



# Proceedings of the Workshop "Improving Electricity Service for the Urban Poor" December 4-6, 2007



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## ABSTRACT

The workshop, “Improving Electricity Service for the Urban Poor,” was held in São Paulo, Brazil from December 4-7, 2007 and attended by over 100 experts, distribution company managers and development officials from 23 countries drawn from Asia, Africa, Latin America, Europe and North America. The objective of the workshop was two-fold, the first being to disseminate the results of the Slum Electrification and Loss Reduction (SELR) pilot project of the U.S. Agency for International Development (USAID), International Copper Association (ICA) and AES Eletropaulo. The second objective was to share experiences and explore sustainable solutions to the many technical, economic and social issues associated with SELR-type programs, focusing on best practices, techniques, tools, and technologies. The primary targets of the dissemination were distribution companies serving large urban areas in developing countries and development and government officials and NGOs who could assist their efforts in substantive ways.

As described in these Proceedings, the participants’ discussions and presentations focused on the following topics:

- Transforming consumers and their communities to be ready and willing to become “normal” customers and able pay their electricity bills,
- Transforming distribution company operations to develop service models that aid in successfully converting consumers into customers,
- Putting the enabling conditions into place (with community leaders, NGOs, local and national governments and regulators), and
- Achieving overall sustainability of program results.

Session and presentation topics and the presenters are listed in the final agenda in Appendix A and a list of participants is found in Appendix B. The full set of presentations can be found at [http://www.procobre.org/procobre/cobre\\_para\\_especialistas/improving\\_electricity.html](http://www.procobre.org/procobre/cobre_para_especialistas/improving_electricity.html).

## 1.1 OVERVIEW

In a world-wide trend, people are moving from rural areas into cities and towns hoping for better jobs and futures. In 2000, about 2.9 billion people - nearly half of the global population - lived in urban areas. This figure is expected to increase to about two-thirds of the population by 2025. The most rapid change will occur in the developing world, where urban populations are growing at about 3.5 percent per year and the vast majority of the growth will occur in slums if governments remain unprepared to provide the urban infrastructure required to avoid slum creation and growth<sup>1</sup>. The prospect of these changes in the composition of the urban population poses an enormous challenge for the economic and social sustainability of urban areas, for the creation of incomes and employment, and for the provision of infrastructure, social, and administrative services – electricity, water, health, education, security and other services. Yet, the expansion of these services in slum areas will be critical for stimulating economic growth and social development.

Despite the challenges in keeping pace with urbanization and providing goods and services to low-income communities, electricity utilities and other businesses are increasingly seeing them as an important market segment. The large number of consumers comprising the “base of the pyramid” or BOP represents a significant and growing purchasing power. BOP households total about 4 billion people and constitute a \$5 trillion global consumer market of which energy’s portion is \$220 billion and growing. In Africa, Eastern Europe, and Latin America, energy ranks third in BOP household expenditures, following food and housing. In Asia, energy ranks second, surpassing housing.<sup>2</sup>

The challenges for utilities are to find a way to tap into the BOP market. Historically they expect low or negative returns from poor people. In part, this reflects a lack of experience with surmounting the problems associated with serving slum consumers effectively: e.g., their lack of tenure, their high degree of transience, and their expectation of being excluded and having to “take matters into their own hands,” such as illegally tapping into electricity lines. These challenges are compounded by poor legal recourse for non-payment, lack of right of way to bring infrastructure into the areas, and the unique technical and administrative solutions needed to confront fraud and adapt to geography or poor housing conditions. Furthermore, few governmental or regulatory incentives may exist to serve poor communities, and yet universal service requirements may be imposed that do not recognize the problems and extra costs of providing service to these informal areas.<sup>3</sup>

These problems can lead to high technical and commercial (revenue) losses<sup>4</sup> for distribution companies, threatening their viability or raising cost of power for other consumers or taxes for all taxpayers, highly dissatisfied consumers, and conundrums for governments whose mandate

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<sup>1</sup> United Nations Habitat, Human Settlements Programme, The Challenge of Slums, Global Report on Human Settlements, 2003, Chapter 1.

<sup>2</sup> World Resources Institute (2007) The Next 4 Billion: Market Size and Business Strategy at the Base of the Pyramid

<sup>3</sup> Lawaetz, “The Challenges and Opportunities for Providing Electricity Service in Low-Income Urban Areas” Day 1.

<sup>4</sup> Commercial losses are non-technical losses and comprise theft and fraud wherever they occur in the revenue management stream. The commercial losses in the slums tend to be either tapping illegally into service lines or bypassing the meter.

includes ensuring adequate public services to its citizens. But, as described in these Proceedings, new electricity service models for serving the urban poor are being developed and tested to cope with these problems.

## 1.2 USAID/ ICA/ AES-ELETROPAULO SELR PROGRAM

Recognizing the importance of meeting these challenges, the U.S. Agency for International Development (USAID) began its Slum Electrification and Loss Reduction (SELR) program in 2003 with a multi-country study of slum electrification programs, leading to the publication of the USAID report entitled ‘Innovative Approaches to Slum Electrification’ in 2004.<sup>5</sup>

Subsequently, USAID in collaboration with several partners<sup>6</sup> held a workshop in September 2005 in Salvador, Brazil called “Meeting the Energy Needs of the Urban Poor: The Case of Electrification.” At this multi-country, stock-taking workshop, delegations of 3-5 practitioners attended from 12 cities in Latin America, Africa and Asia (including all the programs studied in the 2004 report) to discuss their experiences with expanding access to electricity service in poor urban neighborhoods. Proceedings entitled “Meeting the Needs of the Urban Poor: Lessons from Electrification Practitioners,” were produced in June 2007 by ESMAP.<sup>7</sup>

With this basis, the next step was to put concepts and lessons learned into practice. The SELR Brazil Partnership (i.e., between USAID, the International Copper Association (ICA), and AES Eletropaulo) launched the SELR Brazil pilot in July 2006 with the objective of developing, testing and evaluating a sustainable and widely-replicable approach for increasing access to electricity services for low-income urban consumers. The pilot tested the efficacy of a combination of anti-theft technologies and assistance to consumers to make their electricity consumption more affordable and safer, and is described in Appendix C. A detailed description of the pilot, including an analysis of its financial and social impact, will be presented in a case study, available in mid-2008. In parallel, USAID and ICA designed a pilot project having similar objectives with Reliance, Inc., the distribution company serving Mumbai, India. About 20,000 slum households living in the target area will benefit from project activities. The World Bank’s Output Based Aid program will support this pilot and, after recently conducting comprehensive economic, environmental and technical assessments, will launch project activities in the Fall of 2008. A third pilot in the Africa region is currently being planned for.

The workshop, “Improving Electricity Service for the Urban Poor,” was held in São Paulo, Brazil from December 4-7, 2007. Invitations were extended to distribution company managers, development officials and experts working on slum electrification and loss reduction or related activities in Asia, Africa, Latin America, Europe and North America. There were just over 100 participants from 23 countries, many of whom were sponsored by the three SELR Brazil partners, USAID, ICA and AES Eletropaulo.

The objective of the workshop was two-fold, the first being to disseminate the results of the Slum Electrification and Loss Reduction pilot project in Brazil (SELR Brazil). The second objective was to share experiences and explore sustainable solutions to the many technical, economic and social issues associated with SELR-type programs, focusing on best practices,

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5 The report is available for download at [http://www.usaid.gov/our\\_work/economic\\_growth\\_and\\_trade/energy/publications.html](http://www.usaid.gov/our_work/economic_growth_and_trade/energy/publications.html)

6 Co-sponsored with Energy Sector Management Assistance Program (ESMAP), Cities Alliance, EdF, InterAmerican Development Bank, and COELBA, the electricity utility serving Salvador, Brazil.

7 The report is available at [http://esmap.org/filez/pubs/1252007111830\\_ESMAPMeetingTheEnergyNeeds.pdf](http://esmap.org/filez/pubs/1252007111830_ESMAPMeetingTheEnergyNeeds.pdf)

techniques, tools, and technologies. The primary targets of the dissemination were distribution companies serving large urban areas in developing countries and development and government officials and NGOs who could assist their efforts in substantive ways.

### *Collaboration Brings Synergies to Partners' Goals*

The partnership of AES, USAID, and ICA to develop and implement the SELR Brazil pilot project helped each partner to achieve its broader objectives. Likewise the resources, different skills, and perspectives that each partner brought to the partnership contributed substantially to the overall success of the pilot.

### *USAID and Slum Electrification*

USAID is an independent agency of the United States Government that has the twofold purpose of furthering America's foreign policy interests in expanding democracy and free markets while improving the lives of the citizens of the developing world. It supports worldwide programs in economic growth, agriculture and trade, global health, and democracy, conflict prevention and humanitarian assistance. In the energy sector, USAID works to improve access to safe, affordable and reliable electricity and other modern energy services. Electricity supply is an essential requirement for economic growth and poverty reduction; it can provide key inputs to stimulate new businesses, improve the quality of life, allow for increased social services (health, education), and reduce the need for dirtier and less safe energy forms such as kerosene and charcoal.

Given expanding slum populations as a result of continued rural to urban migration, USAID launched the SELR program to assist governments, utilities and other stakeholders with extending legal, reliable and affordable electricity service to these consumers. Furthermore, the program aims to assist utilities with reducing their technical and non-technical losses in poor urban neighborhoods and improving the sector's operational and financial performance. Specifically, USAID's program objectives include:

- Testing, evaluating, and disseminating the results of replicable and sustainable approaches to slum electrification;
- Improving the safety and affordability of electricity service for slum customers through efficiency interventions and education on the management of electricity consumption;
- In partnership with public and private sector organizations, implementing pilot projects that test innovative ideas and have strong potential for replication, scale-up, and economic and social impact; and
- Supporting the exchange of knowledge and sharing of international experiences in slum electrification and loss reduction.

### *ICA's Role in Slum Electrification*

Copper plays an important role in providing economic growth and a better quality of life for the world's population. Global challenges, such as the growth occurring in developing countries and environmental concerns – particularly global climate change – require solutions, of which a major one is improving energy efficiency. Gains in efficiency give multiple benefits: energy and economic savings and environmental and other socio-economic improvements. A range of actions, such as setting efficiency standards, can dramatically improve the efficiency of new appliances, motors and other electrical equipment.

ICA's Sustainable Electrical Efficiency Program aims to improve the efficiency of air conditioning, refrigeration, motors, and transformers. Its objective in slum electrification is modernization and reduction of energy losses in the supply and demand of power and improving the safety and quality of electricity supply, leading to a better quality of life for slum communities. The main actions that it supports in slum electrification are:

- Rewiring of homes to code to improve safety,
- Energy efficient refrigerators and transformers, and
- Anti-theft coaxial cable, sized for energy efficiency, to be used in service drops and secondary distribution

ICA's specific aim in its partnership with USAID and AES Eletropaulo and in the pilot project is to develop and demonstrate a sustainable, affordable and widely-replicable approach to electricity services in slums across Brazil, Latin America and globally. Two products of the work are particularly important:

- A Business Case that will show the financial results of the pilot
- A user-friendly model to analyze the economic feasibility of slum electrification projects to be made available to communities and utilities as an orientation guide for management decisions.

*Sources: John Mollet and Glycon Garcia of ICA*



### *AES Eletropaulo's Strategy for Serving Slums*

AES is one of the world's largest global power companies, with 2007 revenues of \$13.6 billion. With operations in 28 countries on five continents, AES's generation and distribution facilities have the capacity to serve 100 million people worldwide. AES' 13 regulated utilities amass annual sales of over 78,000 GWh and their 121 generation facilities have the capacity to generate approximately 43,000 megawatts. The global workforce of 28,000 people is committed to operational excellence and meeting the world's growing power needs. AES Eletropaulo distributes electricity to 24 cities in the metropolitan region of São Paulo including the capital which together comprise a population of 16.5 million inhabitants. The concession area of the company covers 4,526 km<sup>2</sup> which includes the most important socioeconomic region of the country with around 5.5 million consumers (customers). In terms of billing, AES Eletropaulo is the largest distributor of electricity in Latin America.

AES' strategy for dealing with the challenge of serving the very large number of slums in its service territory in São Paulo contains these main elements:

- Develop and maintain a relationship with the people and community leadership
- Establish commercial policies adequate for sustainably serving slum neighborhoods
- Establish network standards that ensure safety for the residents while deterring fraud and theft

The primary challenges to the sustainability of this strategy are:

- Finding solutions to bad debt and serving populations that live in areas of risk
- Stopping new illegal connections due to growth of slums
- Stopping fraud from reoccurring

<sup>1</sup>Source: Charles Capdeville, "Responsibly Tapping the Base of the Pyramid" Day 1

The workshop was opened by representatives of the project partners, with each presenting overviews of their organizations' perspectives and SELR activities. The SELR Brazil project was then presented by the local and international experts and AES-Eletropaulo personnel who implemented the main pilot activities. On the second and third days of the workshop, representatives from distribution companies, electricity regulators, local and federal government, NGOs, multilateral development banks, and other stakeholders shared their experiences with similar projects throughout the developing urban and peri-urban world. While panel topics were organized so that each covered a key aspect of SELR activities, each presentation on a city or country case provided an overview of the initial conditions and the full range of actions that had been taken to accomplish slum electrification and loss reduction. Session and presentation topics are summarized in the box on the next page while the complete agenda with the names of presenters is provided in Appendix A. A full list of the workshop participants is found in Appendix B. All of the presentations as given can be found at [http://www.procobre.org/procobre/cobre\\_para\\_especialistas/improving\\_electricity.html](http://www.procobre.org/procobre/cobre_para_especialistas/improving_electricity.html).

Rather than present the main points of the presentations in the sequence in which they were given, these proceedings are organized around topics that reflect the major outcomes of the workshop, as follows:

- Transforming consumers and their communities to be ready and willing to become “normal” customers and able pay their electricity bills,
- Transforming distribution company operations to develop service models that aid in successfully converting consumers into customers,
- Putting the enabling conditions into place (with community leaders, NGOs, local and national governments and regulators), and
- Achieving overall sustainability of program results.

## 2.1 TRANSFORMING CONSUMER AND COMMUNITY ATTITUDES ABOUT ELECTRICITY SERVICE

Developing an approach that is acceptable to the future customers and their community should be the first concern in the design and roll out of new approaches to serving low income communities. Transforming the consumer into a customer requires:

- Getting accurate information on consumers and their community to aid in program design,
- Working with the community and the consumer to understand and accept the process of regularization and the benefits and responsibilities that come with becoming a good customer, and
- Improving affordability of and control of consumption (particularly when going from higher pre-regularization levels to lower more affordable levels).

## Overview of Workshop Agenda

### DAY 1

- Official Opening
- Responsibly Tapping the Base of the Pyramid at AES
- ICA's Global Perspective on Energy Sustainability
- The Challenges and Opportunities for Providing Electricity Services in Low Income Urban Communities: Overview from USAID
- Overview of the Paraísopolis (SELR Brazil) Project
- SELR Brazil's Customer Oriented Approach
- SELR Brazil's Focus on Affordability, Safety and Reliability for the Consumer
- SELR Brazil's Technical Solutions to Minimize Theft and Improve Reliability & Quality of Service
- Partnership with Municipal Infrastructure Upgrading Program
- Sustainability from the Company's Perspective

### DAY 2

- Panel 1: Know Your Future Customers
- Panel 2: Affordability, Safety and Reliability for the Customer
- Panel 3: Obtaining and Maintaining Community and Local Government Support for Electrification
- Panel 4: Regulation and Institutional Factors

### DAY 3

- Panel 5: Sustainability from the Utility's Perspective
- Panel 6: Technical Solutions to Minimize Theft, Improve Reliability & Quality of Service
- Panel 7: Effectiveness of Consumer Measures

Break-out Sessions on:

- Technical Solutions,
- Knowing Your Customer and Maintaining Community Support,
- Learning More about the AES-USAID-ICA Brazil Pilot, and
- Regulatory and Institutional Issues

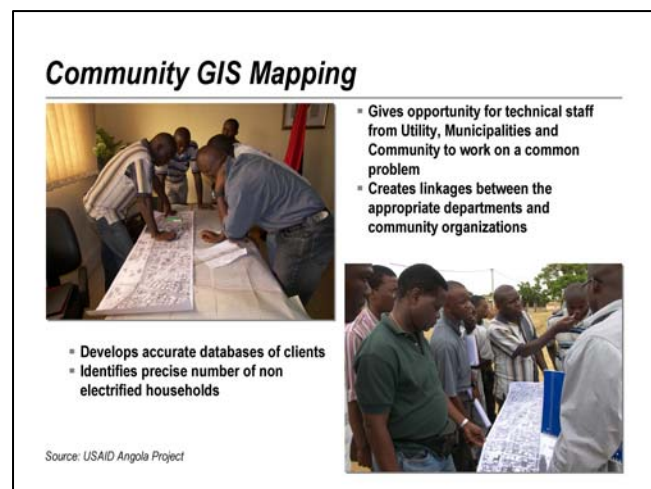
**DAY 4:** Site visit to AES-USAID-ICA Brazil Pilot area in Paraísopolis

## 2.1.1 Obtaining Accurate Baseline Information on the Community and Consumers

Prior to regularization, a program priority is obtaining better information on the community and consumers' attitudes and socio-economic and technical situation for planning the regularization effort. Because of their informal status, slum residents and businesses and their community are generally poorly understood by outsiders. Reliable data is often lacking or outdated. Most practitioners reported that they encountered little or no up-to-date data on attitudes, socio-economic and technical conditions of potential customers, the community leadership structure, and the physical area to be regularized. The result was the need to develop that data which was often a time consuming and complicated endeavor.

The SELR Brazil pilot illustrated some of the problems to expect and overcome in starting work in an established informal area that has grown haphazardly over many years.<sup>8</sup> Mapping existing structures and linking each housing unit with a head of household who would be responsible for bill payment was a major challenge especially as the slum had been growing for over 40 years. The resulting difficulties delayed or caused additional work for the subsequent planned activities. The Angola presentation<sup>9</sup> described a collaborative approach using the community residents themselves to develop a GIS database and map of the areas that were to be regularized. Mapping was completed within a matter of months, was probably more accurate than could have otherwise been produced, and had the added advantage of actively tapping local knowledge. The presentation on Liberia<sup>10</sup> showed how preconceived notions about slum areas in war torn cities could be quite inaccurate. Initial socio-economic and technical data collected at the outset raised several needs to be addressed: rewiring virtually all structures for safety concerns, sharing of a meter among multiple households occupying one structure, and obtaining permission from overseas landlords for tenants to take responsibility for rewiring and bill payment. The data collected on the ability to pay for the alternatives to electricity surprisingly showed that while the two pilot areas that were physically very different (one appearing to be very low income and the other almost middle class), they actually had average incomes and demonstrated ability to pay for electricity substitutes that were roughly the same.

Initial data may be available from local sources or researchers involved in studying low income consumers. For example, in the SELR Brazil project the Municipal Secretariat of Housing (or SEHAB) had a veritable treasure trove of data on the socio economic and physical layout of the Paraísopolis slum because of the numerous infrastructure projects that it has been implementing in recent years.<sup>11</sup> It provided the basis for beginning the additional survey work that was



<sup>8</sup> Zampolli, Nexant "Socio-economic conditions in the project area" and Andrade, AES "Customer Preparation for Regularization" under Day 1 Session: SELR Brazil's Customer Oriented Approach.

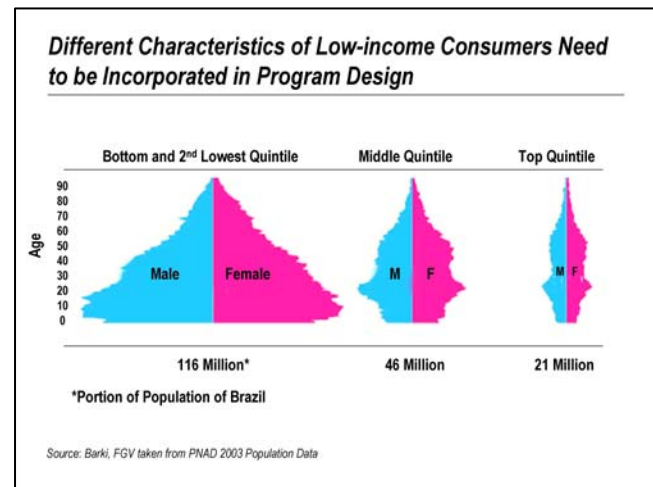
<sup>9</sup> Melikian, AED. "Utility-Municipality-Community Collaboration in Angola for Electricity Distribution Improvement" under Day 2, Panel 3.

<sup>10</sup> Smyser, IRG/Smyser Associates. "Preparation to re-electrify war-torn low income communities" under Day 2, Panel 1.

<sup>11</sup> Diniz, SEHAB. "Land regularization process, improving urban infrastructure in poor neighborhoods"

undertaken in the project and a useful baseline against which to judge the new results. However, it was not recent enough to use for locating and registering all of the individual residences and heads of household because of the demographic changes that had occurred since the survey.

An example of research data on attitudes of Brazilian low income consumers was also provided, illustrating that the “drivers” for low income families are both similar and dissimilar to those of middle and upper income families.<sup>12</sup> All families regardless of income want a better life, good employment, and hope for the future. However, the proportion of young people in low income communities is significantly larger and their attitudes differ dramatically as a result. Low income families are far less educated, and “normal” modes of communication (graphs and texts) are often ineffective. Face-to-face communication is far more successful. Low income families seek social inclusion while higher income families seek marks of distinction. Not taking such differences into account could lead to errors in the choice of information delivery mechanisms and decreased effectiveness of information and messages that need to be impressed on the population.



Socio-economic and technical surveys go a long way towards developing a basic understanding of the physical and fiscal profile of the targeted customers. Consumer polls can gauge attitudes and should be done both pre and post regularization to measure satisfaction with the project and changes in attitudes. The results of the SELR post-pilot consumer poll<sup>13</sup> provided some important insights on sustainability issues (addressed later). Argentina’s ENRE representative, Codensa (Bogota, Colombia), Empresas Publicas de Medellin (Colombia) and Light (Rio de Janeiro, Brazil) use consumer polls to keep their finger on the pulse of the community and to judge the effectiveness of their approaches before scaling them up or replicating them elsewhere. For example, the largely positive view of prepayment by those that used it helped to convince regulators and other stakeholders to allow scale up in both Argentina and Colombia.

Maintaining an accurate database on the community after regularization was also highlighted as an important issue. Several companies mentioned very high rates of turnover of residents within the community and rapid changes in the structures (usually expansion upwards or outwards depending on the age and geography of the slum). Information on these changes can be readily collected and tracked by maintaining at least one local (easy to reach) office as well as community agents that roam the community, solve problems and identify irregularities and changes in the clientele (e.g., Light, COELBA, AES, and CEMIG).

<sup>12</sup> Barki, FGV University. “Understanding and incorporating low income behavior into program design” under Day 2, Panel 1: Know Your Future Customers.

<sup>13</sup> Cervellini, “Gauging Consumer Satisfaction” in Day 1 Session: SELR Brazil’s Customer Oriented Approach.

### 2.1.2 Preparation for Regularization

To improve consumer acceptance of regularization, several key components emerged. The first was engaging the community leaders from the beginning. Informal areas tend to have informal, but still powerful, governance structures. Virtually all practitioners underscored the importance of this as the first essential step. Brazil's slums often have a Residents Association, and they have proved to be essential partners, but LIGHT also encountered conflicts between these associations and slum lords and power struggles between competing slum lords that complicated their partnerships. NGOs were useful partners but did not represent the entire community and lacked decision-making powers.

Another component was making a "social compact" or social contract between the company and the soon-to-be-regularized consumers. This compact in essence is a promise on the part of the distribution company to provide high quality, reliable, safe and affordable electricity to new customers. In return the customers agree to cease illegal tapping of lines, take seriously the payment of the electricity bill, and to use electricity wisely and safely. Several presentations highlighted this point and in at least one case, Colombia, agreements were actually written and signed between the targeted communities and the companies to improve conditions of service provision in exchange for community cooperation with the efforts.

Another key element was continuous communication and follow through. The efforts of the SELR pilot project included an extensive community campaign (door to door and events held on weekends and in schools) spread out over the full length of the pilot to first inform consumers of the benefits of regularization, followed by information on using electricity safely and wisely. Other benefits of regularization were also repeatedly emphasized, e.g., greater security in the streets from new public lighting, greater safety in the home from improved electrical wiring, establishing an address so that they could be eligible for credit in stores, etc.<sup>14</sup> AES will soon be opening a customer service branch office in the Neighborhood Association building in the area to continue easy access for residents to report problems or seek advice.

### 2.1.3 Affordability of Service

A likely initial barrier for low income consumers becoming regular customers can be the relatively high connection costs (e.g., for service drop and meter and sometimes line extension). In the SELR Brazil project, this charge was dropped (after approval by the regulator), thus removing any initial barrier to connection. In Liberia, connection fees were lowered dramatically, household wiring materials provided at no cost, and the cost for installation of the wiring was negotiated to get a very low "bulk" price (for 100 households). Empresas Publicas de Medellin provided prepayment meters to regularized customers at no charge. Likewise in Argentina most of the companies do not charge for connection under the prepayment and/or fixed invoice system; although a small charge must be paid when a customer is reconnected (where prepayment is not used) after being disconnected for non-payment.

In some areas, debts still on the company's books from customers who had stopped paying their bills (and reverted to theft instead) needed to be resolved before regularization. Such debts were either forgiven (as part of the social compact) or allowed to be repaid in very small amounts over

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<sup>14</sup> See Taninaga, "Basic efficiency and affordability measures" Day 1 SELR Brazil Project.

a long period. The SELR Brazil pilot started with a “clean slate” for all residents in the pilot area that had been connected before. Codensa has a program to negotiate repayment of prior debts when the regularized customer is reconnected. They generally repay their debt over 6 to 36 months while paying for their current consumption.

A basic tenet of slum electrification emerged: if consumers can afford the payments for their electricity consumption, they are more likely to pay their bills. So, one of the most important aspects of the assistance to new customers in the SELR Brazil pilot was getting them registered to receive the low income tariff which reduces the cost of the bill by about one half of the normal residential rate.<sup>15</sup> Those that were illegally connected to the distribution system in the past had never established eligibility for the preferential tariff. However, in many cases, even this benefit was insufficient because many new customers were accustomed to consuming more than the limit for the low income tariff and would be receiving relatively high bills at the outset. The SELR project not only worked tirelessly to get as many families registered for the tariff, but also allowed for a transition period (lasting until three months after the last connection was made) where all newly regularized customers had their consumption capped at 150 kWh per month with resulting lower bills. Although the customer only paid up to 150 kWh, he or she was also informed of actual consumption levels and the amount that this would cost once the cap was lifted. The communication campaign emphasized to customers that exceeded the cap that they should start reducing consumption to get it to affordable levels before removing the cap.

Throughout the workshop sessions the importance of including appropriate safety and energy efficiency measures for residential and commercial consumers was emphasized as a means to accomplish a number of objectives: reduce pre-regularization consumption to affordable levels, allow budget control and awareness of consumption prior to receiving a bill, reduce risks of electrical accidents, and improve power quality and safety within the home or business. AES Eletropaulo and other Brazilian distribution companies described their efforts to make newly regularized customers more energy efficient so that their bills were more affordable.<sup>16</sup> These efforts included: provision of information on the relative usage of different appliances and habit changes that could reduce consumption, the exchange of inefficient light bulbs with highly efficient compact fluorescent light bulbs, the exchange of old refrigerators in very bad condition with new ones meeting the government’s requirements for energy efficiency, and solar thermal units to replace or supplement electric showers. Under the SELR Brazil project, the mini-audits of residences were conducted to determine which households were eligible to receive refrigerator and rewiring assistance.<sup>17</sup>

Commercial customers were another concern in the SELR Brazil pilot as approximately 10% of the consumers in the pilot area (but representing a larger proportion of total consumption) were commercial operations, most employing people from the community and some of which had

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<sup>15</sup> The low income tariff inscription was directly linked to the efforts of the municipality to qualify households for other welfare benefits as described in Hora, “The importance of low income registration: targeting the most vulnerable” on Day 2 under the Panel 1.

<sup>16</sup> In addition to Mr. Taninaga’s presentation referenced above, see Altman, Whirlpool. “Targeted Assistance to Those Most Likely to Revert to Bad Debt” on Day 1; Coutinho, LIGHT. “The influence of the community for the success of electrification projects” on Day 2, Panel 3; Mascarenhas, COELBA. “COELBA’s income generation and energy efficient projects in low-income communities” Day 3 Panel 7; Costa, CEMIG. “Results from Minas Gerais, Brazil”; and Michel, E2Solar. “Solar water heaters for low-income households,” on Day 3, Panel 7.

<sup>17</sup> Taninaga Ibid



very high consumption that would probably be unsupportable post regularization.<sup>18</sup> To reduce the numbers of businesses that might go out of business, the SELR project included a commercial component with energy audits and recommendations of energy efficient practices and investments that the businesses could make to reduce their bills.

## 2.1.4 Prepayment and Other Schemes

Another tenet of slum electrification is: if customers have control over their payments, such as the control that prepayment affords, they will be able to stay within their budget and keep receiving service when they feel they need it and can afford it. A number of practitioners reported on their prepayment programs as their preferred means to help low income customers monitor and control their consumption in order to keep the cost of service within their budget.

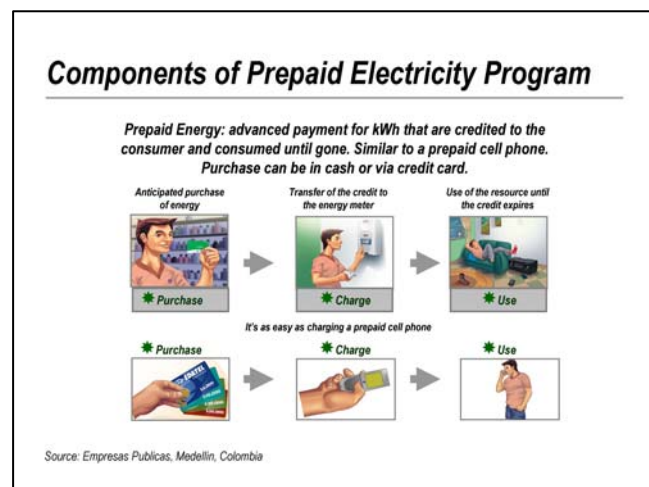
Eskom's representative described the overall virtues of a prepayment approach: it allows customers to pay for a consumption credit in advance while enabling automatic switch off once credit expires. This has the potential to: increase cash flow to the utility, lower operating costs and management complexity, prevent bad debts and recovery of arrears, and provide a sustainable solution with community involvement. However, he also cautioned that a "prepayment solution is only as good as your management systems" meaning that without constant vigilance and use of data mining techniques, recidivism to theft could easily overcome the prepayment setup.<sup>19</sup>

Empresas Publicas de Medellin, Colombia also emphasized the benefits of its prepayment program which had been expanded from a pilot (that was presented at the 2005 workshop) to a full fledged program. Follow up on the acceptance of prepayment showed that this payment option was seen by users as a benefit that improved their quality of life.<sup>20</sup>

Kenya Power and Light Company reported that it was planning for the next stage of its slum electrification program and would be providing residences with prepaid meters.

This would replace its present load limiting approach (described in the next section).<sup>21</sup>

Argentina's regulator presented the progression of its efforts to bring electricity service to low income communities and provided an update on its prepayment program (the pilot project of which was presented at the 2005 workshop).<sup>22</sup> He emphasized the concrete results that they had obtained, particularly that, on average, prepayment customers reduced their consumption by 37%



<sup>18</sup> Gimenes, "Maintaining Economic Viability in the Commercial Sector" under Day 1 SELR Brazil's Focus on Affordability, Safety and Reliability for the Consumer.

<sup>19</sup> Maphaka, Eskom "ESKOM distribution prepayment overview" under Day 2, Panel 2.

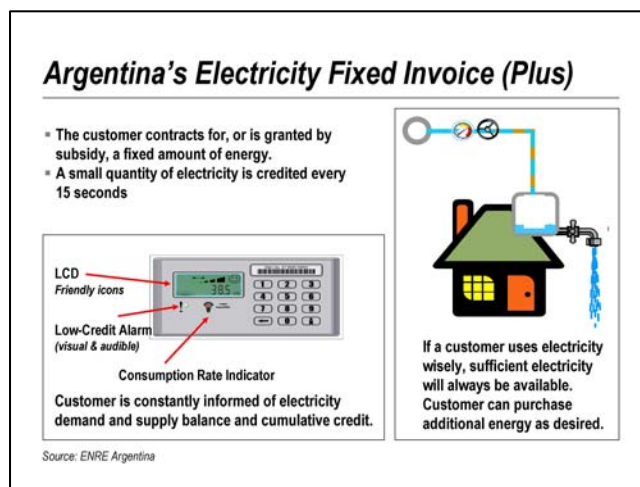
<sup>20</sup> Encinales, Empresas Publicas de Medellin. "Prepaid energy program" Day 2, Panel 2.

<sup>21</sup> Othieno, KPLC. "Load limiters and prepayment meters" Day 3: Panel 6.

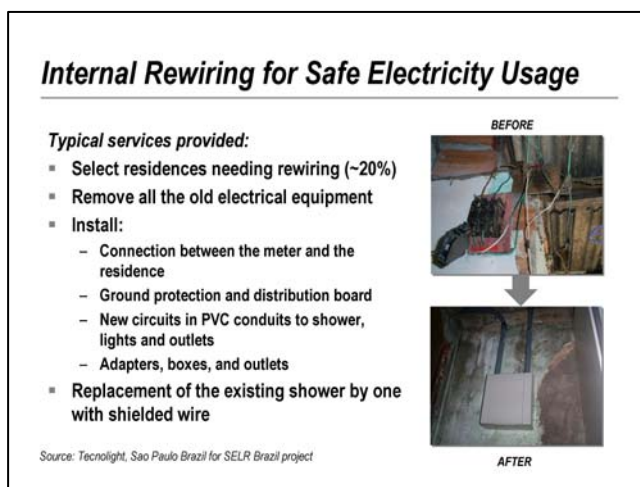
<sup>22</sup> Damiano, ENRE. "Regulation promoting slum electrification and loss reduction in Argentina" Day 2, Panel 4.



compared to other low income customers without prepayment and that they had achieved a 95% satisfaction rating after over 1 million transactions. Argentina is continuing to improve its program and the most recent innovation is the development of a new metering technology (called Meter Administrator) that allows for either “conventional” prepayment by the customer or the “Fixed Invoice” with allowable additional (prepayment) purchases. Around 90% of all customers are now using one of these two options. Likening fixed invoice to using the meter as a “faucet dripping small quantities of electricity into the meter,” the Argentine regulator pointed out that it could be adapted to provide a limited quantity of either free electricity for households eligible for the subsidized social tariff (while eliminating the administrative and operational burdens usually associated with such subsidies) or for a fixed payment for others (with the option to purchase more when needed via the same prepayment system used elsewhere). The “drip” approach prevents the customer from using all of the allotment too quickly, e.g., by inadvertently running a high consumption appliance, and is like a sophisticated load limiter with a prepaid override option.



All of the prepayment systems presented used what is called a split meter technology which allows for reduced access to the portion of the meter that a thief would try to bypass (the meter is usually located on a pole 10 meters above ground). Split meters allow for the “customer interface unit” to be located inside the house where it is very easy for the user to monitor the amount of credit left on the meter and can include warning lights or signals to alert the consumer to a low balance in time to add more credit. Another advantage of the prepayment technology that several practitioners pointed out is the small amounts of electricity that can be bought at one time (e.g., as low as \$1 per “token” purchased). This definitely helps to fit the variable income streams of low income families and is one reason that prepayment is popular with them.



### 2.1.5 Safety and Other Customer Benefits

The replacement of internal electrical wiring to reduce risks of electrical accidents and improve power quality was a feature of the SELR Brazil project that was much appreciated by those who qualified for and received it. In addition to the improved safety (accidents relating to poor wiring plummeted to virtually none after regularization), they valued the cleaner look of the

interior space. Other companies, e.g., COELBA, LIGHT, and KPLC, also emphasized the importance and effectiveness of their activities to improve the safety of internal wiring of homes.

Several practitioners highlighted the importance of providing benefits to new customers to help maintain their appreciation of their social compact with the distribution company. Codensa's appliance purchase credit program, "Codensa Hogar," provides credit to its low-income customers, many of whom did not previously have access to credit, for goods such as appliances and services. The program provides a new source of revenue to Codensa but also helps low income customers establish a credit rating, which allows them to transition to traditional lenders for other credit needs.

The program works in partnership with appliance and other vendors to open up new market segments for them. Begun in 2002, the program lent over US\$ 230 million in 2007. Overall appreciation of Codensa as a result of this program increased significantly.<sup>23</sup> In Angola, the project developed the Community Electrification Revolving Fund (CERF) in part to gain community support for the project. Part of the money collected from electricity bill payments goes back into the Fund to provide capital to expand access to new project areas.<sup>24</sup> COELBA shared the results of a new activity where eligible (low income) customers collect recyclables from ordinary waste and turn them in to a COELBA collection station which in turn gives them a credit on their electricity bills.

Several practitioners mentioned that their programs included public lighting. This is an important and appreciated benefit to the entire community because of the increased security that such lighting provides. In the SELR project, many who were polled spontaneously cited the improved security provided by the public lighting as a positive improvement in their lives.


## 2.2 TRANSFORMING DISTRIBUTION COMPANY OPERATIONS

As many of the presentations showed pictorially, pre-regularization slums are often littered with the infrastructure detritus of previous electrification efforts and have a characteristic look of

**Codensa's Consumer Credit Program**

- The program, Codensa Hogar (CH), provides credit to low income consumers who formerly could not get credit, e.g., to purchase appliances. Consumers then develop a payment history that helps them get access to conventional forms of credit.
- 45% of Codensa Hogar credit recipients began to have access to new financial services and their probability to get access to a second line of credit is around 60%.

Customers can also use CH to pay utility bills when temporarily short of funds



Source: Codensa, Bogota, Colombia

**COELBA's Vale Luz Project**

Customers collect and turn in recyclable materials in return for discounts on their electricity bills.

A community NGO operates the project for COELBA

Translations:  
Valeluz = valuable light  
Your waste is worth a lot



Source: COELBA, Brazil

<sup>23</sup> Acosta, Codensa "Codensa Hogar's program to help with legitimizing citizenship and increase client satisfaction" Day 2, Panel 2.

<sup>24</sup> Melikian, Ibid.

“informality” with webs of illegal wires tapping into nearby power lines or other customers’ service lines. Furthermore, such distribution systems are usually undersized and in neglected condition. Recognizing that theft will always be a problem and that the revenue losses can be significant is the first step in finding solutions. Typically levels of theft are increasing even to the extent that businesses move into such an area and base their “business model” on the free input of electricity to their product. Ampla estimated that, if they did nothing, their energy losses would increase by around 3 percentage points annually.

The first impulse might be to make a clean sweep and start over using conventional technologies and service models. Yet, practitioners argued against this approach as they have found that it has only short-lived effectiveness. Instead, they recommend that, along with the effective, continuous engagement of communities, new customers and key stakeholders in the effort, a set of actions must be instituted, focusing on:

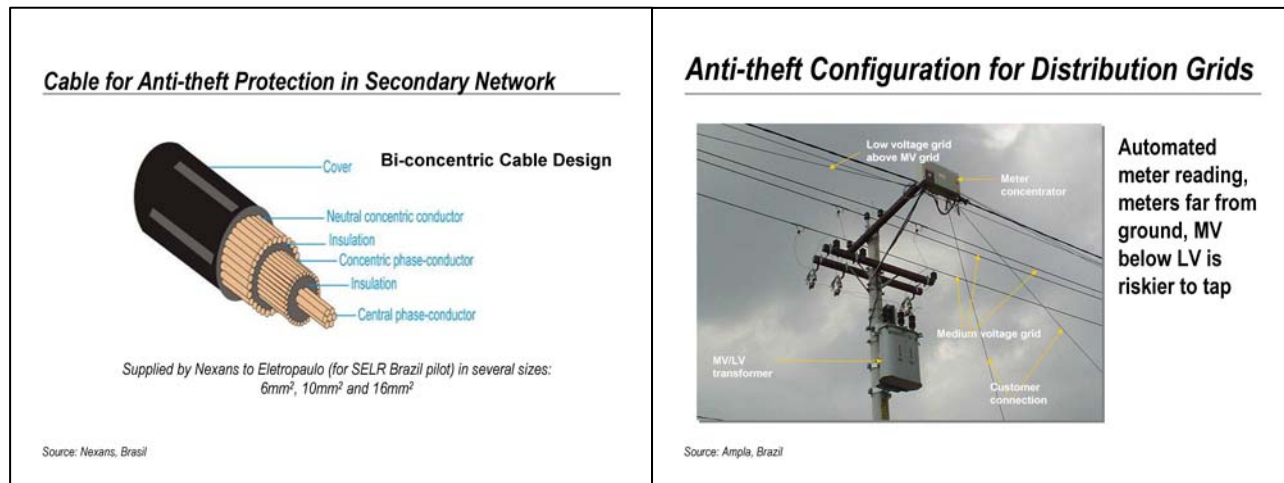
- Anti-theft and anti-fraud technologies and techniques that address technical losses, such as those caused by overloaded transformers, alongside non-technical losses
- Detailed analysis, mapping, and targeting of the sources of technical and non-technical losses and possibly reorientation and reorganization of company functions to achieve integration of efforts to reduce losses

## 2.2.1 Technologies and Techniques for Reducing Technical and Non-Technical Losses

Anti-theft technologies and techniques form a key component of successful slum regularization or electrification efforts, but are not considered sufficient on their own for preventing theft and reducing losses. The following were presented as companies’ technological solutions at the workshop:

- Cable designs that impede attempts to bypass the meter and connect directly<sup>25</sup>

Meter enclosure boxes that either send a signal to the utility with GPS location or shut down when tampering is occurring<sup>26</sup>



<sup>25</sup> Ueda, “Development of bi-concentric cable for secondary network” Day 1, SELR Brazil’s Technical Solutions to Minimize Theft and Improve Reliability & Quality of Service.

<sup>26</sup> Sukhtankar, Reliance. “Experience with electrification “under Day 3: Panel 6.

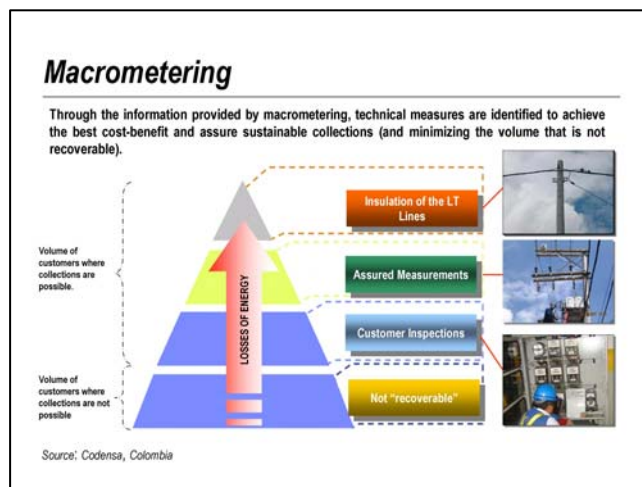
- Split meters (described earlier), tamper resistant boxes containing several meters, and physical location of meters and service drops so that visual inspection is made easy and unauthorized access made difficult<sup>27</sup>

Other technologies allow for limiting the amount of consumption, thus minimizing losses from bad debt, for example:

- Load limiters (mini-circuit breakers) to avoid over-consumption in a group supply situation<sup>28</sup>
- Electronic meters with remote reading and disconnection capability<sup>29</sup>
- Argentina's Meter Administrator "drip system"

Other techniques allow for monitoring of areas and individual accounts to identify potential cases of fraud that may need to be field checked (see Section 2.2.2):

- Macro-metering of areas as a check against aggregated readings of individual meters and energy balancing to identify areas of losses<sup>30</sup>
- Account management software that provides analysis of aberrations in consumption that might be cases of theft or fraud<sup>31</sup>



Dealing simultaneously with technical losses included:

- Replacing overloaded transformers with more efficient ones<sup>32</sup>
- Replacing distribution system cables and connectors with more efficiently sized cables

Not all of these solutions need to be used in every case but instead should be seen as a menu from which options can be selected and combined to fit the particular stage of loss reduction and the nature of the problem. There needs to be a balance between the cost and effectiveness of the loss reduction technologies and the increase in revenues that can be expected as a result of their use.

## 2.2.2 Analysis, Mapping, and Targeting of Losses

<sup>27</sup> Filpo, AMPLA. "Results of external metering and anti-fraud network installations," Day 3: Panel 6.

<sup>28</sup> Othieno, KPLC Ibid.

<sup>29</sup> Sabença, AES Eletropaulo, "Remote meters and "theft-proof" grounding" under Day 1: SELR Brazil's Technical Solutions to Minimize Theft and Improve Reliability & Quality of Service.

<sup>30</sup> Acosta, Codensa, "Macro-metering" under Day 3: Panel 6.

<sup>31</sup> Filpo, AMPLA. Ibid

<sup>32</sup> Picanço, University of Itajuba, "Efficient distribution transformers" Day 1: SELR Brazil's Technical Solutions to Minimize Theft and Improve Reliability & Quality of Service.

The presentation from Bangladesh<sup>33</sup> provided a detailed analysis of technical and non-technical losses. These included: irregularities in meter reading and billing, poor customer accounting and defective meters in addition to the typical losses associated with informal low income areas, such as interference and by-passing of energy meters and unauthorized connections. These sources of losses can exist amongst other classes of customers, which highlights the importance of aligning loss reduction efforts in slums with those in other areas of the company's operations even when the approach to slum loss reduction may be quite different from other loss reduction initiatives.

Sources	Typical Remedies
Unauthorized Connection	"On the spot" connections, improved surveillance, install anti-theft cable, penalties and legal action
Meter tampering/ bypassing	Sealed meter enclosures, meter replacement with electronic, increased vigilance, penalties and legal action
Irregularities in meter reading and billing	Energy balancing, rotate/transfer or outsource meter readers, billing comparisons, training and motivation of meter readers
Poor customer accounting	Identify unbilled customers, verify applicable tariff, improve procedures for collection entry and reconciliation
Bad debt	Prepayment meters, education on electricity uses, energy efficiency assistance.

Sources: DESCO, Bangladesh; PLN, Indonesia; Eskom, South Africa; SELR Brazil

The representative from Indonesia presented his company's Loss Mapping which identified all sources of losses including non-technical ones as part of a concentrated effort to reduce all losses with appropriate means. Non-technical losses included those discussed above plus the installation of illegal public lighting. He also highlighted another source of fraud that was eliminated when corrupt company meter readers were replaced by a third party contractor.<sup>34</sup> The presentation from ESKOM further underscored the importance of integrating all loss reduction efforts within the company's operations.

Pinpointing sources of losses helps companies to identify and utilize technologies that can deliver the biggest "bang for the buck." Energy balances are studied to identify and isolate the areas with the highest losses. For example, AMPLA used the technique to discover that 50% of the non-technical energy losses were associated with 30% of its residential customers, that a few areas had exceedingly high losses (e.g., 35% losses against a system average of around 24%), and that traditional anti-fraud techniques were not sustainable in these areas, e.g., experience shows that 30-40% will revert to fraud within a year. This helped the company to localize their newly designed anti-theft technology upgrades to the highest and riskiest loss-making areas.<sup>35</sup> Likewise, in the SELR Brazil project, electronic meters with remote reading and disconnection capability were installed for commercial consumers who were judged (or found) to be likely to forego paying their bills. In this case, the meters can be programmed so that a non-paying customer could be cut off when a set level of consumption was exceeded, giving a signal to the customer but not cutting off essential power supply to a business in the slum (dubbed "social cutting" by AES).<sup>36</sup>

<sup>33</sup> Kamal, DESCO Ibid.

<sup>34</sup> Widyastomo, PLN. "Technical solutions for improving electricity service for the urban poor in Indonesia" Day 3, Panel 7.

<sup>35</sup> Filpo, AMPLA, Ibid

<sup>36</sup> Sabenca, AES. Ibid



## 2.3 PUTTING ENABLING CONDITIONS IN PLACE

Having a regulatory framework that allows for operational and technical changes that may need to be made to achieve a sustainable approach to slum electrification is crucial to the success of any such effort. One of the primary reasons that so much progress in serving the poor has been made in Brazilian cities is that the electricity regulator (ANEEL) strongly encourages such activities by the distribution companies through its low-income tariff, regulations requiring investments in energy efficiency in low income areas, and its control over concession contracts and allowable returns on losses and investments. ANEEL's mandate includes providing incentives to reduce waste of electricity on both the demand- and supply- sides. A law in 2000 set the stage for concentrated efforts in improving energy efficiency by requiring all distribution companies to set aside and use no less than 1% of their net profits for research and development and energy efficiency (half for each). At least 50% of the funds for energy efficiency is presently required to be spent on projects helping low income customers. The actions must directly benefit the customer and cannot include marketing, educational activities or public lighting (which in principle is the responsibility of the municipalities). Most of the consumer measures taken by AES, CEMIG, COELBA, and LIGHT were purchased with these set-aside funds.<sup>37</sup>

The regulator must also approve special measures undertaken in SELR projects. For example, Brazil's ANEEL had to approve the 150 kWh cap on billing imposed on the Paraísopolis pilot and the elimination of the usual connection fee for residential customers. It must also approve technological innovations that fall outside adopted standards. Electronic meters with remote reading and disconnection capability have been approved after issues concerning their accuracy and mode of use were resolved.<sup>38</sup> Argentina's regulator ENRE approved the stages of the prepayment meter program and recently approved the use of the "Meter Administrator." Regulatory approval is also required for any tariff modifications that might be needed to implement a prepayment program. When AES owned Electricidad de Caracas it was thwarted in its efforts to implement a prepayment pilot because it could not obtain regulatory approval to include a special prepayment tariff, even for a limited duration to test consumer acceptance.<sup>39</sup>

In 2003, the Colombian regulatory body and policymakers began to focus their efforts on improving or establishing electricity service to "below normal urban neighborhoods." Under Law 812 of 2003 – National Development Plan for 2002-2006, a "normalization" program made resources available for the improvement of grids in the slums. The program's primary objectives were to expand electricity coverage and reduce losses. It allowed for new billing schemes such as community billing schemes and flexible billing periods. Under the Law, a Special Social Energy Fund was set up and agreements (social compacts) to improve conditions of service provision were signed between communities and companies in 82% of the municipalities served by the companies. As a result, levels of satisfaction with the electricity service increased from 57% to over 86%, and loss indicators were substantially reduced. Satisfied with its approach, the Government of Colombia believes that flexibility in the schemes for service provision in slums are fundamental and that resources should be made available to subsidize the normalization of service provision in these areas. Regulations should permit the recovery of the costs of service

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<sup>37</sup> Firmeza, ANEEL. "Regulations in Brazil to promote energy efficiency programs for low-income consumers" Day 2, Panel 4.

<sup>38</sup> Filpo, AMPLA Ibid

<sup>39</sup> Pettersson, AES. "Learning to provide electricity to urban poor in a sustainable way. The AES experience in Venezuela" Day 2, Panel 3.

provision through the tariff and grant a reasonable return on capital invested. However a clear exit strategy will be needed as the problem areas become fully normalized.<sup>40</sup>

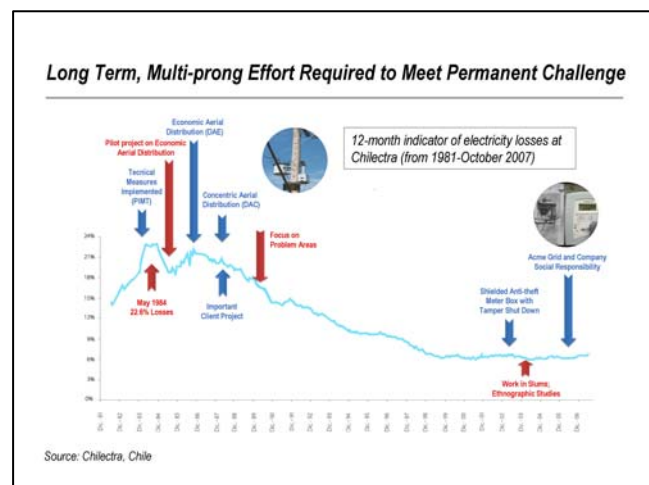
Another enabling condition is access to financing, given the large investments required for distribution system upgrading, new meter technologies and other costs associated with regularization. While program financing was not a focal area of the workshop, a variety of funding sources was mentioned. As described earlier, ANEEL mandates that 0.25% of companies' net revenues be spent on energy efficiency measures in low-income communities. Ampla supported its "REDE Ampla" program with loans from the government development bank, BNDES, after it was able to demonstrate that the proposed technology to be used under the program could provide a positive return on investment.

The representative from ESMAP indicated that non-technical loss reduction projects could receive up-front ESMAP technical assistance that could be used to assist in the preparation of a proposal for a loan from multilateral development banks.<sup>41</sup> UN-Habitat reported that assistance will soon be available through its new initiative, Global Energy Network for the Urban Settlements (GENUS), which will promote energy access for the urban poor worldwide through expert meetings and workshops, a website and weblog to share experiences, and a knowledge management toolkit on urban energy policy, program design and implementation.

## 2.4 ACHIEVING OVERALL SUSTAINABILITY OF THE NEW APPROACHES

In Panel 5: Sustainability from the Utility's Perspective, panelists underscored two key areas for achieving long term sustainability of program results:

- Intense focus on and long-term commitment by the utility, government, regulators and other stakeholders to loss reduction. (Indeed, whenever presenters wanted to illustrate the effectiveness of their efforts in slum electrification and loss reduction, the loss reduction curve was used as a primary indicator of progress.)
- Maintaining the support of customers and communities.



### 2.4.1 Utility and Other Stakeholders' Commitment

Eskom,<sup>42</sup> Codensa<sup>43</sup> and Chilectra<sup>44</sup> presented integrated business models that draw on the expertise of multiple company departments serving the low income segment. All of these (and

<sup>40</sup> Riaño, Superintendent of Public Services. "Colombian government framework for slum electrification and loss reduction" Day 2, Panel 4.

<sup>41</sup> Seck, "ESMAP: Technical assistance for energy project development" on Day 2, Panel 4.

<sup>42</sup> Maphaka, "How prepayment can make a difference in financial viability for Eskom" Day 3, Panel 6.

<sup>43</sup> Millan Fedesarrollo "From red ink to financial viability with aggressive integrated loss reduction program (Codensa)" Day 3, Panel 5.

<sup>44</sup> Arévalo, Chilectra. "Energy theft in low income areas: From confrontation to corporate social responsibility" Day 3, Panel 5.

many others presented in other sessions such as LIGHT, Kenya and Argentina) illustrated that slum electrification programs must be given a long term commitment by the company and that programs must be flexible and evolve as the company learns more about how to best serve its new clientele in order to keep them good customers. Indeed some of the time frames for evolving programmatic efforts spanned decades (e.g., almost three for Colombia and Chile and almost two for Brazil and Argentina).

Beginning with pilot projects seems to be an accepted way to test new approaches and to gain experience and the approval of authorities that regulate electricity distribution and that provide or oversee other social and public services to poor populations. A number of pilot projects were presented (e.g., SELR Brazil, prepayment pilots in Argentina, Colombia and Liberia, AES' experience in Venezuela, and others). Pilot projects launched at the outset of a contemplated larger scale roll-out of a regularization effort seem particularly well-suited to finding the combination of elements and activities that could be most effective with the target populations. In these pilots, the importance of doing pre- and post pilot surveys was highlighted. Indeed, the mainly positive results of a poll conducted regarding Argentina's prepayment pilot led to expansion of the program to the greater metropolitan areas and innovations in program design to fit the needs and payment capabilities of the target customers.

#### 2.4.2 Maintaining Community Support

Some key lessons for program design regarding customer and community satisfaction were related to sequencing activities, creating an accurate starting database (and preparing for large turnover), allowing enough time to assess the technical and socio-economic conditions of the area and understanding of the attitudes, expectations and cultural norms. The program design should also include actions, such as efficiency measures and community education campaigns, to enhance consumers' ability to pay for their consumption and enable them to become and continue to be good customers.

Community support for the pilot can be bolstered by interventions to improve the economic conditions in the area. Several companies included activities to enhance (or retain) employment in the community. As described earlier, in the SELR Brazil project, efforts were made to retain commercial customers in the area post-regularization (see Section 2.1.3). The Angola pilot bolstered the economic strength of a regularized slum by developing public-private partnerships where small and medium size enterprises were compensated for sharing their existing commercial space with the distribution company to establish customer service points within the community. Bangladesh's DESCO filled its need for new meters by employing slum dwellers to do the assembly.<sup>45</sup> COELBA reported on its income generation projects that provide ancillary benefits to the community. In their case, the proceeds from the sale of scrap from recycled refrigerators were used to create projects to generate income in low income communities. For example, one of the first of these was the purchase of the equipment needed to start a cooperative cookie factory.

Likewise, Colombia's low income electricity access program included a component that provided opportunities to local businesses to provide some of the new services that would be required during and after regularization. This resulted in the creation of 27 small enterprises and

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<sup>45</sup> Kamal, DESCO "Working with slum community for loss reduction" Day 2, Panel 3.



over 850 new jobs within the communities in such services as bill collection, basic system maintenance, and disconnections and reconnections.

Almost all practitioners mentioned that no approach will be fool proof and that constant vigilance and good customer relations will always be necessary. LIGHT pointed out the need for continuity of the company's presence and efforts in a community to ensure the sustainability of program results. They highlighted their use of community agents ("multipliers") to be the company's mouthpiece for close communication and eyes and ears for problem resolution.<sup>46</sup>

IBOPE found that new customers in the SELR Brazil pilot clearly saw the connection between saving energy and lowering their bills and felt that they had gained societal respect and benefits from the program. However, it also uncovered attitudes that must continue to be addressed if the company wants to retain the newly acquired paying customers. Many customers reported that they would be able to pay for their electricity in the upcoming months but that if they ran into financial difficulties, they would very likely choose to defer payment of their electricity bill (choosing from a long list of normal expenses). This is a challenge to project sustainability and needs to be taken into account by AES as they move forward with the rollout of their program.

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<sup>46</sup> Coutinho, LIGHT. Ibid.

Many of the presentations underscored or reinforced what had been learned in the 2005 workshop and the 2004 USAID study referenced in Section I, such as:

- Successful approaches to slum electrification and loss reduction must involve three key stakeholder groups: electricity distribution companies; slum consumers and their community; and local and national governments and institutions. Distribution companies are inevitably the first line of offense on attacking the problem which they see as a loss reduction activity directly affecting their “bottom line.”
- Companies must devise new approaches to serving slum communities incorporating the following challenges:
  - Slum conditions: lack of land tenure, low and irregular income streams, informal community governance systems, densely and poorly constructed homes and businesses, and very poor or non-existent basic infrastructure, such as roads, water, sanitation, and electricity distribution networks.
  - Most households resort to non-legal, poor quality, dangerous and sometimes more expensive means to acquire electricity (through illegal service providers) to meet their lighting, ventilation, refrigeration, and information/communication needs; and
  - Supply and network infrastructure constraints for both publicly- and privately-owned electricity distribution companies lead to heavily overloaded networks and resulting unreliable and poor quality power supply.
- An explicit “social compact” is needed prior to beginning the regularization process to ensure that expectations (in terms of the process and the resulting benefits and costs) on both sides are reasonable and transparent. To maintain consumer and community support, the distribution company must deliver on its promise to provide reliable and affordable electricity service. To enhance affordability, distribution companies should consider measures that will help households and businesses manage their consumption, increase the efficiency of their electricity use and support activities that improve the economic conditions in these areas.
- Enabling regulatory and institutional frameworks are critical for establishing an environment conducive for the implementation of effective slum electrification programs. Incentives for utilities to implement programs can encompass the establishment of special funds, recovery of investments through the tariff, and concession requirements to serve low income communities. Regulators can approve subsidies to cover part or all of connection costs or of efficiency measures for low-income households.

The workshop brought some new insights and emphases on certain topics, which reflected recent trends and changes in approaches to slum electrification:

- Prepayment has advanced from the pilot stage to a full blown program alternative that was quite effective in several programs primarily because it allows customers to “control” their consumption and to purchase small amounts at a time.
- Good relations and continuous engagement with the customers such as setting up door-to-door communication channels and community events to keep in direct contact with customers, have proven to be essential for project sustainability,
- Working “outside the box” of distribution companies, such as providing credit for appliance purchase, assisting the start up of local enterprises, providing public lighting, re-wiring of households and businesses, and supporting community projects, may be an essential part of serving low income communities in the future, and
- Manufacturers and appliance retailers are recognizing the BOP potential and are working more closely with distribution companies to develop appliances, credit lines and other products and services that meet the specific needs of low income communities.



*Improving Electricity Service for  
the Urban Poor*

**December 4-6, 2007; São Paulo, Brazil**  
**Location: HOTEL GRAN MELIÁ MOFARREJ**

**Sponsored by: AES Eletropaulo, International Copper Association,  
United States Agency for International Development, Nexans, and Itaipu**

## Agenda

Monday, December 3, 2007

**5:00 – 6:30 pm**     **Advance Registration**  
**6:30 – 8:00 pm**     **Welcome Reception**

Day 1, Tuesday, December 4, 2007

<b>7:30 – 8:30 am</b>	<b>Registration</b>
<b>8:45 – 9:00</b>	<b>Introduction to Workshop</b> Milton Carvalho, AES Eletropaulo and Connie Smyser, Consultant, USAID/Nexant/Smyser Associates
<b>9:00 – 9:30</b>	<b>Official Opening</b> Britaldo Soares, President, AES Eletropaulo Miguel Riquelme, Director, ICA LAC Sara Ainsworth, US Vice Consul for Economic Affairs, US Consulate General
<b>9:30 – 9:50</b>	<b>Responsibly Tapping the Base of the Pyramid</b> Charles Capdeville, Manager of Collections, AES Eletropaulo
<b>9:50 – 10:10</b>	<b>ICA's Global Perspective on Energy Sustainability</b> John Mollet, Vice President, International Copper Association and Glycon Garcia, Sustainable Electrical Energy Project Leader, ICA Latin America
<b>10:10 – 10:30</b>	<b>The Challenges and Opportunities for Providing Electricity Services in Low Income Urban Communities: Overview from USAID</b> Simone Lawaetz, Project Manager, USAID

<b>10:30 – 11:00</b>	<b>Coffee Break</b>
<b>11:00– 11:30</b>	<b>Overview of the Paraisopolis (SELR Brazil) Project</b> José Cavaretti, Loss Reduction Manager, AES Eletropaulo
<b>11:30 – 12:30</b>	<b>SELR Brazil’s Customer Oriented Approach</b> Moderator: Jaime Millan, Consultant, Fedesarrollo <b>Socio-economic conditions in the project area</b> Eng. Marisa A. Zampolli, Consultant, USAID/Nexant <b>Customer Preparation for Regularization</b> Marcelo Rocha, Manager of Customer Services, AES Eletropaulo <b>Gauging Consumer Satisfaction</b> Silvia Penteadó Cervellini, Director, IBOPE
<b>12:30 – 2:00</b>	<b>Lunch</b>
<b>2:00 – 3:00</b>	<b>SELR Brazil’s Focus on Affordability, Safety and Reliability for the Consumer</b> Moderator: Fernando Bacellar, Coordinator of Energy Efficiency Projects, AES Eletropaulo  <b>Basic efficiency and affordability measures</b> Oswaldo T. Taninaga, Director, Tecnolight  <b>Targeted Assistance to Those Most Likely to Revert to Bad Debt</b> Paulo Altman, Sales Manager, Whirlpool  <b>Maintaining Economic Viability in the Commercial Sector:</b> André Luiz Veiga Gimenes, Researcher - GEPEA USP
<b>3:00 – 3:45</b>	<b>SELR Brazil’s Technical Solutions to Minimize Theft and Improve Reliability &amp; Quality of Service</b> Moderator: Paulo Roberto Pimentel, Director of Distribution Technology, AES Eletropaulo  <b>Efficient distribution transformers</b> Alessandra Picanço, University of Itajuba  <b>Development of bi-concentric cable for secondary network</b> Sidnei Ueda, Engineering Department Manager, NEXANS Brasil  <b>Remote meters and “theft-proof” grounding</b> Leandro Sabença Cesar, Manager of Meter Technology, AES Eletropaulo
<b>3:45 – 4:15</b>	<b>Coffee Break</b>
<b>4:15 – 4:45</b>	<b>Partnership with Municipal Infrastructure Upgrading Program</b> Moderator: Mary Worzala, Director, Energy Programs, Academy for Educational Development <b>Land regularization process, improving urban infrastructure in poor neighborhoods</b> Maria Teresa Diniz dos Santos, Paraisópolis Program Coordinator, Secretaria da Habitação (SEHAB)

<b>4:45– 5:15</b>	<b>Sustainability from the Company's Perspective</b> Moderator: Sérgio Werneck, Director of Strategic Management, AES Eletropaulo  José Cavaretti, Loss Reduction Manager, AES Eletropaulo
<b>5:15 – 6:00</b>	<b>Question and Answer Session on Presentations</b>

**8:00 pm**                    **Dinner hosted by Nexans, Brasil and Itaipu (Churrascaria Jardineira). Transportation to be provided.**

Day 2, Wednesday, December 5, 2007

<b>8:30 – 9:30</b>	<b>Panel 1: Know Your Future Customers</b> Moderator: Ms. Awa Seck, Economist (Energy/NRM) – AFTEG, The World Bank - Senegal Country Office  <b>Understanding and incorporating low income behavior into program design</b> Prof. Edgard Barki, Professor, FGV University  <b>The importance of low income registration: targeting the most vulnerable</b> Sérgio Hora, São Paulo Municipality  <b>Preparation to re-electrify war-torn low income communities</b> Connie Smyser, Consultant, IRG/Smyser Associates
<b>9:30 – 10:00</b>	<b>Discussion: Know Your Future Customers</b>
<b>10:00 – 10:30</b>	<b>Coffee/tea Break</b>
<b>10:30 – 12:00</b>	<b>Panel 2: Affordability, Safety and Reliability for the Customer</b> Moderator: José Cavaretti, Loss Reduction Manager, AES Eletropaulo  <b>Codensa Hogar's program to help with legitimizing citizenship and increase client satisfaction</b> David Felipe Acosta, Commercial Manager, Codensa – Hogar  <b>ESKOM distribution prepayment overview</b> Maboe Maphaka, Senior Manager - Distribution Energy Trading, ESKOM/South Africa  <b>Prepaid energy program</b> Nestor Encinales, Manager of Energy Transmission and Distribution, Empresas Publicas de Medellin/Colombia
<b>12:00 – 12:30</b>	<b>Discussion: Affordability, Safety and Reliability for the Customer</b>
<b>12:30 – 2:00</b>	<b>Lunch</b>
<b>2:00 – 3:00</b>	<b>Panel 3: Obtaining and Maintaining Community and Local</b>

	<p><b>Government Support for Electrification</b> Moderator: Simone Lawaetz, Program Manager, USAID</p> <p><b>The influence of the community for the success of electrification projects</b> Marcia de Moraes Coutinho, Manager of Community Relations, LIGHT, Rio de Janeiro, Brazil</p> <p><b>Learning to provide electricity to urban poor in a sustainable way. The AES experience in Venezuela</b> Ivar Pettersson, Vice President Strategy &amp; Business Excellence, AES Eletropaulo</p> <p><b>Working with slum community for loss reduction</b> Mostafa Kamal, Deputy General Director, DESCO, Dhaka, Bangladesh</p> <p><b>Utility-Municipality-Community Collaboration in Angola for Electricity Distribution Improvement</b> Hugo Melikian, Chief of Party USAID Angola Electricity Support Program, Angola</p>
<b>3:00 – 3:30</b>	<b>Discussion: Obtaining and Maintaining Community and Local Government Support for Electrification</b>
<b>3:30 – 4:00</b>	<b>Coffee Break</b>
<b>4:00 – 5:00</b>	<p><b>Panel 4: Regulation and Institutional Factors</b> Moderator: John Mollet, Vice President International Copper Association</p> <p><b>Regulations in Brazil to promote energy efficiency programs for low-income consumers</b> Carlos Eduardo Firmeza, Regulation Specialist, ANEEL/Brazil</p> <p><b>Regulation promoting slum electrification and loss reduction in Argentina</b> Claudio Damiano, Transmission and Distribution Manager, ENRE/ Argentina</p> <p><b>Colombian government framework for slum electrification and loss reduction</b> David Riaño, Superintendent for Energy and Gas, Superintendent of Public Services/Colombia</p> <p><b>ESMAP: Technical assistance for energy project development</b> Awa Seck, Economist (Energy/NRM) – AFTEG, The World Bank - Senegal Country Office</p>
<b>5:00 – 6:00</b>	<b>Discussion: Regulation and Institutional Factors</b>

Day 3, Thursday, December 6, 2007

<p><b>8:30 – 9:30</b></p>	<p><b>Panel 5: Sustainability from the Utility’s Perspective</b>  Moderator: Charles Capdeville, Manager of Collections, AES Eletropaulo</p> <p><b>From red ink to financial viability with aggressive integrated loss reduction program (Codensa)</b>  Jaime Millan, Consultant, Fedesarrollo</p> <p><b>How prepayment can make a difference in financial viability for the company</b>  Maboe Maphaka, Senior Manager - Distribution Energy Trading, ESKOM/South Africa</p> <p><b>Energy theft in low income areas: From confrontation to corporate social responsibility</b>  Rodrigo Arévalo, Deputy Manager of Commercial Operations, Chilectra</p>
<p><b>9:30 – 10:00</b></p>	<p><b>Discussion: Sustainability from the Utility’s Perspective</b></p>
<p><b>10:00 – 10:30</b></p>	<p><b>Coffee/Tea Break</b></p>
<p><b>10:30 – 12:00</b></p>	<p><b>Panel 6: Technical Solutions to Minimize Theft, Improve Reliability &amp; Quality of Service</b>  Moderator: Glycon Garcia, Sustainable Electrical Energy Project Leader, Latin America, ICA</p> <p><b>Results of external metering and anti-fraud network installations</b>  Felipe Filpo Ferreira da Silva, AMPLA/ Rio de Janeiro</p> <p><b>Load limiters and prepayment meters</b>  Jared Otieno, Ag Chief Manager, Nairobi Region, KPLC, Kenya  Sara Candiracci, Associate Human Settlements Officer, UN-Habitat Energy and Transport Section</p> <p><b>Macro-metering</b>  David Felipe Acosta, Commercial Manager, Codensa</p> <p><b>Experience with electrification</b>  Sukhtankar Dattakumar Rajaram, Sr. Vice President (Operations &amp; Maintenance), Reliance Energy Ltd, Mumbai, India</p>
<p><b>12:00 – 12:30</b></p>	<p><b>Discussion: Technical Solutions to Minimize Theft, Improve Reliability &amp; Quality of Service</b></p>
<p><b>12:30 – 2:00</b></p>	<p><b>Lunch</b></p>
<p><b>2:00 – 3:30</b></p>	<p><b>Panel 7: Effectiveness of Consumer Measures</b>  Moderator: Jaime Millan, Consultant, Fedesarrollo</p> <p><b>COELBA’s income generation and energy efficient projects in low- income communities</b></p>



	<p>Ana Cristina Mascarenhas, Energy Efficiency Coordinator, COELBA, Brazil</p> <p><b>Implications of USAID’s study for ANEEL of refrigerator programs</b> Gilberto Jannuzzi, Professor, Mechanical Engineering Faculty, Energy Department , University of Campinas</p> <p><b>Technical solutions for improving electricity service for the urban poor</b> Widyastomo Sarli, Assistant to Deputy Director for Distribution, PLN, Indonesia</p> <p><b>Results from Minas Gerais, Brazil</b> Henrique Costa, Engineer, Energy Solutions, EFICIÊNCIA/CEMIG/Brazil</p> <p><b>Solar water heaters for low-income households</b> José Reinaldo Michel, Director, E2 Solar</p>
<b>3:30 – 4:00</b>	<b>Discussion: Effectiveness of Consumer Measures</b>
<b>4:00 – 4:30</b>	<b>Coffee/Tea Break</b>
<b>4:30 – 6:00</b>	<p><b>Break-out Sessions:</b></p> <p><i>In these sessions we will offer delegations the opportunity to discuss solutions to common problems, e.g., special problems of mega-cities, prohibitions on serving informal communities, “hardened” theft cases, etc. Up to five separate topics will be explored. Participants will rank in advance the problem areas that they want to explore in these smaller sessions so that they can meet the most urgent needs.</i></p> <p><i>If there is demand, we will also offer organize “focused or individual” assistance to participants from programs that are in their initial stages and would like to brainstorm approaches and solutions with other participants that have solved common problems.</i></p>
<b>6:00 – 6:15</b>	<b>Closing Ceremony</b>

Morning/Day 4: 9:00 am

Visit to SELR Brazil project in Paraisópolis.

Transportation provided.

## Appendix B

## Participants List

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Before project implementation in Paraísopolis, the second largest ‘favela’ (slum) in São Paulo, the quality of electricity service was very poor: almost all the households and businesses had illegal electricity connections, were exposed to dangerous network and wiring conditions and did not pay for service. Households and businesses consumed high amounts of electricity – on average 250 kWh/ month – due to the very poor condition of household appliances and electrical equipment (especially refrigerators and electric water heaters for showers), and the lack of price signal to encourage consumers to use electricity wisely.

Through a Global Development Alliance partnership with the International Copper Association (ICA), USAID and ICA teamed with AES-Eletropaulo to develop, test, and evaluate customized approaches to regularizing electricity service in a target area of Paraísopolis. The pilot was the first to be launched under the USAID-ICA Slum Electrification and Loss Reduction (SELR) program, which was initiated in October 2005 on the theme of regularizing and improving electricity service to low income communities. In addition to the pilot in Paraísopolis, a second is in the design phase in Mumbai, India and a third is being planned for Africa.

#### THE PROBLEM AND PROPOSED SOLUTIONS

The selected pilot area covers two neighborhoods (Antônico and Centro) within Paraísopolis, a favela with approximately 20,000 households in the middle of São Paulo. This target area includes 4,365 low income households and businesses (of which 60 households had small home businesses and 423 were stand-alone commercial enterprises of varying sizes and types of services/sales). Like most other favelas, Paraísopolis is an informal community which lacks many municipal services and is home to families that migrated from rural areas over the years. Located in a large ravine, Paraísopolis has a physically challenging geography and is surrounded by middle- and upper-income residential areas. Although the land is publicly owned, the Paraísopolis households have occupied it for generations and the São Paulo city government is currently implementing a land tenure program to register residents and transfer title to them.

As a first step in the regularization program, AES-Eletropaulo contacted community leaders to work with them on the scope and scale of the project and then held a series of community meetings to educate residents about the program, bill payment, their energy consumption and measures that could be taken to reduce electricity usage. Identifying, registering and numbering the individual households and businesses was sometimes a challenging task given the narrow, winding streets and alleys; the fact that multiple families often live in a single home; the lack of street names; and parallel registration efforts being made by the municipality and other service companies. The community campaigns were carried out over several months and were supplemented by door-to-door visits by community “agents” and utility staff to each household both pre- and post- regularization. As residents previously did not have to pay for electricity (except in some cases to get their illegal connection), these campaigns were important to educate consumers on the importance of paying, understanding their electricity bill, and implementing efficiency measures that could be undertaken to reduce consumption and costs.

Under the project, the distribution network was upgraded and households and businesses were metered. The households were not charged a connection fee and any debts owed were forgiven. A key component of the SELR program was the use of new technologies and techniques to reduce theft and improve the efficiency of the distribution network. These included the following:

- Using bi-coaxial cable in the new service drop to each individual meter.
- Introducing electronic metering for large commercial consumers to allow easy disconnect or “social cutting” in the case of non-payment.<sup>47</sup>
- Replacing 12 conventional overloaded transformers with efficient transformers.

Given the high level of consumption by households and the urgent need to reduce their usage and enhance the affordability of service, the project undertook a number of measures to increase household efficiency. These encompassed energy audits of every household to identify energy efficiency opportunities, the replacement of three incandescent bulbs with efficient compact fluorescent bulbs in each home, the replacement of refrigerators in bad condition, and rewiring of homes with especially poor internal wiring in households that met low-income criteria. An audit of a sample of commercial customers provided the project with the information needed to make recommendations on the energy efficiency measures these customers could adopt to reduce their bills.

USAID, AES-Eletropaulo, ICA and its local affiliate – Procobre, worked closely to ensure a coordinated approach to project design and implementation. A ‘responsibility matrix’ was prepared which presented the project components and indicated the organization that was responsible for funding and implementing each task. AES-Eletropaulo picked up the bulk of the project costs, including the distribution network upgrades, metering, consumer registration, purchase of CFLs and new refrigerators (with ICA); ICA paid for the efficient transformers, rewiring of households, and preparation of a financial model (with USAID); USAID covered the community campaign costs, audits of each household and selected commercial customers, , post-project survey, and efficiency recommendations to targeted commercial customers. Total project costs were \$1.8 million.

## THE OUTCOME

Data on pilot project results are presented in the box on the following page. A consumer poll, conducted after project completion and several months of billing, showed that most of the regularized families in the pilot area were highly satisfied with their better quality service and the assistance received in improving their household energy efficiency. Of the 400 households surveyed, 62% rated their overall satisfaction with the project as a 9 or 10 on a scale of 1 to 10. Not surprisingly, this percentage increased to 98% for those who received a new refrigerator and were re-wired and to 80% for those who were only re-wired. The majority (88%) of the households considered the quality of the electricity service to be good or very good after project implementation compared to only 17% before the project. Eighty-nine percent of the households would recommend the program to other residents.

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<sup>47</sup> Social cutting is limiting the amount of kWhs that a customer can use (but not disconnecting) in the case of non-payment.

The energy efficiency measures taken in the households and distribution network are expected to yield annual energy savings of over 2 million kWh. Until recently, bills to households and businesses were capped at 150 kWh to help households transition to paying for service as well as to educate them about their actual consumption levels and charges once the cap is removed. It is expected that additional savings will accrue (but additional bad debt may also occur) when larger consumers start to experience the true cost of their consumption.

After project implementation, AES-Eletropaulo began to collect a significant amount of new revenue from consumers who had not previously paid for their electricity consumption. Annual billing is expected to reach over \$920,000; currently, the bad debt rate is about 35%. This bad debt rate is relatively high and is due to the large number of commercial customers with high consumption levels that are unable or unwilling to pay. The bad debt rate is expected to decrease, based on experience in other areas, as AES-Eletropaulo implements its ‘social cutting’ program and enforces collections. However, while survey results show that nearly a third of households took a ‘great effort’ to pay their electricity bill, 56% said that if budgets were tight, they would select to forgo paying this bill. This is a challenge to project sustainability and needs to be taken into account by AES-Eletropaulo as it rolls out of the SELR program to hundreds of thousands of additional favela households in São Paulo over the next two to three years.

<b>PILOT RESULTS</b>	
<i>Measure</i>	<i># installed or completed</i>
Conventional meters and posts installed	3890
Remote meters	475
Pre- or post regularization door-to-door visits by community agents	8594
Community and school events (# events; # attending)	27 events with 4906 attending
Replacement of inefficient incandescent light bulbs with efficient compact fluorescent bulbs (CFLs)	9588 CFLs
Refrigerator assessments completed	2598
Inefficient refrigerators replaced with PROCEL A-rated ones as needed <sup>48</sup>	497
Wiring safety assessments completed	2433
Rewiring of unsafe internal wiring and fixtures and replacement of electric water heaters <sup>49</sup>	496
Replacement of individual outside lights with public lighting	505 (472 in alleys and 33 in main streets)
Commercial audits and recommendations made	70

<sup>48</sup> Overall 727 needed replacement with 444 in bad condition and 283 in very bad condition; however only 532 families signed agreements to replace their refrigerators (they were either consistently absent or refused the refrigerator) and only 500 refrigerators were available.

<sup>49</sup> 1406 were found to be in bad and very bad condition but funds were limited to 500 in the pilot.