

## THE BOTTOM LINE

Substantial gains have been made in recent years in electrifying urban and peri-urban areas in the developing world, in partial fulfillment of the global commitment to ensure access to affordable, reliable, and modern energy for all by 2030. But additional efforts are required to reach slum dwellers, who often fall back on power theft or informal connections to obtain access to electricity. This kind of access, however, comes at a high cost for paying customers and distribution companies. Joint efforts by government, utilities, and local populations can break the vicious cycle of theft and poor service.

# Where and How Slum Electrification Succeeds: A Proposal for Replication

## How have slum dwellers fared in gaining access to electricity?

### Early efforts to regularize electrical service to slums were half-hearted and had mixed results

Today, 55 percent of the world's population lives in urban areas; by 2050, the level is expected to rise to 68 percent.<sup>1</sup> The number of slum dwellers will grow apace, from 1.6 billion to almost 3 billion by 2050.<sup>2</sup> In some countries, such as Brazil, Kenya, and Pakistan, more children are already growing up in slums than outside them.

With urbanization, access to electricity has grown. Urban areas across the world have close to universal access (96 percent), although challenges remain in the rapidly growing cities of Africa and Asia–Pacific. “Although urban access rates have increased relatively little in the last 25 years,” notes the leading report on progress toward sustainable energy for all, “even sustaining those rates represents a major achievement given the rapid urbanization that has added 1.6 billion people to the world's cities during this period” (IEA and World Bank 2017: 11). However, this assessment does not distinguish between safe, reliable, and legal connections, and the unsafe, unreliable, and illegal ones that are ubiquitous in urban slums and peri-urban areas.

In the developing world in the latter half of the 20th century, electrical service was often extended to informal urban and peri-urban areas well below cost as a social benefit (to make those areas safer, healthier, and more livable), often in exchange for political support. The cost to utilities was initially small, because few residents could afford more than a lightbulb. But as slums grew, so did demand for electricity. And as rate-paying customers and taxpayers began to balk at providing further subsidies for electricity consumption in slums, utilities became trapped in a downward cycle of financial losses and deteriorating service.

Slum dwellers responded to poor service quality by ceasing to pay their bills; load limiters and meters were bypassed or tampered with; so-called flying connections became rampant; and efforts to collect monthly payments fell far short of the mark (figure 1). Residents and organized criminals became hostile to the distribution company's efforts to collect, causing the company to withdraw and allow infrastructure to deteriorate to the point of failure. Utilities appealed to government, usually without much success, to make up their mounting losses. Customers in slums were left with unreliable, unsafe, and often illegal services—a far cry from the affordable, reliable electricity they had been promised. Low-income areas and informal settlements throughout the developing world are still littered with the remains of failed electrification projects.



**Ritu Dave** is an energy specialist with the World Bank's Energy and Extractives Global Practice.



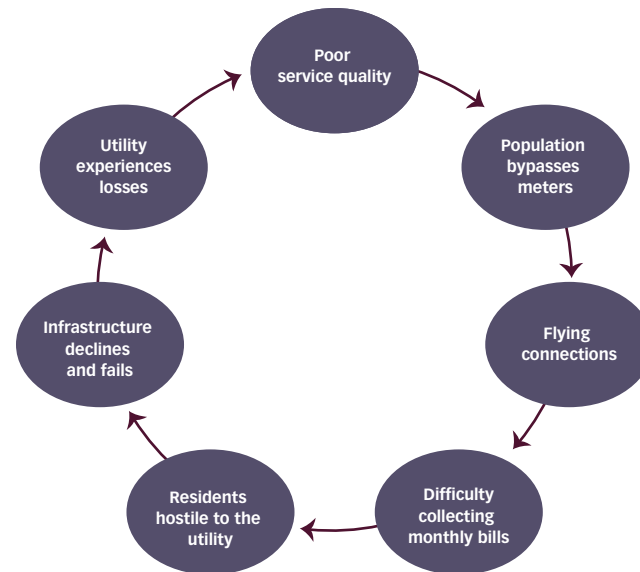
**Connie Smyser** is a consultant with the World Bank's Energy and Extractives Global Practice.



**Fabian Koehrer** is a consultant with the same practice.

<sup>1</sup> <https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html>

<sup>2</sup> <https://unhabitat.org/up-for-slum-dwellers-transforming-a-billion-lives-campaign-unveiled-in-europe/>

**Figure 1.** The vicious cycle of deteriorating service

The causes of these common failures were several.

After years of receiving a service at no cost, consumers came to believe that they had a right to free electricity—however unreliable and unsafe. Once electrified, low-income communities continued to be marginalized through bare-bones services, lack of consultation, and only rare hiring from within the newly served areas. Governments and utilities seemed to expect technology alone to solve social problems. Improved distribution and metering technologies, for example, may be necessary, but they are insufficient to address electricity theft.

Utility companies often block or resist slum electrification efforts, expecting that, despite their best efforts, the initiatives will result in poor return on investment. This is especially true where systems have been poorly maintained and the need for rehabilitation is high. The return that can be achieved from connecting new customers for whom affordability is not a problem is usually significantly higher.

In other words, regularizing electricity service in slums where electrical service has slipped into the cycle depicted in figure 1 is

---

Utility companies often block or resist slum electrification efforts, expecting that, despite their best efforts, the initiatives will result in poor return on investment.

---

distinct from adding previously unconnected areas to the distribution grid. Typically slums will have already obtained access one way or another—the challenge is to ensure that service is safe, reliable, and affordable so that it contributes to the area’s economic development.

Enabling conditions are needed to improve the utility’s expected return from investments in regular service for slum dwellers, such as the assurance that special tariffs for low-income customers will be subsidized from outside the utility (e.g., by the government or donors). In fact, most slum electrification programs will require some financial stimulus either to the distribution company or to the prospective customer. Putting those supportive instruments in place requires substantial planning to avoid common pitfalls, such as the following.

- Costly subsidies to unprofitable utilities (often state-owned) leave the government no space to provide social support to the slum population.
- Many utilities are unable to get corruption under control or to implement a system of cost-recovery tariffs.
- Connection fees and costly requirements such as structural safety certifications and concomitant rewiring costs may deter customers from connecting.

Without an appropriate business and service model and a regulatory environment that removes these barriers, slum electrification efforts will not be successful in the long term.

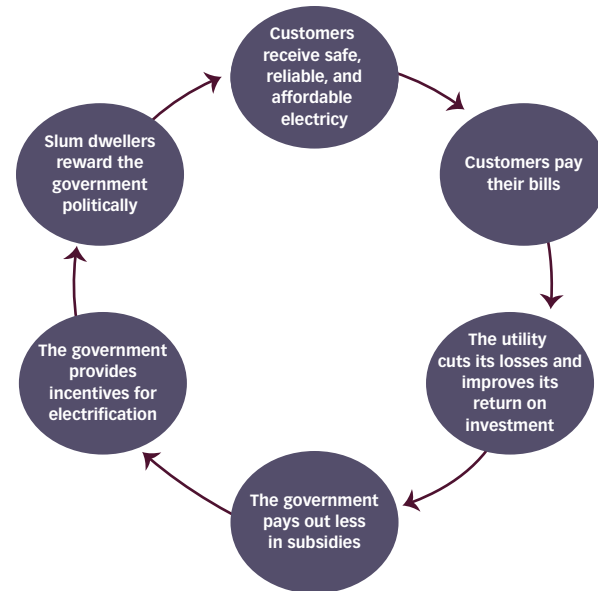
## Has the prognosis for slum electrification improved?

### Several recent developments suggest a path to success

Slum electrification has been successful when governmental institutions at all levels work together, utilities are on board with the political program, and marginalized communities are brought into the planning process and have a stake in its successful outcome.

At bottom, sustainable access to safe, reliable electricity benefits everyone, and several recent developments have made it easier to set a virtuous cycle in motion. Governments seek the stability and social and economic development that are achieved through

**Figure 2.** The virtuous cycle created through social compact



Costly subsidies to unprofitable utilities (often state-owned) leave the government no space to provide social support to the slum population.

electricity access. Governments and utilities have evinced greater willingness to invest and engage in slums. In several prominent cases, government and utility leaders have demonstrated that sustainable slum electrification is possible, especially when good leadership is paired with upgraded technology and systems and when the specific characteristics of slum communities are reflected in business models. Within the bounds of affordability, consumers are willing to pay for a safe, reliable electricity supply. In particular, making regular service affordable for low-income customers has been shown to help maintain losses at low levels. Electricity companies want to provide safe, reliable electricity profitably to customers who are happy with their service and not prone to vandalism or theft. Figure 2 depicts the virtuous cycle.

**Governments and utilities are increasingly willing to invest and engage in slums.** Through their commitments to the Sustainable Development Goals or Sustainable Energy for All (SE4All)

governments have acknowledged that unsafe, substandard access no longer meets the basic electricity needs of households and small businesses. Providing populations with safe and reliable electricity services is increasingly seen as an opportunity for economic development rather than as a burden for taxpayers and ratepayers. And—as always—politicians understand that providing safe and reliable electricity to slum populations is a major vote enhancer.

Mandates for full electricity access are being established. As an example, Kenya Power’s mandate to achieve full electricity access in Kenya by 2020 is complemented by financial support to overcome barriers. Kenya’s government launched the “Last Mile Program,” under which electrification is to reach 100 percent for both regular residential customers and slum consumers. Support from the World Bank’s International Development Association to subsidize connection fees allowed Kenya Power to restart its slum electrification program—within two years, nearly 150,000 legalized household connections were established (World Bank 2015).

When making policy decisions about how the electricity sector will be structured and delineating the lines of authority, responsibilities, and rules under which utility companies will operate, governments and regulators have an opportunity to build in incentives to provide sustainable energy for all. Governments and regulators must join forces to make slum electrification a triple win: enhance electricity savings, staunch electricity theft, and ensure that new paying customers are satisfied.

During the process of privatizing a nonperforming utility, goals for reducing losses and increasing connections can be stipulated in a concession agreement.

Governments should work with utility regulators to bring tariff relief to those who cannot afford to pay the full electricity tariff. Social and welfare policies can be coordinated to make electricity more affordable for low-income households. Examples include prepayment systems, which make it easier for consumers to control their electricity consumption, and direct cash payments to slum dwellers, which enable them to make their tariff payments. Prepaid systems are especially suited for customers with irregular incomes who need to control their spending.

---

Basing utility compensation on achievement of performance goals has proven to be a major game changer.

---

Governments can support additional enabling conditions to mandate, design, and implement a successful strategy for slum electrification. In order of effectiveness, the most important of these enabling conditions are:

- Creating regulatory incentives or penalties linked to return on investment for shareholders and key performance indicators for utility management (including moving toward cost-recovery tariffs).
- Favorable treatment of the extraordinary investments and initiatives required to bring highly degraded distribution systems up to standards for quality, reliability, and theft-reduction, possibly as part of a concession award.
- Allowing the company to “internalize” the initial cost of connections rather than charge the customer all or part of the connection fee. If a connection fee is mandated by law, ways to reduce the “down payment” and incorporate the remainder into monthly payments through the billing cycle should be evaluated.
- Adoption of low-income (social) tariffs funded by social cash transfers or other assistance aimed at the poorest. In other words, targeted subsidies should enable providers to charge a social tariff, or provide low-income customers with enough cash to pay for their (efficient) electricity usage.

**Utility leadership has proven to be essential to sustainable slum electrification.** The main implementer of any slum electrification program is the utility. Reliable supply for consumers and return on investment for the company both depend on stemming technical and commercial losses. This needs to become a company-wide priority. A change of ownership can be a key entry point for slum electrification and other loss reduction efforts. Where top management have embraced slum electrification and eliminated internal corruption, the job was done successfully. Additionally, efforts by the utility need to be complemented by the government in the form of decrees or laws. Basing compensation or return on investment on achievement of performance goals has proven to be a major game changer.

**Upgrading technology and systems facilitates slum electrification.** New and smarter technology systems improve overall utility operations and help to prevent, reduce, and monitor theft. Metering and monitoring equipment provides information on where problems are occurring and whether they are caused by tampering. Analytical tools for energy balancing, which help to localize theft, are an essential backbone and a necessary part of any prepaid system. Some utilities have applied ultra-high deterrence technology in locations where gangs have taken over the distribution system. Prewired “ready-boards” reduce the cost of required wiring upgrades.

**Improving affordability for low-income customers is key to maintain a low-loss situation.** Lowering or eliminating the connection fee, or providing financing to allow the fee to be paid in monthly installments, helps low-income consumers to overcome the upfront barriers to becoming a legal customer. As just noted, ready-boards cut wiring costs. More energy-efficient appliances and lighting reduce electricity expenditure.

**Adapting business and service approaches to slum conditions is essential.** A common pitfall is rushing into slum electrification with insufficient knowledge of the service territory. Successful efforts have been characterized by a deep understanding of the targeted communities and enough resources to carry out the mandate. A plan must include reconnaissance, engagement, and trust building exercises with the community.

### What is the way forward?

**The government, the utility, and the local population must work together to provide everyone with safe, reliable, and affordable electricity**

Efforts to advance slum electrification should be embedded in a system of assistance for the slum population. Government must provide an enabling environment (including a sound regulatory framework) and subsidies to assist low-income households. Utilities must be willing to engage in activities that are outside of their normal role, notably in designing and implementing approaches and business models keyed to slum realities. Community engagement is

Community engagement has often been the missing component in slum electrification programs.

necessary at every stage; communities should be enlisted in efforts to reduce illegal connections and inefficient consumption behaviors. Community-based organizations and nongovernmental organizations often have local knowledge invaluable to the utility.

Large-scale regularization means making a concerted effort to bring the following elements together:

- A social compact
- Affordability, through the reduction or elimination of connection costs
- Solutions to problems such as unsafe wiring and informal land tenure
- Technology adapted to payment capability
- Social (low-income) tariffs
- Linking good payment performance to eligibility for social-economic benefits.

Community engagement has often been the missing component in slum electrification programs. As communities become formalized, interdisciplinary teams composed of social scientists, economists,

and engineers can greatly improve effectiveness of efforts to regularize electricity service through community engagement. In some instances, nongovernmental organizations may be better at certain functions. These include public outreach or management of aspects of utilities' corporate social responsibility efforts, such as programs to benefit disadvantaged groups.

Figure 3 depicts the different stages of a successful slum electrification intervention. All these stages provide the opportunity to apply the previously mentioned game-changers. Through a holistic approach in which utilities, political leaders, and communities work together, the groundwork for successful electrification can be laid.

Development partners can provide leverage to kick-start slum electrification projects, since they can offer much-needed support for governments. The World Bank can aid in the successful electrification of slums by supporting projects that invest in such efforts, by sharing its know-how (e.g., through South-South Knowledge efforts or communities of best practice), and by bringing stakeholders together.

**Figure 3. Stages of slum electrification**





## MAKE FURTHER CONNECTIONS

Live Wire 2014/16. "Capturing the Multi-Dimensionality of Energy Access," by Mikul Bhatia and Nicolina Angelou.

Live Wire 2015/34. "Scaling Up Access to Electricity: Pay-as-You-Go Plans in Off-Grid Energy Services," by Alejandro Moreno and Asta Bareisaite.

Live Wire 2014/35. "Planning for Electricity Access," by Debabrata Chattopadhyay, Rahul Kitchlu, and Rhonda L. Jordan.

Live Wire 2015/44. "Mapping Smart-Grid Modernization in Power Distribution Systems," by Samuel Oguah and Debabrata Chattopadhyay.

Live Wire 2015/50. "Implementing Rooftop Solar Projects: Public-Private Partnerships in India," by Pankaj Sinha and Shaina Sethi.

Live Wire 2016/66. "Can Utilities Realize the Benefits of Advanced Metering Infrastructure? Lessons from the World Bank's Portfolio," by Varun Nangia, Samuel Oguah, and Kwawu Gaba.

Live Wire 2016/69. "Smartening the Grid in Developing Countries: Emerging Lessons from World Bank Lending," by Varun Nangia, Samuel Oguah, and Kwawu Gaba.

Live Wire 2018/93. "Does Electrification Make a Difference in People's Lives? The Case of Rural Electrification in Laos," by Hussain Samad and Elisa Portale.

Find these and the entire Live Wire archive at <https://openknowledge.worldbank.org/handle/10986/17135>.

## References and sources

- Antmann, P. 2009. "Reducing Technical and Non-Technical Losses in the Electricity Sector." World Bank, Washington, DC. [http://siteresources.worldbank.org/EXTESC/Resources/Background\\_paper\\_reducing\\_losses\\_in\\_the\\_power\\_sector.pdf](http://siteresources.worldbank.org/EXTESC/Resources/Background_paper_reducing_losses_in_the_power_sector.pdf)
- IEA (International Energy Agency) and World Bank. 2017. "Sustainable Energy for All: Global Tracking Framework 2017—Progress toward Sustainable Energy" (Summary). World Bank, Washington, DC. [https://trackingsdg7.esmap.org/data/files/download-documents/eegp17-01\\_gtf\\_summary\\_final\\_for\\_web\\_posting\\_0331.pdf](https://trackingsdg7.esmap.org/data/files/download-documents/eegp17-01_gtf_summary_final_for_web_posting_0331.pdf).
- IED (Innovation Energie Développement). 2015. "Modèle d'électrification de zones périurbaines d'habitat spontané: Revue de l'expérience internationale." Lyon, France: Innovation Energie Développement.
- Lawaetz, S., and C. Smyser. 2011. "Challenges and Opportunities in Electricity Service Provision for Urban BOP Communities." In *Private Utilities and Poverty Alleviation: Market Initiatives at the Base of the Pyramid*, ed. P. Marquez and C. Rufin (Chapter 7). Cheltenham, England, and Northampton, Massachusetts: Edward Elgar.
- Rojas, J., and D. Lallement. 2007. Meeting the Energy Needs of the Urban Poor: Lessons from Practitioners." ESMAP technical paper 118/07, World Bank, Washington, DC. <https://openknowledge.worldbank.org/handle/10986/17915>.
- Smyser, C. 2010. "Slum Electrification Programmes: An Overview of Global versus African Experience." Report prepared for UN Habitat, GENUS.
- TERI (The Energy and Resources Institute). 2011. *Energy Access and Productive Uses for the Urban Poor: Final Report on Ghana Scoping Study*. Energy Sector Management Assistance Program, World Bank, Washington, DC. <https://openknowledge.worldbank.org/handle/10986/17497>.
- UN Habitat and GENUS (Global Energy Network for Urban Settlements). 2010. "Promoting Energy Access for the Urban Poor in Africa: Approaches and Challenges in Slum Electrification." Nairobi, Kenya.
- USAID (U.S. Agency for International Development). 2009a. "Optimal Feeder Level Connection Toolkit, Energy Tool Box." Washington, DC. <http://www.energytoolbox.org/oflc/index.shtml>.
- . 2009b. "Transforming Electricity Consumers into Customers: Case Study of a Slum Electrification and Loss Reduction Project in São Paulo, Brazil." Washington, DC. [https://pdf.usaid.gov/pdf\\_docs/PNADO642.pdf](https://pdf.usaid.gov/pdf_docs/PNADO642.pdf).
- World Bank. 2009. "Grid Intensification, Innovation, and Cost." "African Electrification Initiative workshop session no. 5. Washington, DC. <http://documents.worldbank.org/curated/en/891141468209043296/Grid-intensification-innovation-and-cost>
- World Bank. 2015. "Bringing Electricity to Kenya's Slums: Hard Lessons Lead to Great Gains." Washington, DC. <http://www.worldbank.org/en/news/feature/2015/08/17/bringing-electricity-to-kenyas-slums-hard-lessons-lead-to-great-gains>.

# Get Connected to Live Wire

The *Live Wire* series of online knowledge notes, an initiative of the World Bank Group's Energy and Extractives Global Practice, offers rich insights from project and analytical work done by the World Bank Group.

Every day, Bank Group experts apply their knowledge and expertise to solve practical problems in client countries. *Live Wire* captures the rich insights gained in the field, allowing authors to share their findings with other practitioners, policy makers, and planners.

*Shouldn't you be connected to Live Wire?*

Since 2014, the 80 briefs in the series have dealt with vital topics such as energy demand and supply; renewable energy; energy efficiency; energy policy; economic growth; environmental protection; climate change mitigation; power systems; rural and urban development; access to energy; infrastructure economics; private sector participation; access to finance; and regulation.

- **Topic briefs** offer technical knowledge on key energy issues.
- **Case studies** highlight lessons from experience in implementation, often with insights from private sector engagement.
- Briefs on **global trends** provide analytical overviews of key energy data and developments.
- **Bank views** portray the Bank Group's energy and extractives sector activities.

The format is accessible, rigorous, and concise enough to be easily shared. The 4–12 pages of each brief make ample use of graphics. Briefs are peer-reviewed by seasoned practitioners within the World Bank Group and professionally edited and produced. While their main channel of dissemination is online, Live Wires are available in print-ready files for specific client needs.

“Live Wire is designed for practitioners, policy makers, and planners inside and outside the World Bank Group. It is a resource to share with clients, colleagues, and counterparts.”



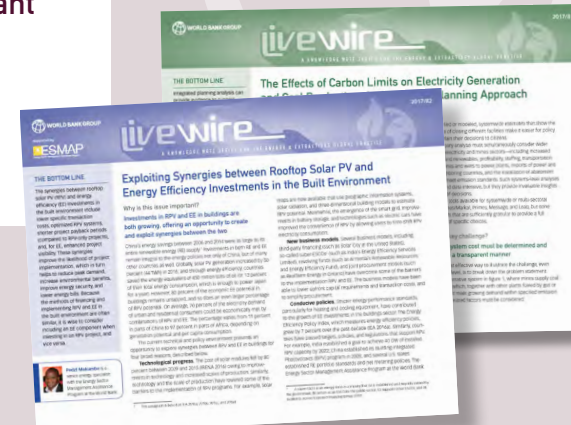
Please visit the World Bank Group's Open Knowledge Repository to browse the Live Wire collection and download the issues important to you: [www.worldbank.org/energy/livewire](http://www.worldbank.org/energy/livewire)



Live Wire briefs are designed for easy reading on the screen and for downloading and self-printing in color or black and white.



For World Bank Group employees: Professional printing can be done on a customized basis for meetings and events by contacting GSDPM Customer Service Center at (202) 458-7479, or sending a written request to [cgsdpm@worldbank.org](mailto:cgsdpm@worldbank.org).



# An invitation to World Bank Group staff

## Contribute to **liveWire**

### Do you have something to say? Say it in *Live Wire*!

Those working on the front lines of energy and extractives development in emerging economies have a wealth of technical knowledge and case experience to share with their colleagues but may not have the time to write for publication.

*Live Wire* offers prospective authors a support system to make it easier to share their knowledge:


- Staff from the Energy and Extractives Global Practice are available to assist operations staff in drafting *Live Wire* stories.
- User-friendly guidelines help authors mold their contribution to the expectations of the *Live Wire* audience.
- A professional series editor ensures that the writing is punchy and accessible.
- A professional graphic designer assures that the final product looks great—a feather in your cap!

Since 2014 the Energy and Extractives Global Practice has produced 80 *Live Wire* briefs under the bylines of 240 staff authors. *Live Wire* briefs have been downloaded thousands of times from the World Bank's Open Knowledge Repository and circulated in printed form for countless meetings and events.

*Live Wire* aims to raise the profile of operational staff with practical knowledge to share—wherever they are based.



**Your Name Here**  
Become a *Live Wire* author and contribute to your practice and career, while modeling good “knowledge citizenship” by sharing your insights and experience with others.



If you can't spare the time to contribute to *Live Wire* but have an idea for a topic or case we should cover, let us know! We welcome your ideas through any of the following channels:

Via the Communities of Practice in which you are active

By participating in the Energy and Extractives Global Practice's annual *Live Wire* series review meeting

By communicating directly with the *Live Wire* team (contact Jonathan Davidar, [jdavidar@worldbankgroup.org](mailto:jdavidar@worldbankgroup.org))

