.5 mmsq cable is assumed to be equal to 1
2. The same diversity factor is assumed for all other cables

Overall the network design is sufficient to meet the estimated load with adequate margins for future load growth. The main supply cable while being adequate to meet present demand with some margin for load growth, it is considered to be too small from a loss/investment optimisation point of view. Having said that it is also fair to say that few distribution network designers consider loss reduction as a primary design parameter.

Implications for access, investment and pricing

From the bill of materials supplied by the contractor (summarised in Table 7) it can be concluded that the each customer is required to pay upfront for the investment in the supply infrastructure. The payment includes a security deposit as well.

Table 7 Connection cost summary (derived from contractor's Bill of materials)

Item description	Cost	
	Indian Rupees	*Pound Sterling (£)
Materials	669.88	8.12
Labour	175.44	2.13
Security deposit	150.00	1.82
Total material + labour + security	***995.32***	***12.06***
Single phase meter	325.00	3.94
Meter box fabrication	185.00	2.24
Labour for meters	50.00	0.61
Total metering cost	***560.00***	***6.79***
Total Connection Cost	**1555.32**	**18.85**
*Exchange rate (Indian Rupees/£)	82.5	

The customers would then be expected to pay for the electricity consumed on a regular basis, typically this would be monthly. This case can be analysed in terms of impacts on electricity access, investment and pricing in the slum area.

Access
The upfront payment is a deep connection charge in which the customer carries the risk with a security deposit as an added cost. This clearly presents a barrier to access, as the cost of connection can be very high relative to income levels of most people living in unplanned settlements. In this example the cost of connection is 1555.32 Indian Rupees (equivalent to £18.85). While this may appear to be a small cost in developed countries or even to affluent people in developing countries, it can be prohibitive for poor people who typically subsist on less than a dollar day. In most developed countries the terms of connection are far less onerous and no security deposits are requested. It is recognised this could be associated with the lower risk involved in these societies where all customers are well known and have well defined addresses. It is ironic that the communities that need the service most face the most stringent access conditions essentially due to poor credit worthiness.

Investment
In the absence of information on the financing arrangements for this project it is not possible to assess the financial efficiency of the project and the impact on the customers. With regard to this matter suffice it to say that depending on the source of funding for the project (contractor borrows to finance project or the utility provides funding to the contractor), the overall cost of investment will be affected. To reduce overall cost the utility would be better placed to approach the capital markets, as it would be perceived to have a better credit profile.

Pricing
The tariff for on going electricity usage is not given. The main point to note here is that the electricity tariff could be structured in such a way that the bulk of the investment costs could be recovered through a connection charge which would be included as part of the on going energy charge. This would have benefits by reducing the upfront cost.

Comments on selected model for private sector involvement

The private sector involvement model applied in this example is one in which the utility supplies power to a private operator in bulk and the private operator takes responsibility for distribution and billing of final customers. This model has obvious advantages for the utility. To start with the utility deals with a single bulk customer with a single meter thus

circumventing the hassle of dealing with many customers, in this case 500. This improves the utility targets on loss reduction and revenue collection. The issues of safety and quality of supply are also delegated to the private operator reducing operation and maintenance costs for the utility. The private operator in turn minimises the risk involved in this undertaking by charging deep connection charges and demanding security deposits. Such a scenario clearly favours the utility and the private operator leaving the customer carrying all the risk and financially worse off. Moreover the questions of safety and quality of supply are unlikely to be adequately addressed.

5 Conclusions and recommendations

Commercial arrangements: The two most important issues under commercial arrangements are (1) to ensure the electricity supplied is paid for and (2) electricity is not stolen. Prepayment metering is an innovation that holds out promise to solve the first problem and with judicious choice of the prepayment system and careful management; it can also assist in dealing with the second problem.

From the utility perspective the key benefit of prepayment schemes lies in significant reduction in the cost of customer debt management and meter reading. They are especially attractive in areas where the population's disposable income is low (such as slums) and there are many competing demands on people's income and any money owing to the utility tends to have lowest priority. It has been argued however by some industry analysts that prepayment metering disadvantages the poor. For example Andrea Sharam [4] states:

> *Pre-payment Meters (PPM) are primarily a credit management tool promoted by utilities to recover debt on the one hand and prevent the future accumulation of debt on the other. The termination of the credit relationship in favour of pre-payment effectively removes the role of the utility from the disconnection process. The act of disconnection is for all intents and purposes privatised. This enables utilities to avoid public reporting of disconnection rates (as they relate to inability to pay) and allows them to abrogate social responsibilities. PPMs do not address inability to pay, and are often the most expensive payment option. This reduction in affordability exacerbates rather than limits the impact of fuel poverty.*

While the above arguments against prepayment are valid in general, more especially in developed countries, it should also be recognised that the arguments for opting for prepayment metering in unplanned settlements in developing countries are also compelling and will in many cases prevail.

Despite the high initial cost of prepayment metering compared to conventional credit metering utilities tend to prefer them on account of lower life cycle cost [5], [6]. In very rough terms a prepayment meter would typically cost 5 times more than a conventional credit meter. Typical prices of prepayment meters average around US$50 while single-phase electro-mechanical credit meters cost about US$10 and an electronic single-phase credit meter costs about US$16. Apart from the high initial cost, experience in areas where these systems have been implemented has shown that they require careful management, and should be based on proven technology. A poor choice of technology especially coupled with poor management can leave the utility even more vulnerable to the risk of fraud/electricity theft. Other industry observers have made similar remarks in the past.

The issue of the initial cost of prepayment meters could be addressed through subsidy mechanisms (Government or Donor) where this is feasible.

Regulation and other Government policies

- The responsibility for design and specification should ideally lie with the utility in order to safeguard public interest as well as ensure consistency and compatibility of systems.
- Construction of infrastructure could be undertaken by the private sector through a competitive process to minimise cost.
- Shallow connection charge policy should be promoted. This policy reduces the upfront payment for connection and is therefore likely to improve access to electricity by poor households living in unplanned settlements around urban areas.
- The utility should source the financing, as it presents as a low risk borrower compared to smaller entities such as co-operatives and some private sector operators. The lower the perceived risk to the lender the lower the lending interest rate and hence the lower the cost of borrowing. This would translate into lower cost to the customer.
- Co-ordination between service providers and local authorities – some form of co-ordination or integrated development would ultimately lower the overall cost of infrastructure delivery and should be encouraged.
- Supply to unplanned settlements should be a licence condition: The licensee should be obligated to provide supply to unplanned settlements as part of the license conditions.
- The Government should underwrite risk of supply to unplanned settlements: The Government in return must underwrite the risk of supplying unplanned settlements by providing a mechanism for investment recovery should the unplanned settlement be demolished or the assets become stranded. One such mechanism could be to allow the utility to recover any losses through tariff increases to other customers - a form of cross-subsidy.
- Main licensee to be responsible for supply: The main responsibility for supply to the unplanned settlement must remain with the licensed utility. The utility can subcontract any licensed activity to the private sector but must remain accountable for service quality and safety. This would provide protection and comfort to the customers in the event the private operator, for whatever reason, goes into liquidation.
- Licences must have a long duration: Licences must be of long duration, typically above thirty years, subject of course to satisfactory performance. This would allow long term planning and also lower the cost of capital.
- Strong regulation: It is very important to have strong and diligent regulatory oversight on the utility pricing practices, service quality and safety related issues not only for electricity supply to formal settlements but also to unplanned settlements.

6 Recommendations for further work

- **Analysis of variations in price of electricity between countries**: The results could be used to inform policy on electricity access, investment and pricing in different countries.
- **Data collection**: Data on primary sources of energy and associated cost, regulatory environment and pricing policies, taxation regime and utility efficiency is required to carry out a quantitative evaluation of differences between tariffs in different countries.

7 References

1. Curcic, S., G. Strbac, and X.-P. Zhang, *Effect of losses in design of distribution circuits*. Generation, Transmission and Distribution, IEE Proceedings, 2001. 148(4): p. 343-349.
2. Mutale, J., et al. *A Framework for Development of Tariffs for Distribution Systems with Embedded Generation.* in CIRED'99. 1999. NICE, France.
3. Green, J.P., S.A. Smith, and G. Strbac, *Evaluation of electricity distribution system design strategies.* IEE Proceedings on Generation, Transmission and Distribution, 1999. 146(1).
4. Sharam, A., *Second Class Customers: Pre-Payment Meters, the Fuel Poor and Discrimination*. http://home.vicnet.net.au/~eag1/ppmfinal.pdf, Energy Action Group 2003.
5. Sloan, J.W., *Prepayment for electric service with the PowerStat*. IEEE Transactions on Industry Applications, 1988. 24(5): p. 777 - 781.
6. ESKOM, *Prepayment Electrification*, http://www.eskom.co.za/electrification/index.htm.

Appendix 6

Policy Paper

(by Narendra Singru, Halcrow Group Limited)

1 Regulation

1.1 The assignment

Halcrow have been requested to provide background information and expert opinion to help guide the field research. This document has been prepared to review the results of the field research and provide a generic high level policy document.

1.2 Background

As part of the power sector reforms in many countries, power distribution has witnessed a shift from being a public owned and operated utility to being a largely private managed enterprise. The objective of this paper is to identify issues relating to the regulatory and policy issues surrounding electricity supply to the low income urban communities in the context of these reforms.

The generic regulatory framework in the power sector is broadly similar to other infrastructure sectors such as water and transportation. The Regulatory Body is typically assigned the twin tasks of:

- Promoting competition by creating conditions which allow companies to compete fairly and which enable customers to make an informed choice between suppliers ;
- Regulating areas of electricity industries where competition is not effective, by setting price controls and standards to ensure a reasonable return on capital for the industry. Customers get value for money and a reliable service.

The levels of regulation vary from country to country. In most developing countries, the Regulatory Body is an offshoot of the government structure, although efforts are being made to give such a Body greater independence.

The role of a Regulatory Body assumes importance in a situation where there is a monopoly in the supply of electricity to a particular community/area. In the absence of a clear competition, the Body needs to protect the consumer's interest without overburdening the utility provider.

1.3 Regulatory Issues

- **Connection charges**: Low income consumers find it difficult to invest a large sum upfront for an electricity meter, internal wirings, switches etc. Given the high risk profile of such consumers, the utility operator cannot offer credit/instalment packages fearing that the credit will not be sustainable. In such a situation the Regulatory Body should step in to provide a solution. Typical solutions include an output based aid mechanism that enables the government to pay for the connection

charges provided the utility operator achieves specific outcomes such as expanding the network.

- **Quality of supply**: Consumers usually are happy to pay for electricity if they are assured of a reliable supply. Quite often a private utility operator increases the tariffs with a promise to improve quality of supply, but finds it difficult to maintain the quality owing to several reasons such as increased fuel costs, incorrect generation cost predictions, power losses etc. In such circumstances, the Regulatory Body needs to be closely involved to find a solution without burdening the low income consumers.

- **Health & Safety**: Private utility operators in their zeal to control their costs use poor quality assets when increasing the network size. This creates serious health and safety hazards in the form of short circuits leading to fires, frequent transformer burnouts, damage to appliances and even transmission losses. A robust regulatory regime needs to be put in place for monitoring the quality of utility assets during construction period as well as after that when the assets are being operated. Such a regime could be a combination of regular audits as well as spot audits.

- **Illegal connections**: Often low income communities are characterised by illegal connections or flying connections. These connections have several appliances connected at one point causing an overload, lowering the voltage, blowing the fuse and damaging the appliances. Although utility operators tend to provide a contingency for such cases in the form of spare generating capacity, it is nevertheless a burden on the utility. Reducing illegal connections should be the responsibility of the utility operator but this activity should be monitored by the Regulatory Body. Procedures for converting illegal connections in to legal meter connections should be simplified to limit the number of such illegal connections.

- **Tariff setting**: A utility operator would be keen to set consumer tariffs at a level that enables full cost recovery including a profit element. Tariffs are usually pegged separately for different users such as industrial tariffs, commercial consumers, domestic consumers etc. Generally, in developing countries tariffs are set in close consultation with the government and this process could be politically sensitive. Typically, the utility operator tends to push for higher tariffs to enable better rates of return or in some cases better cost recovery. The latter is usually the case when the utility operator is making losses and needs to regain its profitability position. On the other hand, the consumers push for lower tariffs to reduce their expenses. The Regulatory Body needs to ascertain what the realistic tariff levels should be and bridge the gap by using subsidies effectively. Such subsidies should be structured to reduce the burden on consumers and simultaneously ensuring that the utility operator is incentivised to improve its efficiency levels. The Regulatory Body has to balance the utility needs with the consumers' capacity to pay.

- **Tariff revision**: A utility operator needs to revise tariffs every few years if not every year. Such revision usually reflects the change in the fuel costs and inflationary effects. Although not all the cost impacts can be passed through to the consumers, it is inevitable that consumer tariffs will need to be revised to reduce the burden on the utility operator. Typically, such tariff revisions can be implemented only after the Regulatory Body approves them. In such a situation the latter needs to understand the drivers of tariff change and the precise impact on the

consumers. Tariff revision mechanisms could be built into the operator's contract thus avoiding protracted negotiations between the Regulatory Body and the utility operator. At the same time, such mechanisms should be transparent enough to prevent any collusion between the two entities.

2 Electricity Supply to Unplanned Settlements

2.1 Introduction

The work carried out under DFID Contract Number R8146 - Barriers to access to modern energy in slums has produced three valuable surveys of the introduction of electricity services to unplanned settlements in diverse situations. Among the results, it is clear that there is recognition of the benefits of having the service and therefore a demand for it. Equally, there is graphic demonstration of the numerous barriers to acquisition of the service besides the cost. The diversity of needs, issues and approaches found in the surveys, even within one country, reminds of the need not to assume a 'one size fits all' solution to the successful wider implementation of electricity services.

2.2 Clean Energy

Electricity is generally seen by the end-user as 'clean energy' because it is silent and apparently non-polluting. For the low income home it is preferable on health grounds to poorly controlled combustion of liquid hydrocarbon fuels or wood in confined spaces. When properly installed it is also likely to be safer.

Environmental emissions are a very low priority for the low income family but need to be considered in developing policies and programmes for provision of services in the enormous and expanding urban sprawls on most cities in developing countries. The displacement of wood fuel is likely to be essential to meet energy demand, mainly for cooking but also for seasonal heating in climates such as South Africa or mountainous regions of the Indian sub-continent. Thus a renewable resource must be replaced directly by hydrocarbon fuels or by electricity which may be generated from them with greater resultant emissions due to the inefficiency of the conversion process and transmission losses.

In most cases electricity is not used for space heating and not usually for cooking, although this might change with rising living standards, depending on the cost of alternatives such as bottled gas and liquid fuels. Electricity is highly preferred for lighting and is the only solution for small domestic power applications which reflect and enhance living standards such as fans and television. Are there environmentally sound solutions? In the national context the increased use of renewable energy and perhaps in future nuclear power may be a policy direction in order to reduce global emissions of greenhouse gases. Some countries already have a high proportion of hydro power and a few have geothermal power generation (the Philippines). Other contributions to the solution such as more efficient use of hydrocarbon fuels for generation or combined heat and power plants are beyond the scope of this paper. The expectation of huge increases in electricity demand in urban areas makes it very important that these issues are addressed in national energy policies.

The option of local renewable energy for domestic applications in the urban context reduces to solar photovoltaics or possibly small wind generators. Aside from issues of access and

management both will need battery back-up and be far outside the affordable price range of the low income family.

2.3 Electrical System Design

It is very common for the electrical systems in developing countries to be designed to standards developed for industrialised countries. These standards will provide a high level of security and safety in supplying electrical power of good quality over along lifetime if systems are maintained and operated to high standards. These standards are not necessarily applicable or affordable. A major concern for the utility extending its system into an informal community is the risk of redevelopment being imposed and hence assets being lost or stranded. Also, while the domestic energy demand of urban communities remains low, constrained by income, it is more difficult to recover sufficient charges to warrant the investment.

Low cost options are needed for the informal community without compromising safety. A scheme to serve 500 hutments in Delhi is used as an example in one of the outputs from the DFID research. This design inferred from available information is low cost and would not meet design standards in other countries. It is also weak on protection of the system in case of faults and has limited capacity to cope with increased demand which may be expected if the economic circumstances of the inhabitants improve.

Assuming that a utility feels confident enough to invest in a distribution system to an informal community it will be wary of the risk of losing the assets through redevelopment of the area. The cost can be alleviated by locating the expensive components such as transformers and meters where they can be retrieved easily. For example, in the Philippines the meters are placed on high boards near the roadside.

The quality of the power supply is partly a function of the reliability of the local distribution system and partly of the remainder of the electrical infrastructure. While a degree of disruption is acceptable to domestic supplies in a low cost system the expectations of consumers will rise with time and income. Voltage drops cause poor performance and may result from poor system design or from too many connections, whether legal or not. Voltage surges appear from some reports to be a great concern because of the resulting damage to appliances.

The experiences reported suggest that there is a case for providing some design guidance for supply to informal communities which would be particularly relevant in the case of external funding being provided. The development of standards tends to be an expensive business in which many conflicting interests need to be resolved. With the globalisation of products there is a tendency to develop international standards. An interesting comparison may be drawn with the Global Approval Programme for Photovoltaics in which the industry and potential customers drew up standards for photovoltaic systems for developing countries which have now been formalised and adopted by the World Bank.

2.4 Consumer access to electricity

The issue of access to the electricity has both a physical and a contractual aspect. This assumes that it is not the consumer intent to steal the electricity. Illegal connections into the distribution wires which are usually overhead can be hard to detect and protect against. It

appears that in some communities the provision of electricity is felt to be a responsibility of someone other than the consumer and this may increase the likelihood of theft.

Normally the utility will require a meter for each property with the concurrent requirement for documentation of the premises and the consumer responsible for paying the bill. The documentation can be daunting for the low income householder who will need to seek support in the process. The help may be sought from family, friends, the community officials, political representatives or others. In many cases the householder will turn to the person with influence – perhaps to bypass procedures or utility officers – or simply as an expression of the power that person holds in the community. Clearly, the cultural and community context is important to any solution to this problem. However, simplified procedures and documentation requirements should be an objective for any scheme.

It is quite common for 'flying connections' to be made to another person's meter or household circuit – a family member or neighbour. In this way the utility does not lose income but the connection is strictly illegal. This solution may be adopted as a way of avoiding the complications of a formal connection and probably does not do much harm. There is a stronger possibility that the principle domestic connection will meet its capacity limit and cut out if properly protected. The household connected in this way will pay to the meter holder on a basis which may be more expensive than having a dedicated connection but the upfront costs are reduced. There would seem to be no reason why a shared metered connection could not be acceptable to the utility provided that there is some confidence that the bills will be paid.

2.5 Sharing the Risks

The costs of capital investment for an electricity system by the utility and the consumer are considerable relative to their respective assets and income. The utility needs reassurance that income will continue to flow and the consumer needs reassurance that connection will continue. Traditionally some of the risk of expansion to low income communities has been taken up by government either through ownership of the utility or by its regulatory processes. Direct intervention is less of an option with increased private capital participation but the regulatory procedures can be used to assist, for example by requiring simplified connection procedures. Some of the risk on the utility can be reduced by government, by adopting informal communities to regularise their position or by offering guarantees on duration for the community for example. Generally any financial initiative will have to come from central government as local government is too poor to offer financial support.

High connection charges can be a particular barrier for the householder. Recovering utility connection costs in the regular revenue stream ('shallow connection charges') is an option in relatively stable communities, perhaps supported by some form of guarantee from a third party.

The ADBs Project Performance Report on the Seventh Power Project Loan in Nepal concluded "Considering the relatively high initial connection charges and the transaction costs of making the monthly journey to pay electricity bills possibilities of subsidizing the initial connection charges and reducing costs of payment for rural customers should be explored so the tariff might be raised at least to a break-even level for rural supply." The logic should apply to the informal urban community also.

Subsidy to support development of an electrical network or to keep it running can be directed in many ways. One of the commonest forms which may be more difficult to maintain in a private operator environment is the rate subsidy, often disguised by a loss-making public sector enterprise. This can extend to a free energy supply up to a maximum which is the approach taken in South Africa. In this example the free supply is available to all legalised connections. The scheme implementation cost is capitalised and thus charged to all paying users while the running cost is met by central or local government subsidy.

The conventional approach to ensuring that payment is made for electricity used is to use pre-pay meters. These can now be operated with smart card systems, removing risk of meter theft. It may be possible to provide subsidy to selected consumers by discounting at the point of sale of the card. However, it is important to gauge the consumers' acceptance to such pre-payment mechanisms before they are implemented.

2.6 Managing Investment

The rapid growth of urban areas presents a continual demand on utilities to continue with new investment. Planning for this investment is made more difficult by the growth of unplanned communities which need services. The investment in supplies to such communities is usually sub-optimal, i.e the revenue produced will be low in comparison to that from investments in supplies to other sectors unless low cost systems and subsidies are applied. Sarkar and Sharma in reviewing the experience of privatisation in Orissa State noted the need for a universal service obligation to prevent the utility focusing only on the more remunerative classes of customer.

It is usual for a Regulator to take into account investment needs when approving new rate structures and due allowance should be made.

It is difficult to see how a sound business case can be made, and investment approved, for extension of a utility system to specifically serve illegal connections. While the utility may be able to adopt and regularise an identified illegal connection in an established community if its licence conditions permit, it cannot easily regularise an illegal community which operates illegal connections. Government may be reluctant to regularise the community status because of precedence and loss of control of development. An alternative could be the creation of an interim status, which would offer enough guarantee for the medium term to permit investment in the utility system.

In rural electrification the supply through the local community body is often considered an option, particularly when considering an island grid to supply that community only. In Tbilisi, Georgia, the utility has addressed major system losses in urban areas by installing community meters and holding the community responsible for payment. An NGO helps to advise and set up the community. Customers can have individual sub-meters. It is not known if supplying to a single point for the community has been tried in the unplanned urban community but it could solve the problem if the community body is fiscally responsible.

2.7 Suggestions for further research

There appears to be limited actual experience of applying some of the remedies suggested above but one example demonstrates well the possibilities of how the barriers can be broken down and a supply arranged to the most extreme form of unplanned community. The case study of Electricity Supply to Pavement Dwellers in Mumbai demonstrates features including

exploitation by third party sellers of illegal electricity, excessive connection requirements, intervention by NGOs, lengthy negotiations to break down resistance, government guarantee for a period of occupation, communal supply meters, agreed installation standards for the dwelling and electrical installations and training of residents to assist installation.

This research could be extended into wider areas relating to disseminating conclusions on the following:

- Simplification of connection processes and associated documentation requirements
- Further examples of how some countries address the difficulties, notably formalising informal communities to allow a legal service.
- Study of risk sharing strategies between utility, consumer and government or agency, including shallow or deep connection charges, tariffs and subsidy
- Prepare design guidance for electrical installations in informal communities to include power quality and metering systems
- Study to quantify health and other social benefits in order to justify intervention in the private sector operation of power distribution and sales.

Appendix 7

Power Sector Reforms – Overview and Country Papers

(by Narendra Singru, Halcrow Group Limited)

1 Literature and practice review

1.1 Background - Power sector reforms

The power sector in most countries has typically been owned and managed by the government. With budgetary constraints and increased private sector capabilities, there is a clear trend to transfer this utility to private companies. Power sector reforms have thus involved a reduction in the role of the government and an increase in the role of the private sector.

Typically reforms in this sector are characterised by the following :
- Functional separation by unbundling the vertically integrated government utilities into generation, transmission and distribution companies ;
- Independent regulation of the sector through an autonomous body ;
- Corporatisation and commercialisation of the new entities in the power sector ;
- Private sector participation in new power generation projects ;
- Privatisation of distribution business ;
- Leveraging the existing generation assets through joint ventures or dis-investments
- Competition in the supply business
- Help create a market for power producers (through pool trading)

1.2 Structure of the power sector

Power sector worldwide is divided into three basic categories :
- Power generation
- Power transmission
- Power distribution

Governments have encouraged varied levels of private sector participation in each of these sectors, but power generation remains the priority in the developed and developing world, including the emerging economies of the former Soviet Union.

Typical characteristics of each of these categories are described below :

(a) Power Generation

Involves
- Construction of power plants
- Fuel procurement
- Operation & maintenance of power plants
- Arranging for power to be purchased
- Connectivity with transmission/distribution agents
- Ensuring a minimum level of power generated (in terms of kWh)
- Investments from private sector to finance capex as well as operations & maintenance activities

(b) Power Transmission

Involves

- Construction, operation & maintenance of transmission lines
- Connectivity with generation and distribution
- Keeping a check on transmission line losses
- Investments mainly in capex. Operations & maintenance activities are not very cost intensive
- This sector is less attractive for private sector participation because of its monopolistic nature. Governments normally prefer to retain ownership of transmission lines

(c) Power Distribution

Involves

- Expanding and maintaining distribution network
- Metering, billing and collecting power charges from consumers
- Investments mainly in setting up new networks
- Limited degree of competition, but privatisation can prove beneficial if regulated appropriately

1.3 Regulation

The generic regulatory framework in the power sector is broadly similar to other infrastructure sectors such as water and transportation. The Regulatory Body is typically assigned the twin tasks of :

- Promoting competition by creating conditions which allow companies to compete fairly and which enable customers to make an informed choice between suppliers ;

- Regulating areas of electricity industries where competition is not effective, by setting price controls and standards to ensure a reasonable return on capital for the industry. Customers get value for money and a reliable service.

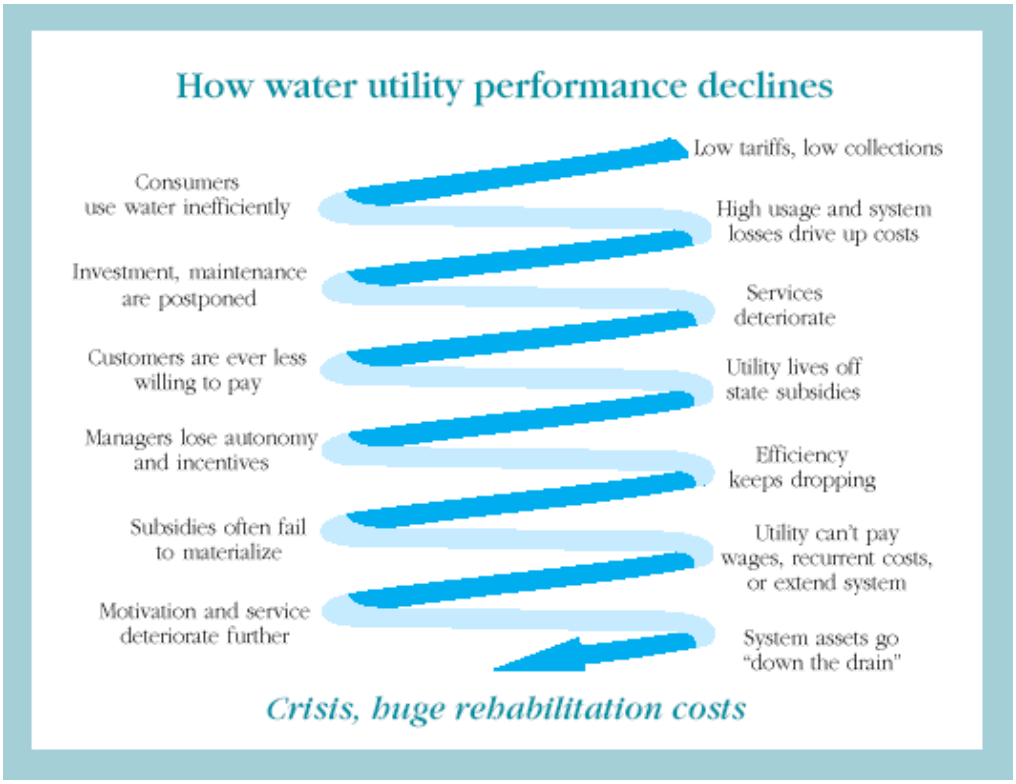
The levels of regulation vary from country to country. In most developing countries, the Regulatory Body is an offshoot of the government structure, although efforts are being made to give such a Body greater independence.

1.4 Tariff structures

Different categories of consumers of electricity are charged different rates. The tariffs for domestic and agricultural consumers are, generally, less than the average unit cost of supplying electricity. The tariff rates for the commercial and industrial categories (including power supplied to railways) are more than the average per unit cost. Thus the consumers of the first set of categories are cross-subsidised by the consumers of the second.

1.5 Lessons from the Water Sector

Operationally and from a customer service viewpoint, in most developing countries, publicly owned and run water utilities have been unsuccessful in providing reliable water supply and sanitation services. Most find themselves locked in a downward spiral of weak performance incentives, low willingness to pay by customers, insufficient funding for maintenance leading to deterioration of assets, and political interference.



(Source : PPIAF Water and Sanitation Program, 2000)

To reverse this spiral, massive time and political efforts have to be invested to :

- Inject capital to reverse a backlog of under investment
- Make institutional changes
- Improve policy
- Institute changes to the financial structure including tariff
- Establish robust sector governance, and
- Introduce more efficient and professional management of utility

Water infrastructure is costly to provide and has a long life. As a result planning horizons of 10 – 20 years are not uncommon. This is fundamentally different to the electricity sector.

Some of the current approaches to achieve the above objectives are summarised below :

(1) Business Partners for Development (BPD) comprises an informal partnership involving business, government and civil society. For example, in Bolivia, civil society groups helped to organise groups of slum dwellers to install and maintain low cost condominial sewerage systems in partnership with a private water company and the municipal authorities. This requires recognition of the motivations, incentives and obligations of each stakeholder.

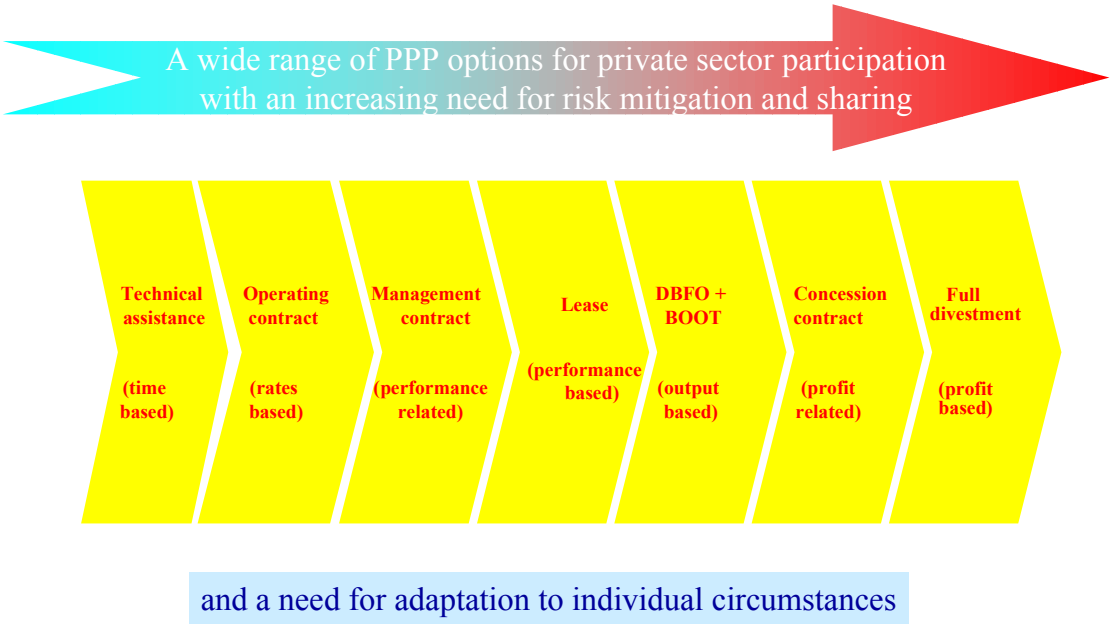
(2) A key component of the water sector reform has been institutional change. Many different institutional models exist in developing countries depending upon the overall government set up. A common feature of most of these models is that inefficiencies and inequities exist in their service deliveries. The most popular and widely used reform measure is to bring in private sector participation (PSP) to provide efficient management and new sources of capital. Johannesburg could be viewed as a successful transition using PSP. The duplication of services in overlapping urban centres was resolved by centralising the municipal authority into one city management but decentralising services such as water, solid-waste collection and public transport into companies with different PSP options.

A common perception of tariff reforms in water sector is that the poor will suffer due to the increase in the tariffs. There have been cases where the poor are willing to pay for good quality and reliable services. While it is true that that PSP in water sector has resulted in increase in the water charges in the short term, it is equally true that in the long term these charges can potentially decrease.

(3) PSP in water sector can be different forms :

- Service contracts and management contracts in which the operator does not make his revenues from the tariff, so there is no incentive or mandate for him to propose changes. The operator has limited operational responsibility. Examples include Johannesburg, Amman, Gambia and Mali.
- Affermage arrangements in which an operator collects the tariffs, but remits all but his agreed fee to the government; this fee is not differentiated by customer class and is unrelated to the tariff. The operator has greater responsibility of management (technical and commercial) of operations. Examples include Senegal, Niger and Guinea.
- Lease arrangements in which a fee paid to the government, which is unrelated to the tariff or the class of customer served. However, in this case the operator is responsible for collection of tariffs from the customers. Examples include Mozambique.
- Concession contracts in which the operator bears the tariff risk, and can propose tariff changes; during the course of a 20 or 25 year contract he will certainly do so, however, these changes must be approved by the government. Examples include Manila, Buenos Aires, Gabon and Chile.

Typically, a PSP or a Public Private Partnership (PPP) option is selected from a range of options shown below depending upon risk distribution arrangements agreed between the public sector and the private participants :



The above options are used in other utilities sectors also. The Build Operate Transfer (BOT) structure in the electricity sector forms a part of the above range of options. However, the exact nature of PSP in the electricity sector is country specific.

1.6 Subsidies

Subsidies in the power sector for the domestic consumers are the general rule rather than the exception in most developing countries. They are often created as result of public policy and usually rest on the assumption that low-priced electricity is critical to accelerating economic and social development. Electricity supply is also often seen as a public good and therefore should be subsidized.

Most power utilities in developing countries are the beneficiaries of subsidies. Generally, subsidies in the form of lump sum or per unit output transfers from the government budget to the utility are rare because budgetary resources are usually scarce. For this same reason, subsidies granted directly to consumers to lower the price of electricity are also uncommon. Subsidies to the power sector are usually indirect.

The most common forms of indirect subsidies are as follows :

- **Tax Exemptions.** Public policy often exempts power utilities from paying income taxes, or taxes on some inputs in the production of electricity, such as capital equipment and fuel.
- **Fuel Subsidies.** Fuel may be sold to the utility at a below-market price or below the economic cost of production because the government has a monopoly or controls hydrocarbon production, refining, and pricing. The effect of this subsidy is to lower the cost of producing electricity and to lower electricity tariffs paid by all consumers connected to the power supply system.
- **Interest Subsidies.** Implicit subsidies are often found in the financing of capital expenditure programs. The government budget may provide loans to the power utility at below market interest rates.
- **Inadequate Returns on Equity Capital.** Normally, power utilities are required to earn a rate of return on equity capital to meet shareholder requirements, or to reflect the opportunity cost of this capital in the case of a public sector power utility.
- **Cross Subsidies.** Cross subsidies are defined as one group of consumers paying a higher price for a good or service, so that another group of consumers may be charged a lower price. By definition, cross subsidies in an electricity tariff have no impact on the revenue requirement of the utility and thus the average tariff level. In the power sector, cross subsidies occur in a number of ways. The most common cross subsidy is in the electricity tariff paid by domestic and other consumers. Industrial/commercial consumers typically pay more for electricity than domestic consumers, consumers engaged in agriculture, and other rural consumers, even though the cost of supply for industrial/commercial consumers is normally lower than that for domestic and rural consumers. The usual reason given for the cross subsidization is social and political considerations.

1.7 Issues of interest

PSP projects typically raise some contextual issues that can be resolved only after understanding the local situation. On a generic basis the following issues are crucial for policy makers :

<u>Institutional</u>

- Interaction with the consents process (planning permissions, environment clearances etc.)
- Approving authority/regulatory structure

<u>Financial</u>

- Funding requirements and resources available
- Ownership of assets
- Maintenance levels/ depreciation and accounting principals
- Roles for off-balance sheet financing
- Role for public equity
- Project risks

Technical

- Target price vis-à-vis fixed price contracts
- Risks associated with existing asset condition
- The customer base

Legal

- Treatment of contractors default
- Treatment of force majeure
- Competition issues

1.8 Latest Thinking

The latest thinking in the electricity market in the developing countries is summarised below :

- Liberalisation of the market – There is a definite move from highly controlled market conditions to a more liberal private sector friendly economic conditions.
- BOT for IPPs – There is an emergence of Build Operate Transfer (BOT) type of Integrated Power Plants (IPPs). IPPs are typically large sized power generated producing upward of 100 MW.
- Multi-utilities for supply – At the retail supply end of the power chain, there are a number of players offering combination of power, gas and telephone utilities.
- Vertical unbundling of the electricity sector – This comprises separation into the following elements :
  - Generation – This element is moving towards competitive market scenarios with heavy private sector involvement
  - HV Grids (Transmission) – This element is heavily regulated and is usually a natural monopoly
  - Reticulation - This element is heavily regulated but is subject to competition
  - Retail Supply (Distribution) – There is a potential for converting this element into a wholly competitive market.

2 INDIA – Review of the electricity industry

2.1 The liberalisation of the industry

In December 1996, the Indian Government announced the "Common Minimum National Plan for Power" – this plan outlined its policy vis-à-vis the country's electricity industry. In short this policy aimed to facilitate the restructuring and corporatisation of the State Electricity Boards (SEBs).

Earlier than this, in 1991, the New Economic Policy was launched. Among other things this removed controls on foreign investment, the gradual sale of government stakes in public organisations and encouraged private investment in infrastructure (including electricity). However, the Government retained control over electricity prices.

Reforms have taken place at both State and national level. By 2001 7 States had broken up their respective SEBs into generation, transmission and generation businesses and in doing so have effectively privatised the industry in the State In addition 21 States had established SERCs (see below).

By 2001 Orissa, Mumbai, Kolkata, Ahmedabad, Andhra Pradesh and Surat had privatised distribution services while it was being planned in Delhi, Karnataka and Rajasthan.

The 2001 Electricity Bill made the establishment of SERCs mandatory and stated that retail rates would be laid down by the principal Regulatory Commission.

2.2 The Independent regulator

Carried out at both state and national level. State Electricity Regulatory Commissions (SERCs) regulate at a micro level while the Central Electricity Authority (CEA) and the Central Electricity Regulatory Commission (CERC) oversee the industry at national level.

CERC's remit is to regulate tariffs and resolve intra-industry disputes

2.3 Regulation

CERC promotes "efficiency, economy and competition in bulk electricity supply" and does so by regulating "the tariff of generating companies".

The key tasks facing the CEA is "to develop a sound, adequate and uniform national power policy; formulate short-term and perspective plans for power development; and co-ordinate the activities of planning agencies in relation to the control and utilisation of national power resources"

2.4 Government policy on supplying low-income urban areas

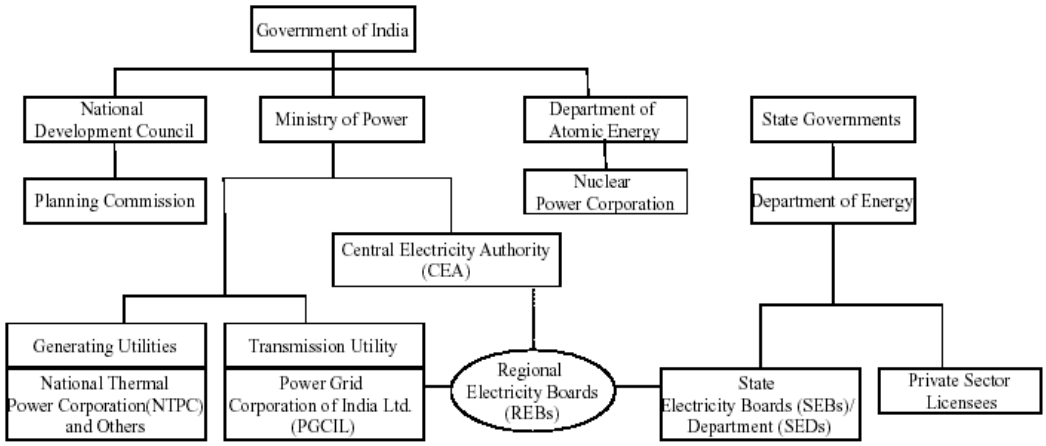
In 2002 Suresh Prabu (Minister of Power) stated that by 2012 all households would have access to electricity (at the time 60% were electrified) and that by 2007 all villages would be electrified (from 80% in 2002)

2.5 The structure of the industry

State Governments have traditionally owned and managed the SEBs who purchase electricity from utilities licensed by the Indian government. In addition, some utilities have been permitted to supply directly to customers (at a rate negotiated with the SEBs). The government owns and manages NTPC (National Thermal Power Corporation – the country's largest generator) and the Power Grid (which runs the national transmission system).

The principal generators are the centrally owned utilities such as the NHPC, Nuclear Power Corporation, other state owned generators such as the North Eastern Electric Power Corporation (NEEPCO), the SEBs (some of which have been corporatised), private operators such as the Calcutta Electric Supply Corporation (CESC) operating under government licence, and smaller independent power providers. Electricity transmission is still largely in the hands of the SEBs, although, as discussed elsewhere, a large number of SEBs have been privatised. Similarly with electricity distribution, SEBs, or their privatised equivalents, are responsible for distribution.

The institutional structure of the electricity industry is summarised by the following chart :



2.6 Principal markets

The following table gives a breakdown of consumption by consumer type in 1998-99:

Sector	Consumption (mn kWh)	%
Domestic	57553	18.4
Agriculture	93687	30.0
Commercial	15182	4.9
Industry	105207	33.6
Railway	6660	2.1
Export	3642	1.2
Others	30754	9.8
Total	**312685**	**100.0**

Source: http://www.karvy.com/compresearch/final%20sectors/power/generation.htm

2.7 Review of progress

Since the early 1990s electricity tariffs have steadily increased (between 1991 and 1996 a 53% average increase was reported)

Progress seems to have been backwards in some states, e.g. increasing tariffs, increasing debt of operators, increasing rates of non-payment etc.

2.8 Data availability

Data published by CERC and CEA is of a technical nature – capacity of network, generating facilities etc. Most information from these sources is available to the public.

2.9 Issues

In the 1980s India faced a chronic shortage of power of up to 11% of off-peak demand and 18% of peak demand (World Bank).

Key problems in the power sector (reported by Suresh Prabu) are a worsening financial position (in 2000-01 there was a 92paise difference between unit cost of supply and revenue) with losses of Rs205billion in 2000-01 at the SEBs; persistent shortages and variable quality of supply

The key problems facing the industry may be summarised as follows:

- generation capacity has consistently fallen short of the requirement and what capacity exists has historically been poor utilized .
- SEBs have a poor record of successfully implementing projects and managing them through to completion
- Poor financial standing and prospects of the industry
- High transmission and distribution losses

2.10 Revenue collection rates

In 1995/96, it has been estimated that total arrears were some 37.5% of billings across India

Source: http://www.idfc.com/pages/Policy/writings/Power/Policy.pdf

In Orissa, revenue collection was only 54% of total billing in 2000. Steep increases in tariffs no doubt contributed to this poor performance.

2.11 Losses - technical and non-technical, non-payment and non-billed.

In 1998 it was reported in the Electricity Journal that up to 20% of electricity was lost through either technical inefficiencies or "nontechnical" losses such as theft or errors in meter reading, accounting, and billing procedures

Year	T&D losses (%)
1995-96	22.2
1996-97	23.0
1997-98	21.8
1998-99	20.8
1999-00	NA

Source: http://www.karvy.com/compresearch/final%20sectors/power/generation.htm

2.12 Reform of other urban utilities

2.12.1 Other liberalised areas of public service

Reform of the telecomms sector was initiated at the same time as that of the electricity sector and, over recent years, the Government has sought to attract the private sector to the country's rural water and wastewater supplies.

2.12.2 Justification for pursuing liberalisation policies by the Government

Increasing demand and the inability of government to install and operate adequate infrastructure.

2.12.3 Views on success

Progress in telecomms has been slow because of delays in granting of licenses to private operators, non-availability of affordable finance and some difficulties in laying new cables. Progress has been concentrated in urban areas.

3 PHILIPPINES – Review of the electricity industry

3.1 The liberalisation of the industry

The Filipino electricity industry is dominated by Napocor (state owned National Power Corporation). In the summer of 2001 the *Power Industry Reform Act* came into force. Among other things this aims to encourage foreign investment. The Act is scheduled to be implemented in 2003 with the deregulation of the power industry and the privatisation of Napocor.

Liberalisation has been in place since 1995, when Napocor (NPC) allowed "open access" over its high voltage transmission system. This move allowed Independent Power Producers to sell directly to distributors and large industrial customers.

With a view to eventual privatisation Napocor designated two new subsidiary companies. The two firms are known as Transco and Psalmcorp. Transco will take over the state's high voltage transmission lines and infrastructure, while Psalmcorp will be responsible for the Philippines' power plants.

In 2001 the Power Sector Assets & Liabilities Management (PSALM) Corporation, was created. As noted above, PSALM has taken ownership of all existing generation assets, liabilities, Independent Power Producers (IPP) contracts, real estate and all other disposable assets of Napocor, including debts.

On January 27th 2003 the Filipino President approved the privatization plan of Transco. The privatization will be carried out in two phases. The first phase will see PSALM awarding a concession to operate, maintain, rehabilitate, expand and finance the nationwide high voltage transmission grid. Until the Concessionaire obtains from Congress a franchise to operate as a utility, Transco will continue to perform certain functions while the Concessionaire applies for a franchise. The second phase will commence when a franchise is approved for the Concessionaire to run the entire transmission system.

3.2 Regulation

The Department of Energy (DOE) sets policy direction for the energy industry, while the National Electrification Administration (NEA) provides financial and technical assistance to electricity cooperatives.

The key regulatory body is the Energy Regulatory Commission (ERC). It is an "independent, quasi-judicial, quasi-legislative and administrative regulatory body". We discuss its powers and functions below.

The Chairman and Commissioners of the ERC are appointed by the President

The DOE is responsible for long-term planning, strategy formulation and the monitoring of the country's national energy programme. The key aims of its 10 year plan are security of supply, "affordable and reasonable" prices and the implementation of socially and environmentally compatible infrastructures projects

The ERC is "committed to ensure public interest and consumer protection, encourage market development, enhance the competitive operation of the electricity market and penalize abuse of market power in the restructured industry". In order to do this the ERC aims to "set transparent and reasonable prices of electricity in an environment and regime of free and fair competition and full public accountability to achieve greater operational and economic efficiency in the electric power industry and ensure quality, reliability, security, availability and affordability of the supply of electric power and energy".

The key powers held by the ERC include the power to enforce the Energy Industry Reform Act, set prices in the market, issue and revoke operating licences, specify and impose minimum performance standards, specify a "lifeline tariff" for low income consumers. A full list of powers may be found at the following site: http://www.erc.gov.ph/about.asp

3.3 Government policy on supplying low-income urban areas

The Government has committed itself to electrifying all villages/barangays by 2006. It has set up the O-Ilaw programme at a cost of some 14bn Peso. Due to the geographic nature of the Philippines, there are problems associated with linking all of its islands together. Many islands cannot be economically linked to the main grid, where this is the case micro-grids are being created. Off-grid electrification is also being used, including such things as solar panels.

At the end of 2002 100% electrification had been achieved in the cities while 30% of households in rural areas had yet to receive an electricity supply.

The law enabling the deregulation of electricity generation and supply includes various pro-poor initiatives. Rates for domestic consumers reduced by 30c/kWh, as discussed elsewhere there is also a "lifeline" tariff for low income customers and also mandates the extension of supply to remote areas.

The planned privatisation of the sector is planned to eliminate cross subsidies in an attempt to relate end-user prices to the direct cost of services. Cross subsidies currently exist between the major distribution networks and between consumer groups.

3.4 The structure of the industry

The Philippine power industry is divided into three major sectors: generation, transmission and distribution. The industry was structured so that Napocor (NPC) operated its own generating facilities and also bought additional electricity from independent power providers (IPPs). NPC then provided electricity supplies to distributors (comprising private and municipally owned utilities and rural electricity cooperatives) and to large industrial customers.

Distribution of electricity to consumers was performed by utilities (most notably the partly state-owned Manila Electric Company (Meralco)), a small number of local government-owned utilities and some electric cooperatives.

As noted above, the privatisation of the NPC required the establishment of the

National Transmission Company (Transco) and the Private Sector Assets and Liabilities Management Corporation (PSALM). Transco operates the transmission system. PSALM manages the assets and liabilities of NPC

Under the new structure there is competition between the generating companies, with only the generation and supply side of the industry being fully deregulated. Prices between the generating companies will be set by the market and long run contracts between parties will be permitted.

As noted above moves to increase the degree of competition in the electricity sector by unbundling generation and transmission services and providing open access for the private sector to transmission and distribution.

It is anticipated that the generating companies will compete amongst themselves through long term contracts or on the wholesale spot market which is to be created by the Department of Energy (DOE). Distribution companies will be faced with rates based on their performance.

3.5 Sources of investment

There is a long history of investment in the Filipino electricity industry by Western utility firms. GEC, CMS and California Energy of America all sunk money in new plant in the 1990s, as did Japanese (Tomen), Finnish (Wartsila) and Hopewell of Hong Kong.

ADB and WB have funded projects and loaned money to the Philippines to improve the electricity industry. For example, in late 2001 the ADB agreed a $40m loan to help a establish a wholesale electricity spot market and to support the rural electrification programme. A grant of some $800k was also granted to help the DOE in its attempts to move to a deregulated market.

3.6 Review of progress

3.6.1 Priority problems areas of the electricity industry being addressed by liberalisation

The Filipino electricity sector has struggled to meet demand since the early 1990s. Low economic growth in this period was caused in part by blackouts/power outages. This inability of the sector to meet demand was caused by a number of factors including inefficiency on the part of the NPC, lack of clear policy from government and inefficient regulation. Investment was inadequate.

This prompted the first element of market liberalisation. The Government forced Napocor to enter into supply contracts with private generating companies allowing private investment in electricity production.

Private involvement in the sector was a success, but the downturn in the Asian economy in the mid 1990s caused there to be a surplus in capacity. Falling demand and long term contracts signed by Napocor meant that the NPC was obliged to purchase electricity with no demand from end-users. These costs were passed onto consumers who were charged for electricity they hadn't used, sparking widespread public demonstrations. Deregulation and increased PSP is seen as a way of ameliorating this situation.

Over the next ten years demand for electricity is expected to grow. The private sector is seen as being better able to meet the required investment in the sector and the Filipino government also wishes to minimise its own exposure to risks in the sector.

By introducing a more competitive environment it is hoped that electricity prices will fall and that efficiency in the sector will increase. The Government is also aware that if it is to meet its electrification targets it will need to bring in the expertise of the private sector, especially when off-grid technologies are required to meet the targets.

3.6.2 Electricity losses

In 1998 it was estimated by the Manila Electric Co that across the country's grids, distribution losses ranged from 4-42% of distribution input. In the same year, losses in Manila were some 11.8%.

3.7 Reform of other urban utilities

Over recent years the Philippine government has liberalized telecommunications, deregulated the air and water transport sector and partially privatized the supply of water.

In the transportation sectors, the national road system was upgraded and rehabilitated, Batangas Port was expanded, the construction of the Ninoy Aquino International Airport was completed, and the Metro Rail Transit Line 3 was completed.

In 1996, Manila's water and wastewater system was successfully privatised.

3.7.1 Views on success

Prior to privatisation the Manila water system was characterised by high losses, theft of water and only limited coverage. Progress is being made to address these weaknesses while post-PSP tariffs have fallen by between 43% and 74% .

4 SOUTH AFRICA – Review of the electricity industry

4.1 The liberalisation of the industry

The entire electricity distribution industry in South Africa is to be restructured, with the eventual aim being to have six regional, autonomous distributors. This will replace the current fragmented structure where over 400 suppliers operate.

In 1998 the Ministry of Minerals and Energy published its White Paper, which proposed the privatisation of the electricity sector. This paper underlined the Governments commitment to increasing the degree of competition and private sector involvement; separating generation and transmission functions; and also to restructure the electricity distribution system.

The process sped up in August 2000 when the Department of Public Enterprise (DPE) unveiled the *Accelerated Program for Restructuring of State-Owned Enterprises*. Electricity is one of the key industries targeted, with Eskom (the state owned main player) set to become an incorporated entity. The three main business functions of Eskom (transmission, distribution and generation) will become independent corporations. Due to the nature of the transmission business (a natural monopoly) it is expected that this will remain in the hands of the Government.

Pursuant to this the Government has approved the *Eskom Conversion Bill*. This will enable Eskom to become a limited liability company. PSP will follow, possibly through a public offering.

The first independent power project in RSA was in Johannesburg in late 2001 when AES (an American energy company) acquired two coal-fuelled power plants from the Municipality

4.2 Regulation

There are a number of bodies with regulatory responsibilities in the electricity sector in South Africa. The overall body is the Department of Minerals and Energy (DME), under which are several entities with prescribed duties.

The first of these is the National Electricity Regulator (NER). This replaced the Electricity Control Board (ECB) in 1995. The DME appoints board members but the NER is independent and reports directly to Parliament. The NER is funded indirectly by electricity consumers via a charge to electricity generators (which is then passed on to consumers).

The second body is the Competition Commission (CC). This has a more general remit to "promote and maintain competition in South Africa". Like the NER the CC is independent but its decisions may be contested through appeals to the Competition Tribunal and the Competition Appeal Court.

In 2002 the NER and CC signed a Memorandum of Agreement. This formalised procedures for dealing with mergers in the electricity industry.

The final organisation to be considered is the National Nuclear Regulator (NNR). This is responsible for the South African nuclear industry. As with the NER its board is appointed by the DME. is the government agency responsible for overseeing South Africa's nuclear industry, with a primary concern to ensure public safety.

4.3 Aim of regulation

The NER's stated aim is to ensure that South Africa has an "effective and efficient" electricity supply industry. "Crucial" to this is that "appropriate" electricity should be made available to all of the people of South Africa. The NER monitors the electrification targets laid out by the Government.

4.4 Government policy on supplying low-income urban areas

As far back as 1994 Nelson Mandela stated, "by 2010 no community in South Africa will be without electricity". In the same year, the Government published its White Paper on Housing. This aimed to give all South Africans access to a permanent residential structure with secure tenure and adequate water, sanitation, waste disposal and (pertinently) electricity services.

In 1998 a further White Paper on the *Energy Policy of the Republic of South Africa* was published. It suggested that Growth, Employment and Redistribution (GEAR) would be a key feature of future policy; this will necessarily entail pro-poor policies. The White Paper laid out the governments key policies vis-à-vis energy and the first of these was to increase access to affordable energy services. In 2000 the Government approved a "poverty tariff".

The National Distribution Tariff System proposed by the NER notes that flexibility in tariff structuring may be required if all of South Africa's people are to be able to afford an electricity supply. The country's constitution obliges local authorities to make the same tariffs available to all. But the NER recognises that one-off charges (such as connection and meter charges) may have to be incorporated into volumetric charges for some customers while others will be able to afford distinct capital charges.

In November 2000, South Africa's government approved an electricity "poverty tariff" to reduce electricity prices for the poor.
(http://www.eia.doe.gov/emeu/cabs/safr_renew.html).

It is recognised that not all customers will be able to draw their electricity supplies from the National Grid. With government support, Eskom and Shell are undertaking a project to supply 50,000 rural properties with solar energy systems. Affordability constraints have been overcome by the Eskom/Shell joint venture charging consumers a flat rate per month rather than a separate bill for the cost of purchasing and installing each solar unit.

It has been noted by the World Bank that electrification may not be the most appropriate solution to the "energy poverty" faced many of the country's populace and that alternative strategies may be better suited to the South African environment.

4.5 Subsidy mechanisms

As noted above, the South African government is supporting a rural policy of

electrification using solar power. This support extends to financial backing to the joint venture. Along with the NER, the Government set aside $10.5m in 2000 (two years after the scheme was initiated). Government subsidies of approximately $450 per system covered at least 50% of the total system installation costs. The subsidy is a direct response from the government to ensure that the system is affordable to poorer customers.

The International Energy Agency suggested in 2002 that 6.4% of the price of electricity in South Africa was made up of government subsidies.

In 2002 The World Energy Council reported that any subsidies for consumers in South Africa came directly from Eskom, with the Government not providing support. In 2001 these subsidies from Eskom amounted to some $350m. Both connection costs and then volumetric charges are subsidised. The Government has stated that it is aiming to ensure that any cross-subsidization is working in favour of commercial customers.

There is a general move in South Africa towards full cost recovery and fiscal policy at national level means that it is harder to introduce cross-subsidy at a local level. Most local authorities have had rising block tariffs, with large initial increases in charges as consumption increases with prices then tapering off. This has had the effect of penalising the poor, while wealthier consumers benefit.

In December 2000 the ANC promised households free electricity (50kWh/household/month), this is a good start but is estimated to be only 10% of electricity consumption in low income households in South Africa.

4.6 The structure of the industry

The principal player in the South African electricity supply and distribution industry is Eskom, the vertically integrated state owned enterprise. Eskom produces approximately 97% of electricity in South Africa. The remaining 3% is generated by eight municipalities. A small number of privately owned co-generators generate electricity for their own use.

The South African constitution states that it is the responsibility of local authorities to provide electricity services to the population. Eskom distributes power to around a third of customers while small distributors owned by local government supply the remainder. Local authorities purchase electricity from Eskom at wholesale rates. The distribution sector is highly fragmented with approximately 400 small distributors owned by municipalities.

Eskom is the only entity licensed to transmit electricity.

Under the Government's restructuring plans a number of regional electricity distributors (REDs) would be created. Each RED would be joint ventures between Eskom and the municipalities in each region. The distributors would then purchase electricity from the incumbent generators (as described above). Tariffs for these bulk purchases would be set by the NER.

As described above, the market structure in South Africa is such that Eskom dominates both the generation and transmission aspects of the electricity industry while the distribution side of things is highly fragmented. Municipalities serve only those customers covered by the jurisdiction of the local authority while Eskom serves customers on a

national basis.

We have noted that the Government's restructuring plans envisage the creation of regional electricity distributors (REDs) with each RED being a joint venture between Eskom and the municipalities in each region. The distributors would then purchase electricity from the incumbent generators (as described above). Tariffs for these bulk purchases would be regulated by the NER. It is expected that the regulatory regime will be structured so that the REDs have an incentive to provide low prices to their customers.

Following these reforms the market will still essentially be monopolistic. Transmission will remain in state hands, although generation will be carried out by a privatised (and regulated) Eskom. After 2010 it is expected that PSP will be reconsidered. We are not aware of plans to allow consumers to choose to take supply from different REDs.

4.7 Principal markets

The principal markets served by the South African electricity industry are the domestic (split into industrial and domestic consumers) and exports of surplus capacity to neighbouring countries.

In 1999, Eskom exported 1.564 GWh to Lesotho and Swaziland, 1,564 GWh to Zimbabwe, 934 GWh to Botswana, 562 GWh to Namibia and 68 GWh to Mozambique and overall, exports for 1999 were up 25% from 1990 levels.

The nature of the industry in South Africa is such that Eskom directly supplies a third of South African electricity consumers, while the remaining consumers are supplied by Local Authorities.

In 2000, the NER reported the following sales:

2000	Number of Customers	Number of Customers as % of total	MWh Sales	MWh Sales as % of total
Agriculture	101,101	1.5%	4,213,447	2.4%
Commercial	210,914	3.1%	16,448,672	9.2%
Domestic	6,264,068	92.2%	36,087,583	20.2%
General	97,748	1.4%	9,373,437	5.2%
Manufacturing	80,778	1.2%	75,201,091	42.0%
Mining	21,754	0.3%	32,065,725	17.9%
Transport	17,193	0.3%	5,605,056	3.1%
Total	**6,794,383**		**188,648,346**	

4.8 Review of progress

The NER has produced the following data table detailing progress against the Governments electrification target:

Year	Type of Area	Population	Houses	Houses Electrified	Houses Not Electrified	% Electrified	% Not Electrified
2001	Rural	20 832 416	4 267 548	2 095 229	2 172 319	49.10	50.90
	Urban	23 723 327	6 503 427	5 023 186	1 480 241	77.20	22.80
	Total	**44 560 743**	**10 770 975**	**7 118 415**	**3 652 560**	**66.10**	**33.90**
2000	Rural	19 967 564	4 267 548	1 952 494	2 315 054	45.75	54.25
	Urban	23 357 452	6 503 427	4 828 103	1 675 324	74.24	25.76
	Total	**43 325 016**	**10 770 975**	**6 780 597**	**3 990 378**	**62.95**	**37.05**
1999	Rural	20 009 245	3 873 990	1 793 193	2 080 797	46.29	53.71
	Urban	23 045 062	5 745 180	4 585 185	1 159 995	79.81	20.19
	Total	**43 054 307**	**9 619 170**	**6 378 378**	**3 240 792**	**66.31**	**33.69**
1998	Rural	19 550 322	3 785 454	1 612 168	2 173 286	42.59	57.41
	Urban	22 580 078	5 636 392	4 322 820	1 313 572	76.69	23.31
	Total	**42 130 400**	**9 421 846**	**5 934 988**	**3 486 858**	**62.99**	**37.01**
1997	Rural	19 111 522	3 700 494	1 409 681	2 290 813	38.09	61.91
	Urban	22 115 078	5 520 200	4 097 981	1 422 219	74.24	25.76
	Total	**41 226 600**	**9 220 694**	**5 507 662**	**3 713 032**	**59.73**	**40.27**

The Reconstruction and Development Programme (RDP) set the target of electrifying 2.5 million households, 72% of the total, by the year 2000. From the data above it is clear that this target has been met. Statistics are misleading however, nearly 84% of the homes in the Western Cape province are electrified, while only 53% of the Eastern Cape's houses have electricity (source:http://www.eia.doe.gov/emeu/cabs/safr_renew.html)

Domestic consumers are suffering in the run-up to privatisation of Eskom. In August 2002 bills had risen for domestic consumers while commercial consumers had enjoyed a cut of approximately 15% in their bills.

A report by PricewaterhouseCoopers has cast doubts on the viability of the proposed REDs. Since Municipalities would lose revenues because the REDs would relieve them of their responsibility to supply electricity. Such revenues are often used by the local authorities to subsidise other activities. The report suggested that the REDs would only be a success if:

- Prices could be increased by over 50% from their present level for domestic customers;
- Government is able to provide funding for electrification of small customers;
- Local governments are able to recover a levy in the range of 6-7% of customer bills;
- REDs could reduce their operating costs by 3% p.a., in real terms, for next 10 years; and
- REDs could buy from Eskom at rates which are lower by 30-50% from the presently applicable rates

It is not clear if these criteria have been met.

More than 3m households (out of 10.7m) still have no electricity (Feb 2001)
http://www.economist.com/displayStory.cfm?Story_ID=510641

4.9 Issues

The electricity industry in South Africa faces problems in both the supply and distribution side of the industry.

We gave the example above of the first PSP arrangement in Johannesburg. This was brought about because the city council in Johannesburg faced financial difficulties and a review of municipal services and administration was required to improve the financial situation. As the new utility is also an independently registered company it is hoped that it will be better able to raise capital funding than the council and therefore provide a better service to customers.

A fundamental problem with the distribution system is that prices do not accurately reflect relevant costs and the prices consumers are charged for electricity vary greatly across consumer class and between local markets. The highly fragmented nature of the industry means that economies of scale can't be realised. The ability of management at some distributors is also questionable. The distribution sector is characterised by lots of small companies operating at a loss, with many of the cash-flow problems being caused by local authorities dealing with an unstable and untenured customer base. This results in poor service to customers, Eskom not always get paid and a duplication of resources across the country

On the supply-side, the need to maintain an adequate generating capacity given an increasing population, increasing electrification and growing wealth.

4.10 Reform of other urban utilities

4.10.1 Other liberalised areas of public service

In August 200 the Department for Public Enterprise published its *Accelerated Program for Restructuring of State-Owned Enterprises* strategy. It sought to increase competition in the principal consumer markets of telecomms, energy and transport. As discussed above, Eskom will be affected, as will Denel (aerospace, ordnance and transport), Transnet (transport) and Telcom (telecomms).

In the same year the Metro Gas Company was privatised. This company was the distributor for Johannesburg and was renamed Egoli Gas following its acquisition by Cinergy (US) and Egoli Holdings of South Africa.

In June 1999, Swissair agreed to buy a 20% stake in state-owned South African Airways for 1.4 billion rand ($229m). In 1997, 30% of Telcom was privatised.

In the water sector there has been considerable PSP over recent years. Queenstown, Johannesburg and the Nelspruit concession are the most notable.

4.10.2 Justification for pursuing liberalisation policies by the Government

At local level due to financial weakness of public utilities and the need to extend service/improve existing services to large sections of the population who had previously been excluded under apartheid.

4.10.3 Views on success (or otherwise) of these.

The contracts for PSP in the water sector noted above have been finalised smoothly enough, concern has been raised, however, over the social impacts of this "commoditisation" of basic services.

In 2002, academics from the University of Witwatersrand revealed that in Johannesburg perhaps as many as 22,000 customers/month are disconnected for non-payment of (increasing) water bills. Following disconnections, increased incidences of water-borne diseases such as cholera have been reported.

Appendix 8

Summary of data analysis from household surveys - India

1 Economic conditions

1.1 Household income

The mean earned household income is 3,500 Rs/month ($70/month); incomes in Vikas Nagar (unauthorised) and Inderpuri (slum community) are similar, but incomes in Holumbi Kalan, the resettlement community, are substantially lower. It is typical for people living in resettlement areas on the outskirts of the city to have been evicted from slums located within the city; they often struggle to gain employment are they have to travel to get work in the city.

Table 8 Household incomes by community

Settlement	N	Mean earned income (Rs/month)
Vikas Nagar	69	3,800
Inderpuri	68	3,900
Holumbi Kalan	70	2,900
Total	207	3,500

Unearned income levels are so low as to be insignificant compared to earned income levels; only one person received senior citizens pensions, three receive widows pension, and one receives rental income. Across the whole sample, mean unearned income is only 40 Rs/month ($1/month). None of the respondents claimed to have family living abroad, and none claimed to receive any income from gifts (from family).

1.2 Household expenditure

Respondents were asked for estimates of average monthly spend on priority household items. The results, presented in Table 9, show that food is the single most expensive item, accounting for one half of declared expenditure; energy is the second most expensive item, but is equivalent to only about one quarter of the expenditure on food. A comparison of mean monthly expenditure by community is given in Table 10.

Table 9 Mean monthly expenditure on priority household items

Item	Valid N	Mean (N = 206)
Food	206	1370
Energy	205	370
Transport	186	350
Clothes	151	190
Education	121	170
Rent & repairs	100	120
Debt payment	18	45
Telephone	34	35
Water & Sanitation	22	25
Total expenditure		2680

Table 10 Mean household expenditure by community

Community	Mean expenditure (Rs/month)	N	Income (Rs/month)	Mean expenditure as proportion of income
Vikas Nagar	2340	68	3,800	62%
Inderpuri	2870	68	3,900	74%
Holumbi Kalan	2820	69	2,900	97%
Total	2680	205	3,500	77%

The mean declared expenditure accounts for 77% of mean declared household income; this degree of consistency indicates that both income and expenditure figures are reasonable reliable, although the discrepancy in figures for Vikas Nagar (unauthorised community) is higher than might be explained by additional disposable income.

The mean proportion of income spent on energy is 12% (see Table 11). This figure is highest in the relatively wealthy slum community of Inderpuri, and lowest in the unauthorised community of Vikas Nagar where most people have metered electricity supplies (Table 12).

Table 11 Proportion of income spent on energy (by community)

Community	Mean %	N
Vikas Nagar	8.7	68
Inderpuri	16.1	68
Holumbi Kalan	12.0	69
Total	12.3	205

2 Problems with Electricity Supplies

Data confirms the extent of theft of electricity – over half of the sample claim to use illegal supplies. Table 12 shows that the type of electrical connections made are clearly demarcated according to type of community.

Table 12 Types of connections found in types of communities

	Type of Community			Total
	Slum Inderpuri	resettlement Holumbi Kalan	Unauthorized Vikas Nagar	
not connected		28	2	30
Illegal	68	29	1	98
Flying		11		11
Metered		2	66	68
Total	68	70	69	207

The main complaints about power supplies concern voltage stability – voltage drop preventing use of appliances, and spikes causing fusing of appliances. The priority issue for residents in the slum community is power cuts, which is not surprising bearing in mind that they all have illegal connections. Electric shocks also appear to be regularly experienced, even amongst metered supplies in the unauthorized community.

3 Energy needs

Principal energy needs are:

- Cooking
- Water heating
- Lighting
- Space cooling e.g. fans, coolers (water spray)
- Space heating
- Entertainment e.g. TV, radio-cassette

The priority uses of electricity are cooling in hot seasons in order to control mosquitoes (health and good sleep), and lighting at other times of the year.

4 Choice of fuels

Gas is the fuel of choice for cooking amongst those with legal electricity connections. Where people have access to kerosene on ration cards, it tends to be kerosene. Even amongst those who steal electricity it is not commonly used for cooking as quality of supply is inadequate. It is, however, used for heating (space heating and water heating) where quality of supply is not critical. In the absence of illegal electricity, the choice is wood and kerosene. There is evidence that an illegal connection appears to be a second choice coping mechanism, whilst the wealthy can pay for alternative fuels.

There is a high degree of consistency when it comes to preferred fuel for domestic activities, with the following preferences expressed by all categories of electrical connection:

Cooking – gas
Space and water heating – electricity

Table 13 Main fuels for cooking (by type of electrical connection)

	Type of Electrical connection				Total
	not connected	illegal	flying	metered	
electricity		17	1		18
gas	10	37	**4**	**61**	112
kerosene	**19**	**42**	3	7	71
wood	1	2	3		6
	30	98	11	68	207

Table 14 shows a clear grading in choice of fuels:

- Gas users regard kerosene as a back up
- Kerosene users regard wood as a back up
- Wood uses regard dung as a back up

Electricity users are something of an anomaly as they are not paying for the service (only households with illegal supplies use electricity as their main cooking fuel - Table 13). The fact that they use gas and kerosene as back up fuels suggests that they are high grade energy users, indicating a relatively high ability to pay.

Table 14 secondary fuel by main fuel - cooking

secondary source - cooking	main energy source - cooking				Total
	electricity	gas	kerosene	wood	
gas	8	0	0	0	8
kerosene	9	32	0	1	42
wood	0	6	46	0	52
dung	0	1	0	4	5
coal	0	1	0	0	1
Total	17	40	46	5	108

When asked about their attitudes towards the main fuels, respondents are most positively disposed towards gas, and least keen on kerosene (see Table 15), and this is true for respondents with all types of electrical connection (see Table 16). Safety and access are the most important characteristics of fuels – economy is near the bottom of the list.

Table 15 Means of weighted attitudes - main fuels (whole sample)

	Range	Electricity	Gas	Kerosene	Wood
Access	(-8 to +8)	-4.79	2.53	-6.59	-2.95
Efficiency	(-8 to +8)	2.48	3.02	-1.46	0.88
Economy	(-8 to +8)	1.88	2.19	-3.29	-2.47
Polluting	(-8 to +8)	4.26	4.22	-3.85	-3.86
Convenience	(-8 to +8)	2.86	3.64	-2.54	1.53
Safety	(-8 to +8)	1.86	3.64	-3.68	-2.89
Sum	(-48 to +48)	8.57 (2)	19.22 (1)	-21.37 (4)	-9.71 (3)

Numbers in parentheses are ranks.

Table 16 Mean sum of weighted attitudes to main fuels (by type of connection)

	N	electricity	gas	kerosene	wood
not connected	30	11.30	18.77	-27.03	-13.77
Illegal	96	5.18	18.89	-17.26	-5.45
Flying	11	12.45	20.27	-25.18	-15.00
Metered	68	11.53	19.73	-24.06	-13.15
Total	205	8.57	19.22	-21.37	-9.71

5 Change in fuels

Only around 10% of the sample have changed their choice of main cooking fuel during their stay in their present house; most have changed to using electricity.

Table 17 Changes in choice of fuel for cooking

	From which fuel			
main energy source - cooking	electricity	gas	kerosene	wood
electricity		8	6	0
gas	0		4	1
kerosene	0	0		1

6 Electricity appliances

Fans are the most popular household appliance (Table 18); these (and coolers) were identified by focus groups as a priority use of electricity, yielding benefits not only in terms of comfort (getting a good night's sleep), but also in terms of health by keeping mosquitoes off at night. It is interesting to note the relatively high proportion of households with a TV, and the relatively low proportion with radios.

Table 18 Households with electrical appliances

Item	% of households
fan	78%
tv	61%
cooler	34%
fridge	18%
iron	14%
radio	14%
2 plate stove	9%
immersion rods	4%
music system -	4%
space heater	2%
washing machine	1%
video	1%

Table 19 confirms that filament bulbs remain the choice of lighting appliance, although one third use fluorescent tubes, and energy saving compact fluorescent lamps are beginning to make an impact on the market.

Table 19 Households with lighting appliances

Lighting appliance	% of households
light bulbs	76%
kerosene lamp	48%
light tubes	38%
Compact fluorescent lamp	3%
gas lamp	1%

7 The importance of relationships (social capital)

Relationships are an important factor in securing an electrical supply, especially amongst those with illegal connections. People were then asked who they regarded as most effective regarding getting an electrical connection (Figure 11), which yielded the following features;

- Amongst those with legal connections, community leaders are regarded as most effective in securing a connection, and neighbours are second.
- Similarly, those with illegal connections also regard neighbours and community leaders as most effective. This is the group with the highest regard for political leaders and city officials, reflecting the tendency of political figures to condone the theft of electricity where metered connections are not provided.
- Those with no connection are the group with the highest regard for the utility company – this group has a high willingness to pay, so their concern is to make a legal supply available.

These comments need to be considered in the social context of each type of community. For example, metered connections were only to be found in the unauthorised settlement of Vikas Nagar; this is a relatively well established community where community structures are mature. Households with no connection were located in the resettlement community of Holumbi Kalan which, by way of contrast, is likely to have relatively weak social structures – different ethnic groups will have been resettled from different areas of Delhi, and only relatively recently.

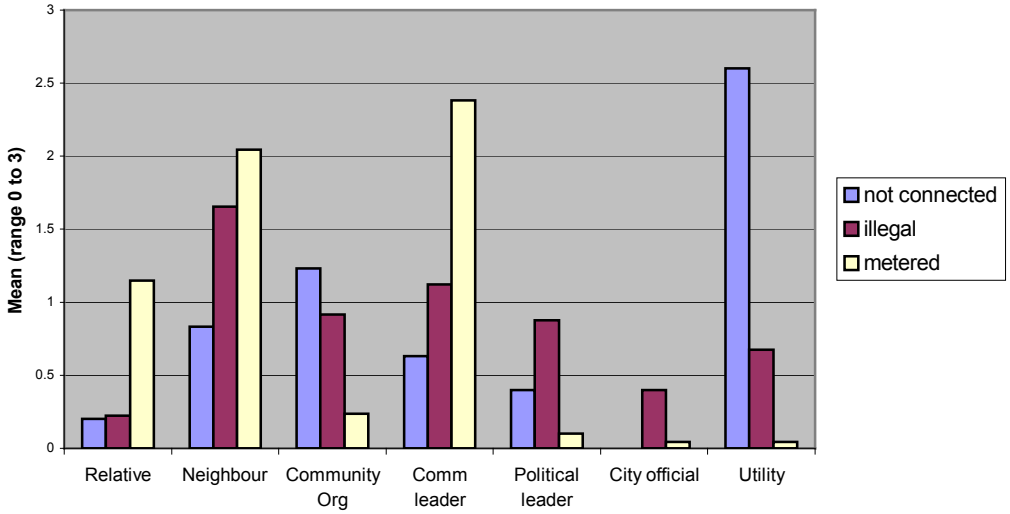


Figure 11 Entities most effective in getting an electricity supply

Those with metered connections and those without any connection felt that getting a connection was an individual rather than a community responsibility, whilst those with illegal connections (mostly in the slum community) registered a neutral view, again reflecting the strength of community structures in the slum community of Inderpuri which would appear to be the most establish community (see Table 20).

Table 20 Maturity of settlements

Community	Average stay in house (years)
Vikas Nagar	5.8
Inderpuri	12.1
Holumbi Kalan	1.8
Total	6.5

Table 21 shows that most people are unable to pay for metered supplies out of their own resources, and that they tend to turn to family members.

Table 21 source of money to pay for electrical connection by type of connection

source of money	Type of Electrical connection		Total
	illegal	metered	
Relative	18	39	57
Neighbour	6	0	6
credit scheme	1	0	1
money lender	3	0	3
own savings	76	29	105
Total	104	68	172

Within the communities surveyed, there was a view that electricity should be regarded as a basic service, to be provided by government, as is often promised by politicians.

8 Willingness to pay

- Willingness to pay for a legal connection is strongest amongst those with illegal connections.
- Amongst those with no connection there is a positive intention to connect to a supply, but intention to connect to a legal supply is negative, indicating that it is illegal connections that will be made. (N.B. legal connections are not available).
- Amongst those with illegal connections, willingness to pay is higher where people hold the view that securing a supply is a communal responsibility.
- willingness to pay appears to be enhanced by vulnerability of forced expulsion. This may reflect an eagerness to secure a legal supply, which may in turn confer some degree of legitimacy on a tenure and reduce the risk of expulsion.
- Willingness to pay appears to be only weakly linked to wealth indicators, despite the fact that the most commonly reported difficulty with legal supplies is the cost.
- Perceived difficulty in meeting requirements of getting a legal supply is important.
- Where the view is held that electricity is a basic right, it impedes willingness to pay (amongst those with illegal connections)

An illegal connection is not necessarily a free connection. Although one third pay nothing for their connection (many report making the connection for themselves), the mean cost of an illegal connection amongst those who do pay is around 150 Rs ($3), which is the mode cost of a metered connection. People with legal connections tend to spend nearly twice as much on internal wiring as those with illegal connections.

High levels of willingness to pay are confirmed by the data on how few people use illegal connections when given a choice (unauthorised community where supplies are available in the neighbourhood).

9 Intention to connect to a legal supply

- Where people intend to connect to an electrical supply it is illegal supplies that people intend to connect to – metered supplies are not available.
- Perception of safety is the only characteristic of electricity that appears to be influential across a range of groupings. Those who have concerns about electrical safety will be more likely to make a legal connection.
- The efficiency and convenience of wood are influential. This simply shows that where people have a positive view of wood, they have a weak intention to connect to legal electricity supplies, indicating that wood is in some way an alternative for electricity (note wood is commonly used for heating and water heating).
- Low voltage is a barrier to legal connections; those people who report (perceive) frequent problems with low voltage exhibit a weak intention to connect to a metered supply.
- Attitude regarding whether electricity is an individual responsibility is an influential factor amongst those with illegal connections; where people believe electricity provision is a community responsibility, they have a weaker intention to connect to a legal supply.
- Amongst those in rented accommodation, perceived vulnerability to expulsion appears to act as a driver to getting a legal connection; securing a legal supply may in some way reduce their vulnerability.
- Vulnerability to expulsion acts as a barrier amongst those who are not connected.
- Intention to connect to a legal supply is not influenced by financial (wealth) status of households, nor is it influenced by perceived difficulty in getting a legal supply.

The main benefit of legal supplies appears to be reduction of power cuts (reliability of supply) – nevertheless, customers still complain of voltage instability (drop and surges). The principal disadvantage of legal supplies is a perception of high monthly cost; some also mentioned the initial cost of the meter (Table 22). There is a strong relationship between the issue of officials cutting supplies and the payment of bribes. This may suggest that officials are taking bribes so as not to cut illegal supplies. While this second level exploitation of illegal supplies continues the risk of fire and electrical shock will remain high in areas without access to metered supplies.

Table 22 Commonly perceived advantages and disadvantages of legal electricity supplies

Advantages
• Permanent electricity
• Ability to complain about faults
• No need to fear officials
Disadvantages
• Amount of bills (affordability)
• Cost of meter

10 Experience of the Private Sector

People clearly regard the main advantage of private electricity companies over municipal utilities to be reliability of supply (see Table 23), especially amongst those with experience of private companies (metered households). Note that with illegal connections were the only group where negative views were registered (no advantages).

Table 23 Main advantage of private company supply by type of connection

Advantage of private electricity supply	Type of Electrical connection			Total
	not connected	illegal	metered	
cheap	0	6	0	6
difficult to approach	1	1	0	2
good sevice	0	2	0	2
improved quality of supply	1	0	0	1
improved reliability (no power cuts)	10	70	66	146
improved voltage stability	0	0	2	2
no advantages	0	7	0	7
no comment	16	18	0	34
Total	28	104	68	200

The information in this summary is drawn from the full analysis report entitled ‘Preliminary Analysis – Delhi Data’.

Appendix 9

Summary of data analysis from household surveys - Philippines

1 Household expenditure, and expenditure on energy

1.1 Household Income

The average number of income earners per household in 1.87. 86% of household heads bring in earned income, and half of spouses bring in additional income. The mean total earned income is 9,060 P/month ($165/month). However, 37% of the sample also received unearned income, mostly from family members, but also senior citizens pensions. The average unearned income is 1,020 P/month ($20/month) (note that this is the average across the whole sample – the average amongst those who actually receive unearned income is 2,800 P/month ($50/month)). This gives an average monthly household income of 10,080 P ($180). Table 24 shows there are large differences between the three communities sampled. According to government estimates, a family of five in Metro Manilla needs 450P/day to meet its basic needs (13,500 P/month ($245)), so it is clear that the majority of families in the sample are living below the poverty line.

Table 24 household incomes by community

	N	Mean total earned income	Mean total unearned income	Mean household income
Rodriguez	82	8650	590	9240
Payatas	80	13250	1100	14350
Davao	78	5200	1410	6610
Total	240	9060	1020	10080

Of the 70 households with family members living abroad, only 16 (23%) claim to receive a regular income from family members, but the average amount remitted to these families is estimated at 3,600 P/month ($65/month). The mean monthly household income for these households is 14,500 P ($265), so gifts account for 25% of total income. The same proportion of households without family members abroad (21%) receive gifts from family members, but the amount received is much less – 2,200 P/month ($40/month). The mean monthly household income for these households is 9,100 P ($165), so gifts account for 24% of total income.

1.2 Household expenditure

Respondents were asked for average monthly expenditure figures for a number of priority household items.

Table 25 Mean monthly expenditure on priority household items (whole sample)

	N Valid	Mean
Food	240	3749
Debt payments	103	1110
Transport	218	1042
Electricity/Gas/Fuel	237	832
Education	160	828
Housing	128	694
Other[17]	66	591
Telephone	107	454
Water & sanitation	229	429
Clothing	160	275
Entertainment	113	143
Religious/Charity contribution	176	110

Based on these responses, the average total monthly household expenditure was 8,020 P ($145); a comparison of the three communities is given in Table 26.

Table 26 Mean household expenditure for each community

COMMUNITY	Mean (P/month)	N
Rodriguez	8120	82
Payatas	9350	80
Davao	6560	78
Total	8020	240

There are other differences within the districts (based on percentage of total expenditure):

- Transport costs are higher in Rodriguez[18]
- Education costs are lower in Rodriguez;

Note that the high expenditure on debt payments covers items such as payment to neighbourhood stores (for food and basic household items), payments to relatives and neighbours, or payment for items bought on instalments. Note that expenditure on housing is not very high, most likely because households pay only small monthly amortization for the socialized housing program in the resettlement area (Rodriguez), or they simply cannot afford to spend more due to other needs.

Note that for the sample as a whole, the priority expenditure items considered here appear to account for 80% of household income (88%, 65%, and 99% in Rodriguez, Payatas, and Davao respectively); this consistency indicates that both expenditure and income figures are reasonably reliable, although the discrepancy in figures for Payatas is higher than might be explained by additional disposable income.

[17] Mostly toiletries and medicines

[18] The most likely reason is the distance of the Rodriguez resettlement area from work and commercial areas and the residents have to shell out comparatively large amounts for fares. The Davao community on the other hand is just a walking distance or a short ride away from the city's commercial areas or places of employment.

The mean proportion of income spent on energy is 11% (see Table 27), and this figure is lower in the more affluent community of Payatas.

Table 27 Percentage of income spent on energy

COMMUNITY	Mean	N
Rodriguez	12.4651	80
Payatas	9.2276	80
Davao	11.1318	77
Total	10.9391	237

2 Poverty indicators

Table 28 shows a high degree of correlation between a range of indicators that represent poverty in some way:

- Although having family members abroad does not correlate with household income, it does correlate with per capita household income, such that having a family member abroad corresponds with higher per capita income levels;
- Interestingly, there is little correlation between housing indicators, with the exception that larger houses tend to be of better construction (and small houses tend to be of poorer construction). However, type of construction, number of rooms, and size of house all correlate with income levels.
- There is high degree of correlation between household expenditure and household income, confirming reasonable reliability of figures.
- Although the percentage of income spend on energy does not correlate with any household indicators, it correlates strongly with income levels, such that the percentage drops with increasing wealth i.e. the poor spend a greater proportion of their income on energy.

These results indicate that per capita income is the strongest poverty indicator.

Table 28 Correlation of poverty indicators

	family abroad	type of house	number of rooms	size of house	persons per room	h/hold expenditure	per capita h/h exp	h/hold income	per capita h/h inc	Adult units	% income on energy
family abroad		-0.212***		-0.217***			-0.228***		-0.224***		
type of house	-0.212***			0.616***		0.269***	0.358***	0.32***	0.393***		
number of rooms					-0.751***	0.295***		0.509***	0.382***	0.218***	
size of house	-0.217***	0.616***				0.36***	0.26***	0.356***	0.276***		
persons per room			-0.751***				-0.441***	-0.259***	-0.473***	0.397***	
h/hold expenditure		0.269***	0.295***	0.36***			0.647***	0.594***	0.415***	0.341***	
per capita h/h exp	-0.228***	0.358***		0.26***	-0.441***	0.647***		0.367***	0.594***	-0.379***	
h/hold income		0.32***	0.509***	0.356***	-0.259***	0.594***	0.367***		0.828***	0.295***	-0.508***
per capita h/h inc	-0.224***	0.393***	0.382***	0.276***	-0.473***	0.415***	0.594***	0.828***		-0.235***	-0.513***
Adult units			0.218***		0.397***	0.341***	-0.379***	0.295***	-0.235***		
% income on energy								-0.508***	-0.513***		

3 Choice of fuels

The main energy intensive domestic activities are cooking and water heating. Two thirds of the sample use LPG as their main energy source for cooking, and 20% use kerosene; only

7.5% use charcoal, and 3% use electricity. Charcoal and wood tend to be commonly used as backup sources. This preference for LPG and kerosene is also reflected in fuels for heating water, although a greater number of households use electricity (9%). Again, charcoal and wood are used as backup sources. Use of kerosene and charcoal is highest in Davao, confirming these as fuels of choice amongst the poorest.

Use of electricity for lighting is almost universal – only two households claimed to use kerosene as their main source of lighting; candles a re commonly used as a backup. Electricity is also commonly used for other tasks including cooling, ironing, clothes washing and refrigeration.

Table 29 shows that people tend to use only one fuel for both cooking and water heating. An ordinal scale representing quality of fuel choice is proposed in Table 30 – it is proposed that LPG is the highest quality fuel (based on ease of use, cleanliness), and wood is the lowest quality fuel (smoke, heavy).

Table 29 Main fuels used for cooking and water heating

		Main energy source - Water heating					Total
		Electricity	Gas	Kerosene	Wood	Charcoal	
Main energy source - Cooking	Electricity	6	0	0	0	0	6
	Gas	10	143	1	1	2	157
	Kerosene	3	0	40	3	0	46
	Wood	0	0	0	7	1	8
	Charcoal	3	0	0	0	11	14
Total		22	143	41	11	14	231

Table 30 Typology of fuel choice

Scale	cooking	Water heating	N
1	LPG	LPG	143
2	LPG	Electricity	10
3	Electricity	electricity	6
4	Kerosene	Kerosene	40
5	Charcoal	charcoal	11
6	Wood	Wood	7
Total			217

Using this variable, choice of fuel shows a close correlation with poverty, as indicated in Table 31. Mean fuel choice scores in Table 32 follow the income distribution given in Table 24

Table 31 Correlations of fuel choice with poverty indicators

	Type of house	Size of house	Rented / owned	Per capita income	Fuel choice
Type of house		.616***		.393***	-.429***
Size of house	.616***		.196**	.276***	-.310***
Rented / owned		.196**			-.135*
Per capita income	.393***	.276***			-.379***
Fuel choice	-.429***	-.310***	-.135*	-.379***	

Table 32 Fuel choice by community

COMMUNITY	Mean	N	Std. Deviation
Rodriguez	1.73	73	1.294
Payatas	1.58	79	1.346
Davao	2.88	65	1.719
Total	2.02	217	1.551

4 Attitudes regarding fuels

Table 33 Means of weighted attitudes - main fuels (whole sample)

		Score [19] ***(Rank)***	***Electricity***	***Gas***	***Kerosene***	***Wood***
		(0 to 4)				
Access	(-8 to +8)	3.33 (3)	4.33	4.24	2.94	1.98
Efficiency	(-8 to +8)	3.33 (3)	4.22	3.91	1.87	0.10
Economy	(-8 to +8)	3.41 (2)	-2.78	-2.28	2.66	4.36
Polluting	(-8 to +8)	3.10 (6)	3.52	2.06	-1.63	-3.21
Convenience	(-8 to +8)	3.26 (5)	4.19	4.02	0.41	-2.15
Safety	(-8 to +8)	3.47 (1)	0.59	0.69	0.04	-0.58
Sum (Rank)	(-48 to +48)		14.07 (1)	12.65 (2)	6.29 (3)	0.50 (4)

Numbers in parentheses are ranks – figures in the score column gives the ranking of fuel characteristics; figures in the sum row gives the ranking of fuels.

Table 33 shows that there is very little spread in the importance attached to each of the fuel characteristics explored; the spread is only 0.37, with safety having the highest importance with a score of 3.47 and polluting having the lowest importance with 3.10. This table also gives a ranking of how fuels are regarded, with people being most positively disposed towards electricity and gas, and least keen on wood (note electricity appears to preferred to gas, which is different to the order proposed in Table 30).

5 Changes in fuels

One third of the sample have changed their choice of cooking fuel[20]. Table 34 shows an impressive migration from low grade fuels (kerosene, wood and charcoal) towards LPG. Change has been highest in Davao, where 61.% have changed fuel.

[19] The score column refers to the mean importance of each characteristic as reported by respondents, the other columns are calculated by taking the mean values of each characteristic of each fuel and multiplying them by the score. The sum of the weighted means are given at the bottom.
[20] Whilst living in their present house

Table 34 Changes in choice of fuel for cooking

		From which fuel did you switch?					Total
		Electricity	Gas	Kerosene	Wood	Charcoal	
Main energy source - Cooking	Electricity	0	0	1	1	0	2
	Gas	2	1	20	13	15	51
	Kerosene	0	7	1	10	7	25
	Wood	0	1	1	0	0	2
	Charcoal	0	2	6	2	0	10
Total		2	11	29	26	22	90

The main reason for changing was convenience (37%), followed by improved efficiency (28%); economy was ranked third (16%).

6 Energy audit

6.1 Consumption of fuels

The mean monthly consumption of the main fuels is presented in Table 35. This confirms that the ordinal fuel choice scale tracks fuel cost i.e., people using high quality fuels pay more. There is a good agreement between the calculated total expenditure on energy (based on the expenditure on the four main fuels), and the declared expenditure on fuels (asked in the context of priority household expenditure items).

Table 35 Monthly consumption and cost of fuels, by type of fuel

			Consumption[21]				Expenditure (P/month)				Totals		
N	cooking	Water heating	LPG (kg/month)	Electricity (kWh/month)	Kerosene (litre/mth)	Wood	LPG	electricity	kerosene	wood	calculated	declared	Ratio (calc'd/ declared)
143	LPG	LPG	9.4	137	1.2	0	263	768	23	1	1055	1018	1.04
10	LPG	Electricity	8.4	195[22]	0.0	0	244	702	0	0	946	721	1.31
6	Electricity	electricity	8.3	104	0.0	0	228	580	0	0	808	785	1.03
40	Kerosene	Kerosene	0.7	67	10.8	0	17	330	206	0	553	543	1.02
11	Charcoal	charcoal	0.0	66	0.9	0	0	220	14	0	234[23]	538	0.44
7	Wood	Wood	0.9	44	3.9	0	21	338	78	0	438	447	0.98

N.B. figures are based on average for total umber of households in each category.

[21] based on estimates provided by respondents rather than bills i.e. inaccurate
[22] seems unreliably high
[23] data for charcoal consumption was not gathered

6.2 Electricity appliances

It is not surprising that almost all households have a fan (see Table 36). The Philippines is a tropical country, and the situation is exacerbated by the congestion in most urban poor communities. Besides easing the heat, the fan also serves other functions, like warding off mosquitoes and other insects, eliminating foul odours and drying clothes (during rains). Generally, fans are also an affordable commodity. Table 37 indicates that over a third of households use low energy bulbs (CFLs) as a means of controlling consumption and cost.

Table 36 Top 10 household appliances (excluding lighting fittings)

	% of households
Fan	92%
TV	86%
Gas stove	67%
Iron	66%
Video	57%
Ref	48%
Washing machine	45%
Music system	44%
Radio	43%
Kerosene stove	34%

Table 37 Lighting fixtures

Appliances- Lighting fixtures	% of households
Light tubes	70%
Light bulbs	74%
CFLs	39%
Kerosene lamps	15%
Gas lamps	5%
Others	1%

7 Analysis of home businesses

A third of the sample operate small businesses from home (see Table 38); an almost equal number of them come from the three communities. Enterprises vary from fixed stores in front of houses (mostly in Payatas and Rodriguez) to market stalls and mobile vending (predominant in Davao).

Table 38 Types of business activities

Type of Business	# of households	%
Others	3	4%
Room leasing	3	4%
Hardware/Electrical shop	4	5%
Small manufacturing	6	8%
Cooked food	10	13%
Vending/Variety store	52	67%
Total (w/ home business)	78	100%

The majority of these rely on electricity for fuel (60%); it is used for lighting and to power appliances used like refrigerators (see Table 39). Other home businesses use gas (13%), mainly for cooking food; charcoal (5%), for grilling/barbecue; candles (5%), for repackaging products (they seal small plastic packages with candles) and as emergency lighting; and kerosene (4%), for starting grill fire.

Table 39 Type of fuel used in businesses

Type of fuel used in business	# of HHs	%
Electricity	47	60%
Gas	10	13%
Charcoal	4	5%
Candles	4	5%
Kerosene	3	4%
No answer	10	13%
Total (w/ home business)	78	100%

8 Features behind flying connections

8.1 Occurrence of flying connections

In the Philippines, almost all of the sample has an electrical connection (see Table 40). The main distinction that merits research is between households with flying connections rather than metered. This table indicates that flying connections are equally common in resettlement as well as authorised areas (18% in Rodriguez and Davao), and that illegal connections (both 'illegal' and flying) are less common in the relatively affluent community of Payatas (11%).

Table 40 Type of electrical connection by community

	Community			Valid Total
	Rodriguez	Payatas	Davao	
Not connected	1	1	1	3
Illegal	0	4	1	5
Flying	15	5	13	33
Metered	66	69	62	197
Total	82	79	77	238

Table 41 shows that households opting for flying connections tend to:

- Live in smaller houses;
- Be rented rather than owned;
- Have a more temporary view of the duration of stay in the house (and although, overall, they feel it is unlikely they will be forced to leave the house, there is a higher proportion who do feel vulnerable);
- Be poorer – both in terms of household expenditure and total household income;
- Spend a smaller proportion of their household income on energy;

Table 41 Differences between households with flying and metered connections

Indicator	flying	metered	MW sig.
Community			.776
Type of house			.193
Size of house	2.52	2.75	**.028**
Rented / owned	1.67	1.9	**.000**
Length lived in house			.056
Experienced eviction			.383
How long permitted to stay in house	3.48	3.95	**.000**
Likely to be forced to leave			.060
Per capita income			.055

8.2 Differences between households with flying and metered connections

An analysis of these two groupings (using MW) shows the following differences (statistically significant at 95% unless stated otherwise):

Energy choices and use:

Households with flying connections:

- Spend less money (in absolute terms) on energy;
- Have had access to electricity for a shorter period of time;
- Make greater use of kerosene and charcoal for cooking and water heating, whilst those with metered connections tend to use gas, reflecting economic status (NB. Neither tend to use electricity for cooking);
- Are less likely to run businesses from home (15%, compared with 37% of those with metered connections) – these are all vending/stores which will require minimal energy input;

Problems experienced with electricity:

- Households with metered connections complain that power cuts occur more frequently than those with flying connections. This is not due to poorer quality of supply in communities where there are few flying connections (Payatas); in fact the opposite is true – power cuts appear to be less of a problem in Payatas. Rather, this may indicate that people with flying connections are more tolerant of power cuts.
- Households with flying connections complain that voltage drop is a problem than those with metered connections. (This is related to fusing when too many appliances are connected through meter. This is also related to the poorer quality of installation and wiring used in flying connections).

- More of those households with flying connections are concerned with officials cutting wires, and with the theft of wires.

Table 42 shows that respondents with flying connections have a more positive attitude towards all the fuels - particularly gas and kerosene - than those with metered connections.

Table 42 Mean sum of weighted attitudes to main fuels (by type of connection)

	N	*Electricity*	*Gas*	*Kerosene*	*Wood*
Flying	33	15.68	15.26	7.01	0.52
Metered	197	14.25	12.25	5.94	0.34
Total	240	14.07	12.65	6.29	0.50

Table 43 shows that there is not much difference in the reported importance of the different characteristics of fuels between those with flying connections and those with meters; the only significant differences are with safety and pollution – this may reflect a greater experience of electrical hazard amongst those with illicit connections.

Table 43 Importance of fuel characteristics by types of electricity connection

	Score (0 to 4)		
	Flying	Metered	Total
Access	3.39	3.32	3.33
Efficiency	3.33	3.34	3.33
Economy	3.44	3.40	3.41
Polluting	3.21	3.09	3.10
Convenience	3.24	3.28	3.26
Safety	3.61	3.47	3.47

9 Barriers to legal connection

Households with flying connections:

- Find it much more difficult to meet the requirements to get a legal connection, and find it more difficult to overcome these requirements. The main problem given by those with metered connections was difficulty in getting required documents, but this appears to be less of a problem amongst those with flying connections (although still the most commonly given problem) – financial concerns are more important amongst this group (high processing fees);
- Express a stronger willingness to pay for a legal supply; all of those with flying connections express a positive willingness to pay for a legal supply;
- Have a higher opinion of the convenience of using electricity (possibly linked to a higher willingness to pay)
- Paid less for both the electrical connection and the household wiring (high cost is a barrier to getting a metered connection) – see Table 44;

Table 44 Cost of electrical installations (connection and wiring) by type of connection

Type of electrical connection		Cost of connection (Peso)	Cost of wiring (Peso)
Flying	Mean	1068	339
	N	11	14
Metered	Mean	1960	1100
	N	135	102

A substantial number of households (20%) believe meeting the requirements for a legal electricity connection is Difficult or Very Difficult. This was particularly true in Davao where building requirements are hard for the residents to comply with. Those who find it easy to meet requirements are mostly from the resettlement (Rodriguez) and CMP (Payatas) areas where the government, housing developer and the CMP beneficiary association took an active part in providing basic services to the sites, including electricity services. The most difficult issue is getting the documents required, followed by the high cost of processing.

People with flying connections feel it is more difficult to meet the requirements to get a legal connection than those with metered connections (MW p = 0.000), and they also feel it more difficult to overcome these obstacles (MW p = 0.000). Whilst documentation is universally regarded as a difficulty, financial issues appear to be of more importance to those with flying connections, indicating that financial poverty acts as a barrier.

The most commonly perceived advantages and disadvantages of a legal electricity supply are presented in Table 45. Interesting issues evident include:

- Monitoring the use (cost) of consumption – reflecting the value to low income households of being able to conserve costs in times of hardship;
- Safety is important – illegal supplies are perceived as more dangerous;
- The scheduling of payments is important; people are concerned that they will have difficulty paying on a regular basis – there may be value in flexible payment schemes;

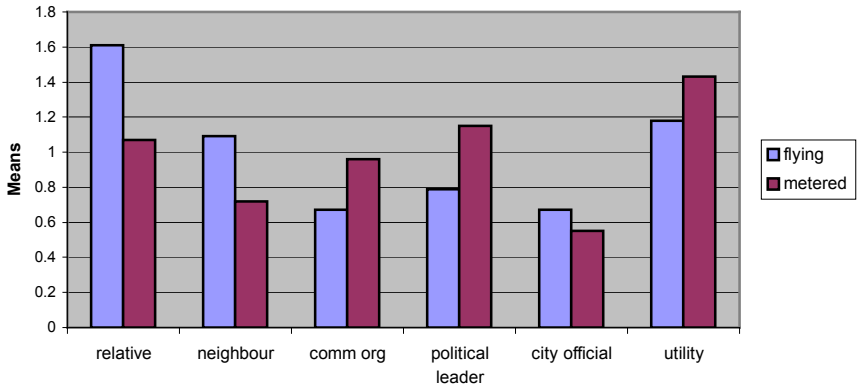
Table 45 Most commonly perceived advantages and disadvantages of legal electricity supplies

	N
Advantages	
• Able to use appliance anytime	69
• No penalty for illegal connections	63
• Able to control/ monitor power usage	29
• Proper and safe wiring installation	24
Disadvantages	
• Expensive/ High electric rates	104
• Obliged to pay monthly bill	34
• High processing fees	24
• Obliged to pay on time	20

10 The Role of Social Capital

Those with flying connections feel more strongly that strong relationships within the community are needed to get an electrical connection (but not statistically significant). This is

reflected in Figure 13, which shows that those with flying connections place a higher value on the role of relatives and neighbours in securing electrical connections; note that the only indicator for which the difference between those with metered and flying connections is statistically significant is the effectiveness of relatives.



Weighted scale: most effective = 3, second most effective = 2, third most effective = 1, no response = 0.

Figure 13 Effectiveness of entities in getting a household electrical connection

Similarly, Figure 14 indicates that family members are stronger referents amongst those with flying connections, and those with metered connections feel a stronger obligation to comply with community organisations. This illustrates a different feature – that, in general, those in a more vulnerable context feel a stronger allegiance to social networks rather than relying on formal structures, given their more temporary residential status.

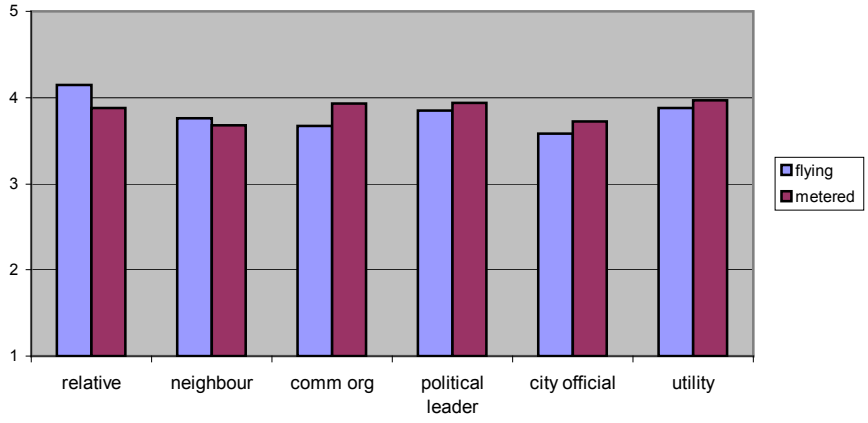


Figure 14 how motivated would you be to take advice from each

It is interesting to note that those with metered connections have feel a significantly stronger level of support towards making legal connections from community organisations and community / political leaders – see Figure 15. This indicates the role that community groups can play in promoting metered connections, and Table 46 shows that community groups have been active in the assisting people with finance.

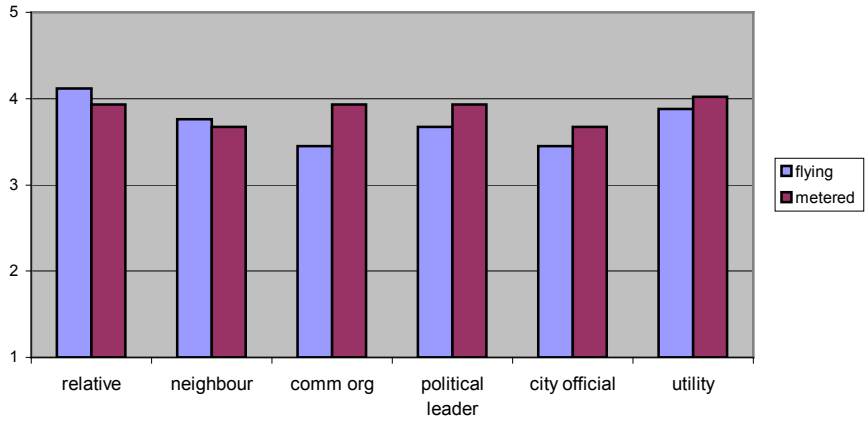


Figure 15 How supportive would each be towards you making a legal connection

Not surprisingly, households have had to use their own cash to pay for flying connections – presumably formal credit schemes would not give credit against illegal activities (see Table 46).

Table 46 Sources of funding for getting a connection

		What type of electricity connection do you have?			
		Illegal	Flying	Metered	Total
Where did you get the money to get a connection?	Relative	0	2	6	8
	Community credit scheme	0	4	57	61
	Money lender	0	0	2	2
	Own savings	1	21	104	126
Total		1	27	169	197

The information in this summary is drawn from the full analysis report entitled 'Energy in low-income urban communities: tables, graphs and analyses', prepared by Philrads.

Appendix 10

Summary of data analysis from household surveys – South Africa

1 Economic conditions

1.1 Household income

Table 47 shows that average incomes in the core housing area are over twice those in the informal shack area. However, this disparity is much less when considering per capita household income. Note that on the basis of per capita income, it is informal shacks in serviced areas that are in weakest economic condition.

Table 47 Average reported household income ($/month[24])

Location:	**Monwabisi**	**Site C**	**Kuyasa**	**Makhaya**	**Whole sample**
Area type:	Informal, unserviced	Informal, serviced	RDP housing	Core housing	
N	*71*	*48*	*54*	*49*	*222*
5% Trimmed Mean income	162	277	263	358	247
5% Trimmed Mean per capita income	69	58	77	83	71

The estimated household poverty threshold for a family of five in Cape Town (2003) is 2,090 R/month ($299/month). Although the average household size in the sample was closer to four, the proportion of households reporting household incomes below this threshold was 68% - highest in Monwabisi (86%) and lowest in Makhaya (52%).

For the sample as a whole, the proportion of adults unemployed was 48%, with little variation between area types; 30% were in full time and 1% in part time employment. However, full time employment is lowest, and part time employment highest, amongst households in the informal, unserviced area. The proportion of pensioners is highest in the well established core housing area (10%), and lowest amongst the informal, unserviced area (4%).

The income figures presented in Table 47 include unearned income. The main sources are presented in Table 48. The breakdown of social payments by area (Table 49) shows that the proportion of households receiving social payments is similar across all areas, and the average contribution of grants to household income is fairly constant at 21%. However, the contribution amongst poorer households (<1,500 R/month) is 29%, whilst the contribution amongst better off households is only 14%, indicating that support is, indeed, targeted at the poor.

[24] Based on an exchange rate of 7 R/US$

Table 48 Unearned income

	N	% of sample	Mean Amount (R/month)	Mean Amount ($month)
Pensions	26	12%	810	115
Child grants	89	39%	200	30
Disability grants	28	12%	720	100
Gifts from family	22	10%	390	55

Table 49 Breakdown of social payments by area

	Location:	**Monwabisi**	**Site C**	**Kuyasa**	**Makhaya**	**Whole sample**
	Area type:	Informal, unserviced	Informal, serviced	RDP housing	Core housing	
	N (sampled households)	74	50	51	51	226
Percentage receiving one or more social payments		49%	66%	53%	51%	54%
Average amount from social payments (Median R/month)		160	320	320	700	320
Average amount from social payments (Mean R/month)		334	502	525	737	508

1.2 Household expenditure

Respondents were asked to indicate average monthly expenditure on a number of priority household items; Table 50 presents results for the sample divided into two according to household income:

- the poorer households spend considerably less on food – a sure sign of poverty
- energy costs are relatively high for both groups (note this is the second highest expenditure amongst the poorer group);
- somewhat discretionary costs, like clothing expenditures, are minimised among poorer households
- richer households pay far more on transport and other "connectivity" bills (e.g. cell-phones) – more than double the lower income group
- the reported debt repayments of richer households are more than four times higher than the poorer half of the sample (assumed to be mortgage and hire purchase)

Table 50 Household expenditure patterns (by two economic groups)

	Households with income <1,500 R/month (N = 108)		Households with income >1,500 R/month (N = 104)	
	N	Average R/month		Average R/month
Food	117	**286**	103	**442**
Energy	118	**83**	104	**110**
Clothing	90	**67**	88	**153**
Transport	71	**71**	93	**197**
Education	61	**9**	69	**40**
Medical	42	**8**	70	**22**
Phone/cell	36	**20**	66	**58**
Debt	22	**49**	42	**218**
Pay people elsewhere	22	**51**	27	**95**
Pre-school	15	**10**	29	**31**
Housing	13	**24**	25	**42**
Water & sanitation	13	**3**	28	**20**
Other	5	**5**	10	**8**
TOTAL	**118**	**686**	**104**	**1436**

For the sample as a whole, the 5% trimmed mean expenditure is 990 R/month (140 $/month). This compares with a mean declared income of 247$/month, indicating that expenditure figures are a bit low.

1.3 Poverty indicators

The flowing features can be noted from correlations between a range of possible poverty indicators presented in Table 51:

- Close correlation between household income and expenditure figures indicating that, although figures contain an expenditure gap (i.e. expenditure is less than income) they are consistent as scales of financial position;
- Results indicate that total household income is the strongest poverty indicator, closely followed by type of housing (ordinal scale from unserviced shack to core housing).

Table 51 Correlation coefficients between poverty indicators

	Area	Area type (ord)	House construction	Rooms in house	Type of elec supply	H/h expenditure	H/h income	Per capita expenditure	Per capita income	N members in household	Total HH energy spend	% income on energy
Area		0.737***	-0.883***		-0.241***	0.351***		0.358***				
Area type (ord)	0.737***		-0.886***	0.308***	-0.705***	0.45***	0.319***	0.239***		0.242***	0.248***	
House construction	-0.883***	-0.886***			0.53***	-0.392***	-0.231***	-0.307***				0.209**
Rooms in house		0.308***			-0.229**	0.361***	0.295***			0.41***	0.515***	
Type of elec supply	-0.241***	-0.705***	0.53***	-0.229**						-0.322***		
H/h expenditure	0.351***	0.45***	-0.392***	0.361***			0.646***	0.696***	0.399***	0.295***	0.515***	-0.2**
H/h income		0.319***	-0.231***	0.295***		0.646***		0.351***	0.692***	0.362***	0.333***	-0.663***
Per capita expenditure	0.358***	0.239***	-0.307***			0.696***	0.351***		0.66***	-0.421***	0.266***	
Per capita income						0.399***	0.692***	0.66***		-0.362***		-0.583***
N members in household		0.242***		0.41***	-0.322***	0.295***	0.362***	-0.421***	-0.362***		0.319***	
Total HH energy spend		0.248***		0.515***		0.515***	0.333***	0.266***		0.319***		0.41***
% income on energy			0.209**			-0.2**	-0.663***		-0.583***		0.41***	

2 Choice of fuels

Electricity and paraffin are clearly the principal fuels – there is some use of LPG, mostly for cooking, and minimal use of wood for space heating. For the sample as a whole, 55% of households used mainly electricity, 38% paraffin and 6% LPGas for cooking, estimated to account for the larger portion of energy consumption in low income households. Most households (50%) use paraffin for space heating, whilst only 15% use electricity (32% did not indicate their main choice of fuel). Electricity is the fuel of choice for water heating (59%) with only 17% using paraffin.

Table 52 shows that electricity is the preferred cooking fuel where available, although many still prefer to use paraffin. Type of cooking appliance is closely linked to wealth – paraffin is used amongst the poorest, through electricity, to gas amongst the more wealthy. Electric appliance users tend to use paraffin as a backup fuel in case of power cuts or inability to buy electricity.

Table 52: Main cooking appliances

	Type of electricity supply		
Main cooking appliance	Pre-payment meter	Extension cord	No electricity
Electric stove / oven	68%	53%	
Gas stove	8%		8%
Paraffin stove	24%	47%	92%
Totals per group	100%	100%	100%
N (households per group):	151	36	37

It is a matter of concern that 21% of the sample said they did not use space heating appliances and a further 23% did not respond (indicating they have no appliance) – energy poverty is contributing to high rates of pulmonary / respiratory disease in the Western Cape. Most households use paraffin, which also presents health hazards. 26% of non-electrified households use an imbhawula[25] which can also be dangerous when used in enclosed spaces. As the costs of electric and paraffin space heating are similar (based on current prices) a programme of demonstration and information campaigns might encourage people to switch to electricity.

Water heating is done mostly by electricity (59%), with 17% using paraffin (23% did not respond).

Nearly all the households with electric lights used conventional incandescent bulbs. Only a few used energy-efficient compact fluorescent lights (3 households) or other fluorescent tubes (7 households). In non-electrified households (N=38), the commonest main lighting appliances were paraffin lamps (84% of these households). Another 13% said that candles were their main lighting source. However, many of these households used both paraffin lamps and candles (40%), apparently with candles in a secondary role. The use of low energy lamps would have a significant impact on reducing electricity bills amongst low use households, and should be the subject of an information and dissemination campaign.

[25] Home made brazier for burning solid fuels (wood, coal, dung)

3 Attitudes regarding fuels

Table 33 gives a ranking of how fuels are regarded, with people being most positively disposed towards electricity, and least keen on wood. Attitudes towards gas are weakened by poor accessibility and a view that it is expensive. There is little spread in the importance attached to each of the fuel characteristics explored.

Table 53 Means of weighted attitudes - main fuels (whole sample)

		Electricity	*Gas*	*Paraffin*	*Wood*	*Candles*
Access	(-2 to +2)	1.64	0.16	1.33	0.35	1.34
Efficiency	(-2 to +2)	1.34	0.41	0.67	0.49	0.92
Cost	(-2 to +2)	0.62	-0.38	0.51	0.99	1.41
Polluting	(-2 to +2)	1.7	0.58	-1.08	-1.13	-0.82
Ease of use	(-2 to +2)	1.65	0.25	0.71	-0.15	0.95
Safety	(-2 to +2)	1.35	-0.81	-0.96	-0.64	-1.36
Sum (mean)	(-2 to +2)	1.386	0.035	0.196	-0.016	0.406

The majority of paraffin stoves used are cheap and unsafe wick-stoves (as opposed to pressurised stoves). If stoves are knocked over they can result in an explosive fire with severe consequences in settlements with combustible building materials, close proximity between houses, high winds, and poor access for fire appliances.

The Khayelitsha survey asked people which fuels were cheapest and most expensive for cooking. Most of the sample expressed an opinion, which was split between paraffin and electricity, marginally in favour of paraffin as the cheapest. This indicates uncertainty about the relative costs, which reflects the actual situation – university research indicates that (at current local prices) paraffin is marginally more expensive than electricity. However, externalities such as health and safety issues would justify more intensive use of electricity.

PN Energy have adopted prepayment technology, and sell electricity vouchers through both their own shops and local retailers. The fact that 62% of the sample regard payment procedures as satisfactory (18% unsatisfactory) indicates that this system does not present a serious constraint to electricity use.

4 Changes in fuels

26% of the sample (58) have changed cooking fuel whilst in their present home. Table 34 shows that this is mostly due to a change from paraffin to electricity. The main reason for changing was that electricity became available (45%), followed by the belief that paraffin is dangerous (22%); economic factors ranked third. This indicates that, where there is only marginal difference in fuel costs, choices are driven by non-economic factors. However, initial data from PN Energy shows how the recently introduced free basic electricity allowance has increased use of electricity (see Section 7.7).

Table 54 Changes in choice of fuel for cooking

		What cooking fuel used before			
		Electricity	Gas	Paraffin	Total
Main fuel for cooking	Electricity	0	4	46	50
	Gas	1	0	1	2
	Paraffin	3	3	0	6
Total		4	7	47	58

5 Consumption of fuels

The patterns of fuel consumption presented in Table 55 are based on reported *payment* figures along with a number of assumptions. Electricity consumption is highest in Makhaya, lowest in Monwabisi, and similar in Site C and Kuyasa. Conversely, paraffin consumption is lowest in Makhaya (and Kuyasa), and highest in Monwabisi, confirming the complementarity of these two fuels.

Table 55 – Estimated household energy consumptions (whole sample).

	Average consumption per month		**N (households)**
Fuel	*Median*	*Mean*	
Electricity	**195 kWh/m**	202 kWh/m	152
Paraffin	**14 litres/m**	18 litres/m	168
LPGas	**9 kg/m**	9 kg/m	18
Candles	**6 /month**	5 /month	77

Total household expenditures are presented in Table 56. For the sample as whole, expenditure on energy correlates with wealth indicators (total income, electricity connection status, household expenditure). These figures are distorted by larger household sizes in Makhaya and Site C - household income correlates with household size (see Table 51). Per capita figures are equal for high and low income groups[26], indicating that per capita energy expenditure is inelastic.

Table 56: Total household energy expenditures (R/month), per area

	Median R/month	Mean R/month	*N (number of households)*
Monwabisi	**65**	80	*74*
Site C	**116**	128	*50*
Kuyasa	**63**	74	*51*
Makhaya	**110**	130	*51*
ALL	**92**	100	*226*

[26] sample divided into household income <1,500 R/month (N = 118) and income >1.500 R/month (N = 104)

It follows, therefore, that percentage of income spent on energy will be higher amongst low income households, and the data supports this (see Table 57 and negative correlation of percentage expenditure with household expenditure and income in Table 51).

Table 57: Energy burden: household energy expenditures as a percentage of reported income

INCOME GROUP	Energy expenditure as % of income		
	Median value	**Mean value**	**N**
< R1500/ month	**9%**	**12.5%**	**118**
> R1500/ month	**4%**	**4%**	**104**
ALL	**6%**	**9%**	**222**

6 Household appliances

The percentages of households owning various appliances offers some challenges to conventional wisdom concerning electrification for the poor:

Conventional viewpoint	Survey finding[27]	Comment
Low-income electrified households do not use electricity for their main cooking activities.	68% of sampled households with a normal electricity supply are using electricity for most of their cooking.	This is rational, since electric cooking is cost-competitive and/or more convenient in the current situation in Khayelitsha.
Even after electrification, low-income households use a mixture of multiple fuels.	Only a minority (33%) of households reported more than one cooking-energy mode, i.e. multiple fuel use for cooking.[28]	However, there is still significant use of paraffin for space heating (50%).
One of the barriers to electricity use is that poor households do not own electric stoves.	65% of the entire sample (74% of electrified households) own electric stoves.	
The ownership of other electric appliances is also limited, which is a constraint to obtaining larger benefits from having electricity.	This remains generally true, although there are quite high ownership rates for TVs (63%) and refrigerators (58%).	

[27] Bear in mind the relatively small sample size, about 200 households, and possibilities of interviewer inaccuracies. Even so, the main trends seem clear.

[28] This result *could* be inaccurate as a result of interviewer/respondent fatigue. Some interviewers and respondents may have passed over questions about "second" and "third" cooking appliances. Great caution needs to be advised in interpreting any survey results – firstly, are they reliable and understandable for the survey sample, secondly are they representative of some larger situation? Given these questions, it is best to feed back survey results to the participants (e.g. interviewers, interviewees, planners, etc.) who are involved in trying to understand and address the issues.

Table 58: The percentage of households owning various types of appliances.

Rank	Appliance	% ownership
1	Electric lights	82%
2	Iron	75%
3	Electric kettle	70%
4	Electric stove	65%
5	Television	63%
6	Fridge	58%
7	Paraffin stove	57%
8	Radio	54%
9	Cellphone	50%
10	Paraffin heater	40%
11	Music system	39%
12	Paraffin lamps	33%
13	Video	15%
14	Telephone (landline)	14%
15	Microwave	13%
16	Washing machine	12%
17	Electric heater	12%
18	Gas stove	12%
19	Fan	8%
20	Imbhawula	4%

High ownership of fridges and cell phones, in particular, is evidence of changes in low income communities; both are related to some extent to wealth.

7 Barriers to electricity

7.1 Description of households without metered connections

17% of the sample have no electricity; 16% have extension cords, and 67% have metered connections. All of those households without metered electricity are unserviced shacks located in Monwabisi Park. All are of wood / corrugated iron construction, and there is little difference in construction between those with no supply and those with extension cords. Those without electricity tend to be smaller - mean number of rooms = 1.9, compared with 2.2 for those with extension cords. Figures for expenditure on food, transport, phones, medical costs, and income all indicate that households without electricity are poorest. People with metered connections tend to be well established and feel it is unlikely they will be forced to leave (mean duration of stay = 10.6 years), whilst both those without electricity and those with extension cords have been in residence much less (3.6 and 3.2 years respectively), and feel it is likely they will be forced to leave. However, Table 59 indicates that security of residence is weakest amongst those with extension cords.

Table 59 expected length of stay by type of electrical connection

		ELECTRICITY CONNECTION STATUS			
		no connection	extension cord	metered	Total
How long expect to stay	< 1 year	0	2	1	3
	2 - 5 years	1	0	4	5
	> 5 years	16	11	92	119
	Don't know	21	23	55	99
Total		38	36	152	226

Characteristics of households with extension cords paint a picture of slightly better off households (within the shack areas), which expect to move on.

Table 60 Differences between electricity status

	ELECTRICITY CONNECTION STATUS			
	no connection	extension cord	Metered	Asymp. Sig.
Area	2	2	2.68	0
Area type (ordinal)	1	1	3	0
House type	3	2.97	1.64	0
Rooms in house	1.86	2.23	3.1	0
Rented or Owned	1.97	2	1.99	
How long in house	3.62	3.2	10.57	0
Reasons for living here 1	1.92	1.8	2.52	0.013
How long expect to stay	4.53	4.47	4.32	0.008
Likely forced to leave	3.37	3.58	2.19	0

7.2 The role of social capital

Amongst those with no electricity connection, most don't know who to approach to get a metered supply, reflecting the fact that metered supplies are not available to households in this location (Monwabisi). Less than one third of respondents said they would approach friends, neighbours, or family to get an extension cord supply.

Community relationships are regarded as essential to getting an electricity supply amongst those with extension cord supplies, whereas those with metered supplies register a neutral attitude towards community relationships. This reflects the fact that where utility supplies are available they are available to all, and where they are not available, a household's ability to get an extension cord supply depends on who they know in the neighbourhood. Similarly, those with extension cord supplies tend to regard getting an electricity supply as a community responsibility, while those with metered connections tend to regard it as their own responsibility.

7.3 Energy choices and consumption

Whilst those without electricity rely on paraffin for cooking, similar proportions of households with extension cords and metered supplies use electricity (two thirds); only amongst metered households (more wealthy) is there significant use of gas. Similarly, around

a quarter of households with extension cords and metered supplies use electricity for space heating. This indicates that people are making rational fuel choices i.e. they are not making profligate use of electricity because it is not metered. This finding is supported by the fact that there is little difference in the amount paid for electricity by households with extension cords and those with metered connections (means of 71 and 76 R/month respectively). Moreover, there is little difference in the total amounts paid for energy (105 and 110 R/month), whilst those without electricity pay much less (57 R/month). Despite these similarities, it should be recognised that households with extension cords do not benefit directly from the advent of FBE[29], and it is likely that users of extension cords use less electricity and, therefore, pay more per kWh. As the income of shack households is less than those in established housing, the percentage of income spent on energy is highest amongst those with extension cords (mean = 9.8%); it is lowest amongst those without electricity (mean = 7.7%).

Households with extension cords registered the highest fuel flexibility (most have changed) - Table 61 shows that most of these have changed from paraffin to electricity, and Table 62 shows that three factors are driving the switch away from paraffin – cost, availability of electricity (through extension cord), and safety. Figures in Table 63 confirm that monthly energy expenditure is lower amongst those using electricity as a main cooking fuel than amongst those using paraffin, indicating that even when people pay fixed amounts for electricity via extension cords it is cheaper than using paraffin. Note that amongst these households, electricity is unanimously the preferred fuel for all applications (irrespective of choice of cooking fuel).

Table 61 Changes in choice of fuel for cooking (households with extension cords)

		What cooking fuel used before			Total
		Electricity	Gas	Paraffin	
Main fuel for cooking	Electricity	0	1	15	16
	Paraffin	1	2	0	3
Total		1	3	15	19

Table 62 Reasons for changing main cooking fuel (households with extension cords)

	Main fuel for cooking		Total
	Electricity	Paraffin	
Electricity cheaper to cook with	5	0	5
Electricity available in area	5	0	5
Paraffin/gas dangerous / cause illness	4	1	5
Electricity expensive to cook with	1	0	1
Gas expensive to cook with	1	2	3
	16	3	19

[29] Free basic electricity

Table 63 Expenditure on fuels by choice of cooking fuel (households with extension cords)

Main fuel for cooking		Elec use (R/month)	Paraffin use (R/month)	Total HH energy spend (R/m)
Electricity	Mean	82	29	100
	N	22	13	22
Paraffin	Mean	52	63	110
	N	12	11	12
Total	Mean	72	45	105
	N	35	25	35

Amongst non-metered households, there is a unanimous preference for electricity as the fuel of choice for cooking and space heating. However, amongst those with metered connections, there is greater diversity of opinion, probably reflecting their experience of the cost and problems associated with electricity.

7.4 Problems experienced with electricity

Data confirms that households with extension cords have a more negative experience of electricity supply than those with metered connections - marginally more households with extension cords experience power cuts, voltage drop that prohibits use of appliances, and damage to appliances. Theft of cables is, naturally, more of a problem amongst households using extension cords. Although more households using extension cords experience electric shocks, there is no difference in the reported incidence of fires caused by electricity.

7.5 Beliefs regarding electricity and other fuels

Respondents in all groups are most positively disposed towards electricity, although those with extension cords have the most strongly positive, and those without electricity have the weakest views. Paraffin is the main alternative fuel, and attitudes towards this show the opposite trend – those with extension cords express a negative view, whilst those without electricity have the most strongly positive view of paraffin.

The only issue where those with metered connections have a significantly more positive view of electricity than both the others is safety. This reflects the risks associated with informal connections. Households with extension cords have particularly positive views on the cost and efficiency of electricity. Issues for which households with extension cords have a particularly weak attitude towards paraffin include efficiency and cost, pollution, and safety.

Note that attitudes towards gas are most strongly positive amongst those without electricity, and negative only amongst those with metered connections – the group with most gas users (9%). However, when separating out the views of gas users, they are positive, but less so than those without electricity (8% of whom use gas).

Informal connections appear to be driven by perceptions of the expense and dangers of paraffin as an alternative and a perception of good value of electricity. This would confirm their willingness to pay for a metered supply, were it available.

Households with extension cords expressed strongest agreement with the statement that relationships within the local community are essential to getting a supply (followed by those without electricity); even those with metered connections registered mild agreement with the statement.

As might be expected, those households with extension cords expressed the strongest disagreement with the statement that electricity should only be for those who can afford it; somewhat surprising is the finding that opinion amongst those who pay is also quite strongly negative. Note that attitudes are influenced by the dominant view (supported to some extent by government) that electricity is a basic service to which all citizens are entitled.

Only those with extension cords were of the view that getting an electrical connection was a community responsibility.

7.6 Why are paraffin users not using electricity?

Amongst households that have electricity, those that use paraffin for cooking have a more positive attitude towards *both* paraffin and electricity than those that use electricity for cooking. Paraffin users feel more positively than electricity users about the cost and ease of use of paraffin. Moreover, paraffin users regard electricity as more attractive than paraffin in all areas with the exception of cost – they regard paraffin as cheaper. This indicates that, whilst there is universal preference for electricity as a cooking fuel, it is issues of cost that drive people to choose paraffin – note also that household incomes are higher amongst those using electricity. In practice, factors affecting perception of cost include not only the cost of fuel but also the low cost of paraffin stoves, and the ability to purchase paraffin in small quantities.

7.7 Impacts of Free Basic Electricity

Since the beginning of 2004, PN Energy has given consumers a free allowance of 50 kWh/month. The impact of this on average electricity consumptions[30] is illustrated in Figure 16. Most respondents in the sample indicated that they are now using more electricity for more purposes.

[30] Calculated by PN Energy for all customers

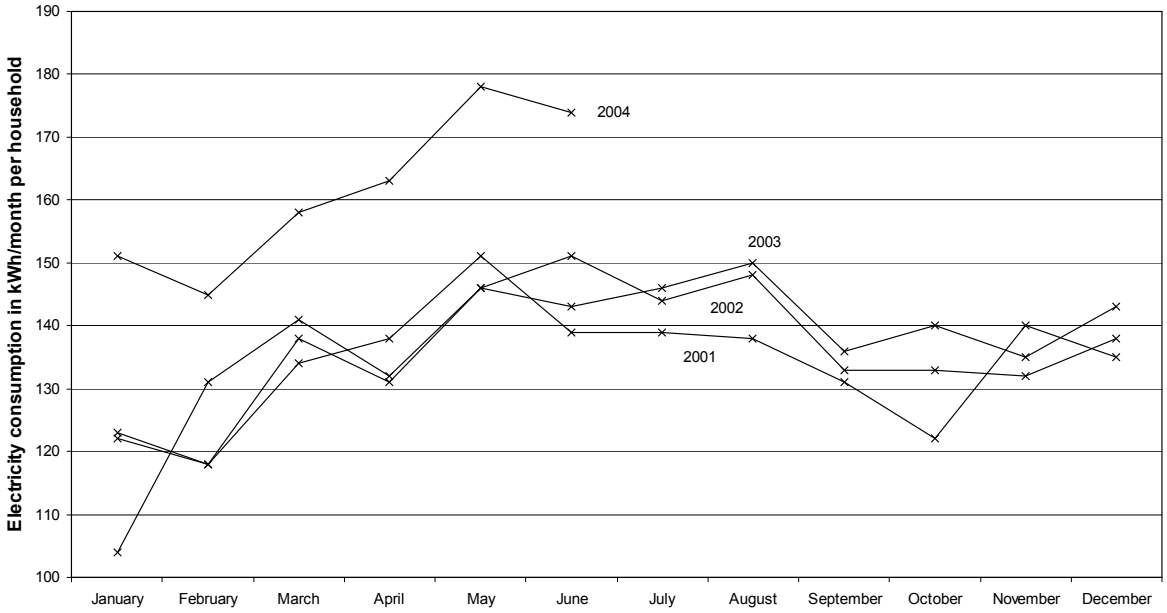


Figure 16: Average household electricity consumption (kWh/month) for PN Energy customers in Khayelitsha

8 Intention to connect to a legal supply

Amongst households without electricity there is very strong intention to connect to electricity in the next year (mean = 4.7); it is not, therefore, possible to identify factors that correlate with intention. All are very willing to pay (mean = 5.0), and the median monthly payment suggested was 50R.

Similarly, amongst those with extension cords, there is very strong intention to connect to a metered supply within the next year (mean = 4.9). There is also a strong willingness to pay (mean = 4.8). People are aware that they pay more per unit than metered customers.

The main disadvantage of extension cords is that the supply is unreliable, which is backed up by the data presented above. However, the complaint that they pay too much is contradictory to the positive view of the cost and efficiency of electricity amongst this group (see above).

Amongst those without electricity, the main constraint to getting a metered connection is that their dwellings are on unauthorised land, and PN Energy is not permitted to supply electricity there. The factors stopping these people getting extension cord connections are location[31], poor reliability, and expense. Only one third of these respondents would approach friends, family or neighbours to get an extension connection, confirming a lack of incentive to make this type of connection.

[31] for houses further away from metered houses, extension cords are less practical, more expensive, more subject to theft etc.; also those in temporary settlements do not have social connections and do not know whom to approach for an extension connection.

The information in this summary is drawn from the full analysis report entitled 'Barriers to modern energy services in low-income urban communities: Khayelitsha energy survey', prepared by Dr. Bill Cowan and Nthabiseng Mohlakoana.

Appendix 11

Logical Framework (KaR R8146)

Narrative summary	Measurable indicators	Means of verification	Important assumptions
Goal: Improved access to clean energy in poorer households	Examples of successful approaches to resolving the institutional, structural and legislative barriers that hinder the provision of clean energy to the poor – indication of empowerment of communities either through community solidarity or technological innovation	Publications by Government, Private and Donors, and PPP consortium that describe their policies and the process of formulating their policies, and their implementation.	No input required.
Purpose: to promote a pro -poor policy in PSP to improve the access and affordability of electricity services to the urban poor	Pro-poor policy adopted to extend affordable services into slum areas in at least one location	Documentation by Government, Donor, private or PPP partnership describes intention to include pro-poor policies collected by Gamos within 6 months of project end date.	(Purpose to Goal) Continued interest of the donor community and international private sector in utility industries in developing countries.
Outputs: *Phase 1 – Proof of concept* 1. Review of electricity industries and pro-poor policy instruments, drawing on other utilities and key players in partner countries. 2. Consolidation workshop (India); partners compare results from Output 1, consultation with local supplier(s). 3. First country survey (India); detailed data on barriers to access gathered from key stakeholder interviews and household surveys; preliminary analysis of barriers to access. *Phase 2 – Comparative analysis*	***Note Start month = 7*** 1. actors concerned with 3 slum areas contribute to research (India, South Africa, Philippines) Review available by month 12 2002/03 2. Workshop held 3. 100 household surveys conducted in slum area. Interviews with CSOs, NGOs, electricity distribution company(s). Stakeholders survey summarised and available by month 5 2003/04	1. Publication of the review by Gamos (project manager – S Batchelor) by month 12 2002/03 2. Workshop report published (2 delegates from each collaborator attend). 3. Collaborator (ASHA) responsible for data collection by month 5 2003/04	(Output to Purpose) Co-operation from slum communities Co-operation from other stakeholders Intentions are not hijacked by other political processes. Approval for Phase 2 granted

4. 2 country surveys; detailed data on barriers to access gathered from key stakeholder interviews and household surveys; analysis of barriers and identification of possible options, including cross country comparison (i.e. a range of policy options to improve access) 5. set of policy reports tailored to each of major stakeholder groups	Interim report available by end of month 6 2003/04 4. 100 household surveys conducted in remaining 2 slum areas. Interviews with CSOs, NGOs, electricity distribution company(s). Analysis and findings summarised and available by month 12 2003/04 Feedback and verification workshops held in each partner country by month 3 2004/05. 5. At least 3 tailored reports available and circulated to 20 actors in the field by month 7 2004/05	*4.* Collaborators (Philrads, EDRC) responsible for data collection by month 10 2003/04. mailing list for consultation exercise (month 2 2004/05) delegates lists from each of 3 national stakeholder workshops (month 3 2004/05) 5. Publication and dissemination of reports by Gamos (distribution list) (project manager – S Batchelor) by month 7 2004/05 Dissemination of reports to National stakeholders by all collaborators in partnership (distribution list, minutes of meetings), Gamos to manage process by end month 7 2004/05	
Activities: Phase 1 – Proof of concept 1.1 review of electricity industries, drawing on other utilities. 1.2 partners carry out stakeholder analysis and gather preliminary data from key players. 1.3 visit each country to coordinate data obtained from key stakeholder interviews, focusing on utilities and community groups (opinion on barriers and solutions). 2.1 partners compare findings and country contexts in workshop; meeting with host country utility(s) to explore options / constraints; coordinate collaborators' input to research design. 2.2 project team drafts research methodology to be carried forward to each country. 3.1 Country visit (India); stakeholder interviews	***Inputs***: *Enter a summary of the resources required (e.g. personnel, equipment) from the Implementation Schedule.*	***Performance Budget:*** *Enter the key costs for each of the main inputs highlighted (use the Detailed Budget).*	(Activity to Output) *Summarise your answer from question 3.3.6.* Co-operation of key players during Phase 1 Co-operation from slum communities. Co-operation from other stakeholders. Intentions are not hijacked by other political processes.

(wide range as necessary), detailed design of survey instruments, conduct survey. 3.2 synthesise data, stats analysis, preliminary analysis and findings. Reporting Phase 2 – Comparative analysis 4.1 Country visit (South Africa); stakeholder interviews (wide range as necessary), detailed design of survey instruments, conduct survey. 4.2 Country visit (Philippines); stakeholder interviews (wide range as necessary), detailed design of survey instruments, conduct survey. 4.3 synthesise data, stats analysis and findings including cross country comparisons. 4.4 email consultation for comment / verification of findings 4.5 stakeholder workshops in each country - feedback and verification 5.1 multiple reports for separate target groups 5.2 distribute reports (global) 5.3 distribute reports in collaborator's countries, supported by briefings with key players.			
			Pre-conditions: *Summarise your answer from question 3.3.5.* Minimal disruption to flights to Asia

Appendix 12

Literature Review (January 2003[32])

1 Introduction

By the end of the 19th Century less than 10% of the world's population was urbanised. By 1970 the figure had increased to 35% and further increased to 50% in 2000. Some 50 years ago around 85-90% of the population in developing countries were situated in the rural areas and rural poverty was the main concern in development studies. Whilst the level of urbanisation in the developing countries is still much less than in developed (35% cf 75%) it is rising at four times the rate of the developed nations and is associated with the very much larger population. The increasing drift of rural populations to the towns is due partly to the depression of the agricultural sector and very much more to the attractions of the town. These are perceived as including employment, better conditions, services (water, sanitation electricity and health), schools etc. Sadly these hopes usually prove to be illusory, development is unplanned, and the reality is poor housing, inadequate or zero services, little health care and schooling and high crime rate.

A feature of urban development has been the rise of the mega-city (cities having population greater than I million). Some of these have been in the developed countries, but the majority (20 out of 24) are in the developing countries and are associated with vast `shanty towns' where living conditions are squalid. `Shanty towns' are not confined to the mega-cities and arise whenever unplanned rapid urbanisation takes place. Hence there is a major problem in finding a way in which these people can achieve a decent and sustainable quality of life. This is clearly an enormous and complex problem to which there is no simple solution. Certainly piecemeal solutions are not the right answer. Nevertheless, because of the complexity it is essential to define problems and identify solutions to the individual components necessary for a good quality of life. These include the technical problems such as water supply, sewage, electricity, housing, infrastructure (roads, schools, health centres); employment and industry development; and the political and economic framework.

Whilst the quality of life of the current inhabitants of the `shanty town' is pretty poor and the outlook sombre, one should note the essential resourcefulness and ability to overcome difficulties characteristic of human nature. Vast numbers exist in these conditions, raise their families and even though unemployment is high, a surprising number find some sort of paid work.

This project looks at one aspect required for development, namely electricity supply. It considers the problems and possibilities of increased availability of electricity in slums/shanty towns in the cities of developing countries. The advantages of this include:

i Improved quality of life
ii improved health
iii facilitate more work-places
iv improved educational prospects

[32] The literature review was submitted to DFID early in the project as a special contract condition.

The obvious obstacle to such action is the general poverty and hence difficulty in payment. There may also be other obstacles including, in some cases, a lack of suitable social structure in the community necessary to sustain the development.

A simple representation of the interaction between the two sectors is shown in Fig. 1. Some of the issues concerned with the demand and supply interface are presented in Table 1.

Fig 1. Demand and Supply Interaction

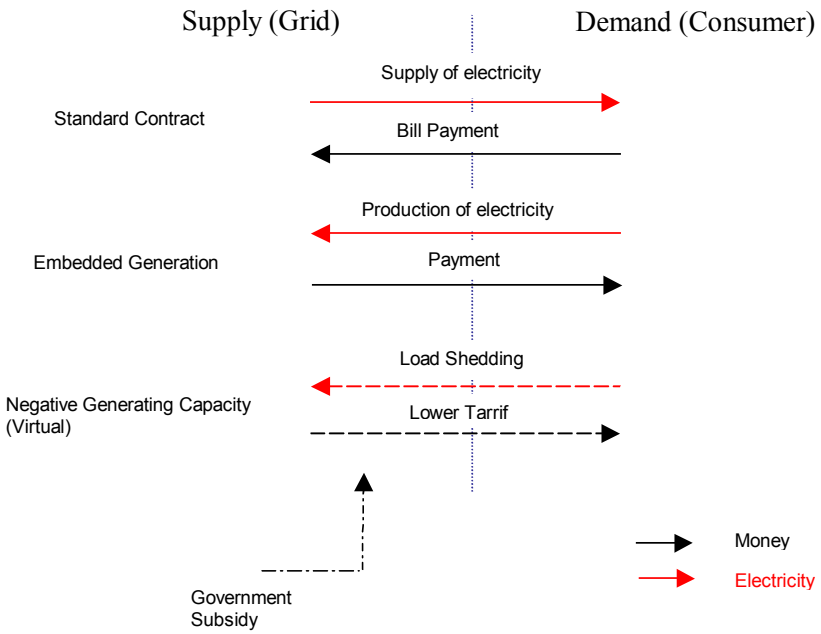


Table 1. Supply and Demand Interface

	Supply	***Demand***
Cost	*Issues affecting the cost at which supplies can be made available:* • tariffs (connection, standing, and unit charges) • generating, transmission and distribution systems - capacity, age (what exists) • technical options for supply to slums (high connection density) • opportunities for cost reduction • subsidies • education – safety and ownership • cost recovery	*Issues relating to the costs that slum dwellers have to pay:* • patterns of demand (what, when, why, how much etc.) • demand side management options e.g. load shedding • low cost installations (wiring looms) • low cost connections (metering, load limiters etc.) • high efficiency appliances • education – how to manage consumption and costs • participation in management activities
Access	*Issues affecting a supply company's decision to provide access in slums:* • constraints to increased load • incentives to increase number of connections (regulator targets) • timescales for investment / cost recovery • risks e.g. theft, non-payment • legal status of slum customers	*Issues concerning ways in which customers in slums can secure access to a supply:* • procedures for getting connected • priorities in terms of quality of supply • waiting lists • illegal connections • multiple household connections • bribery? • Participation in provision of network

The contribution the provision of energy can make to improving the lives of the urban poor is well recognised (Table 2). Although the focus of the literature review has been on the provision of electricity to slum communities, it has considered the whole process from producer to consumer; the limitations and opportunities surrounding the process, including the impact of power sector reform. The conclusions form a basis for highlighting issues to be investigated further in the field research.

Table 2: Potential effects of improved energy services in alleviating poverty

Direct effects on well-being	Direct effects on health	Direct effects on education	Direct effects on economic opportunities for the poor	Trickle Down effect of increased productivity	Fiscal space (coupled with pro-poor policies)
Improved access to lighting, heat, and refrigeration Savings in time and effort (due to reduced need to gather bio-mass and other fuels. Improved access to information (through radio, television and telecommunications)	Improved indoor air quality through cleaner fuel Reduced fire hazard Improved quality of health services (through better lighting, equipment and refrigeration) Easier establishment of health centres Better Education	Improved access to lighting, allowing more time to study Savings in time and effort, releasing time and energy to channel to education	Easier establishment and greater productivity or businesses that employ the poor Creation of employment in infrastructure service delivery Improved health and education and savings in time and effort, increasing individual productivity	Easier establishment and greater productivity of businesses in general (including through positive impact on the environment)	Smaller fiscal burden and higher fiscal returns from more efficient services More benefits to the poor if government spending is effectively channelled to welfare enhancing services Higher fiscal returns associated with higher growth, coupled with pro-poor policies

Source: Waddams Price 2000

2 Demand Side

The demand for improved energy provision in the form of electricity is shown through the impact alternative forms of energy cost the poor, both as a percentage of their income and with regards to their wealthier counterparts. In his article on energy and sustainable development, Jamal Saghir (2002) points out that poor people "already pay more for low-quality energy services then the better off people pay for good-quality services". This view is reinforced through looking at table 3 on the financial costs of cooking fuels in Dar es Salaam to the people. As can be seen there is a significant difference between the cost of electricity and the cost of any other energy fuel.

Table 3: Financial costs of cooking fuels in Dar es Salaam, 1990
(Tanzanian Shillings)

Fuel	Fuel Cost (per effective mega joule)	Total monthly appliance cost	Total monthly cost of 320 mega joules
Firewood	3.94	n.a.	1259.35
Charcoal (traditional)	3.59	22.22	1169.81
Charcoal (improved)	2.39	125.00	890.06
Kerosene	5.24	33.33	1709.52
LPG	3.17	208.33	1224.21
Electricity	0.62	458.33	657.99

Source: Hosier and Kipondya 1993 in Foster 2000

2.1 Electrical Energy Applications

According to the literature poor households tend to use a variety of energy sources to survive (Brook & Besant Jones 2000, Anneke 2000). A recent analysis by Winkler et al (2000) with regards to energy usage among South Africans low cost housing has shown that electricity tends to be used for space heating, lighting and water heating. Furthermore, a recent study by Batchelor et al (1999) in rural China showed that low income people used electricity mainly for light (both for people and animals, Television, Refrigeration, the radio and satellite television.

When looking at this issue and how the poor not only perceive it but respond to their actual daily needs there is also a need to see the level to which they are able to respond to this. A recent NERA article on Energy tariffs in Slovakia points out that recent studies have shown that higher usage of electricity does not necessarily coincide with higher incomes (Voll & Juris 2002). Provision of electric light enables activities such as sewing to be carried out after dark. Food stall vendors also make use of electricity. Small industry can be established, preferably in secure compounds. Improving access to energy should also increase peoples amount of spare time, as less time is needed in the collection of traditional fuels or manual labour (Saghir 2002).

Some have argued, "poor families typically include such vulnerable family members as young children and the elderly" (Voll, S & Juris, A 2002). Such people groups that need healthy temperatures, hot water and safe food to eat. Yet their poverty often limits them in their ability to fulfil these needs, whether through access to electricity or other energy sources. The solution to this will of course have to match available income and their prioritisation within the context of other household needs. Experience suggests that there will be a high priority for lighting, communication (TV), and probably cooking. Also, though generally well aware of domestic equipment members of the various communities may not know about new possibilities and savings which may arise from energy efficient equipment and load control.

2.2 Electrical Load Demand

2.2.1 Barriers arising from costs

With the notable exception of the former communist countries the access to electricity among poor households is low (see table 4).

Table 4: Disparities between rich and poor with electricity are often great

Country	1998 GNP per Capita (1998 US dollars)	Percentage of Households with electricity	
		Poorest Quintile	Richest Quintile
Cote d'Ivoire	700	11.0	71.0
Ghana	390	7.2	43.1
South Africa	2880	13.0	94.6
Ecuador	1530	77.9	97.5
Jamaica	1680	55.4	94.0
Nicaragua	390	28.4	93.1
Panama	3080	23.0	97.1
Nepal	210	3.7	75.0
Pakistan	480	59.8	89.6
Vietnam	330	27.4	76.3
Albania	810	100.0	100.0
Bulgaria	1230	100.0	100.0
Kazakhstan	1310	99.7	100.0
Kyrgyz Republic	350	99.0	100.0
Ukraine	850	99.7	99.7

Source: LSMS surveys in Komives et al. 2000

One of the reasons identified for this is high connection costs which create a barrier to improving access and the affordability of electricity supplies (DFID Issues Paper 'Energy for the poor', see table 5). If we compare the connection costs to some of the countries GDP we can see the problem. For example, in India table 5 shows the connection costs as US$19.6-29.4, whereas the population living below the poverty line of US$1 a day is 44.2% (UNDP 2001).

Table 5: Connection costs in Various Countries

Country	*South Africa*	*Cote d'Ivoire*	*Gabon*	*India*	*Indonesia*	*Nepal*
Cost* *(US$)*	29.4	58.8	58.8	19.6 -29.4	14.7	49 - 58.8
*GDP per capita (US $PPP)***	11,290	1,490	5,990	2,840	2,940	1,310
Percentage (% pc GDP)	0.3	3.9	1.0	0.7 – 1.0	0.5	3.7 – 4.5

*Source: Floor & Masse 2001
** Human Development Report 2003 (UNDP)

An example in DFID's guidance notes is from Ghana where domestic connection charges are too high for the poor. In response to this they began to club together for a meter. However, this increased the electricity usage levels to a point where they entered into the higher commercial rate band. Thereby creating a new set of affordability problems. This issue of price is also shown through the fact that ESKOM in South Africa are constantly lowering the tariffs in an attempt to get the poor connected. However, the poor seem unable to overcome a number of barriers. These include wiring up their houses and in purchasing new appliances (Annecke, W 2000).

Other constraints to do with costs have been highlighted by Christine Kessides (2002). These include the traditional monthly billing method. For many people in poor communities

irregular income limits their ability to be able to pay monthly bills. Added to this she highlights the problem that "*the official subsidy schemes are typically inadequate to cover the utility's costs of extending services to a large share of the urban population living in such circumstances. As a result, many of the poor continue to depend on informal, alternative suppliers (or even "black" markets), and they often pay very significant charges for service through these channels"*. One solution presented in DFID's Energy for the poor document is the use of credit facilities whereby people can spread payments over a period of time. The pattern of which need not be regular. If we look to other utility sectors we can see some examples of how the poor alongside the government and communities have responded to this situation to lower the price and increase access. In the Orangi slum, Karachi, the slum communities organised themselves into small groups. Led by a local Scholar, Dr Khan, each small group was involved in the design, building and maintenance of toilets and local sewage lines and drains (Human Settlements in Asia 1999). In return the government was responsible for the main drains and the treatment plants. The overall cost of provision for each house was low - $34 for each house plus voluntary labour. The total bill for the project was $1.5 million that was meet almost entirely by the local community (Global Ideas Bank, 2003).

For Townsend 2000 however, the issue of reaching the poor is one of access not of economics. This view is supported by Albouy and Nadifi (1999), who point to the fact that the poor spend more on energy then the rich through indirect sources. They also point to the institutional aspect i.e. sector policies, government interference and incentives. They see liberalisation impacting the poor through economic growth and increased labour productivity. However Bouille et al (2002) point to the rise in unemployment that comes with privatisation and subsequent 'efficiency' strategies that all negatively impact the poor.

We can also learn more about the household economic situation by looking more closely at the communities to be studied in India, the Philippines and South Africa. Through this gaining a clearer picture of the amounts of money paid for other services e.g. water and for rent, how these are collected and their success.

2.2.2 Public Services

In addition to domestic services the use of electricity for public services is very important for raising the living standards and sense of security for people living in slums. Public service usage includes:

I. Street lighting. This helps to discourage crime and vandalism
II. Telephones. This may best be offered as a private sale by an individual.
III. Traffic Lights, Security lights.
IV. Public buildings, Schools, community centres, clinics, police stations.

However, our literature search has brought up very little written on this subject. The more immediate household energy needs appear to have been focused on. Thus showing up another important area to be looked at in our investigations.

2.3 Energy Efficient Equipment

In addressing the demands of slum communities for electricity at a price they can afford one answer may lie in the use of energy efficient equipment alongside education on efficient

usage. One should bear in mind that doubling the efficiency of use is equivalent to halving the cost for the consumer. Methods for improving efficiency include:

- Lighting – the use of fluorescent, long life bulbs increases efficiency. However this method is currently costly.
- Refrigeration – the use of chest refrigerators and freezers to reduce the amount of temperature rise when failing to close the door; increasing levels of insulation; introducing education in efficient use; possibility of off-peak operation.
- Television and Radio – encouraging the use of modern energy efficient models.
- Other domestic equipment. Available but not relevant to present application.
- High thermal insulation storage heating.
- Heating as for cooking.

Although desirable in principle it may be difficult at first to introduce energy efficient equipment because of initial higher cost and particularly local availability. Available equipment is often cheap and of poor design and construction e.g. refrigerators have poorly fitting doors and inadequate insulation. It is worth noting that following the oil crisis of the early 1970`s Japanese industry redesigned domestic electric equipment such as televisions and refrigerators and achieved a startling improvement in efficiency equivalent to a reduction in energy use of 60-70%.

High efficiency bulbs, though of greatly increased life, have considerably higher cost than conventional filament lamps. Hence some subsidy will be necessary. One possible problem from such subsidy will be the theft and resale in the market. There are several ways by which this can be discouraged and will require investigation.

2.4 Safety/Education

Some basic understanding is required of users, partly for reasons of safety (particularly important for children) and for reasons of economy in use. A public-private partnership in Rio de Janeiro includes a focus on safety within their energy extension project. Here local students are trained to teach residents of slum communities about the dangers of electricity as well as methods of improving efficiency and in turn reducing bills. They are paid by the private utility company Light Servicos de Electricidad SA (Gentile-Blackwell, A 2002).

3 Supply Side

3.1 Basic Supply Considerations: options for Reducing costs

There are a number of options for reducing costs both at the household and the company level. Overall costs can be brought down by improving generation and transmission efficiency, and in particular by addressing distribution losses (both technical and non-technical), which can be as high as 50%. However, the focus of the project is on domestic consumption in low income areas, in which non-technical losses are a particularly important feature (see Section 3.3), but generation efficiency is beyond the scope of this review.

Léautier, F, Jechoutek, K J, & Bachmann, S (2000) put forward the view that there is need to bring into play two concepts to enable countries to provide electricity to the urban poor: 1) looking for synergies between services; 2) 'mobilising private and community resources, to leverage the finances and skills out of the city'. This however all costs money. To cover the costs they suggest "(a) charging more for services so that they can meet the increasing cost of expanding electricity and water networks to peri-urban areas; (b) using transfers to poorer communities as a way to equalise the differential access to services; (c) decentralising functions to local entities in order to better meet the local demands; (d) spending more, in terms of the capital budget to expand services; and (e) bringing in added capacity to deliver by contracting out services to the private sector"'.

3.1.1 Local Generation

Local generation offers the possibility of some return to the consumer from the utility supplier through electricity sales. The most likely installation is a diesel generator. Combined heat and power seems unlikely unless there happens to be a small industry requiring process heat. Renewable energy does not seem to be promising due to the urban location of slums. Wind, wave and hydro-power resources are not generally available in urban environments. Although biomass can be sourced, its use as a fuel for electricity generation tends to be viable only where conventional fuels are not available, which is not the case in urban centres. This leaves solar (photovoltaic), which is prohibitively expensive when compared with the cost of grid electricity, which is readily available in urban areas.

Options depend on the regulations regarding embedded generation, which comprise legal issues such as what types of equipment are permitted to be connected to the grid and the position regarding independent power producers, technical issues such as connection / protection specifications, and financial issues such as how much a distribution company (or third party) may by required to pay for power. The management of an embedded generation project requires a suitable degree of organisational structure and competence, which may not exist within a community.

3.1.2 Household level

This area has already been talked about briefly. Suggestions have included high efficiency appliances and education. Yet one suggestion put forward by Voll & Juris (2002) puts improving energy efficiency in the hands of the company (energy efficiency programme). The idea is that every household pays a set amount for their energy based on assumptions about usage levels. It is therefore in the company's interest to make sure that each household is as efficient as possible thereby enabling them to be sure of covering costs or even of making a profit. Another option would be the use of prepayment metering (Floor & Masse 2001). This method allows the consumer to create their own budget and allows them to keep track of the amount of money they are spending on electricity. The customer can also follow their own usage patterns on the meter thus reducing their fears of inaccurate readings by the utility company.

3.1.3 Community based infrastructure

Another option for reducing costs is through community infrastructure systems such as multiple household metering; load scheduling / switching. By this is meant connecting a number of households together onto one meter. Floor and Masse (2001) use an example of this from Cambodia. Here the electricity company connect one person in a community (the

wholesaler) to their grid with just one meter point. This person then sets up a small distribution company using bamboo poles, trees etc to get the electricity to their neighbours. The electricity company bills the wholesaler for the amount of electricity used and s/he in turn charges their consumer neighbours. This method has allowed the Cambodian electricity company to electrify most of Phnom Penh through only 250 wholesalers. However, this system is not without its problems; for example, the rates that wholesalers charge consumers is not regulated, leading to charge rates that can be two or three time the formal tariff. The high level of complaints, mostly related to the disparity of charges arising between those billed by wholesalers and those billed by the utility, has led the electricity company to consider abandoning the system.

3.1.4 Community Participation

Opportunities exist for slum communities to get involved in the provision of energy into their communities at all levels of the project cycle (Cotton et al 1998). These include

- Planning and design of provision
- Supply of waged labour for installation
- Procurement of equipment and material from local suppliers
- Supply of volunteer labour
- Sharing of cost
- and Maintenance of the installed service.

From a community development perspective the involvement of communities in planning provisions is seen as longer lasting and more successful with regards to payment than other methods. This is due in part to a sense of community ownership, but also, according to Cotton & Tayler, to the fact that it should take into account existing organisations and power structures. As a concept this has been used in other utility provision areas. For example the Prosanear project in Brazil aims to bring water and sanitation into the slum communities. Rather then the government and utility companies going straight in the project began by asking the communities what they wanted. From this point the communities then participated in the planning and design of the service provision. Part of this included creating the legality of the slum housing. This meant that the community people were now recognised as citizens and in turn they have begun to improve their dwellings. The success of the Prosanear project to date has caused it to conclude that *"the poor will pay [for utilities], as long as they understand what they have paid for and receive adequate services for their payments"* (Katakura, Y & Bakalian, A 1998). This therefore highlights the need for provision to meet the standards required for demand. For electricity this can be translated into meaning an assured supply with few power cuts. However, with regards to community participation Sohail et al (2002) comments that the cost of the community's time needs to be factored in to plans surrounding energy provision. Once the utility provision is up and running co-operatives or local shops could take on the responsibility for meter reading; bill payment; and repairs (Floor & Masse 2001).

3.2 Nature of Load

It may be that there is not enough electricity to meet the additional demand arising from provision to slum communities. There are a number of ways in which this can be addressed. One is through Demand Side Management. This concept is also put forward as a way to reduce costs at the community level. DSM is where a company directly manage the demand

for power. By operating from a local sub-station DSM offers considerable flexibility by the use of prioritised electronic switching. This can be achieved in several ways including radio signals and high frequency waveforms on the power cables. In turn this makes load shedding and load scheduling possible (Padmanaban & Sakar 2001). The inconvenience of load shedding must be balanced against cost benefits. DSM can also include reducing the amount of electricity used through energy efficiency education, rebates for energy efficient equipment or through time of use tariffs or direct load control. For example, one half of a community get electricity at one point in the day and another section at another point in the day. This would clearly need to be managed well to avoid disputes and to make sure that everyone got some electricity when needed. Also where thermal storage exists, as in refrigeration, it may be possible to switch on appliances during periods of low demand when capacity is available, e.g. at night.

3.3 Management of Distribution

Cost recovery is an important factor for any business. The impact of theft, corruption/fraud and non-payment can have a debilitating effect on its effectiveness and efficiency. For the poor the impact is often far greater then for the rich. For they are the first to experience blackouts, limited extension of services and increased tariffs (Lovei & McKechnie 2001).

3.3.1 Theft

In South Africa the problem of the theft of electricity through bi-passing meters using a small piece of wire has caused the Durban Metro Electricity Company to introduce split meters into homes. In the design of this the measure and control unit (mcu) is placed in a secure environment outside the home. Thus significantly reducing the threat of theft through bypassing the meter. The customer instead has only an interface unit in their home (Smart, DJ, 1999). Another angle is to reduce the technical costs associated with electricity transmission to reduce the incentives for theft and increase access to the poor, e.g. load limiting or low cost, prefab wiring.

3.3.2 Fraud/Corruption

Cost recovery is an important factor in determining the effectiveness of a utility company (Floor & Masse 2001). The disabling impact of fraud and corruption in both the public and private sector can therefore have a major impact on the effectiveness of utility companies to deliver any service, no matter how reliable, to the slum communities. This can be through increasing company expenditure or reducing their actual income (IBLF 2002). The problem of corruption then obviously has a major limiting impact on the amount of surplus funds available for a company to be able to actually deliver power and improve services to existing companies let alone extend delivery. According to Transparency International's Bribe Payers Index 2002 the power generation and transmission sector came fifth out of seventeen in sectors most prone to bribing by officials (DFID Energy for the poor 2002). Lovei and McKechnie (2000) put this down to the traditional institutional arrangements and the large quantities of cash that can be generated. The problem is that corruption and fraud can take many forms within the utility sector, from petty corruption at the metering and billing stage, to corruption at managerial levels for sale contracts. For example it is estimated that only 55% of the energy generated in Bangladesh is paid for (ibid). In tackling this Kirkpatrick & Piesse (2001) point to the needs for governments to promote positive environments, including competitive market condition and proper regulation. While little is directly written on

tackling corruption in utility companies much is written about tackling corruption in governments. However, this is not seen as being in isolation from the private sector. For part of tackling corruption is reducing the incentives and opportunities for corruption. This should include reducing face to face contact, addressing low pay, introducing performance management systems and developing better detection and judicial systems for dealing with corruption (see DFID Key sheet on "Fighting corruption" 2001). With regards to the collection of full payment Floor & Masse (2001) call for the need for a good commercial department to keep track of payments and ensure good relations with this higher paying sector.

3.3.3 Non-payment

Non-payment of bills is not only encountered in poor communities. Albouy & Nadifi (1999) point out that "in some countries, electricity users in the industrial and commercial sectors are so overcharged that they evade payment and bypass grid service". This can cause huge problems as it reduces the revenue base form which companies are able to expand their services. Non-payment can also be caused through a persons inability to get to the company's offices to pay (Floor & Masse 2001). Powell and Starks (2000) suggest that using the local community to participate in bill collection and maintenance can help to tackle this problem. They site an example from Bangladesh where local co-operatives buy power from the grid and then distribute it. These groups are then also responsible for keeping track of local billing and maintenance.

4 Government Policy

Policy is important in shaping the energy market. Whether through subsidies, tariffs, regulations etc. There is debate about the usefulness of each. For example, the impact of policy and subsides is shown through an example from India. Here the urban poor switched from biomass to kerosene when it became state-subsidized. This has had a negative impact on health in the slum areas through poor burning and poor ventilation as cooking is brought inside (Dasgupta 2002).

4.1 Power Sector Reform

4.1.1 Energy Sector Ownership

Looking at power sector reform brings us to issues of privatisation and public private partnerships. In the developing countries supply is often inadequate, unreliable and under severe economic stress. Padmanaban and Sakar (2001) write about the problems of electricity supply in India. Here there is not enough electricity to meet demand. This is in part due to high transmission & distribution losses, large commercial losses through poor billing, metering, collection and energy theft; low end use efficiency. Thus the ownership and operation of electrical supply is under consideration in many countries both in the developed and developing world. According to Leipziger and Foster (2002) there is a large amount of evidence that privatisation of utility companies creates substantial dividends. For example, the private management of services often reduces costs, particularly through competition or proper regulation of prices. It is estimated, that efficiency improvements as a result of Argentina's infrastructure privatisation program "were as much as 1 percent of gross domestic

product". (ibid, see also Albouy & Bousha 1998). Added to this is the encouragement by the IMF and World Bank throughout the 1990s for the privatisation of state-owned companies as part of loan conditionality (Bayliss 2001). The assumption is that privatisation will reduce the burden on State funds and encourage outside investment into the country. Thereby improving the economy. Added to this is the assumption that privatisation will increase the efficiency, reduce prices and improve quality of service of the company (Birdsall & Nellis 2002). This is in part due to the introduction of competition (Webb, M 1998), which is based on the assumption that competition will reduce prices and create a new source of capital for the government to cover costs through Foreign Direct Investment.

Much current thought is being given to the privatisation options for the State-owned companies. Privatisation can take many forms e.g. public/private ownership, capitalisation and decentralisation. One example of private-public partnerships comes from Rio de Janeiro. Here the cities main electricity provider (Light Servicos de Electricidad SA) provides the electricity. A $200 million loan is provided through a Banking syndicate managed by Citibank, with MIGA (part of the World Bank) guaranteeing it. The whole scheme is part of the government's utility upgrade programme for Rios de Janeiro, which emphasises not only the upgrading of the network but also meters and transformers. For the low-income residents Light offers a 42% discount on meter installation, payment can also be carried out through 24 $3 instalments. Judging by the number of slums reached to date this programme appears successful. It is estimated that each slum will begin to make a profit after 5 years (Gentile-Blackwell 2002). A less positive example is from the Dominican Republic. Here the government privatise the distribution and generation components, whilst retaining control over transmission in 1999. The aim was to encourage a smooth transition to complete privatisation with little cost implications to the voting public. However, as distribution and generation prices rose inline with inflation and oil prices the government was forced to increase their subsidies. They soon amounted debts of US$100 million to the private companies. The result has been frequent 24hr blackouts and the subsequent with holding of bill payment by consumers. The government is still planning to privatise transmission in accord with World Bank requirements (Bayliss, K 2001).

Léautier, F, Jechoutek, K J, & Bachmann, S (2000) also view the solution to improved energy services to lie in "mobilising private investment and know-how, in partnership with local governments and communities". This would be achieved through "encouraging decentralised business models that are less cumbersome than the old utility model"; and "reforming the electricity industry and opening it up to the market, so the new business models can be accommodated and nurtured, and utilities themselves can become efficient, commercially operating, and consumer-friendly power enterprises".

One of the problems with privatisation in general is that the entity to be privatised needs to be sufficiently attractive to encourage private sector investment. This is shown through the successful example of Bolivia recent restructuring. Here 50% of the state owned electricity companies shares was sold to private companies, 5% given to the company's employees, and 45% into a private pension fund. The result has been that it has successfully brought about foreign investment, whilst at the same time increasing the number of electricity connections which have not by-passed the poor (Barja & Urquiola 2001). In contrast the Southern African Energy sector has failed to make itself attractive. Anneke puts this down in part to current levels of international debt, a weak economic administration and political instability. Even the recent moves to democracy over the past few decades have not been enough, as the real problem lies in high inflation and interest rates (Anneke 2000).

Against the view for privatisation is also the point of reduced electricity price subsidies that will directly impact the poor and a reduced profile of the government. This move away from traditional monopolistic approaches to competition, bill payment and service standards is not without its problems for governments. The administration involved is costly. The traditional approach also carries with it institutional and financial obstacles relating to its format. Problems such as the physical haphazard layout of slums, as opposed to the more even middle class housing layout of individual plots (Kessides, 2002). Townsend (2000) however feels that the impact to the poor will be positive where it is implemented alongside policies to protect the poor, and because it should improve their access and service quality. The problem in proving this is currently information on the subject matter is poor.

One aspect of privatisation is the extension of networks. Increasing competition may reduce prices, which may make grid extensions appear more viable in view of increased demand, but this may not necessarily be sufficient to attract investment in network extension. Whatever approach the reform takes its objectives and the new roles of each party involved need to be clear to all, especially if it includes targeting distribution to slum areas (Webb, M 1998, Powell, S & Starks,, M 2000, Patterson et al 2002). In Christine Kessides view there is a need to "*make the infrastructure utilities more responsive and effective in reaching poor and irregular urban settlements"*. In her view this requires a change to conventional practices, including privatisation. Privatisation that includes small scale entrepreneurs in the settlements in utility provision – *"'Bulk supply', whereby an entrepreneur or community group purchases water or electricity from the formal network supplier for distribution within a neighbourhood*" (Kessides 2002). For Cowen and Tynan (1999) it is not just small scale entrepreneurs that need to be included it is also the local mafia and black market. Whatever the specific problems Brook and Smith point out that the impact of any reform to the poor very much depends on the governments commitment to them as a group.

4.1.2 Regulation Subsidies Tariffs

Regulation of the energy sector is one way to make sure that providers maintain an "acceptable" level of service and include provision to the poor. An acceptable level of service could include such items as the quality of supply (voltage/frequency specifications), price restriction targets (linked to number & type of connections) and the time scale for investments. The form the regulation takes needs to focus on both 1. price control and outcomes, and 2. the initial provision of electricity - taking into account the needs of investors, the government and consumers (Ugaz 2001). In the area of local network expansion there are two primary funding considerations

i Purchase and installation of equipment to establish the system.
ii Continuing funding to cover electricity costs.

In addition a smaller sum would be needed to cover maintenance and education. However, as Barberton points out, the form the regulation takes is not just important in reaching the poor but also important in creating incentives for private investment and demand side management (Barberton 2000).

Along side regulation are suggestions to lower connection charges or extending credit to the poor (Floor & Masse 2001). For example, SONEL in Cameroon reduced their connection charge by 25% and increased their customer base by 18,000 (ibid). Covering the costs of this can be through future profit margins or through government subsidies or tariffs. Tariffs can take many forms:

Lifeline Tariffs - Lifeline rates provide a block on electricity subsidy at a certain rate (ibid). This is linked to government estimates regarding consumption levels to satisfy a households basic needs (cooking, lighting, refrigeration). One method of covering the electricity companies overall costs is that the government could pay 50% of the estimated electricity consumption. Voll & Juris suggest that the funding for this could be through a special fee to all domestic electricity users, i.e. cross subsidy.
Social Tariffs - Cowen and Tynan (1999) write about social tariffs having the potential to create a disincentive to companies to supply low-income areas with electricity. This is because the tariffs are often paid for through higher charges to the commercial sector. A recent article from NERA with regards to the restructuring of the Slovakian Energy sector takes this point further (Voll, S & Juris, A 2002). Voll & Juris say that it may even push companies to produce their own generation, probably very inefficiently, and in so doing cause the energy provider to loose their best customers. If it is covered through fuel taxation the rise in costs will negatively impact the poor.
Targeting of tariffs - Targeting of specific communities is one option on the supply side. Voll & Juris (2002) note however that this is often costly in terms of administration overheads. A negative factor for many poor country governments or for companies who have low administrative capacity.
General Tariffs - Voll & Juris highlight that compared to targeting and metering, across the board tariffing is cheaper both in terms of administration costs and infrastructure costs.

With regards to the poor a major consideration is that subsidies and tariffs often don't reach the poor, as they are not connected to the mains. In Honduras it is estimated that 80% of electricity subsidies go to the non-poor (Leipzeger and Foster 2002). Two of the reasons for this are 1. the non-legal nature of many low-income settlements, i.e. slums; and 2. the irregular income of the poor that leads to poor bill payment (Voll, S & Juris, A 2002). Both reasons provide low incentives to utility companies to provide any level of service. Kessides, therefore puts forward the view for the removal of tariffs. In its place companies would be required to offer flexible payment options and providing credit for initial connection. For Slovakia the lack of connection is a very small problem and it is suggested that it be addressed through temporary supply provision (ibid). With the cost of installation being covered by the government whilst they seek to address the social issues. They also point out the need to include energy efficiency education to people to try to help them reduce their overall usage.

4.2 Legality of land tenure

A major constraint to access often lies in the fact that many slum communities have no legal standing. According to DFID this legal barrier calls for the need for reform (DFID Issues paper: Energy For the Poor: Underpinning the Millennium Development Goals, 2002). But, as they point out, this may bring tensions within government as with legality brings certain responsibilities for the government, due to their subsequent need to provide infrastructure to these areas. A situation which is costly and which many developing countries cannot afford. On the positive side we have seen through the example of Prosanear and Light how through linking utility provision and legality brings about change more far-reaching than just utility provision. This can be seen through Sao Paulo, Brazil programme to electrify slum areas resulted in people being able to clean their homes properly and reduced their fear of fire accidents. These communities began to be seen as real customers and through gaining legal status were able to access credit systems - for their utility bill worked as a proof of residence (Patterson et al 2002).

5 Conclusions and Direction for Research

A report on a World Bank sponsored Workshop on Global Coalitions of Voices of the Poor (Narayan and Shah, 2000) opens with a quote from a participant from Brazil:

> *"Sometimes they do not even let you talk. They say they already know the problem and that they will solve it."*

Whilst this comment was made in the context of emerging information technology, and its potential to redress imbalances of power in decision –making processes that affects the lives of the poor, it may also be applicable to the provision of electricity services. The project will, therefore, seek to explore the opinions and priorities of the poor themselves.

Privatisation policies have been implemented with a view to attracting investment, but attention has been paid more recently to the impact on the poor, and the literature highlights a recognition that little empirical data exists. It is also pointed out that little data on energy demand exists to inform energy sector projects, and it is recognised that the demand amongst poor communities will have its own, unique characteristics. It is, therefore, important that the research gathers data on current practice and electrical demand from a cross section of slum society in each country (domestic, industry, public services).

The literature highlights a number of problems faced both by the poor in securing an electrical supply (such as affordability and access), and by distribution companies in making supplies available on a sustainable basis (such as cost recovery and cost of infrastructure). The research can, therefore, produce some useful findings by gathering data on a range of issues concerning the distributor–customer interface:

- Constraints to electricity supplies – there seems to be debate in the literature as to whether principle constraints are economic i.e. people can't afford electricity, or access i.e. they simply aren't able to get the utility to provide a supply.

- Payment mechanisms – utilities experience problems with non-payment (and theft). What are the reasons behind this? Explore how people pay for other services e.g. water, rent.

- Participation – look for examples of ways in which residents (and community representatives such as local councils) have been involved in utility service provision, and ways in which it might be possible for them to participate.

- Quality of supply – what problems are encountered at present e.g. load shedding, voltage drop, connection tripping (illegal connections)? What are priorities for customers?

There is degree of interaction between these, but in summary, the research should investigate the Distributor-Customer management chain, with a view to gaining an understanding of the concerns and priorities present on both sides, and identifying ways in which current practice may be tailored to accommodate these, in order to promote more effective provision of utility services. The project logical framework includes country surveys amongst the outputs, which will provide opportunities for the project to gather the type of data found to be needed (e.g.

problem with electrical supplies, constraints, energy use, etc.). Country visits will also provide opportunities to loom for examples of innovative payment mechanisms and participation of consumers. Conclusions from the literature review will, therefore, inform the design of surveys.

6 References

R7182 - Energy Provision to the Urban Poor http://www.etsu.com/dfid-kar-energy/html/r7182.htm

R7661 - Energy, Poverty and Sustainable Urban Livelihoods http://www.etsu.com/dfid-kar-energy/html/r7661.htm

Albouy, Y & Bousha, R 1998 **The impact of IPPs in Developing Countries – Out of the crisis and into the future**, (World Bank publication 'Public policy for the private sector, Note 162, Dec 1998) www.worldbank.org/html/fpd/notes/162/162summary.html

Albouy, Y & Nadifi, N 1999 **Impact of Power Sector Reform on the Poor: A Review of Issues and the Literature** The World Bank wbln0018.worldbank.org/.../439eb3b648f5b402852569060079b75c/8525690b0065f5d1852568a30057dad8?OpenDocument

Anneke, W 2000 **Assessment of the impact of the Southern African Power Pool on the poor of the region** (EDRC report no: EDRC/00/R15)

Barberton, C 2000 **Exploring the possible impact of electricity supply industry restructuring on demand side management** (EDRC report no: EDRC/00/R1)

Barja, G & Urquiola, M 2001 **Capitalisation, Regulation & the Poor: access to basic services in Bolivia** (World Institute for Development Economics Research)

Batchelor, S, Scott, N, Daoqi, L & Bagen 1999 **Evaluating the impact of Wind Generators in Inner Mongolia: Project Technical Report** (Gamos Ltd for DFID: Reading)

Bayliss, K 2001 **Privatisation of electricity Distribution: some economic, Social & Political Perspectives** (Public Services Research Unit)

Birdsall, N & Nellis, J 2002 **Winners & Losers: Assessing the distributional impact of privatisation** (Centre for Global Development Working Paper #6)

Bouille, D et al 2002 **Power Politics: Equity and Environment in Electricity Reform**, http://www.wri.org/governance/powerpolitics_toc.html

Brook, P & Besant-Jones, J 2000 **Reaching the poor in the age of energy reform,** Chapter 1 ESMAP Energy Report 2000 http://www.worldbank.org/html/fpd/esmap/energy_report2000/ch1.pdf

Brook, P and Smith, WP 2000 **Better energy services for the poor** Chapter 12 ESMAP Energy Report 2000 www.worldbank.org/html/fpd/esmap/energy_report2000/ch12.pdf

Cotton, A P, Sohail, M & Tayler, WK 1998 **Communities Initiatives in Urban Infrastructure** (Water, Engineering and Development Centre, Loughborough University)

Cotton, A P & Tayler, W (no date) **Services for the urban Poor: Guidelines for Policy Makers, Planners and Engineers** (Water, Engineering and Development Centre, Loughborough University)

Cowen, P B & Tynan, N 1999 **Reaching the Urban Poor with Private Infrastructure,** (World Bank publication 'Public policy for the private sector, Note 188) www.worldbank.org/html/fpd/notes/188/188cowen.pdf

Dasgupta, N 2002**Left on the back burner: time to put energy onto the urban planning agenda? http://www.id21.org/zinter/id21zinter.exe?a=0&i=U3nd1g1&u=3e2414a7**

DFID 2002 **Energy For the Poor: Underpinning the Millennium Development Goals** DFID Issues paper, August 2002

DFID 2001 **Key Sheets for Sustainable Livelihoods: Fighting Corruption: An Overview** http://keysheets.org/red_6_corruption_rev.pdf

Floor, W & Masse, R 2001 **Peri-urban Electricity consumers – a forgotten but important group: What can we do to electrify them?** October 2001Joint UNDP/ESMAP paper www.worldbank.org/html/fpd/esmap/publication/periurban.html

Foster, V 2000 **Measuring the impact of energy reform – practical options** (chapter 4 in ESMAP energy report 2000)

Gentile-Blackwell, A 2002 **Bringing Light to Rio's Slums,** MIGA-backed power project tackles outages and safety hazards, http://www.ifc.org/publications/pubs/impact/issue2/ablackwell/ablackwell.html

Global Ideas Bank 2003 Orangi Slums transforms by street committees and small loans http://www.globalideasbank.org/BI/BI-263.html (accessed January 2003)

Human Settlements in Asia 1999 T**he Orangi Pilot Project in Karachi, Pakistan** (The Best Practices Initiatives, Human settlements in Asia Gateway to Urban planning and Management in Asia) http://www.hsd.ait.ac.th/bestprac/orangi.html

International Business Leaders Forum (IBLF) 2002 **Business and Corruption: Promoting the role of business in combating corruption** (IBLF: London) http://www.IBLF.org/corruption

Katakura, Y & Bakalian, A 1998 **Prosanear: People Poverty & Pipes** UNDP/World Bank Water and Sanitation Programme Working Paper, September 1998)

Kessides, C 2002 **A Framework of Economic Policies for Urban Upgrading,** (contribution to The World Bank Workshop on Scaling Up Urban Upgrading in Latin World Bank Workshop on Scaling Up Urban Upgrading in Latin America) **http://wbln0018.worldbank.org/External/Urban/UrbanDev.nsf/Urban+Slums+&+Upgrading/D580201B786CDA438525694300715F39?OpenDocument**

Kirkpatrick, C and Piesse, J 2001 Regulation for Enterprise Development and Regulatory Impact Assessment **(EDIAS) http://www.enterprise-impact.org.uk/informationresources/application/regulatoryframeworks.shtml**
Komives, K, Whittington, D & Wu, X 2000 **Energy Use around the World – evidence from household surveys** (Annex to chapter 2 in ESMAP Energy Report 2000)

Léautier, F, Jechoutek, K J, & Bachmann, S 2000 **Empowering the Urban Frontier: Electricity for Peri-Urban Communities** (The Journal Online Issue September 2000, City Development Strategies Initiative (CDSI)
http://www.citydev.org/journal/sep00/journal_f15.html

Leipziger, D and Foster, V 2002 **Is Privatisation Good for the Poor?** **http://www.ifc.org/publications/pubs/impact/issue2/dl-vf/dl-vf.html**

Lovei, L & McKechnie, A 2000 **The costs of corruption for the poor** (Chapter 8 in ESMAP Energy Report 2000: World Bank)

Maintaining Utility services for the poor. (print out). **http://www.worldbank.org/wbi/attackingpoverty/eca/maintainingutilities.pdf**

Narayan, D and Shah, T 2000 **Connecting the local to the Global: Voices of the Poor** (Framework Paper prepared for 11-13 December 2000 workshop on Local to Global connectivity for Voices of the Poor, World Bank)

Padmanaban, S & Sarkar, A 2001 **Electricity Demand Side Management (DSM) in India: A Strategic and Policy Perspective,** Office of Energy, Environmental, and Enterprise, USAID/India http://www.usaid.gov/in/whatsnew/articles/dsm.htm

Patterson,W, Eberhard, A & Suarez, CE 2002 **Towards sustainable electricity policy** in Energy for sustainable development: a policy agenda Johansson, TB & Goldenberg, J (eds) 2002 (UNDP) http:// www.undp.org/seed/eap/html.publications/2002/20013108FNRapport.pdf

Powell, S & Starks, M 2000 **Does Reform of Energy Sector Networks Improve Access for the Poor?** (World Bank publication 'Public policy for the private sector, Note 209, May 2000) www.worldbank.org/html/fpd/notes/209/209summary.html

Smart, DJ 1999 **Pre-payment – Separate consumer interface increases flexibility and security** (Conlog (Pty) Ltd, Durban South Africa) http://www.metering.com/archive/994/p28-1.htm

Saghir, J 2002 **The role of energy in sustainable development** in *Renewable Energy for Development Newsletter* vol 15, no 1/ 2 Dec 2002 pp10-11 (Stockholm Environment Institute)

Sohail, M, Cavill, S & Cotton, AP 2001 **Operation, Maintenance and Sustainability of Services for Urban Poor: Findings, Lessons learned and Case Studies Summary & Analysis** (Water, Engineering and Development Centre, Loughborough University)

Sohail, M & Cotton, A P 2001**Public- Private Partnerships & the Poor : Interim findings Part A (Summary & lessons Learned)** (Water, Engineering and Development Centre, Loughborough University)

Townsend, A 2000 **Energy access, energy demand, and the information deficit,** Chapter 2 ESMAP Energy Report 2000 http://www.worldbank.org/html/fpd/esmap/energy_report2000/ch2.pdf

Ugaz, A 2001 **A Public Goods Approach to the Regulation of Utilities** (World Institute for Development Economics research Discussion Paper #2001/9)

UNDP 2001 **Human Development Report**

Villagran, E 2000 **Key drivers of improved access- off-grid service,** Chapter 6 ESMAP Energy Report 2000www.worldbank.org/html/fpd/esmap/energy_report2000/ch6.pdf

Waddams Price, C 2000 **Better energy services, better energy sectors - and the links with the poor,** Chapter 3 ESMAP Energy Report 2000 http://www.worldbank.org/html/fpd/esmap/energy_report2000/ch3.pdf

Webb, M 1998**Power Sector Reform and Regulation,**. (London Economics, Paper presented at the Seminar on the Economics of regulation, Mexico City) www.cre.gob.mx/cid/docinv/mwebb-power.pdf

Winkler, H, Feches, RS, Tyani, L & Matibe, K 2000 **Cost benefit analysis of energy efficiency in low cost housing** (EDRC report no: EDRC/00/R9)

Voll, S & Juris, A 2002 **Alleviation of the Social Impacts of Energy Tariff Rationalization in Slovakia: Identification of Suitable Consumer Assistance Programs** (NERA Economic Consulting) http://www.nera.com/_template.cfm?c=6167&o=5732