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DEVELOPMENT
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UPEA II: FINAL REPORT



**Modern energy access in peri-urban areas of West Africa: The case
of Dakar, Senegal**

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Executive Summary

In Sub-Saharan African countries, the issue of energy access is often understood in the context of two distinct policy target zones. These two distinct zones are: the urban areas characterized by a high population density and the proximity of the energy infrastructure and the rural zones that are less populated and generally located far from the available energy infrastructure. Accordingly, all the policies and actions designed to boost access to energy services and alleviate poverty level are tailored or specialized to meet the needs of either of these two customers. This specialized approach provides a simple analysis framework for the energy policy makers but unfortunately does not take into account the creation of uncharted zones associated with the exodus of rural populations and also intra-urban and regional or international migration that thrive on the edge of African cities. Because of the specialized approach to energy policy, these peri-urban zones are integrated in the urban energy policy even though they possess strikingly different features than traditional cities. This has the detrimental effect of leaving an energy policy vacuum in these peri-urban areas that tends to exacerbate the already existing level of poverty. This article focuses on the status of peri-urban zones of Dakar, Senegal with respect to access to clean energy services for household usage and also for productive purposes. To explore this issue we have conducted surveys including 280 households and 70 businesses from 7 peri-urban areas of Dakar, Senegal. These zones include: Ben Barack, Daliford, Yoff, Barack-Liberte 6, Malika, Rail and Ainoumanou II. All the neighborhoods surveyed are in a large extent composed of slums for example areas like Barack L6 and Ben Barack are all large slums. In other zones even if there is some descent housing we focused our survey on the slums. In addition we relied on secondary data collection and stakeholder's interview to obtain information.

The need for a proper definition and geographic delineation of peri-urban zones

In Senegal there is no consensus over the definition of the concept of peri-urban. The most alarming issue that was identified during our interviews is the inability of key energy actors to give any definition for the concept of peri-urban. For example the Senegalese national statistic agencies along with the power company (Senelec) have a rather simple approach where they recognize zones to be either rural or urban. This issue is rather disturbing especially when it comes to the power company that is responsible for the electrification of the peri-urban areas. The peri-urban zones are strikingly different than the traditional urban zones and it is important to understand its true nature to develop an effective plan to boost energy access for their population. In addition it is critical to collect statistical information about the peri-urban zones and this can be done only when the governmental statistic agency clearly defines and understands the peri-urban domain and its characteristics. The risk here is that the peri-urban data could be wrongly integrated in the urban statistics in a way that will make it impossible to identify issues facing the peri-urban communities. Another important aspect of the debate over the true definition and characterization of peri-urban zone is what we can call a communication break down. All the NGO's (others actors) and the university scholars we interviewed have some level of understanding of the peri-urban concept. The problem is that there's no practical forum where these different groups can exchange ideas and more importantly where they could pass the information onto key decision makers (Power Company, government agencies or department). Another important feature of the debate is the necessity to delineate the peri-urban zone to have a clear understanding of their location relative to the urban centers and their actual size. In Senegal the different stakeholders have a

general idea about the location of these peri-urban niches but could not give an accurate delineation of such zones. The availability of geographic positioning systems can be an asset for the true delineation and geographic characterization of peri-urban zones. This issue is important because the localization of the settlements and their relative distance to main city centres have tremendous implications in term of energy access (closeness to the electricity grid)

Energy Profile of peri-urban areas of Dakar Senegal

The peri-urban energy profile in Senegal can be described as a middle ground between the rural energy profile and the urban profile. Generally the peri-urban energy profile is characterized by a transition from traditional sources of energy (wood and charcoal) to more modern energy type (LPG etc).The extent of this transition is a function of many variables namely : the adequacy of the energy access policies and socio-economical parameters.

Domestic Fuels Consumption

In the different peri-urban households the main fuel used are LPG, charcoal and dry wood. However, depending on the income level the peri-urban households use different combination of these fuels.LPG is widely available in these zones and a reliable distribution network is in place. In peri-urban households LPG is the fuel of choice for cooking because it is easy to use, clean, efficient and economical. The LPG is available in different cylinder sizes ranging from 2.75 kg, 6, 9 to 12 kg. The most popular cylinders in the peri-urban zones are without any doubt the 2.75 kg and 6 kg (popular gas). Cooking stove are attached only to cylinders 2.75 kgs and 6 kgs.The higher volume cylinders weighing 9 and 12 kgs are rarely used in peri-urban households LPG usage in peri-urban zones is important but some significant changes have to be operated in order to maintain this high usage and increase LPG consumption in peri-urban areas. The low income level of the peri-urban population combined with a progressive withdrawal of the governmental subsidies on LPG and an unpredictable oil market have a detrimental effect on LPG consumption among the peri-urban poors. Even though the national demand for LPG is rising, the demand for LPG by poor households is not increasing and this trend will be exacerbated by the planned withdrawal of the governmental subsidies on LPG. The governmental subsidies were introduced to help the poor access clean energy sources but after all these years we see that the subsidies have not been properly channelled to this vulnerable part of the population. The subsidized 2.75 and 6 kg cylinders that were to benefit the poor are instead being profusely used by the middle and upper middle class. This situation warrants a re-evaluation of the impact of the subsidies and the development of a mechanism that will secure the channelling of the subsidies to the target populations. Another issue that relates to LPG use in peri-urban zones is the frequency of shortages due to the weakness in the warehousing infrastructure for imported LPG and also the late payment of the governmental aid to attenuate the impact of rising oil prices. In addition artificial shortages are frequent and are caused by the speculative behaviour of the local suppliers. After LPG the other fuel of choice for peri-urban households is charcoal because it is easy to use and widely available with the possibility to buy in small quantities .Charcoal can be also seen as a back up fuel that replaces LPG during shortages or when the family budget is not able to accommodate the purchase of a new cylinder.Charcaol is rather accessible but the prices are affected by the associated transportation cost that are transferred to the customers. The transportation fees stem from the fact that charcoal is produced in remote forest location (Tambacounda, Kolda: around 500 Km from Dakar) and marketed in main city centers. Another issue is the liberalization of the charcoal market that resulted in an

overall increase of the prices. The government wanted to improve productivity using the self-regulating market mechanisms. However, the charcoal producers are more and more using the rise in the oil prices as an opportunity to dictate their prices to the consumers and there is no longer a mechanism for the government to control prices. Other inefficiencies are related to the low level of technical expertise in the production of charcoal and the impact on the environment. The sustainable management of forestry resources is an issue and the government has developed a system of quota and licensing to control charcoal production. Firewood is third most popular fuel for peri-urban household's. Firewood can be obtained by direct gathering mainly done by women and can be also purchased from local artisans that use wood to build different items. Firewood is also a back-up fuel that is called upon when shortages of LPG or charcoal arise. Firewood is thought to be more appropriate for cooking traditional meals. On the other side the production of smoke in the small peri-urban households provoked by wood burning are a serious health hazards. The generated smoke is a source of pollution, respiratory ailments and irritation. The use of firewood is also inefficient because of the traditional stoves that are energy wasting. The positive outlook for wood usage is the introduction of improved more energy efficient stoves and the progressive substitution of firewood by LPG. The environmental issues that applied to charcoal production are also true for firewood where a sustainable management plan is required. The other fuel used in peri-urban households is lighting petroleum but the extent of its usage is rather small. The lighting petroleum is available in small shops and in local markets.

Electricity access

The reforms operated in the Senegalese electricity sub-sector focused more on the economic performance of the power companies and less on the welfare of the local populations. This situation could have been avoided if the policy makers took some lessons from the successful reform of the water sector. The reforms resulted in the creation of two zones of influence. The urban zones to be electrified are under the responsibility of the national power provider (Senelec). The rural areas are under the responsibility of a new rural electrification agency (ASER). This new specialization leaves the peri-urban zone in an institutional problem. The peri-urban zones show both some rural and urban energy characteristics and host the most vulnerable part of the population of the city. A significant portion of its population is still without electricity because of the prohibitive costs and the hefty connection fees practiced by the power company. Another reason for the lack of power in the peri-urban households is the non-availability of the grid in these areas. Even when the power network is close by the slow connection procedures constitutes an obstacle to electricity access in the peri-urban zones. The peri-urban households that have electricity are also important and are subjected to frequent power outages. Our investigations indicate that the peri-urban zones of Dakar are the areas where power outages are most frequent. These outages reflect electricity production inefficiencies that stems from inadequate production plants and from the rising price of oil. This situation leaves the peri-urban households in a vulnerable state when it comes to electricity access. The vulnerability of peri-urban zones is mostly reflected in the magnitude of illegal electric connections in those areas. The scoping phase surveys show that these illegal connections are present in all the peri-urban zones and represent a challenge for the power company (Senelec) and the energy policy makers. These connections are done generally by digging underground to hide the cables or via suspended cables. These cables are a potential hazard for the local population especially during the rainy season. The connections are made through a neighbour who sometimes charge a connection fee (around 4000 CFA¹)

¹ 1 Euro = 655, 95 F cfa

and establishes a payment method (Agreed sum, Payment by equipment type ect). For illegal connections the most frequent form of payment is the one that use the number and type of equipment to be connected to establish a nominal fee. We note that the closer we are to urban centers the heftier the price of electricity for the illegally connected households.

Policy pointers

The different policies that can be inferred from the present study are numerous. In this section we give a summary of these policies:

- ✚ The first policy option will be the creation of a forum to exchange around the definition and proper delineation of the peri-urban zones .This forum will be held in order to get a consensus around the definition of peri-urban concept and also help in the delineation of these areas. This forum can be in the form of an agency that will work to bring the different energy sector actors and all the other stakeholders to a consensus and also help in the proper delineation of the peri-urban areas. In addition this agency can work to gather statistics about the peri urban areas and fill in the institutional gap that exists in these zones.
- ✚ The main point that was discovered in this study with respect to illegal connection is the fact that this phenomenon is not related to the inability of the peri-urban poors to pay for electricity but has to do with the difficulty to face the prohibitive connection fees applied by the power company. Accordingly the issue of electricity access in peri-urban zone has to be understood in the context of an inadequate connection pricing policy. The key to resolving the problem of illegal electricity access is a new and flexible connection policy. This new connection policy will encourage the peri-urban poors to have access to electric services in a legal fashion. One policy suggestion we have is the payment of the connection fees through long term installments that can be afforded by the peri-urban poors. These long term installments will be included in the electricity bill. In the case where the households are far from the grid and where there is a necessity for extension work we recommend that the government gets involved. These extension costs are too prohibitive and cannot be supported by the poor peri-urban households. Governmental intervention will consist in allocating a budget to undertake such extension at least in part. In addition the penalty (2% of the annual profit) that is paid to the government by Senelec for their lack of performance can be used partially to finance these extension costs.
- ✚ One policy that can help the peri-urban population afford electricity is without a doubt the development of productive applications for electricity. The households can be encouraged to develop small scale productive units (Ice making, cold beverages, poultry and meat conservation ect) that will generate enough income to cover the cost of electricity for the households. Our surveys show that there is very little productive application for electricity in peri-urban zones. The first policy option will be to develop an information campaign aiming to show the benefit of productive applications and its possible use as a mean to afford the electric bill. Another issue is to find an interesting financing mechanism for these applications. We suggest a micro-credit configuration where the households will get together in a micro-credit network to fund their own enterprises in turns.

- ✚ With regards to LPG the main issue is how to target the current governmental subsidies for the poor peri-urban households. One policy option is the creation of some specialized distribution outlet that provides LPG 6 kg and 2.75 kg bottles at a subsidized price. These outlets will be opened only in poor peri-urban areas but not in other wealthier areas. In addition to make sure the subsidy only benefits the poor a subsidized LPG access card will be given to identified poor households of peri-urban areas. The card will enable them to access LPG at the subsidized price upon proper identification. This target approach will enable to maintain the current subsidy for the poor and impose market prices for the wealthier part of the population.

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Chapter 1: Introduction to the study

1.1 Introduction

In developing nations and especially in sub-Saharan African countries, the issue of energy access is often understood in the context of two distinct policy target zones. These two distinct policy target zones are: the urban areas characterized by a high population density and the proximity of the energy infrastructure and the rural zones that are less populated and generally remotely accessible. Accordingly, all the policies and actions designed to boost population access to energy and alleviate poverty level are tailored or specialized to meet the needs of either of these two main target areas. The specialized approach to energy access policy is best illustrated in the way the level of electrification in sub-Saharan African countries is appraised, namely in terms of national, urban and rural electrification rate.

This specialized approach provides a simple analysis framework for the energy policy makers but unfortunately does not take into account the sustained demographic growth experienced by African cities that leads to the emergence of slums or loosely organized neighbourhoods on the cities edge or periphery. The creation of these uncharted buffer zones that thrive on the edge of African cities are associated with the exodus of rural populations and also intra-urban and regional or international migration. In fact these peri-urban pouches are created by urbanites from more central areas (from peri-central districts or former outskirts) who want to buy a plot to build their own house and by newly arriving rural or international (from neighbouring countries) migrants. The direct cause of the creation of peri-urban zones is therefore intra-urban mobility, movement of rural populations and to a lesser extent international migration.

These peri-urban zones are generally characterized by a high poverty rate, a lack of urban infrastructure and a poor urban planning. The energy profile of these peri-urban areas is a function of their distance to main urban centers. The zones that are located far from these centers are characterized by the prevalence of the traditional bio-fuels for commercial and residential use while the settlements that are close to the centers show a progressive transition to more modern sources of energy (LPG, electricity). Because of the specialized approach to energy policy, these peri-urban zones are integrated in the urban energy policy even though they possess strikingly different features than traditional cities. This has the detrimental effect of leaving an energy policy vacuum in these peri-urban areas that tends to exacerbate the already high level of poverty. In addition the poor geographic characterization of peri-urban areas explains the fact that these zones are not taken into account in the new electrification schemes that are part of the key reforms in the energy sector. The energy agencies that came out of these reforms are exclusively working for rural electrification while the traditional power providers still focus on the urbanized areas where the market for energy is strong and the infrastructure robust.

1.2. Objectives of the study

The main objective of this study is to document the status of peri-urban zones with respect to access to clean energy services for household use and also for productive purposes. The study will use Dakar, Senegal as a case study but will hopefully provide critical information that will be relevant to most West African cities. The critical information obtained from this study will hopefully be used to design robust policies and programs that will contribute to

sustainable access to cleaner form of energy and alleviate poverty in peri-urban niches. The findings will constitute a guideline on how to approach energy policy in peri-urban zones of sub-Saharan African countries in a way that will be sustainable and that will enhance economic performance and stimulate social progress.

1.3. Limitations of the study

There are two limitations that need to be acknowledged and addressed regarding the present study. The first limitation concerns the lack of a proper definition of the peri-urban zones that creates confusion between the different actors of the energy sector. The other limitations stems from the poor delineation of peri-urban zones that adds some level of difficulty in locating and characterizing these zones.

1.4 Organization of the report

The UPEA II final report consists of five chapters that aim to characterize the energy profile of peri-urban zones of Dakar, Senegal and develop energy policy alternatives to resolve the energy access crisis in these impoverished zones:

Chapter I: Introduces the issue of energy access in Peri-urban zones and makes the link between demographic explosion, increased urbanization rate and energy crisis in impoverished peri-urban niches of West Africa. In addition we give the main objectives of the study and also the associated limitations.

Chapter II: In this chapter we explore the method that will be used to conduct the study. These methods will consist in surveys, stakeholders interviews and relevant literature review.

Chapter III: Description and findings of the Scoping Phase, areas identified for thematic phase and transition from scoping to thematic phase

Chapter VI: Description and findings of the thematic phase- surveys and interviews including further probing of issues identified in scoping phase and understanding reasons behind them, identification of positive initiatives.

Chapter V: The concluding chapter will consist in giving the different policy pointers that were developed in the study. We will also identify areas for further research and develop an outreach plan.

Chapter II : Methodology and Framework for the study

The study uses Dakar, Senegal as a model city to understand the issue of energy access in peri-urban areas of west africa. The choice of Dakar stems from the fact that it has experienced a substantial urbanization(42% urbanization rate) during the last decades and comprises many peri-urban areas that are confronted to an energy access crisis.

The study comprises two phases : an initial scoping phase that aims to single out the most critical issues facing the peri-urban zones with respect to energy access and a in depth thematic phase that builds up on the issues identified during the early phase.

II.1 Scoping Phase Methodology

In accordance with the guidelines specified in the GNSSED terms of reference for UPEA I, the scoping phase study largely relied on secondary data and on a limited amount of primary surveys (60 households and 30 production units) in three peri-urban zones of Dakar (Ben Barack, Daliford and Rail). Complementary data was obtained by compiling the literature that addresses the theme of energy access in peri-urban and urban zone. Finally the different stakeholders (government agencies, power companies and concerned populations) were also interviewed to understand their views and opinions on the different issues facing the peri-urban zone with respect to sustainable access to energy services.

II.2 Thematic Phase Methodology

In contrast with the earlier phase the thematic phase is a more focused and detailed study that explores the major themes that were identified during the scoping phase of the study. To explore these critical themes we have enlarged our survey samples to include 280 households and 70 businesses from 7 peri-urban areas of Dakar, Senegal. These zones include: Ben Barack, Daliford, Yoff, Barack-Liberte 6, Malika, Rail and Ainoumanou. All the neighborhoods surveyed are in a large extent composed of slums for example areas like Barack L6 and Ben Barrack are all large slums. In other zones even if there are some descent housing we focused our survey on the slums. So we can say that, this work was focused on the energy access situation of poor peri-urban slums. The same interactive process used in the scoping phase involving stakeholders interviews was also used in the in depth phase. Complementary data was also obtained by compiling the literature that addresses the theme of energy access in peri-urban and urban zone.

Chapter III. : Descriptions and findings of the scoping phase

III.1 Description of the Scoping phase study

The scoping phase of this study is a light overview of the energy status of peri-urban zones of Dakar in an effort to identify central issues. The central issues that are identified during this phase will then be studied in depth in the later study phase to give a description of the situation and to develop some strategies to overcome those limitations using appropriate policies.

III.2 Summary of the scoping phase findings

Senegal possess one of the highest electrification rate among West African states and it's capital city Dakar is electrified at almost 90%. However, this high level of electrification hides the disparity that exists between the urban zones and the peri-urban zones.

III.2.1 Definition and Geographic Characterization of peri-urban zones

The scoping phase study shows that in Senegal, there is no consensus over the definition of the concept of peri-urban. The most alarming issue that was identified during our interviews is the inability of key energy actors to give any definition for the concept of peri-urban. For example the Senegalese national statistic agency along with the power company (Senelec) have a rather simple approach where they recognize zones to be either rural or urban. This issue is rather disturbing especially when it comes to the power company that is responsible for the electrification of the peri-urban areas. The peri-urban zones are strikingly different than the traditional urban zones and it is important to understand their true nature to develop an effective plan to boost energy access for their population. In addition it is critical to collect statistical information about the peri-urban zones and this can be done only when the governmental statistic agency clearly defines and understands the peri-urban domain and its characteristics. The risk here is that the peri-urban data could be wrongly integrated in the urban statistics in a way that will make it impossible to identify issues facing the peri-urban communities. Another important aspect of the debate over the true definition and characterization of peri-urban zone is what we can call a communication break down. All the NGO's and the university scholars we interviewed have some level of understanding of the peri-urban concept. The problem is that there's no practical forum where these different groups can exchange ideas and more importantly where they could pass the information onto key decision makers (Power Company, government agencies or department).

Table 1 : Stakeholders definition of the Peri-urban zones

<p>According to the Direction régionale de l'urbanisme de Dakar (Urbanization ministry) Frontier between the city and the rural areas. Located at the city's periphery but is characterized by the development of agriculture and other farming activities</p>	<p>According to SENELEC (Power Company) All the Dakar region is considered to be urban without any distinction.</p>
<p>According to the Senegalese National statistic agency : No definition is given for the Peri-urban zones. The areas are classified as either urban or rural Urban : All areas that are part of Dakar that have a mayor Le rural : All that is not urban</p>	<p>Mohamed SOUMARE (Ex S.E enda ; Cf. préface Urbain – Rural : l'hybridation en marche) : « between the two » its a buffer zone, mix spaces with no defined delineation and that is not well defined by the different stakeholders and government agencies.</p>
<p>Yves Jean (Pr. of Géo university of Poitiers ; Cf. Urbain – Rural : l'hybridation en marche) : Firt definition : the peri-urban is an interfacial zone between rural and urban. The peri-urban zone are the symbols of the evolution of the living habits but are unfortunately not taken into account in the urban planning policy of the different countries. Its also a zone that is very difficult to define and delineate. The geographic limits are always moving because of the rapid population growth. In addition the population are facing an economic crisis that needs to be resolved by the authorities. Deuxième définition : The most dynamic part of the urban areas that represent the interection between urban and rural.</p>	<p>Enda RUP (Mr Malick GAYE) : It's a zone without any urban planning that does not have the basic infrastructure (water, energy, school.....) and that is not part of the national taxation system. Its also a zone where the income are less than 2\$ a day per capita and where we have the development of urban agriculture.</p>

III.2.2 Overview of the energy profile in the peri-urban zones

The peri-urban energy profile can be described as a middle ground between the rural energy profile and the urban profile. Generally the peri-urban energy profile is characterized by a transition from traditional sources of energy (wood and charcoal) to more modern energy type (LPG etc). The extent of this transition is a function of many variables namely : the adequacy of the energy access policies, the location of the peri-urban area respective to main city centers

and finally the socio-economical parameters. In the following section we give an overview of the energy profile of the peri-urban areas of Dakar Senegal.

III.2.2.1 Access to electricity in peri-urban zones

The reforms operated in the Senegalese electricity sub-sector focused more on the economic performance of the power companies and less on the welfare of the local populations. This situation could have been avoided if the policy makers took some lessons from the successful reform of the water sector. From an institutional point of view the reforms of the electricity sub sector resulted in a division of the zones to be electrified into rural and urban. The reforms resulted in the creation of two zones of influence. The urban zones to be electrified are under the responsibility of the national power provider (Senelec). The rural areas are under the responsibility of a new rural electrification agency (ASER). This new specialization leaves the peri-urban zone in an institutional problem.

The peri-urban zones show both some rural and urban energy characteristics and host the most vulnerable part of the population of the city. A significant portion of its population is still without electricity because of the prohibitive costs and the hefty connection fees practiced by the power company. Another reason for the lack of power in the peri-urban households is the non-availability of the grid in these areas. Even when the power network is close by the slow connection procedures constitutes an obstacle to electricity access in the peri-urban zones. The peri-urban households that have electricity are also important and are subjected to frequent power outages. Our investigations indicate that the peri-urban zones of Dakar are the areas where power outages are most frequent. These outages reflect electricity production inefficiencies that stems from inadequate production plants and from the rising price of oil. This situation leaves the peri-urban households in a vulnerable state when it comes to electricity access. The vulnerability of peri-urban zones is mostly reflected in the magnitude of illegal electric connections in those areas. The scoping phase surveys show that these illegal connections are present in all the peri-urban zones and represent a challenge for the power company (Senelec) and the energy policy makers. These connections are done generally by digging underground to hide the cables or via suspended cables. These cables are a potential hazard for the local population especially during the rainy season. The connections are made through a neighbor who sometimes charge a connection fee (around 4000 CFA²) and establishes a payment method (Agreed sum, Payment by equipment type ect). For illegal connections the most frequent form of payment is the one that use the number and type of equipment to be connected to establish a nominal fee. We note that the closer we are to urban centers the heftier the price of electricity for the illegally connected households.

III.2.2.2 Access to Domestic fuels in peri-urban zones

In the different peri-urban households the main fuel used are LPG, charcoal and dry wood. However, depending on the income level the peri-urban households use different combination of these fuels.

LPG is widely available in these zones and a distribution network is in place. In peri-urban households LPG is the fuel of choice for cooking because it is easy to use, clean, efficient and economical. The LPG is available in different cylinder sizes ranging from 2.75 kg, 6, 9 to 12 kg. The most popular cylinders in the peri-urban zones is without any doubt the 2.75 kg and 6

² 1 Euro = 655, 95 F cfa

kg (popular gas). Cooking stoves are attached only to cylinders 2.75 kgs and 6 kgs. The higher volume cylinders weighing 9 and 12 kgs are rarely used in peri-urban households. LPG usage in peri-urban zones is important but some significant changes have to be operated in order to maintain this high usage and increase LPG consumption in peri-urban areas. The low income level of the peri-urban population combined with a progressive withdrawal of the governmental subsidies on LPG and an unpredictable oil market have a detrimental effect on LPG consumption among the peri-urban poor. Even though the national demand for LPG is rising, the demand for LPG by poor households is not increasing and this trend will be exacerbated by the planned withdrawal of the governmental subsidies on LPG. The governmental subsidies were introduced to help the poor access clean energy sources but after all these years we see that the subsidies have not been properly channelled to this vulnerable part of the population. The subsidized 2.75 and 6 kg cylinders that were to benefit the poor are instead being profusely used by the middle and upper middle class. This situation warrants a re-evaluation of the impact of the subsidies and the development of a mechanism that will secure the channelling of the subsidies to the target populations. Another issue that relates to LPG use in peri-urban zones is the frequency of shortages due to the weakness in the warehousing infrastructure for imported LPG and also the late payment of the governmental aid to attenuate the impact of rising oil prices. In addition artificial shortages are frequent and are caused by the speculative behaviour of the local suppliers.

After LPG the other fuel of choice for peri-urban households is charcoal because it is easy to use and widely available with the possibility to buy in small quantities. Charcoal can be also seen as a back up fuel that replaces LPG during shortages or when the family budget is not able to accommodate the purchase of a new cylinder. Charcoal is rather accessible but the prices are affected by the associated transportation cost that is transferred to the customers. The transportation fees stem from the fact that charcoal is produced in remote forest locations (Tambacounda, Kolda: around 500 Km from Dakar) and marketed in main city centers. Another issue is the liberalization of the charcoal market that resulted in an overall increase of the prices. The government wanted to improve productivity using the self-regulating market mechanisms. However, the charcoal producers are more and more using the rise in the oil prices as an opportunity to dictate their prices to the consumers and there is no longer a mechanism for the government to control prices. Other inefficiencies are related to the low level of technical expertise in the production of charcoal and the impact on the environment. The sustainable management of forestry resources is an issue and the government has developed a system of quota and licensing to control charcoal production.

Firewood is the third most popular fuel for peri-urban households. Firewood can be obtained by direct gathering, mainly done by women, and can also be purchased from local artisans that use wood to build different items. Firewood is also a back-up fuel that is called upon when shortages of LPG or charcoal arise. Firewood is thought to be more appropriate for cooking traditional meals. On the other side, the production of smoke in the small peri-urban households provoked by wood burning are a serious health hazard. The generated smoke is a source of pollution, respiratory ailments and irritation. The use of firewood is also inefficient because of the traditional stoves that are energy-wasting. The positive outlook for wood usage is the introduction of improved, more energy-efficient stoves and the progressive substitution of firewood by LPG. The environmental issue that applied to charcoal production are also true for firewood where a sustainable management plan is required. The other fuel used in peri-urban households is lighting petroleum but the extent of its usage is rather small.

Table 2 Matrix Summary of the energy status of peri-urban zones of Dakar, Senegal

Fuel	Use	Rational for use	Issues that relate ro the fuel used	Causes of problems	Good and bad pactices
LPG	- Cooking	- Ease of use	- Limited access : Prohibitive cost	- Low population income level - Reduction of governmental aid and increase in cost - Price dependant on oil market	GP : - Availabilty in different tank sizes : 2.75 ; 6 ; 9 ; 12 and 38 kg. - Subsidy on small LPG tanks (2.75 et 6kg) for easy acces by poor populations - LPG available at close locations - Cooking accessories widely available - Free market approach gives healthy competition - Prices are adequate BP - Speculations on sale prices . - No control mechanism for the governmental subsidy -High tax of oil-derived products
		- Rapid and efficient	- Frequent shortage	- Weak warehousing ability - Retardade règlement de la subvention	
		- Clean	- Artificial shortage	- Speculation of local suppliers to create shortage	
Charcoal	- Cooking	- Easy to use and available	- Supply - Intense lobbying against local suppliers	- Weakness of production - Used almost exclusively in urban areas and produced only in rural areas	GP - Politique de décentralisation de la gestion des ressources naturelles - Control of the production by a licensing and quota system - Environmental management (sustianable management of forestry) BP - Inefficiencies in the application of the Environmental management plan. - Database not updated
		- Accessible possibilty to buy in small amounts	- Transportation from remote areas	- Remote areas of production	
	- Ironing	- Not too polluting	- Inefficiencies in the production and in the usage	- Inadequate Technologies - Weak diffusion of improved stoves	
		- Economical			
		- Available			

Electricity	<ul style="list-style-type: none"> - Lighting - Electric equipments - Motive Force 	<ul style="list-style-type: none"> - Easy to use and very practical - Ease of operation 	<ul style="list-style-type: none"> - Inaccessibility 	<ul style="list-style-type: none"> - Electric grid not available in peri-urban zones - High connection cost - Slow connection procedures - Weak income level 	<p>GP</p> <ul style="list-style-type: none"> - Establishment of a social tariff - Efficient use of electricity (energy saving lamps) - Prepaid services are available <p>BP</p> <ul style="list-style-type: none"> - Increase in electricity cost - Peri-urban zones considered part of urban but without any advantage - Lack of control from the power company (Senelec) - Lack of mechanisms to boost population access to electricity
		<ul style="list-style-type: none"> - Availability - Comfort - Modern 	<ul style="list-style-type: none"> - Power outages very frequent - Price is too prohibitive for poor households 	<ul style="list-style-type: none"> - Technical and production problem - Peri-urban is the most affected by power outages - Billing method inadequate : Based on the equipment(Prohibitive cost) 	
		<ul style="list-style-type: none"> - Production 	<ul style="list-style-type: none"> - Illegal connections 	<ul style="list-style-type: none"> - Inaccessibility - Weak income level 	
Cooking Wood	<ul style="list-style-type: none"> - Cooking - Production of charcoal 	<ul style="list-style-type: none"> - Availability - Accessible : relatively low cost and the possibility to collect free wood 	<ul style="list-style-type: none"> - Supply 	<ul style="list-style-type: none"> - Remote nature of production plants - Controlled Production - LPG shortage 	<p>GP</p> <ul style="list-style-type: none"> - Promotion of improved stoves to save wood. - The control and management of forestry resources - Substitution policy of wood by LPG <p>BP</p> <ul style="list-style-type: none"> - Use of traditional stoves with a significant loss in energy - Non-sustainable or illegal usage of forest resources (wood)
		<ul style="list-style-type: none"> - No access to modern fuels - Alternative solution to the shortage of modern biofuels 	<ul style="list-style-type: none"> - Pollution/respiratory ailments/ irritations 	<ul style="list-style-type: none"> - Smoke production 	
		<ul style="list-style-type: none"> - More appropriate to the cooking of traditional meals 	<ul style="list-style-type: none"> - Not easy to use 	<ul style="list-style-type: none"> - Incompatibility with small dwellings - Lack of kitchens - Storage issues 	
			<ul style="list-style-type: none"> - Inefficiency of usage 	<ul style="list-style-type: none"> - Inadequate Technologies 	

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Lighting petroleum	- Lighting	- No access to electricity	- Pollution	- Smoke	- No specific policy
		- Alternative	- Not a good light source	- Nature of the combustion reaction	
		- Available in small shops and markets	- Cost increasing more and more	- Price affected by oil market	

III.2.3 Productive use of energy in peri-urban zones

The rapid growth of peri-urban zones can be explained by the fact that they constitute the main settlement for the new rural migrants and the urbanites that can no longer be housed by the congested centers. In these zones there exist an internal competition between economic actors for geographic positioning, access to financing mechanisms and to the required infrastructure and equipment. The common trait between all those competing groups is their desire to obtain the following :

- Financing mechanisms
- Networking ability
- Access to the right information
- Access to the job market

These parameters will mean for these population a better quality of life and a substantial increase in economic productivity. In this competition the most important parameters are the ability of the economic actors to obtain the right information and to have the required financial means to exploit that piece of information. For example access to the urban planning schemes by these population will enable them to understand the different roads and infrastructures that will be constructed and anticipate by developing a business plan that will take into account the future urbanization schemes. More specifically it will help the population understand which geographic areas are potentially more viable (Zone with major roads and proximity of the energy infrastructure ect) and which to avoid. This access to critical information combined with a good financing mechanism will undoubtedly constitute a way out of the current status-quo. In this way the availability of electric services and other infrastructure (roads) gives more economic value to the newly emerging settlements. Accordingly, the economic actors can locate themselves in these high value zones because of the relatively small distance to the grid that significantly reduce connection prices. This will decrease the significant connection price gap that exist between the urban zones where the appropriate energy infrastructure is available and the new peri-urban zones that are not necessarily close to the existing grid.

In most cases the peri-urban zones are considered like some temporary settlements for new rural migrants and blue collar workers that are developing generally near cities that have some industrial activities or that have a dynamic harbor. Accordingly the peri-urban economy in Dakar ,Senegal is developing principally around small commercial units :

- Artistic crafts : produces items of intermediate quality but that are appropriate to satisfy the requirements of the local populations.
- The transformation or products from agriculture : requires access to energy is essential because it provides easily processed goods for consumption by the local population. It also gives work to more and more local woman. An increase in energy efficiency and workload will be beneficial.
- The small businesses and other small services :(Beauty shops, small restaurants, barber shops, tailors ect)
- Peri urban agriculture, fruits, horticulture : refers to farm units close to town which operate intensive semi- or fully commercial farms to grow vegetables and other horticulture, raise chickens and other livestock, and produce milk and eggs.

The informal sector is developing and is having an important effect on the level of poverty in these new peri-urban areas. This zone has become an area where the rural population are transitioning more and more from a principally agriculture based economy to a new economy based on other services (development of the secondary and tertiary sector). If this transition is to be successful it has to be paired with a strong energy policy that will increase the availability of energy sources for productive use. The in depth study will give us the unique opportunity to identify the characteristic of these dynamic areas, to determine the constraints and problems that are present and finally the opportunities that needs to be exploited to provide a sustainable future and access to clean and renewable sources of energy in these peri-urban areas.

III.3 Issues identified for the thematic phase

The initial scoping reveals three major themes that need to be explored in the in depth phase of study (UPEA II):

Theme 1: The need for a proper definition and geographic delineation of peri-urban zones

One of the issues of importance that was identified during the scoping phase is without a doubt the necessity to have a consensus around a definition of the concept of peri-urban to tackle the issue of energy access in the peri-urban areas. The initial phase of this study showed that in Senegal there is no consensus over the definition of the concept of peri-urban among key energy actors. The most alarming issue that was identified during our interviews is the inability of key energy actors to give any definition for the concept of peri-urban. A proper definition of the concept is prerequisite to any successful policy and action aiming at improving energy access in peri-urban areas. Another important issue is the necessity to delineate the peri-urban zones to get a clear understanding of their location relative to the urban centers and their actual size. We have decided to further probe these two issues in the thematic phase to try to develop a strategy that will harmonize the views of the different actors of the energy sector.

Theme 2: The issue of illegal connections and implications for the peri-urban populations

The scoping phase surveys show the relative importance of illegal electric connections in peri-urban households. In all the peri-urban zones surveyed these illegal connections are present and represent a challenge for both the power companies and also for the local populations. These illegal connections reflect the failure of the different energy access policies that resulted from the electricity sector reforms. These reforms did not take into account the specificity of the peri-urban zones and left these areas devoid of a mechanism to access electricity in a sustainable way. Because of the magnitude of this phenomenon we have decided to explore the issue of illegal connections and their implications for the peri-urban poor's in the thematic phase of the study.

Theme 3 : The debate over the elimination of LPG subsidies and implications for the peri-urban poor

In term of quantity used LPG is the most important energy source in peri-urban zones of Dakar. The consumption rate of LPG in peri-urban zones is between 10 to 30 kg/month per household. The sustained use of LPG is critical in peri-urban zones to achieve a transition from the traditional biofuels (charcoal and wood) to modern sources of energy. The decision to suppress the existing governmental subsidies on LPG gas cylinders will have a negative impact in peri-urban zones by retarding the desired transition to modern fuels. Accordingly in the UEPA II phase we examine the impact of the LPG subsidy suppression and we develop a strategy to maintain this subsidy for the most vulnerable part of the population.

Chapter IV : Description and findings of the thematic phase

IV.1 Theme 1: The need for a proper definition and geographic delineation of peri-urban zones

Over the years the cities have become centers of modernity and have transformed sub-urban and rural areas into peripheries that have lost their original functions to become hybrid spaces that fulfil residual functions and complete the urban centers. These new peri-urban zones were generated spontaneously via intra urban and rural migration and therefore lack the required infrastructure to become a viable space to live in. They are characterized by the rural origin of their populations that are now being seriously influenced by their new proximity to the urban centers. These characteristics raises the issue of the appropriate definition of such areas and their geographic delineation.

Mapping the peri-urban zone spatially is an issue of widespread variation and contestation. As yet, there is no consensus as to the defining indicators of the peri-urban zone. Further difficulties arise due to the fact that the term peri-urban and analogous terms (including urban fringe, exurban, urban tract, rurban, semi-urban, suburban) are frequently used in academic and policy discussions in situational and case specific ways. Despite the lack of conceptual clarity around its definition, it is generally accepted that the peri-urban region spans the landscape between contiguous urban development and rural countryside. (dense population and mainly houses)

In Senegal there is no consensus over the definition of the concept of peri-urban. The most alarming issue that was identified during our interviews is the inability of key energy actors to give any definition for the concept of peri-urban. For example the Senegalese national statistic agency along with the power company (Senelec) have a rather simple approach where they recognize zones to be either rural or urban (see table.1). This issue is rather disturbing especially when it comes to the power company that is responsible for the electrification of the peri-urban areas. The peri-urban zones are strikingly different than the traditional urban zones and it is important to understand its true nature to develop an effective plan to boost energy access for their population. In addition it is critical to collect statistical information about the peri-urban zones and this can be done only when the governmental statistic agency clearly defines and understands the peri-urban domain and its characteristics. The risk here is that the peri-urban data could be wrongly integrated in the urban statistics in a way that will

make it impossible to identify issues facing the peri-urban communities. Another important aspect of the debate over the true definition and characterization of peri-urban zone is what we can call a communication break down. All the NGO's (others actors) and the university scholars we interviewed have some level of understanding of the peri-urban concept. The problem is that there's no practical forum where these different groups can exchange ideas and more importantly where they could pass the information onto key decision makers (Power Company, government agencies or department).

Another important feature of the debate is the necessity to delineate the peri-urban zone to have a clear understanding of their location relative to the urban centers and their actual size. In Senegal the different stakeholders have a general idea about the location of these peri-urban niches but could not give an accurate delineation of such zones. The availability of geographic positioning systems can be an asset for the true delineation and geographic characterization of peri-urban zones. This issue is important because the localization of the settlements and their relative distance to main city centers have tremendous implications in terms of energy access (closeness to the electricity grid).

IV.2 Theme 2: Access to electricity: The issue of illegal connections and implications for the peri-urban poor

IV.2.1 Electricity access in peri-urban zones

In peri-urban Dakar the level of electrification is not uniform and is a function of the socio-economical characteristics of the target zones (poverty level etc). Surprisingly enough the geographic position of the zones with respect to the main city centers is not a big factor when it comes to electricity access. We would expect the zones that are closer to the city centers to have better access to electricity and the remotely located zones to be poorly connected to the electric grid. However, our survey shows that there is no particular relationship between the peri-urban area location with respect to the main city center and modern energy access. For example the estimated electrification rate in remote Malika (87.5%) and Ben Barack (92.5%) is superior to that of Barack L6 (66%), Rail (77.5%) and comparable to that of Daliford (97.5% even though the latter three areas are close to the city centers. The estimated electrification rate is not a function of the distance from main city centers but rather reflects the socio-economic dynamics of the given area. The Table below shows the estimated electrification rate for 7 peri-urban areas of Dakar. We have to understand that even though these rates seem high they hide the reality of the many illegally connected households. The estimated electrification rate is made up of people who have an established account with the power provider Senelec and the large number of households that are illegally connected to the grid. We note that for electricity connection the following documents are required:

- National or Foreign ID card
- Address, phone number (house and work), Zip code,
- Meter number
- Lease or house ownership titles
- List of electric equipments in the house and their power requirements in Watt or KW.

Table 3. Estimated Total electrification rate in 7 peri-urban areas of Dakar including illegally connected households.

Peri-urban Zone	Rail	Barack L6	Yoff	Ainoumana	Ben Barack	Malika	Daliford
Electrification Rate (%)	77.5%	66%	100%	87.5%	92.5%	87.5%	97.5%

The socio-economical status is the main factor that influences the ability of the local peri-urban population to have access to electric services. The socio-economic parameters that influence the level of access to electric services are the buying power of the local community, and also their political influence and lobbying ability. The first parameter is the most predictable one and our survey shows that among all the people that do not have electricity the main reason is their lack of financial means or the prohibitive connection fee required by the power providers. The problem here is less the availability of the power network or its location respective to the households but more the prohibitive nature of the connection cost and the high price of electricity. To enable the connection of the peri-urban poors it will be necessary to review the connection fee and develop a strategy to attenuate the price of electricity for this vulnerable part of the population. This will be hard to achieve in a context where the oil prices are increasing and where the power providers are shifting the impact of this increase to their customers. An option might be to allow the peri-urban populations to pay the connection fee in an incremental fashion over an extended period of time. Another suggestion will be to organize the peri-urban poor that do not have electricity into a micro-credit network. This network will allow them to pull resources together to connect their households in a sequential fashion. The graph below gives some statistics on the different reason that restrict the peri-urban poor from energy access.

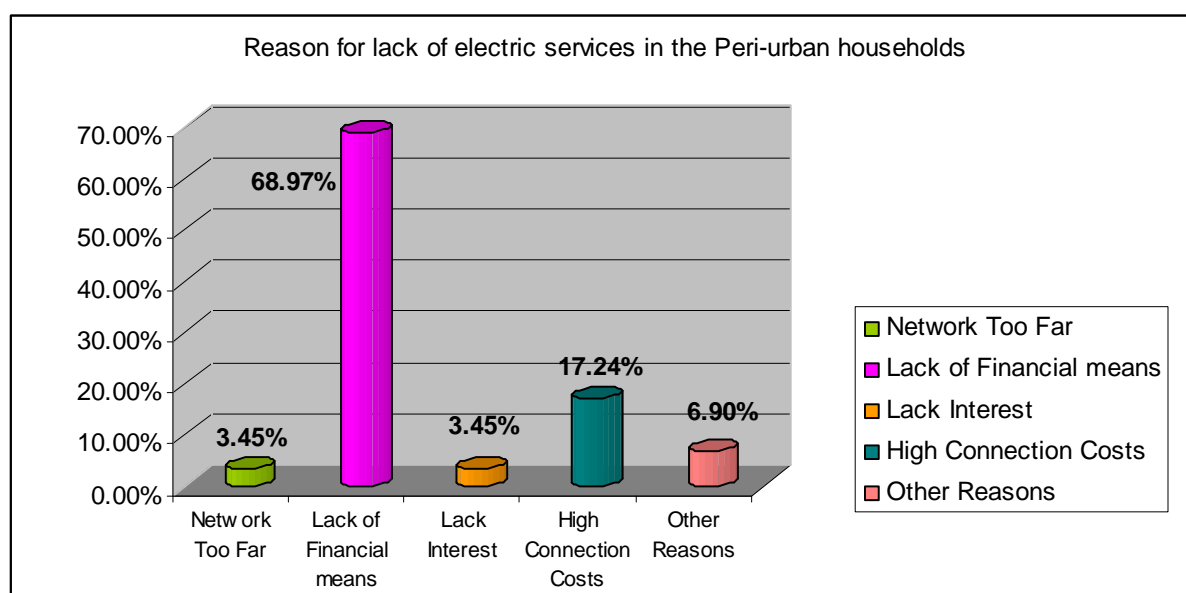


Figure 1. Reasons for lack of electric services in Peri-urban Dakar

Another parameter that influences the ability of the peri-urban poors to obtain electricity is without any doubt their political influence and the local community lobbying ability. For

example the peri-urban zones that host an important religious family or some traditional chiefs are more readily electrified. A policy option will be to organize the peri-urban areas in strong lobbying groups headed by an influential religious or traditional leader in order to obtain a better response from the government and power companies. These lobbying groups will give more visibility to the issue of electricity and energy access in general in peri-urban zones.

Among the people who are able to access electric services we have two main categories: those who have an established account with a meter and the others that are illegally connected to the grid via a neighbour. The people who are able to access electricity legally are generally the wealthier part of the peri-urban zone or are large families that can pool their income to obtain electric services. Our surveys show that among the legally connected households the most important issue is the fluctuation of their bi-monthly bill. The electric bill can vary widely between billing period and is quite unpredictable. There is here a need to review the billing policy of Senelec to insure that the bills reflect accurately the level of electric consumption in peri-urban Dakar. The table below shows the average by-monthly bill for different peri-urban households of Dakar. The peri-urban average bi-monthly electric bill is around 35 000 FCFA which represent a significant portion of the total family income.

Table 4 Average electric bill for legally connected peri-urban households

Area	Average bi-monthly bill (FCFA)
Barack L6	44510
Ainoumani	33450
Yoff Layene	33925
Daliford	34526
Rail	40333
Malika	28791
Ben Barack	34625
Peri-urban	35700

Another issue is the lack of productive applications of electric services among peri-urban households. Only 12.5% of the peri-urban households use electric services for productive services. Even though the profit from such activities could have been use to pay a significant portion of the electric bill the peri-urban poors are not fully exploring that opportunity. This is explained by the fact that the possible productive applications of electric services require a cooling unit which most peri-urban households do not have. The productive application are generally in ice production, cold juices and drink making, meat and poultry conservation) In general the peri-urban poor lacks that have access to electricity lack the equipments and infrastructure to be fully involved in productive applications (figure 2).

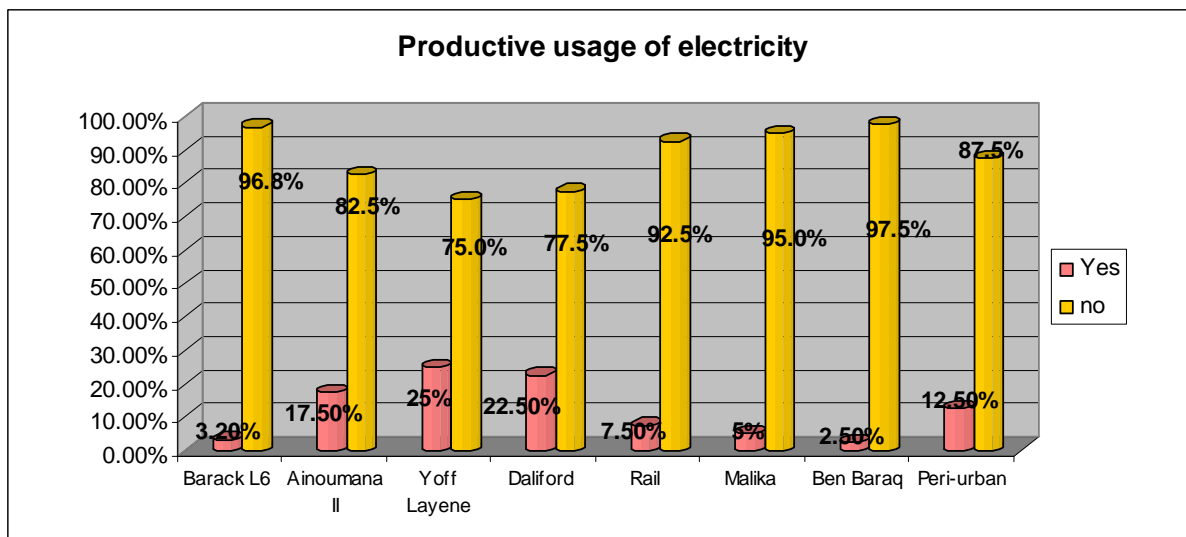


Figure 2 Level of productive application of electric services among households in peri-urban Dakar

This idea is best illustrated in the figure below where the highest productive usage of electricity are in the zones of Yoff Layene 25% and Daliford 22.5% that have the wealthier populations who can access the right equipment to provide paid services. One policy option would be to encourage productive applications of electric services as a mean to afford the price of electricity. The peri-urban households can be helped in acquiring a small loan to develop the appropriate infrastructure and equipments to be involved in productive applications. In the long term the profit that can be generated from these small enterprises will constitutes a mean to afford at least in part the prohibitive cost of electricity.

IV.2.2 Illegal Connections and the implications for the local populations

The most important issue relating to electricity access in peri-urban zones is without a doubt the problem of illegal connections and the implications for the peri-urban poor .Illegal electric connections are connections that are made without the authorization of the power company and generally through an immediate neighbour. The households are generally connected via a neighbor through suspended cables (75%) or burried or underground cables(figure 3).

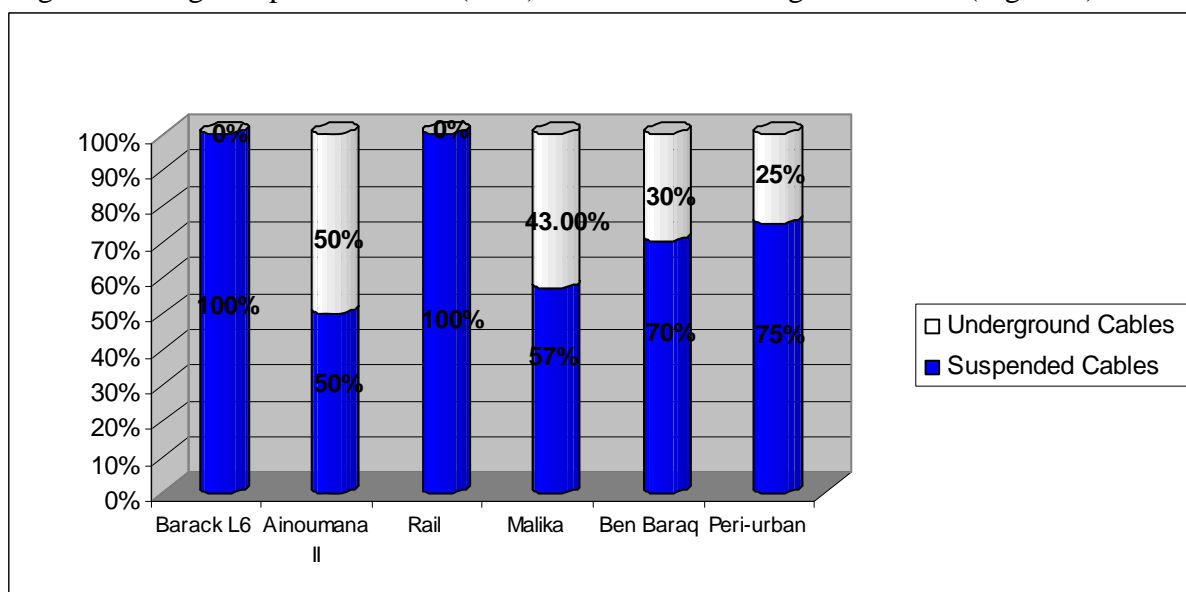


Figure 3 Types of illegal connections in peri-urban Dakar

These connections are rather artisanal and constitutes a safety hazards for the populations especially during the rainy season. The most vulnerable to this threat are the women and children who can recieve an electric shock stepping on a loose cable ect.In addition there is the risk for electric fires that can quickly spread and cause tremendous damage in the area where houses are generally made from wooden materials.

One policy option here is to organize regular safety inspections to evaluate the threats and to inform the populations on how to prevent the occurrence of illegal connection related accidents.These inspections can be done by a public entity , an NGO like Enda or by a group of organized volunteer.The strategic development partners can help train and equip these groups to do the inspections properly. We note that this group will only evaluate the threat and make some safety recommendations to the population.This safety group will not help in any way to make illegal connections or repair existing illegal connections.



Figure 4. Example of underground illegal connections in Ben-barack



Figure 5. Example of underground illegal connections in Ben-barack



Figure 6. Example of suspended illegal connections in Ben-barack



Figure 7. Example of suspended illegal connections in Ben-barack

Overall 25% of the peri-urban households are connected illegally to the electric grid generally via a direct neighbour (figure 8 below).

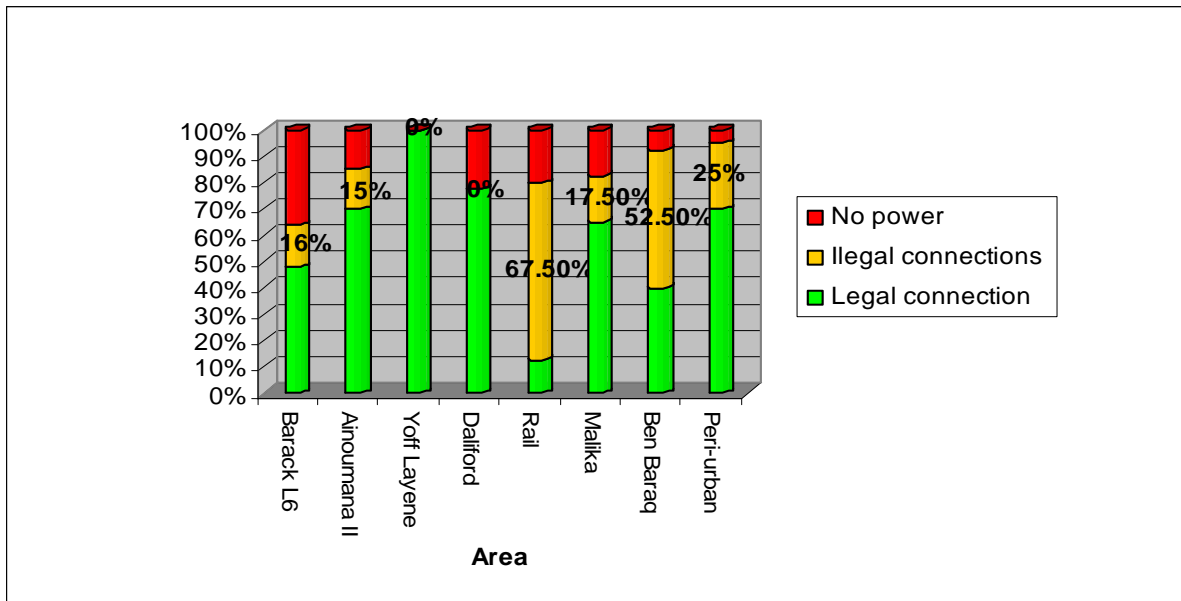


Figure 3. Proportion of illegally connected households in peri-urban dakar

The extent of this issue is a function of many parameters that are mainly linked to the economic status. In fact, this phenomenon reflects the fragile nature of the peri-urban economies and the difficulty for the populations to face the prohibitive connection fees of the power companies. In peri-urban Dakar for example we can see that there is a relationship between the economic status of the area and the extent of illegal connections. In well established, richer peri-urban areas such as Yoff layene and Daliford the phenomenon is almost inexistent while in poorer areas like Rail and Ben-Barack 50 to 70% of the electric connections are illegal in nature. The extent of illegal connections in a peri-urban neighbourhood is well correlated with the buying power of the local populations. This phenomenon reflects the fact that the peri-urban poor are discouraged from legal electricity access by the prohibitive connection fees practiced by the power company. To obtain a legal connection the associated fee is around 19 000 FCFA (\$ 45 US) if the household to be connected is 13 meters or less from the existing grid. For households that are further away the power company adjust the fee to include network extension costs. This applied extension cost can drastically increase the connection fee and constitute a tremendous barrier to legal connections. In contrast the relatively cheap connection fees and the possibility to have to fee waived through social interactions make illegal connections more attractive to poor populations of the peri-urban zones. The table below shows the connection fee in different peri-urban areas of Dakar Senegal. The average fee paid by the population for illegal connections are around \$ 8 US which is five time less than the prohibitive \$ 45 cost practice by the power companies for the households that are close to the grid. In addition the illegal connections give the possibility to access electricity while avoiding the possibly hefty grid extension work for the households located far from the existing grid.

Table 5. Illegal connection fee in the peri-urban zones of Dakar

Area	Average Illegal connection fee (FCFA)
Ainoumani II	2875 (\$ 7)
Rail	3875 (\$ 8)
Malika	4500 (\$ 9)
Barack L6	3580 (\$ 8)
Peri-urban	3700 (\$ 8)

The importance of social ties in the African societies gives the opportunity to get electricity through a neighbor free of any connection cost. In case of illegal connections from neighbors at lower fees or no fees, the neighbor who is generally a relative or a close friend pay to the electricity utility for the entire electricity consumption This is another motivating factor for the peri-urban poors. In peri-urban Dakar 52% of the illegally connected households pay a connection fee and 48% do not (figure 9).

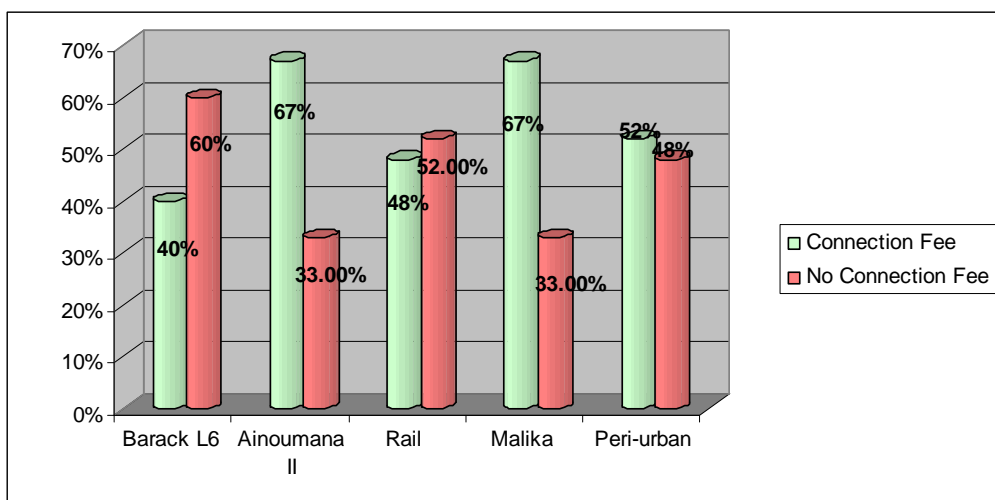
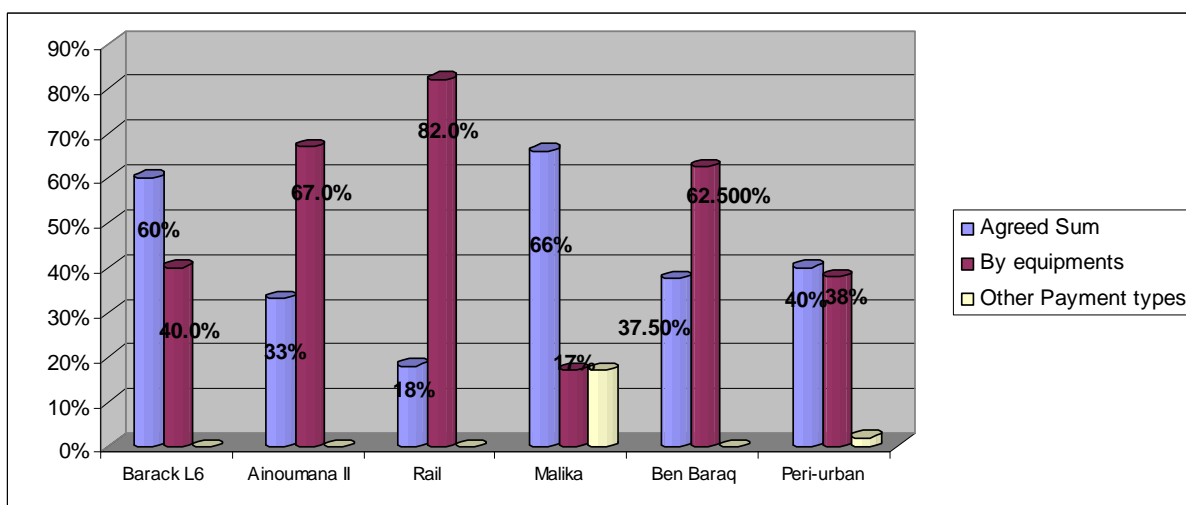


Figure 9. Proportion of households that pay a connection fee for illegal connections

IV.2.2.1 Electricity payment modes for illegally connected households

The payment of the electric services for illegally connected households is done in many ways. The most popular payment types for electric services are the payment made by equipments and those that are fixed (agreed sum) through negotiations (figure 10).

Figure.10 Mode of payments for illegally connected networks peri-urban Dakar.



Sources: Enda surveys, 2007.

In the first mode the illegally connected households or individuals pay a fixed amount according to the type of equipment used. The table below gives the average price paid for equipments in different peri-urban zones of Dakar. The paradox here is that contrary to popular belief the illegally connected peri-urban poor pay substantially more for electric services.

Table 6 Unit prices for equipments in peri-urban zones

Type of equipment	Average Price /month (FCFA)					
Area	Barack (FCFA)	Yoff (FCFA)	Rail (FCFA)	Ainoumani (FCFA)	Ben Barack (FCFA)	Peri- urban (FCFA)
Light Bulb	1350	1170	1800	1750	1180	1200
Radio	1000	510	900	N/A	1000	
TV	2375	1700	2100	N/A	2600	
Fan	N/A	2500	2300	N/A	N/A	
Fridge	7250	2100	N/A	N/A	N/A	

For example for a 40 Watt lightbulb the peri-urban poor pay a monthly fee of 1200 FCA. Considering a five hour usage time and 30 days a month at a 140 FCFA per KW the peri-urban poor pay twice as much than the legally connected households. This shows that the problem of electric services in peri-urban zones of West Africa is less about the price of electricity but more about the prohibitive connection cost. The surveys show that the illegally connected households can afford the electric services and actually pay more than the legally connected households. Accordingly any increase in access to electric services in peri-urban areas will come from an innovative connection price policy. The way out of the current situation characterized by the importance of illegally connected households that pay more for electricity is a re-evaluation of the current connection policy by the power companies in conjunction with the government. There is a necessity to find a mechanism to make these illegal connections legal in order to make the electricity access in peri-urban areas sustainable.

IV.2.3 Access to electric services by peri-urban businesses

Similar to the households the energy profile of peri-urban businesses is characterized by the prohibitive connection prices and the high price for electricity. Generally the peri-urban businesses are informal (85%) and owned by residents. The few formal enterprises are own by outsiders who are investing in the peri-urban because of the low rental fees. Peri-urban businesses are generally not registered and rather informal .They use the same connections procedures as the households because they are not considered as legitimate businesses.

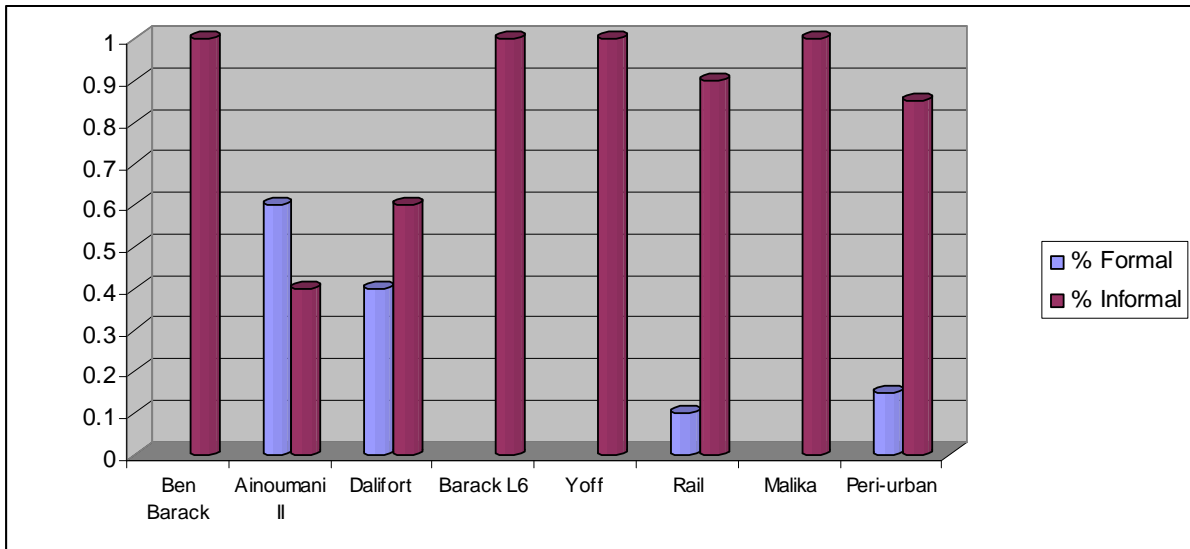


Figure 11. Proportion of formal and informal businesses in the peri-urban areas

Even though illegal connections are also used by peri-urban businesses the magnitude of the phenomenon is less important(Figure 12).We also note that all the peri-urban businesses surveyed have access to electricity legally and have an established account with Senelec or are illegally connected. The survey did not find a single business that did not have electricity access.

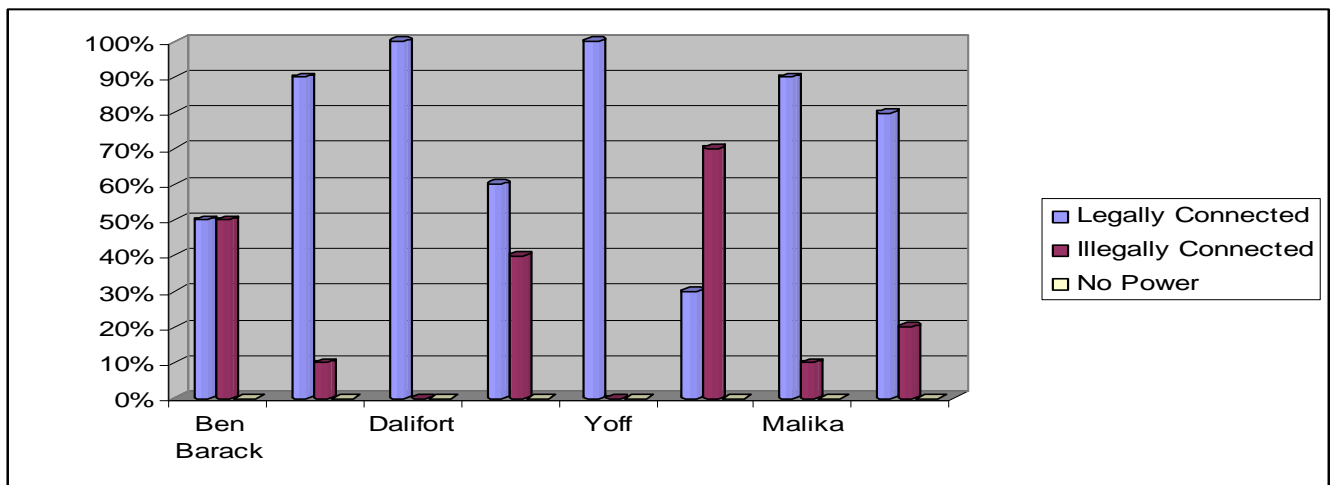


Figure 12. Energy profile of peri-urban businesses

The following Table shows the average bi-monthly bills for peri-urban businesses in the 7 zones surveyed. The average electric bill for the peri-urban businesses is around 43200 FCFA.This average is slightly superior to the one paid for households and reflects the use of heavy equipment for example drills, electric ovens ect.

Table 7 Average electric bill for legally connected peri-urban households

Area	Average bi-monthly bill (FCFA)
Barack L6	16600
Ainoumani	30140
Yoff Layene	35500
Daliford	127000
Rail	45000
Malika	27600
Ben Barack	21250
Peri-urban	43200

Like the households we also find a significant number of businesses that are illegally connected to the grid through immediate neighbours. In general the payment mode is by agreed some or by equipment types. The majority of the business pay a connection fee that is comparable to the one paid by the households.

IV.3 Theme 3: Access to modern fuels: The elimination of the LPG subsidies and implications for the peri-urban populations

IV.3.1 Access to LPG in peri-urban zones

LPG is the most used fuel in peri-urban households and 85% of the households surveyed use LPG (figure 13) in combination with other traditional biofuels.

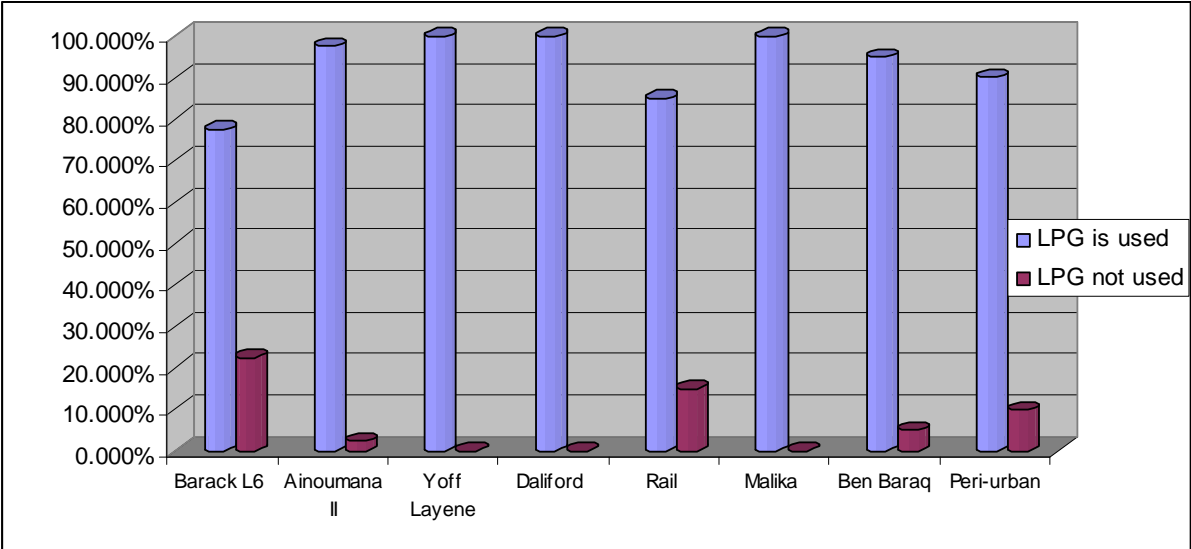


Figure 13 LPG usages in peri-urban areas of Dakar

LPG is becoming more and more an essential component of the peri-urban energy profile. In some areas like Yoff and Daliford the level of LPG usage is almost at 100% of the households. The most used LPG cylinder types are the smaller gas cylinders 6 and 2.75 kg (popular gas) that are cheaper and that benefit from a governmental subsidy. The average peri-urban household's uses 3 monthly 6 kg recharge and 2 2.75 kg LPG recharge cylinders (Table 8).

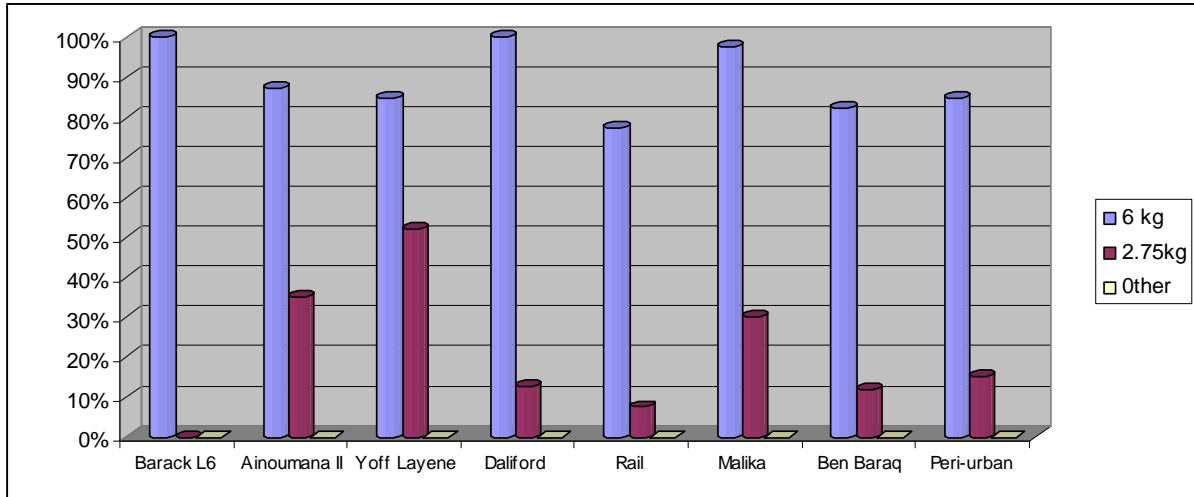


Figure 15 Most popular LPG cylinders among peri-urban households

The LPG prices in peri-urban areas 2500 FCFA for the 6 kg recharge and 1200 CFA for the 2.75 kg are not significantly different than the prices practiced elsewhere (Table 9) .The governmental subsidy on LPG is progressively being eliminated. This situation will decrease the LPG usage in peri urban households especially because the main barrier to LPG use in peri-urban households is the high price of the LPG cylinder recharge (figure 16). To ensure that the transition to more modern fuels is sustained there is a need to find a mechanism to maintain the governmental subsidy for the peri-urban poor.

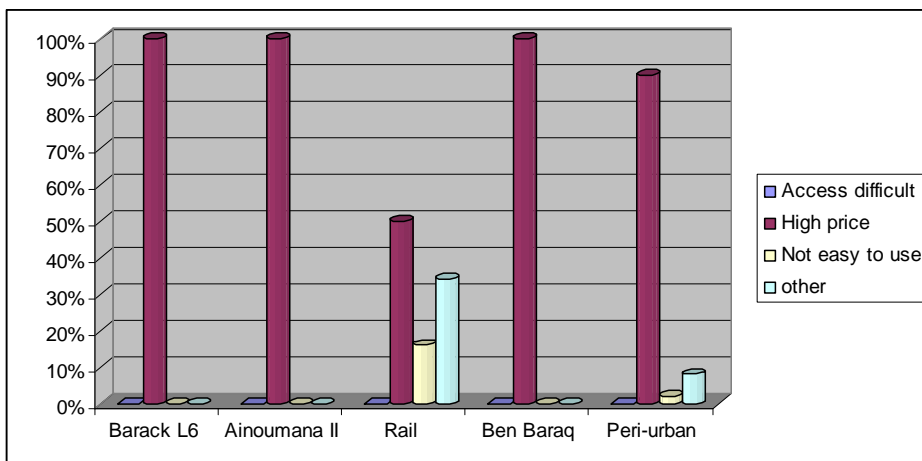


Figure 16 Reason why LPG is not used in peri-urban households

Table 8 LPG usage in Peri-urban areas

Area	Average number of 6 kg LPG cylinder used/month/household	Average number of 2.75 kg LPG cylinder used/month/household
Barack L6	3	1
Ainoumani II	4	3
Yoff Layene	4	2
Daliford	3	2
Rail	2	3
Ben Barack	4	2
Malika	4	2
Peri-urban	3	2

Table 9 Average prices for the 6 and 2.75 kg LPG recharge

Area	Average price of 6 kg LPG cylinder	Average price of 2.75 kg LPG cylinder
Barack L6	2500	1300
Ainoumani II	2510	1190
Yoff Layene	2550	1340
Daliford	2500	1200
Rail	2500	1150
Ben Barack	2515	1125
Malika	2500	1100
Peri-urban	2510	1200

The supply of LPG in the peri-urban areas is judge adequate by the population (Figure). There are occasional shortages that reflect the speculative behavior of the suppliers and also the inadequacy of the stocking capacity for oil derived products.

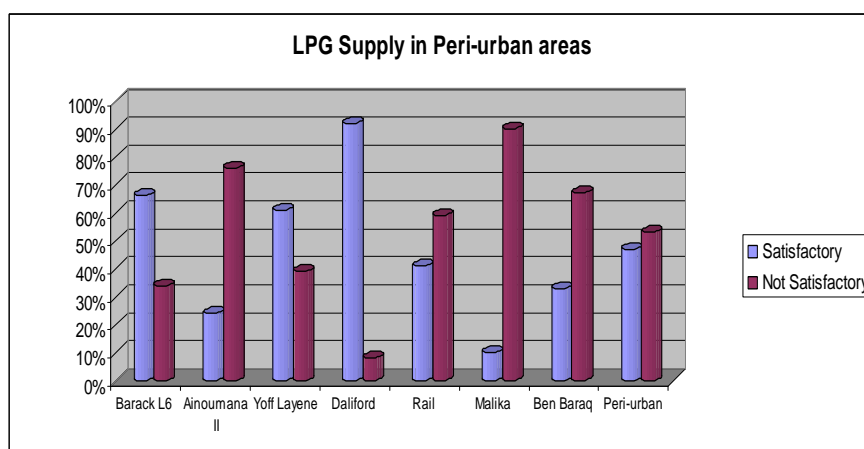


Figure State of LPG supply in peri-urban households

In periods of shortages charcoal and wood are used as substitution fuels by the peri-urban households (Table10).

Table 10 Alternative fuels of peri-urban households

Alternative fuels	Charcoal		Firewood	
	Monthly consumption rate (Kg/month)	Price/Kg (FCFA/kg)	Monthly consumption rate (Kg/month)	Price/Kg
Barack L6	30	210	42	100
Ainoumani	50	200	24	150
Yoff Layene	24	200	15	150
Rail	52	150	No data	No data
Ben Barack	34	200	47	100
Malika	8	210	No data	No data
Daliford	No data	No data	No data	No data
Peri-urban	33	195	32	135

Similar to electric services there's little or no use of LPG for productive purposes in peri-urban houses (Figure 17). The prohibitive recharge price does not encourage the use of LPG for productive purposes. The only applications of LPG are small restaurants that sell cakes or fries food (fish, fries ect).

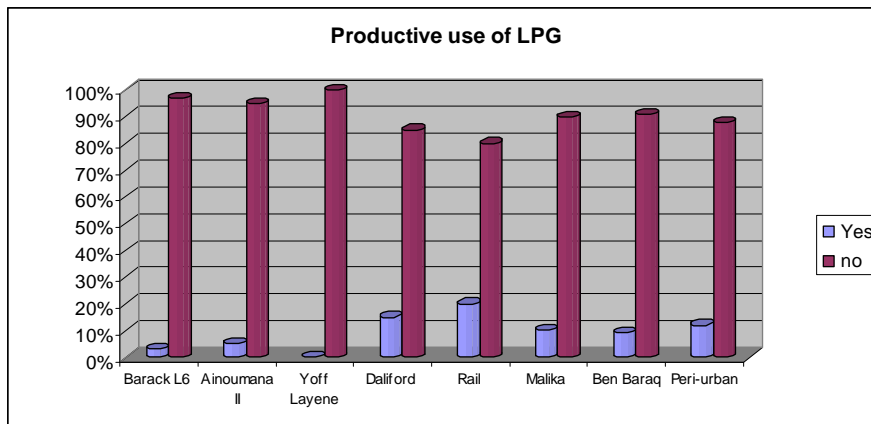


Figure 17 Productive use of LPG in peri-urban households

IV.3.2 The elimination of the LPG subsidies and implications for the peri-urban populations

The debate over the elimination of governmental subsidies for LPG is a burning issue facing peri-urban communities in Dakar. The introduction of LPG for cooking called “butanization” in Senegal shows the critical nature of subsidies on the use of cooking gas by the peri-urban and urban poor. This policy has been largely successful and by the time the subsidy was partially withdrawn in 1998 over 85 % of urban and peri-urban households had switched to LPG. Alarmed by the high rates of deforestation caused by charcoal production for household use, the government aimed at reducing charcoal consumption by 50 % in the major urban areas by introducing policies to make LPG accessible and affordable for poor households. The plan was to substitute charcoal and wood by LPG as the main source of energy for cooking. At first (1974) a cooking stove with an attached gas cylinder containing 2.7 kg LPG was promoted and later in 1983 a more solid cooking stove with a 6 kg gas cylinder which was better adapted to the cooking habits and income levels was also subsidized. In addition the Senegalese government exempted all LPG-related equipment from custom duty and eventually subsidized the gas itself in 1976. The figure below shows the evolution of LPG consumption by urban and peri-urban households of Dakar Senegal.

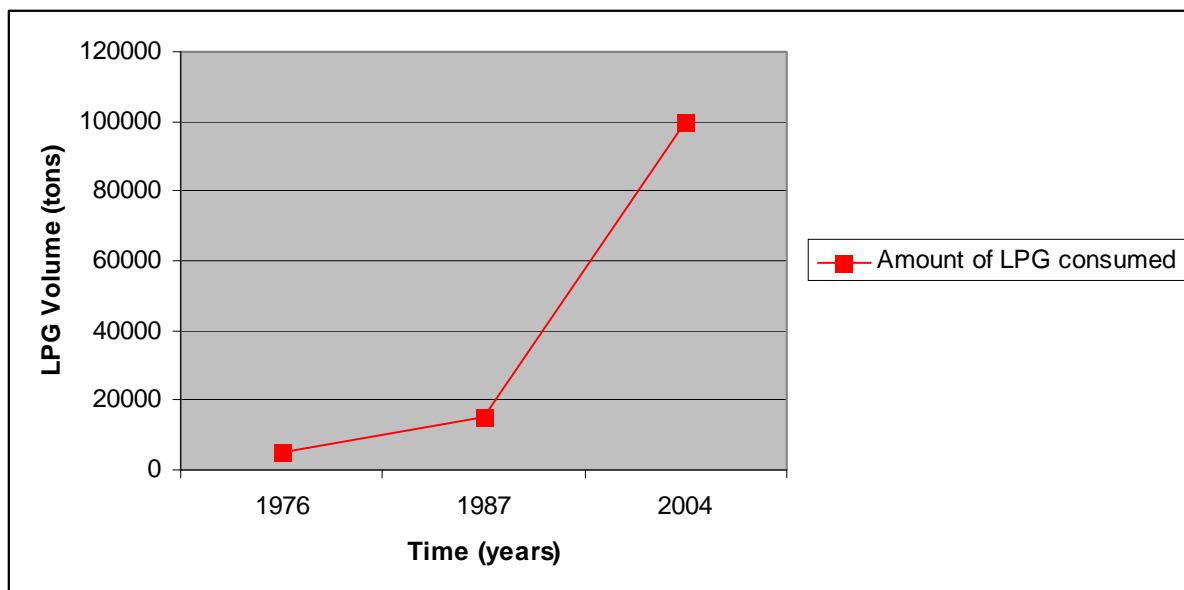


Figure 14: Evolution of LPG consumption in Dakar Senegal

After the first years (1988), the government still felt that the LPG introduction process in Dakar was too slow and took the decision to increase the subsidies on LPG. This had the effect of dropping the retail price for LPG cylinders by 38 % and also increased sharply the demand for two new models (Nopale and Blip Banekh) of LPG-based stoves. The 6 kg cylinder refill price dropped from 1183 CFA to a low 725 CFA and the 2.75 kg dropped from 522 CFA to 325 CFA. This price drop was translated into a substantial increase in LPG in urban and peri-urban areas of Dakar (the demand for 6 kg refills rose from 4,013 tons to 7,145 tons and the demand for Blip Banekh 2.75 kg refill doubled from 10,923 tons to 20,308 tons). The following table shows the elasticity of the demand for the two type LPG cylinders and the resulting increase in total demand.

Table 12. Price and demand variations and price elasticity of demand after Increased subsidy of the combined gas cooking stoves in Senegal Source: Ba 2005

	Nopale (6 kg Cylinders)	Blip Banekh (2.75 kg Cylinders)
Relative Variation of price	-38.7	-37.7
Relative Variation of demand	+ 78.0	+57.2
Price elasticity of demand	-2.0	-1.5

LPG demand in peri-urban and urban zones of Dakar showed a positive evolution (15% annual growth rate) during the decade between 1988 to 1998. At the same time the urbanization rate was about 5% annual with a strong demographic push (5% annual rate). The subsidy on LPG had the double benefit of being a sustainable way to diminish deforestation by decreasing the charcoal consumption and also by giving to the peri-urban and urban poor the possibility to have access to the LPG cylinders at affordable prices.

Unfortunately and despite the wide success of the subsidy policy, the government decided to gradually eliminate the subsidy of LPG gas starting on 1 July 1998 (see table 3) as part of the wider energy sector reforms .

Table 13: Five-phase elimination of subsidies on butane gas in Senegal Source :Ba 2005

Phase	Elimination date	Level of residual subsidy for 6 kg cylinders (CFA/ton)	Level of residual subsidy for 2.75 kg cylinders (CFA/ton)
1	1 July 1998	168652	159603
2	1 July 1999	126489	119702
3	1 July 2000	84326	79802
4	1 July 2001	42163	39901
5	1 July 2002	0	0

The goal of the elimination of this subsidy was to attenuate the impact of the fluctuating oil market on public finances and transfer the cost to the customers. At first, the subsidy was to be incrementally reduced by 20% each year from 1 July 1998 to 31 December 2001. But for environmental purposes (to combat deforestation) the last 20% of subsidy for 6 kg and 2.7 kg cylinders was maintained. The first phase of suppression of LPG subsidies was scheduled to start in 1998 (see table 3) but was actually implemented in July 1999. This prompted an increase in the LPG price (158 CFA before July 1999 to 249 CFA in 2001.)

The policy of LPG subsidies for the poor is overall a very good initiative by the government. The problem is that there were a lack of controlling mechanisms to make sure that the subsidies is channeled properly to reach the most vulnerable part of the population. The mistake that was made was to assume that the 2.75 and 6 kg LPG cylinder called popular gas will be exclusively use by the urban and peri-urban poor and that the wealthier part of the population will use higher volume cylinders. In fact the richer part of the population did benefit more from LPG subsidy that the poor because of the lack of a proper control LPG subsidy access mechanism. The population that will suffer the most from LPG elimination will be the peri-urban poor who now face the prohibitive LPG prices. The elimination of the LPG subsidy will have two type of effect depending on the location of the peri-urban areas relative to the urban centers. For the peri-urban areas located near cities and that are generally characterized by a transition to more modern fuels such as LPG the elimination of the subsidy will discourage the introduction of these fuels and the population might revert to the more noxious traditional biofuels. For the peri-urban zones that are a little farther down the urban centers it will be extremely difficult for the energy policy maker to induce a transition to more modern energy sources in light of the prohibitive LPG prices. It is therefore critical to find a solution that will enable the poor to have access to LPG subsidies. In the in depth phase of UPEA we will study the impact of the elimination of this subsidy and try to develop a strategy to attenuate its impact on the peri-urban poor.

Chapter V. Conclusion and study recommendations

V.1 Policy Pointers

The different policies that can be inferred from the present study are numerous. In this section we give a summary of these policies.

- Suggested Policy 1 Peri-urban Definition and Characterization Forum

The first policy option will be the creation of a forum to exchange around the definition and proper delineation of the peri-urban zones .This forum will be held in order to get a consensus around the definition of peri-urban concept and also help in the delineation of these areas. This forum can be in the form of an agency that will work to bring the different energy sector actors and all the other stakeholders to a consensus and also help in the proper delineation of

the peri-urban areas. In addition this agency can work to gather statistics about the peri urban areas and fill in the institutional gap that exists in these zones.

- Suggested Policy 2 :Fighting illegal connection in peri-urban zones through a better electricity access policy

The main point that was discovered in this study with respect to illegal connection is the fact that this phenomenon is not related to the inability of the peri-urban poors to pay for electricity but has to do with the difficulty to face the prohibitive connection fees applied by the power company. Accordingly the issue of electricity access in peri-urban zone has to be understood in the context of an inadequate connection pricing policy. The key to resolving the problem of illegal electricity access is a new and flexible connection policy. This new connection policy will encourage the peri-urban poors to have access to electric services in a legal fashion. One policy suggestion we have is the payment of the connection fees through long term installments that can be afforded by the peri-urban poors. These long term installments will be included in the electricity bill. In the case where the households are far from the grid and where there is a necessity for extension work we recommend that the government gets involved. These extension costs are too prohibitive and cannot be supported by the poor peri-urban households. Governmental intervention will consist in allocating a budget to undertake such extension at least in part. In addition the penalty (2% of the annual profit) that is paid to the government by Senelec for their lack of performance can be used partially to finance these extension costs.

- Suggested Policy 3 :Productive applications as mean of affording electricity in peri-urban zones

One policy that can help the peri-urban population afford electricity is without a doubt the development of productive applications for electricity. The households can be encouraged to develop small scale productive units (Ice making, cold beverages, poultry and meat conservation ect) that will generate enough income to cover the cost of electricity for the households. Our surveys show that there is very little productive application for electricity in peri-urban zones. The first policy option will be to develop an information campaign aiming to show the benefit of productive applications and its possible use as a mean to afford the electric bill. Another issue is to find an interesting financing mechanism for these applications. We suggest a micro-credit configuration where the households will get together in a micro-credit network to fund their own enterprises in turns.

- Suggested Policy 4 : Development of a mechanism to maintain LPG subsidies for the peri-urban poor : The LPG concession

With regards to LPG the main issue is how to target th current governmental subsidies for the poor peri-urban households. One policy option is the creation of some specialized distribution outlet that provides LPG 6 kg and 2.75 kg bottles at a subsidized price. These outlets will be opened only in poor peri-urban areas but not in other wealthier areas. In addition to make sure the subsidy only benefits the poor a subsidized LPG access card will be given to identified poor households of peri-urban areas. The card will unable them to access LPG at the subsidized price upon proper identification. This target approach will enable to maintain the current subsidy for the poor and impose market prices for the wealthier part of the population.

V.2 Outreach Plan

The findings of the UPEA II will be discussed in a series of seminar organized by ENDA and regrouping all the actors and stakeholders of the energy sector. A town meeting will be organized in the different peri-urban zones to share our findings with the local populations. In addition some pamphlets summarizing the different findings will be available for the interested parties.

V.3 Areas for further research

One area that needs to be investigated in depth is the safety aspects of illegal connections and the implications for the peri-urban poors. Another interesting issue that could be addressed in future studies is the possible development of small peri-urban energy producers or entrepreneurs that will generate and supply energy on site to the peri-urban poors at a lower cost.

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