CASE STUDY

ENERGY

The Fight for Light: Improving Energy Access through Digital Payments

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BETTER THAN CASH ALLIANCE

UNCDF

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The Sustainable Development Agenda and the accompanying 17 Goals (SDGs) would represent the greatest increase in human welfare in history. Ending poverty and hunger, achieving universal access to education, health care, energy, and water; targets that would have seemed inconceivable in recent memory are now within reach. Yet meeting this ambitious agenda will require new paradigms for connecting markets and people that have been historically overlooked. Digital payments are at the core of the most successful new models for reaching last-mile customers, enabling businesses and governments to link under-served households with essential services.

Modern energy will likewise play an essential role in this development agenda as it powers growing economies, facilitates connectivity, and improves the quality of peoples' lives. Sustainable Development Goal #7 is to ensure access to affordable, reliable, sustainable and modern energy for all. This report examines new business models and government initiatives for energy access that rely upon digital payments. While numerous solutions exist to meet the needs of the more than one billion people who still lack access to clean, affordable, and reliable energy options, one of the key challenges is in how to expand efforts to rural areas, where a lack of traditional grid expansion has denied many households opportunities for advancement. In the following study, we see how, by incorporating digital payments into existing energy services, off-grid innovators, progressive utilities, private investors, and government agencies have all found ways of bringing light to some of the darkest corners of our world.

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1. EXECUTIVE SUMMARY

Over 1 billion people live in darkness, and 3 billion people light open fires in their homes every day to eat. Without a connection to modern energy, even minor visions of advancement remain out of reach: "Energy is central to nearly every major challenge and opportunity the world faces today. Be it for jobs, security, climate change, food production or increasing incomes, universal access to energy is essential."[1]

The Sustainable Development Goals (SDGs) were adopted on September 25, 2015 by the 194 member states of the United Nations, which spearheaded their creation. Collectively, they represent an ambitious and vital agenda for the next 15 years of global development, during which the world's nations have pledged to eliminate poverty, reduce inequality, and shift the world's economy to long-term sustainability. A core component of this agenda is SDG #7: Ensure access to affordable, reliable, sustainable modern energy for all.

The purpose of this paper is to explain the important role that digital payments and inclusive digital ecosystems will need to play in order for the world to achieve universal energy access, and to outline specific actions that policymakers, energy businesses, and payment providers can take to bring this goal closer to reality.

ENERGY ACCESS AND ENERGY POVERTY

SDG#7 is a crucial acknowledgment that energy enables households to boost their productivity, living standards, and human capital.[2] Conversely, a lack of modern energy – energy poverty – prevents households from participating in the modern economy. SDG #7 recognizes that almost 1.1 billion people live without access to electricity and 3 billion people do not have access to clean fuels for cooking and heating,[3] creating indoor pollution responsible for 4.3 million premature deaths each year.[4]

At the same time we acknowledge that increasing energy access is crucial for inclusive social and economic development, there exists a parallel and growing imperative to combat the global threat of climate change, which threatens to derail recent developmental advances and push millions of people out of their homes and into deprivation. This imperative is reflected in SDG #13: Take urgent action to combat climate change and its impacts, as well as the Paris Climate Agreement struck in 2015 which created a framework requiring all signatory countries to put forward nationally determined contributions for climate change mitigation.

IMPROVING ENERGY ACCESS THROUGH DIGITAL PAYMENTS

DID YOU KNOW?

DIGITAL PAYMENTS CAN HELP

1.1 BILLION

PEOPLE GAIN ELECTRICITY

SOLUTION

UNIVERSAL ENERGY ACCESS WILL REQUIRE DIGITAL PAYMENTS FOR:

ENABLING GRID UTILITIES & MINI GRID OPERATORS to shift towards **lower-cost, pre-paid service**

CATALYZING NEW BUSINESS MODELS such as pay-as-you-go solar, which could reach **15 million households by 2020**

7 AFFORDABLE AND CLEAN ENERGY

Securing the

$50 BILLION

that is required annually in

PRIVATE INVESTMENT AND GOVERNMENT

transfers to achieve universal energy access

Key Findings

This study finds that if the world is to achieve universal energy access, the expansion of digital payments and the development of inclusive digital payments ecosystems will be critical. As a mounting body of evidence now demonstrates, digital payments have the capacity to drive financial inclusion, create new economic opportunities particularly for women, increase transparency across the private, public, and development sectors, and support economic growth by driving major cost savings, efficiencies, and higher productivity. The study also finds that decoupling economic growth from the growth of greenhouse gas emissions will be extremely difficult, if not impossible, if cash remains the dominant method of transaction, particularly in developing countries.

CASH AS AN ENERGY PAYMENT MECHANISM

Central among the findings of this report is that utility bill payments are overwhelmingly made in cash. In the 2014 Global Findex survey 79 percent of adults who had made a utility payment in the past year had paid in cash. For low- and middle-income countries it was even higher, at 93 percent.[5] Findex does not disaggregate utility payments by sector, but assuming that these results hold true in the energy sector, cash creates the following problems for utilities and energy service companies:

- Slow to collect, process, and reconcile, creating cash flow problems for postpaid energy service providers, including many electricity companies in emerging markets
- Extremely difficult to track, allowing cash to easily be misappropriated throughout the energy supply chain
- Entails high costs in terms of travel and time required to make payments; problems magnified if regular payments are required by providers, such as electric utilities or financiers of energy assets
- Exacerbates existing challenges for energy consumers in rural and low-income areas caused by "last-mile" energy distribution issues, small and irregular incomes, limited access to formal finance, and low population densities

Energy is the golden thread that connects economic growth, increased social equity, and an environment that allows the world to thrive

BAN KI-MOON
FORMER UN SECRETARY GENERAL

BARRIERS TO UNIVERSAL ENERGY ACCESS
Digital Payments Can Help

This report examines three of the major barriers to expanding energy access, and how digital payments can help overcome each of those challenges.

BARRIER 1 Lack of cost recovery impedes grid extension and mini-grid establishment.

Centralized electricity systems represent the most efficient means of extending energy access, as millions of people can be provided with electricity via a small number of large-scale generation facilities. Unfortunately, municipal and national utilities often fail to leverage these efficiencies:

- A 2016 World Bank evaluation looked at the financial sustainability of national utilities in 40 developing countries, and found that only 10 were profitable.[6]
- In 2015, 19 out of 39 power sectors evaluated in sub-Saharan Africa did not collect enough tariffs to cover overall operating expenses, and only two of the 39 collected enough revenue to cover operating and capital expenses. Over the long term this means that only 5 percent of the countries could reasonably expect to attract outside investment to their power sectors. This gap between expenses and revenue represents an implied subsidy equal to 1.5 percent of GDP on average.[7]

The problem is exacerbated in rural areas, where nine out of 10 people without electricity live. According to the IEA, 46 percent of the total rural population without electricity would be most cost-effectively connected via mini-grids – almost 500 million people.[8] But rural energy service needs to be a low-touch model to scale, even more so than traditional grids. An IFC benchmarking of mini-grids stated that using mobile payments is "more cost-effective in terms of collections, but also substantially minimizes the risk of non-payment" and that "prepayment is the preferred method of collection."[9]

©Fenix International

POTENTIAL SOLUTION: Bundling prepaid smart meters with a digital payment instrument for new electricity connections.
Digital payments represent a major opportunity for utilities and mini-grids to realize cost savings by reducing expenses in metering, credit operations, disconnections, reconnections, transporting cash, leakages, and through better monitoring of electricity consumption. Digital payments also enable, allowing utilities to shift customers to smart, prepaid metering systems. In prepaid systems, a customer purchases a set amount of kilowatt hours prior to consuming them, with tamper-proof meters reducing the risk of energy theft.

Prepaid electricity is valuable for customers, who can align their consumption with their income. Instead of queuing in line to pay their electric bill, customers can pay over the phone with a card, online, or via their mobile money wallet. Although prepaid systems can exist without digital payments and digital payments can still cut costs within postpaid systems, when combined, the two innovations create an automated, digitized, efficient utility that can viably expand access.

For energy providers, digital payments reduce operating expenses, limit energy losses, improve their cash flow position, and enhance the business case for connecting rural customers by building out rural grid networks or mini-grids, both of which are more likely to rely on renewable energy. For consumers, this can improve the sustainability of energy use and make paying for the service more convenient. The digitization of a routine expenditure will also increase familiarity and comfort with digital payment platforms, leading to more advanced uses of digital payments.

"The cost of collecting small amounts of cash regularly from low density populations is simply too great without digital payment infrastructure."

Hugh Whalan,
CEO of PEG Africa

BARRIER 2 The high upfront cost of energy access, particularly for clean-energy assets.

For customers that live in sparsely populated areas, stand-alone systems may represent the most economical means of accessing electricity reliably. Unfortunately, even entry-level solar home systems (SHSs) can cost $100 or more, a large sum for rural households. The same is also true for cooking assets: Improved cookstoves or liquefied petroleum gas (LPG) tanks can save time and improve household health by eliminating indoor air pollution, but they require a level of upfront investment that is frequently unaffordable for households that most need them. Even access to the traditional grid can entail high upfront costs for wiring and installation, which leads to a large number of "under-grid" households that remain disconnected.[10]

The majority of consumers require some level of financing in order to afford an SHS, LPG tank, or grid connection, but until recently such financing was available only through microfinance institutions, requiring high levels of collateral and/or group guarantees.

POTENTIAL SOLUTION: Fostering access to digital financial services can enable creative financing schemes that extend energy access. A growing number of private sector companies are relying on digital payments to overcome this challenge and offer financed, distributed energy services. In East Africa alone, pay-as-you-go solar (PAYGo) operators have financed the sale of over 800,000 units, and it is estimated that digital payment-enabled solar units will bring distributed, renewable electricity to 15 million households and 75 million people by 2020.[11] This is accomplished by outsourcing cash management to payment providers, linking usage to payment through lockout technology, and allowing customers flexibility in their repayment terms. In rural Uganda, for example, customers of Fenix International can access lighting and phone charging through a system that costs just $0.19 a day – but only if they are able to pay digitally. And financing for on-grid connections has helped countries such as Laos and Kenya to rapidly expand connectivity.

Digital payment-enabled PAYGo units will bring distributed, renewable electricity to 15 million households and 75 million people by 2020

The benefits of flexible financing via digital payments do not end with the first-order practical impacts such as better household lighting or cleaner cooking fuels. Companies that are able to monitor long-term repayment behavior gain invaluable consumer insights, and are using that data to provide additional financing or financial services. PAYGo companies offer financing for cookstoves and smartphones, and utilities like Kenya Power now extend top-up credit for prepaid customers in good standing.[12] The financing of energy products could prove to be the gateway to a deeper and ongoing financial relationship.

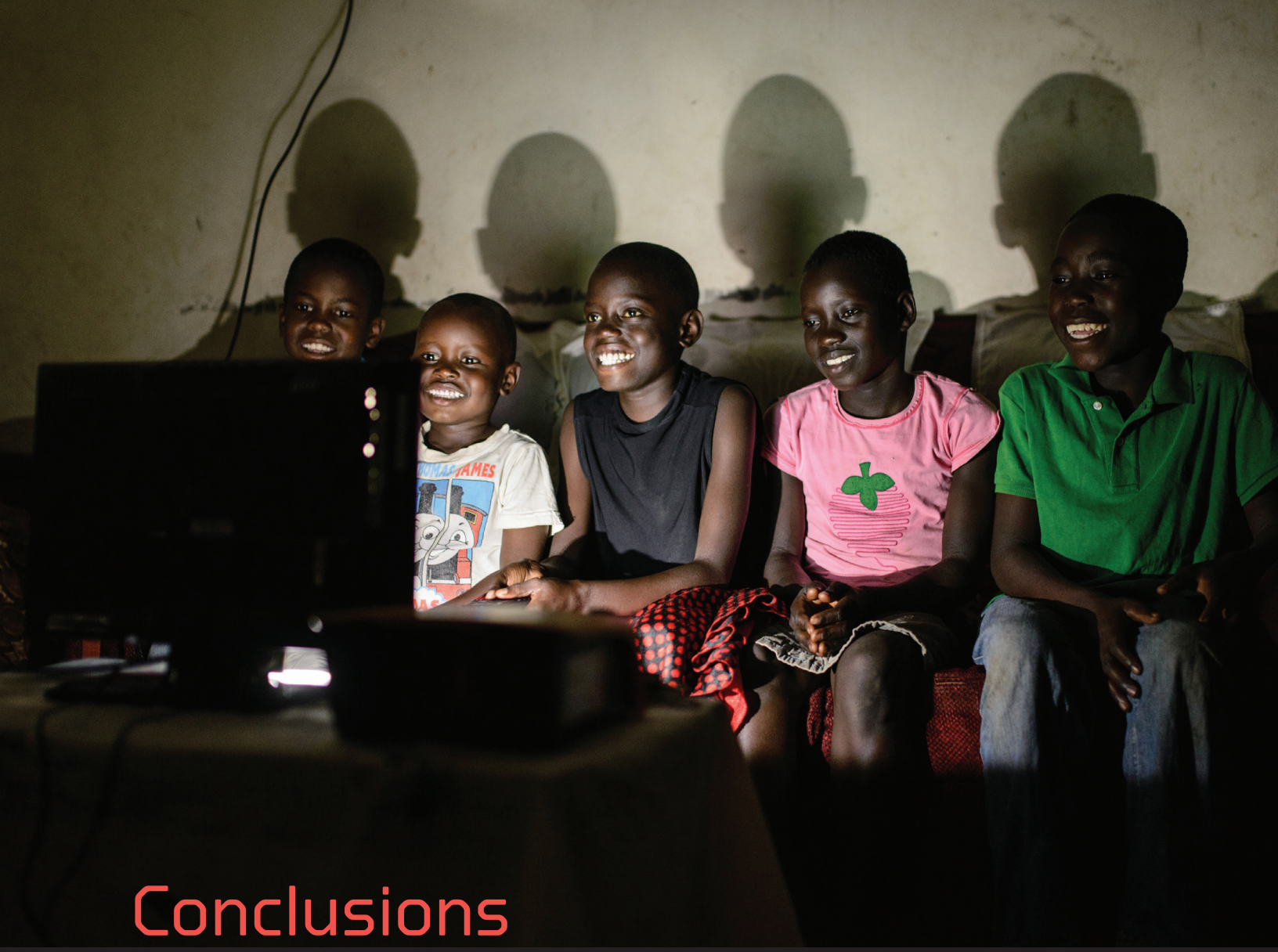
Lack of private investment and well-targeted subsidies to expand energy access.

Energy access is a capital-intensive sector. Solar home systems, micro-grids, and large-scale generation require upfront investments that are recovered over one, 10, or even 20 years. Unfortunately, the global energy access space has been limited in the amount of private capital it has been able to attract, with only 18 percent of 2013 investment coming from private sources.[13] This financing gap represents the largest single barrier to universal access.

Energy consumption is considered by many governments to be a critical sector for public support. Unfortunately, this support often takes forms that are economically regressive and climatologically unsustainable. Globally, the IEA estimates that governments spent US$493 billion on fossil fuel subsidies in 2014, against $135 billion in renewable energy subsidies.[14] These subsidies, although often meant to assist lower-income households, are in fact quite regressive: A 2010 IMF study of 20 countries showed that the top 20 percent of households by income captured 43 percent of the subsidies, compared to 7 percent in the bottom quintile.[15]

POTENTIAL SOLUTION: Digitizing energy collections/receivables, existing energy subsidies, and exploring a shift to more progressive subsidies. Digital payments have allowed off-grid providers to access private financing in ways that were unthinkable just a decade ago. In Kenya, Vulcan Impact Investing worked with PowerGen, a mini-grid company, and SteamaCo, which manages off-grid assets, to build and manage 10 micro-grids. Although SteamaCo is monitoring and facilitating payments, all revenue is routed directly to Vulcan's paybill account. Mini-grids can take up to a decade to achieve system payback, and so investors need security to make long-term investments.[16]

At the same time, digitization of energy subsidies can also enable more accurate targeting of recipients and monitoring to ensure intended recipients receive their payments on time and in full. Digitization can also prevent fraudulent or misdirected payments, delivering significant cost savings to governments. Shifting LPG subsidies to bank accounts in India cut transfer leakages by 24 percent, while providing access to cleaner cooking fuel.[17]



Conclusions

By implementing targeted and progressive policies, including incorporating digital payments into energy access agendas, it is estimated that 150 million people annually can gain access to electricity by 2030, the minimum necessary for universal access, according to the International Energy Agency (IEA) and the World Bank.[18] At the same time, using digital payments to enable better access to cleaner forms of energy, and to improve the efficiency of energy use generally, can play a vital role in decoupling economic development from increasing greenhouse gas (GHG) emissions, as has been the clear but alarming trend accompanying improvements in living standards in recent decades.

Outcomes like this are critical not only to achieving SDG #7, but also to putting the world's energy consumption on a sustainable, inclusive, and equitable footing for the long term. In this respect, the role of digital payments and an inclusive digital payments ecosystem is one that merits very close attention as a set of policy tools that can help solve some of the world's most intractable environmental and developmental challenges.

RECOMMENDATIONS

By taking the actions specified below the following actors can see immediate returns on investment, achieve important development goals, and lay the groundwork for more ambitious digitization of payments and services.

Large-scale utilities looking to expand their customer base:

- Prioritize the digitization of collections as a means of improving operational efficiency
- Adopt prepaid meters tied to digital payments in order to dramatically improve cash flow position and allow lower-income households to access electricity
- Explore ways of financing connections, allowing households to pay over time

Private energy service companies bringing modern energy to frontier customers:

- Embrace digital payments as a means of lowering operational costs and facilitating investment by securing revenue streams
- Leverage the customer data produced by digital payments to offer additional energy products and services, as well as other digital financial services that can expand economic opportunities

Governments looking to achieve SDG #7:

- Facilitate collaboration between digital payment providers, utilities or energy service companies, regulators, and other stakeholders
- Emphasize off-grid, renewable solutions as a means of achieving universal access
- Explore the digitization of direct benefit transfers as a way of achieving more precise targeting around clean energy subsidies
- Work with regulators, the private sector, the development sector, and other stakeholders to foster digital financial services

Digital payment providers looking to expand use cases:

- Recognize that the digitization of routine bill payments (as described in the Better Than Cash Accelerators report) has the potential to onboard new users to digital payment platforms and activate passive users
- Support utilities and energy service companies by providing adequate network, cash-in points, billpay integration, and technical support

Social and impact investors looking to achieve maximum impact and return on investment:

- Provide risk capital to energy service companies that want to integrate digital payments into their business model
- Encourage potential investees and existing portfolio companies to adopt digital payments as a means of securing investments

ENERGY ACCESS AND ENERGY POVERTY

1.1 billion people live without access to electricity,[19] with another 1 billion having unreliable access at best.[20] Three billion people do not have access to modern cooking solutions (electricity or gas).[21]

The repercussions of these access gaps are global in scale and deadly in scope:

- Household air pollution, resulting from the indoor burning of wood, charcoal, kerosene, and biomass, caused 4.3 million premature deaths in 2012 alone.[22]
- 60 percent of those affected were female or children, with household air pollution causing more than half of all pneumonia deaths among children under 5.[23]
- In sub-Saharan Africa, household air pollution exposure represents the "single greatest health risk for women and girls."[24]
- For the environment, residential combustion, primarily in developing countries, accounts for just under half of man-made black carbon emissions.[25]
- A third of all woodfuel deforestation is considered unsustainable.[26]
- Kerosene lamps alone produce 230 million tons of CO^2 emissions annually.[27]

The human and environmental costs of unsafe energy sources are obvious to all. Yet the lack of affordable, viable alternatives keeps billions of people trapped in a cycle of energy poverty, forcing them to continue to rely upon these dangerous fuels. Energy poverty prevents households from participating in the modern economy and providing their children with quality education: Rural households in India that were not connected with electricity saw children study two hours less per week on average, and were twice as likely to be living in moderate poverty as their peers that were connected.[28]

Meanwhile, access to energy is an economic game-changer: "Energy is central to nearly every major challenge and opportunity the world faces today. Be it for jobs, security, climate change, food production or increasing incomes, universal access to energy is essential."[29] A comprehensive 2008 study by the World Bank found that rural households which accessed electricity benefited from increased lighting, social connectivity, higher educational attainment, time saved on household chores, and more productive home businesses.[30]

SUSTAINABLE DEVELOPMENT GOALS AND ENERGY

The Sustainable Development Goals (SDGs) were adopted on September 25, 2015 by the 194 member states of the United Nations, which spearheaded their creation. Collectively, they represent an ambitious but vital agenda for the next 15 years of global development, during which the world's nations have pledged to eliminate poverty, reduce inequality, and shift the world's economy to long-term sustainability.

Ban Ki-moon, the UN Secretary General during the passing of the SDGs, has said that **"Energy is the golden thread that connects economic growth, increased social equity, and an environment that allows the world to thrive."** Sustainable Development Goal #7 reflects that sentiment in its call to **"ensure access to affordable, reliable, sustainable modern energy for all."** Within SDG #7 there are sub-goals and numerous indicators, but in summary the goal commits the global community to achieving universal access to electricity and clean-energy cooking fuels by 2030, while at the same time making our energy usage more renewable and efficient.

As the world expands electricity generation by 10,000 terawatt hours between now and 2030 – a 42 percent increase on 2013 levels – it must be conscious of the need to do so while still limiting the rise in global temperatures to less than 2 degrees Celsius, as compared to pre-industrial levels.[31] Collective action is required to combat the existential threat of climate change, and one of the main challenges will be to uncouple economic growth from greenhouse gas emissions, which have historically advanced in lockstep, while still expanding energy access to all.

The Paris COP21 agreement in 2015 codified these responsibilities into a legally binding framework in which individual countries commit to putting forward nationally determined contributions as part of a collective pledge to limit global warming to 2 degrees Celsius (or less) above pre-industrial averages.

In summary, modern energy is a catalyst for economic development, and its absence perpetuates poverty and suffering throughout the world. Expanding energy access to every person everywhere is a global responsibility, but must be accomplished using clean and sustainable methods. As former Secretary Ban Ki-moon also said, "there is no Planet B."

WHERE ARE THE WORLD'S ENERGY POOR?

Electricity

The vast majority of people living without any access to electricity are located in sub-Saharan Africa, which accounts for 55 percent of all people globally without electricity access, and Asia, which accounts for 40 percent.[32] Figure 1 shows the size of the access gap and the percentage of electrification for all countries that have more than 1 million people living without electricity. India alone has a quarter of the deficit, with 270 million people without power in 2014; however, the percentage of its population with access to electricity (79 percent) is higher than many other developing countries.[33] In sub-Saharan Africa, six countries (Nigeria, Ethiopia, DRC, Tanzania, Uganda, and Kenya) had a collective 313 million people living without electricity as of 2014; 30 percent of the global total and half of Africa's deficit.[34]

Clean Cooking Fuels

Universal access to clean cooking fuels (electricity, gas) faces an even larger gap. (Figure 2). In just two countries, India and China, 1.4 billion people still cook with solid or dirty fuels. The rest of the population without access is spread throughout South Asia, East Asia, and sub-Saharan Africa, where less than one in seven people cooks using clean fuels.[35]

BEYOND NATIONALITY, ENERGY ACCESS IS A RURAL PROBLEM

Globally:

85% **of those without electricity and**

87% **using solid cooking fuels**

live in RURAL AREAS.

This is particularly problematic, given that recent energy gains have largely occurred in urban areas. All told, 27 percent of people living in rural areas worldwide have no access to electricity, and 78 percent cook with polluting fuels.[36]

FIGURE 1

Access to Electricity

(SE4ALL Global Tracking Framework, 2015)

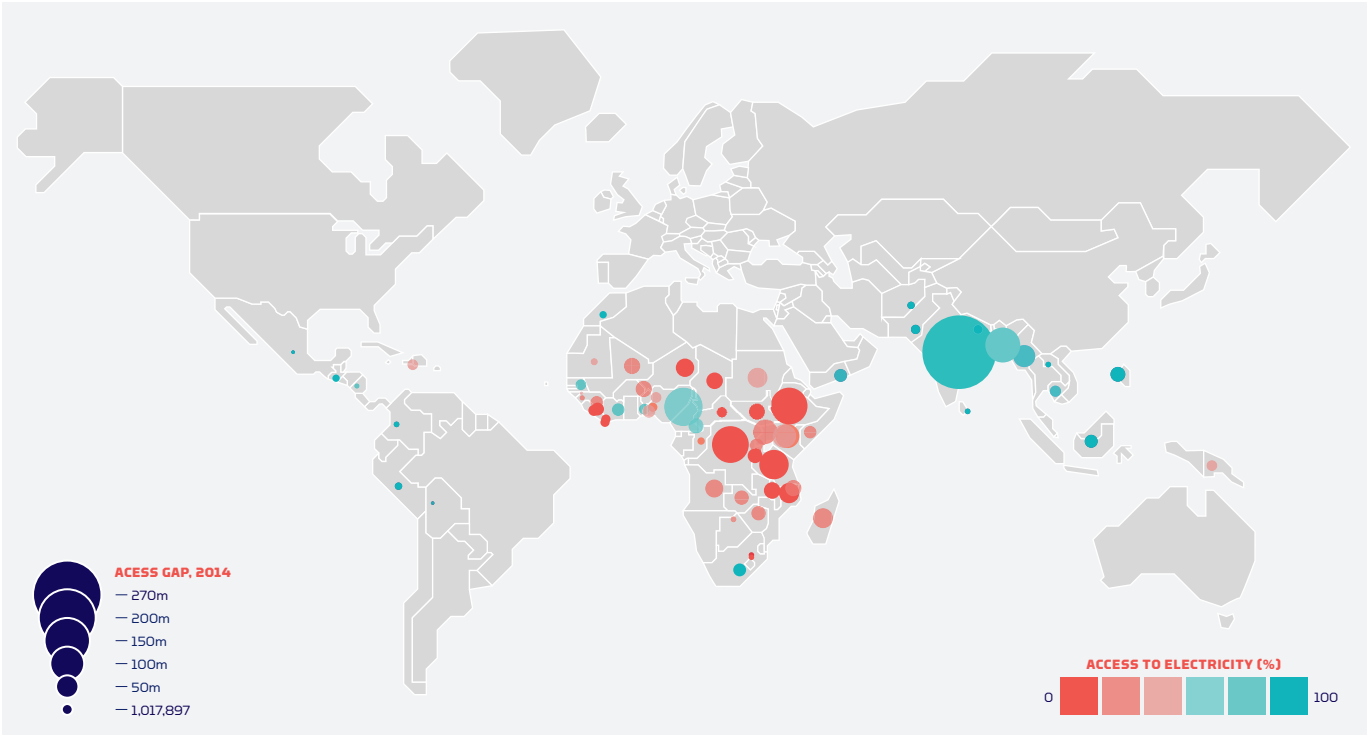
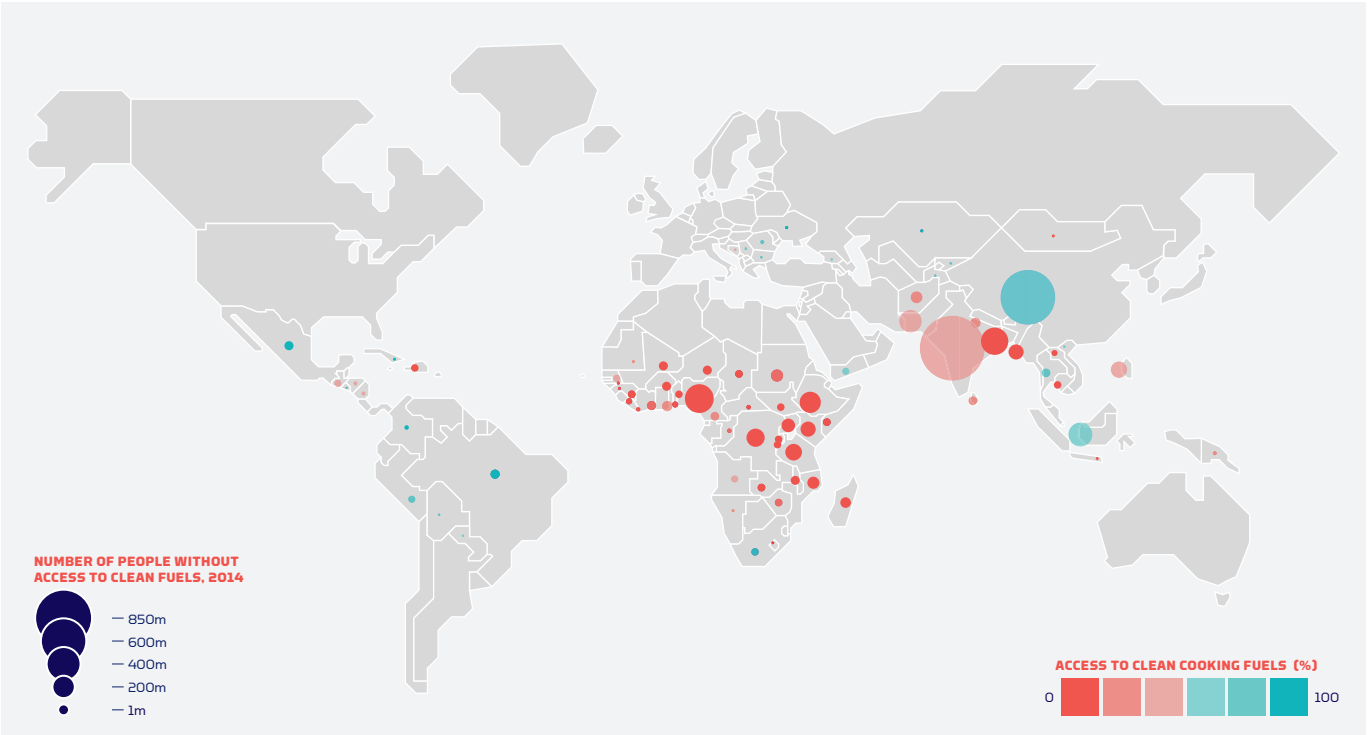


FIGURE 2

Access to Clean Cooking Fuels

(SE4ALL Global Tracking Framework, 2015)



3. OVERCOMING BARRIERS TO ENERGY ACCESS: DIGITAL PAYMENTS CAN MAKE A DIFFERENCE

Rural communities and low-income customers are difficult to serve across most sectors: "Last-mile" distribution issues, small and irregular incomes, limited access to formal finance, and low population densities all combine to create higher per-household costs.

The energy access sector is no different, with significant obstacles to expanding access only made worse when cash is the payment instrument. As a payment mechanism, cash has the following drawbacks:

- Is slow to collect, process, and reconcile, creating cash flow problems for postpaid energy service providers, including many electricity companies in emerging markets
- Is extremely difficult to track, allowing cash to easily be misappropriated throughout the energy supply chain
- Entails high costs in terms of travel and time required to make payments; problems magnified if regular payments are required by providers, such as electric utilities or financiers of energy assets

And yet, 2014 data from the Global Findex surveys shows that in lower- and middle-income countries, utility payments (which this study treats as a proxy for energy payments) are overwhelmingly made in cash. In those countries, 56 percent of adults had made a utility payment in the last year. Of those people, 2 percent had paid using their mobile phone, 13 percent had paid using a bank account, and 93 percent had paid in cash. Breaking that data down by country, Figure 3 shows the percentage of an adult population that has paid a utility bill in the last year. Figure 4 shows the percentage of those bill payers who made utility payments in cash.[37]

For energy providers seeking a viable business case to expand energy access and operate across a wide geographic footprint, the cost of collecting, transporting, and managing cash quickly erodes already-narrow margins. Utilities operating in urban areas are also disadvantaged by cash, as collections agents and long queues at payment centers represent deadweight losses to both providers and customers. To overcome these challenges, utilities and private energy distributors that wish to expand energy access must establish a convenient, inexpensive method of paying for their service.

FIGURE 3

Percent of Adults that Paid a Utility Bill in Last Year

(Global Findex 2014)

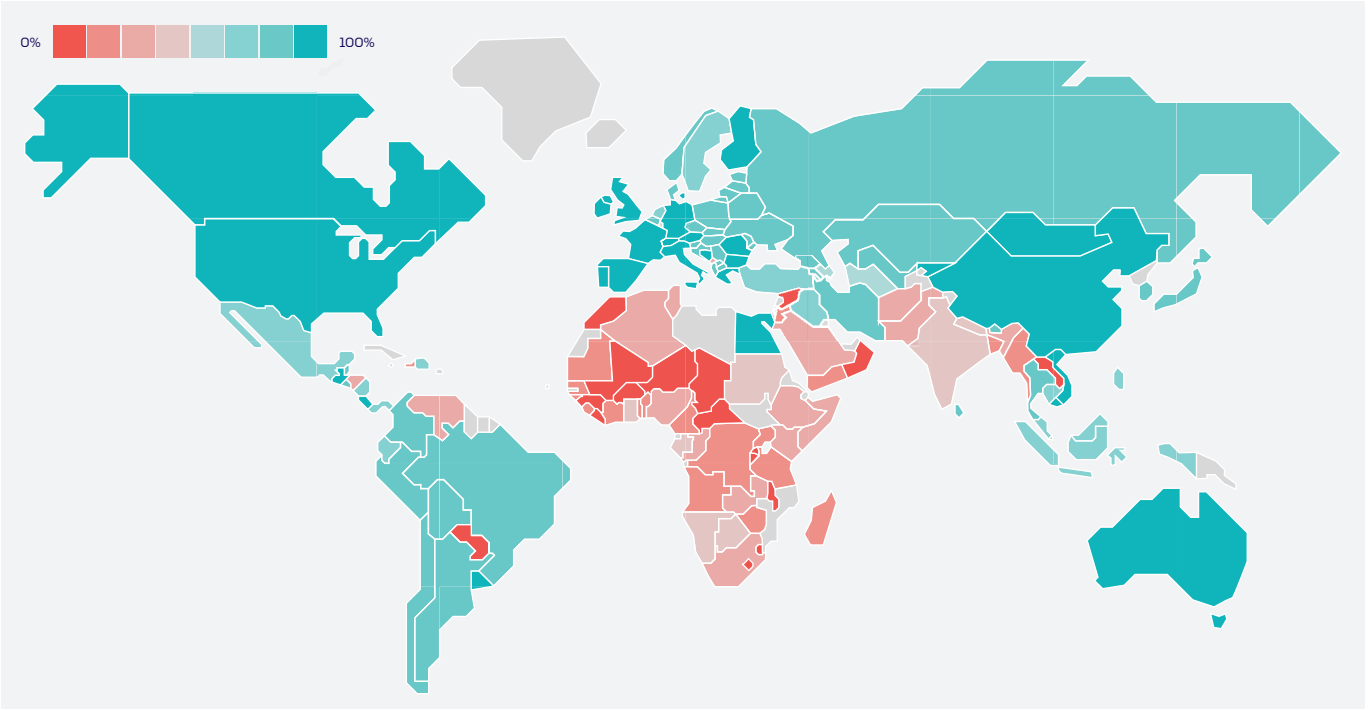
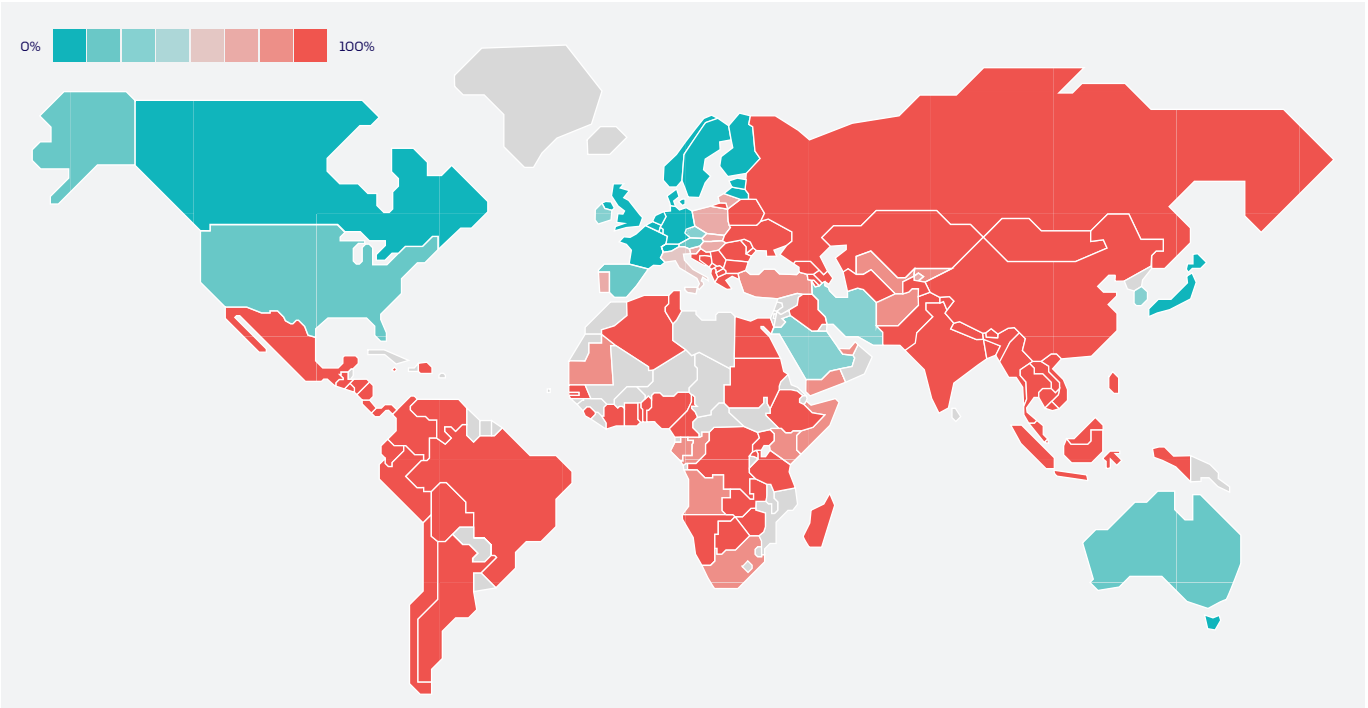


FIGURE 4

Percent of Adults that Paid a Utility Bill in the Past Year Who Paid Using Cash

(Global Findex 2014)



BOX 1

The 21st annual session of the Conference of the Parties (COP21) was held in Paris in November and December of 2015. 195 countries crafted the Paris Agreement, a global pact to reduce GHG emissions in order to limit the global warming below 2° C above a pre-industrial baseline, with all effort made to remain below 1.5° C above the baseline.[38]

GHGs absorb and emit thermal radiation, effectively trapping heat within the atmosphere. Water vapor, carbon dioxide, nitrous oxide, methane, and ozone are the primary GHGs in our atmosphere.[39]

The burning of fossil fuels emits carbon dioxide. With the beginning of the industrial revolution around 1750, humans began burning more fossil fuels, releasing additional carbon dioxide. Since 1750, the concentration of CO^2 in the atmosphere has risen from 280 parts per million to 400.[40]

BOX 2

UBL in Pakistan

When floods in the Indus River Basin directly impacted 20 million people in Pakistan in 2010, over a million prepaid Visa debit cards were distributed within three months and used to channel US$223 million to those most affected.[44]

DIGITAL PAYMENTS AND CLIMATE ACTION

According to the International Energy Agency (IEA), energy production and use account for two-thirds of the world's historic greenhouse-gas (GHG) emissions.[41] While in recent years the growth of China and India has pushed the developing world ahead of the developed world in terms of overall emissions, developed countries produce twice the global average of GHG emissions per capita.[42]

Historically, increases in CO_2 emissions have risen in lockstep with economic growth. Yet as access to electricity expands and rising incomes facilitate higher levels of consumption in emerging markets, it is crucial that economic growth becomes decoupled from GHG emissions growth.

The primary ways in which digital payments can expand energy access are via the establishment of smarter energy grids and through distributed energy solutions. Distributed energy is generated at or near the point where it is consumed; in the case of solar home systems, directly on the roof. While smarter grids can rely on any power source, renewable solutions are particularly appropriate for distributed energy. The advantages of distributed solutions – that they eliminate energy losses in transmitting electricity – are greatly reduced if fossil fuels must still be purchased and transported on a regular basis. Digital payments make off-grid solutions more economically viable, and those solutions disproportionately tend to be solar or wind-based.

Such solutions need not be located exclusively off-grid. Decentralized energy systems, such as mini-grids or solar home systems, can improve local resiliency in the face of climate or weather-related shocks. Given their higher energy, digitizing collections is important for financial sustainability.

Digital financial services (DFS) can also offer more general benefits, helping to build adaptability and resilience in the face of adverse climate-related events. The COP21 agreement, as well as other climate agreements, has called for an increased focus on crisis prevention and community resilience before disasters strike. The United Nations Capital Development Fund (UNCDF) has previously highlighted the potential for DFS to enable resiliency, noting: "The more [digital financial services] infrastructure, ecosystems and experience is in place prior to the onset of a crisis, the better the post-crisis humanitarian relief response will be, and the further along markets will be to full financial inclusion—and the greater the resilience of individuals, institutions and markets to such crises."[43] Box 2 offers a vital example.

KEY BARRIERS TO EXPANDING ENERGY ACCESS

This section looks at three key barriers to expanding energy access, and how digital payments can help overcome each of those challenges.

BARRIER	RESULT	ROLE OF DIGITAL PAYMENTS	STAKEHOLDERS
Grid Extension **Lack of cost recovery for major utilities makes expanding services difficult** **Financially non-viable to extend the grid to certain remote areas**	In a World Bank study, only 10 out of 40 developing country utilities were found to be profitable[45] Nine out of 10 people without electricity globally live in rural areas. Only 30 percent can be most efficiently connected via the grid[46]	Lower operational costs for revenue collection Link with prepaid meters to create smart, efficient utilities Enable mini-grid solutions in remote areas	a) Municipal or national utilities b) Payment providers c) Ministries of Finance d) Private mini-grid operators
Financing Distributed Assets **Clean-energy assets have high upfront costs** **Lower-income segments have difficulty accessing credit**	Stand-alone energy assets (e.g., solar home systems) are unaffordable to the people who need them most	Facilitate the scalability of consumer financing for clean energy assets	a) Digital payment providers such as MNOs b) Companies financing energy assets
Facilitating Private Investment and Public Subsidies toward Clean Energy Access **Leakages in public programs** **Risk to private investment**	Of US$13 billion invested globally in expanding energy access in 2013, only 18 percent came from private sector[47] US$495 billion was spent on regressive fossil fuels subsidies,[48] with high leakages[49]	Improve targeting of energy subsidies Reduce program leakages Catalyze private investment by securing cash flows	a) Ministries of Energy b) Private investors in energy access

FIGURE 5

Energy Value Chain (adapted from IFC, 2012)

4. POTENTIAL SOLUTIONS

A. GRID EXTENSION

Electricity is a physical commodity, and like oil or water it requires physical infrastructure. Generation, transmission, distribution; this infrastructure is capital-intensive, but becomes progressively more affordable when costs are spread out over greater numbers of users. Centralized, interconnected systems that serve tightly clustered populations offer the lowest price per unit for electricity, due to these simple economies of scale. Such systems have traditionally served large municipal areas, but in the last few decades mini-grids have been built to serve more remote population centers. Although these systems differ drastically in size, the effect of digital payments is similar on each: They reduce the cost of collections, provide valuable consumer insights, and combine with prepaid meters to create lean, automated energy service that can scale rapidly.

Utilities

Centralized urban electricity systems are typically managed by municipal utilities. These can be private, quasi-private, or fully public entities that are responsible for providing electricity to consumers within a designated area, although they may outsource various aspects of the electric supply chain. In optimal conditions, they represent the most efficient means of extending energy access, as millions of people can be provided with electricity via a small number of large-scale generation facilities.

Unfortunately, municipal and national utilities often fail to leverage these efficiencies. A 2016 World Bank evaluation looked at the financial condition of national utilities in 40 developing countries, and found that only 10 were profitable.[50] A similar look at power sectors in sub-Saharan Africa in 2015 found that 19 out of 39 evaluated utilities did not collect enough tariffs to cover their operating expenses, and only two of the 39 collected enough revenue to cover operating and capital expenses. This means that over the long term only 5 percent of the countries could reasonably expect to attract outside energy investment. In the average country the gap between power sector expenses and revenue represented an implied subsidy equal to 1.5 percent of GDP.[51] Implied, because national or local funds transferred to the power sector in order to cover deficits are not usually perceived as subsidies, but nonetheless represent state support for a commercial entity, support that is badly needed elsewhere.

Although problems can and do beset utilities at each level of the supply chain, digital payments offer the potential to overcome key challenges related to billing and collections.

BOX 3

Eskom and Prepaid

Prepaid electricity service was pioneered globally by Eskom, South Africa's public electric utility. In 1990 electricity was ubiquitous in South Africa's urban areas, but rural access was below 30 percent. Rural service was difficult to provide due to cost and safety concerns, but by working with local manufacturers, Eskom developed prepaid meters and a vending platform for top-up tokens, which were purchased as-needed. Between 1992 and 2003 Eskom installed 2.8 million meters.[52]

But users still disliked the inconvenience of paying for prepaid energy. In the early 2000s Eskom worked with private vendors to incorporate electronic payments from banks, web portals, and mobile platforms. Platforms like Prepaid24 now allow users to top-up their credit anytime, anywhere. As a result: From 1990 to 2012, while South Africa's population grew 49 percent, the number of people with electricity almost doubled, from 22.4 to 44 million.[53] 67 percent of rural South Africans now have electricity, with over 80 percent on prepaid meters. Prepaid service is now more cost-effective for Eskom than postpaid, with some Eskom executives calling for the entire country to shift to prepaid.[54]

Billing challenges:

- Postpaid meters that are read manually can easily be tampered with – of 76,000 households audited by Tanzania's national utility in 2012, 5 percent were found to be stealing energy.[55] Cash-based, postpaid systems do not allow utilities to detect energy theft or leakages in real time.
- Cash flows are difficult to manage, as the utility must provide a service 15-45 days before payment, requiring significant working capital.
- The utility is forced into the role of debt collector, pursuing unpaid bills for weeks or months on end, with public institutions often being among the worst offenders: In the Indian state of Punjab, 22 state departments combined to be over $3 million in arrears for 2015 electricity bills.[56]
- Shutting down postpaid connections is an inefficient tool for enforcing repayment – in a 2014 survey that asked 462 Ghanaian electricity users what happens when they fail to pay their electricity bill, 82 percent said "nothing." Over a quarter of respondents did not pay for their electricity.[57]

Collections challenges:

- Cash payments necessitate either sending collection agents to households at a direct cost to the utility – which also presents significant security and leakage risks – or establishing centralized payment points at a significant cost to the consumer, who is required to spend time and limited household income traveling to payment points.
- In postpaid systems, customers often do not know how much electricity they have consumed, and are vulnerable to overcharging.
- Postpaid also forces customers to pay their entire bill in lump sums, which can present a serious burden for poorer households with low and volatile cash flows.

Digital payments represent a major opportunity for large utilities to address many of these challenges, particularly in rural areas. Utilities are

able to save costs on metering staff, credit operations, disconnections, reconnections, security of transporting cash, reduced leakages, and better monitoring of electricity consumption. Digital payments also act as an enabler, allowing utilities to shift customers to smart, prepaid metering systems. In prepaid systems, a customer purchases a set amount of energy (in kilowatt hours) prior to consumption, with tamper-proof meters reducing the risk of energy theft.

Prepaid electricity is advantageous for customers, who can align their consumption with their income. Instead of queuing in line to pay their electric bill, customers can pay over the phone with a card, online, or via their mobile money wallet. Although prepaid systems can exist without digital payments, and digital payments can still cut costs within postpaid systems, when combined the two innovations create an automated, digitized, efficient utility that can viably expand access.

BOX 4

Distribution Reform in Uganda

In 2005, the Uganda Electricity Distribution Company Limited, which has a monopoly on electricity distribution in Uganda, granted a concession to Umeme, a partnership between the South African company Eskom and Globeleq. The concession was in large part the result of unsustainable distribution losses: 38 percent of electricity generated was never billed to a customer, 20 percent of billed revenue was never collected, and less than 300,000 households were connected in a country of 28 million people.[58]

Umeme launched an immediate campaign to modernize the distribution of electricity. In 2011, they piloted their most successful service to date: Yaka, a prepaid meter installed at no cost.[59] In 2012, they launched TouchPay, a digital payments portal allowing users to pay from banks, POS devices, or mobile money accounts.[60]

The results have been impressive: Umeme now distributes to 860,000 households and businesses, up 290 percent from 10 years ago. 59 percent of those connections are prepaid, including almost all new connections. Distribution losses have halved, now standing at 19 percent. And in 2015 the company reported 100 percent collections. All of this enabled the Ugandan energy sector to become one of the few profitable energy sectors in Africa, and for Umeme to pay its shareholders a dividend in 2015 to their bank or mobile money accounts.[61]

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Mini-Grids

Mini-grids are decentralized groups of connected households that are managed by a provider, acting as a "mini-utility." Although they can be connected to a main national/municipal grid, these are by definition stand-alone systems. In the context of energy access, mini-grid solutions are generally implemented in villages that are too far from urban clusters to be served by a large-scale utility, but are still densely populated enough to warrant a communal solution. Mini-grids can be operated by national utilities, individual entrepreneurs, or distributed energy service companies (DESCOs).

The advantages of mini-grids in energy access include the following:

- They can be sized to fit community demand, then expanded over time as more households come online and individual household demand increases.
- Closer generation enables lower technical losses than large-scale utilities.
- They enable electricity service beyond simple lighting and small DC appliances.

The size of the potential mini-grid market is vast: In 2011, the International Energy Agency forecast that only 30 percent of the rural population without electricity would eventually receive it from central grid extension. Of the remaining population, two-thirds – the equivalent of 46 percent of the total rural population without electricity – would be most cost-effectively connected via mini-grids – almost 500 million people.[62] The sector is already growing significantly: One market research firm forecasts that the global mini-grid sector will see growth in annual revenue from US$9.3 billion in 2013 to almost $35.1 billion in 2020.[63]

Mini-grids are not a new technology: China alone had installed over 60,000 by 2002,[64] and a World Bank study in 2014 found that 42 percent of all rural households with electricity in Cambodia were being served by private mini-grids.[65] What is new is the opportunity for renewable energy mini-grids to become a viable business model. This relatively recent shift has been enabled by two main factors:

1. The falling cost of renewable energy technologies, specifically wind and solar, has made renewable energy the technology of choice for most mini-grid operators.
2. Digital payments enabling energy service companies to install prepaid systems and manage portfolios of mini-grids across wide geographies.

The last five years have seen the rise of for-profit, scalable mini-grid operators. These operators, such as PowerHive (in Kenya), Devergy (in Tanzania), and EarthSpark (in Haiti) have built their operations using digital payments. The major driver is efficiency: Rural energy service needs to be a low-touch model to scale. An IFC benchmarking of mini-grids stated that using mobile payments is "more cost-effective in terms of collections, but also substantially minimizes the risk of non-payment" and that "prepayment is the preferred method of collection."[66] Setting up automated grids in remote areas can be a loss-making proposition if an agent must still go door-to-door for metering and collections.

BOX 5

PowerHive

PowerHive is an energy access company providing micro-grid electricity to rural homes and businesses around the globe. They have built and operated their own micro-grids in Kenya, using their Asali smart meters linked to a cloud-based server called Honeycomb. This integrated system enables customers to pre-pay for electricity using M-Pesa, while also allowing PowerHive to remotely monitor performance, consumption, and cash flows. Customers are able to upgrade their energy consumption over time, "moving up the energy ladder," and the higher generation capacity of micro-grids means that even light commercial activity (welding, milling, etc.) is possible on the grid.[67]

Mobile payments allow PowerHive to overcome the major obstacles to rural electrification: The cost of collecting payments and the difficulty of deactivation. Prepaid meters linked to mobile payments have allowed PowerHive to build up a rural network of micro-grids that they can manage remotely. In May of 2015 they became the first private company in Kenya to be licensed to generate, distribute, and sell electricity directly to Kenyan customers.[68]

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B. FINANCING OF DISTRIBUTED RENEWABLE ENERGY ASSETS

For customers that live in sparsely populated areas, grid solutions may not be the most efficient form of electrification. In such cases – and for households that require backup electricity – stand-alone systems represent the most economical means of accessing electricity reliably.

Unfortunately, even entry-level solar home systems (SHSs) can cost $100 or more, a large sum for rural households. The same is also true for cooking assets: Improved cookstoves or liquefied petroleum gas (LPG) tanks can save time and improve household health by eliminating indoor air pollution, but they require a level of upfront investment that is frequently unaffordable for households that most need them.

The majority of households require some level of consumer financing in order to afford an SHS or LPG tank, but until recently such financing was available only through microfinance institutions, requiring high levels of collateral and/or group guarantees. However, the introduction of mobile money and other digital payment channels has enabled pay-as-you-go (PAYGo) financing schemes for distributed energy assets, completely altering how these assets are financed and sold in developing markets.

PAYGo financing relies on two key innovations:

- Lockout technology – the ability to remotely activate and deactivate a device.
  - This technology transforms a static asset into a prepaid service platform
  - The asset is eventually "unlocked" and owned by the customer (in most PAYGo models)
- Small, frequent digital payments made as and when households are able.
  - Companies can outsource their cash management to payment providers
  - Households are able to match energy consumption with cash flows

These innovations enable providers to sell an asset to a customer for a small down payment, allowing them to either pay for ownership of the device over the 12, 18, 36 months, or to pay for the service indefinitely. For solar, average monthly payments can be as low as $5 for basic lighting units, or as much as $40 for high-wattage units that power multiple consumer appliances.[69] In rural Uganda, for example, customers of Fenix International can access lighting and phone charging through a system that costs just $0.15 a day – but only if they are able to pay digitally.[70]

The PAYGo solar sector has received deserved recognition for its last-mile distribution, fast growth, and high-quality service. In the last five years over a million solar home systems have been sold on a PAYGo basis, primarily in East Africa. Bloomberg New Energy Finance predicts digital payment-enabled PAYGo units will bring distributed, renewable electricity to 15 million households and 75 million people by 2020.[71]

The model has also been shown to work – albeit on a smaller scale so far – for LPG, where startups like PayGo Energy and KopaGas are working to fit gas containers with smart meters. This would allow them to put canisters in households across Africa, while recovering their costs from the ongoing fuel purchases. In Uganda, fuel-efficient cookstove manufacturers like Eco Group and Biolite have also started to integrate lock-out and mobile payments technologies with their stoves, which are integrated with solar home systems, to offer their products on a pay-as-you-go basis.

The benefits of flexible financing via digital payments do not end with the first-order practical impacts such as better household lighting or cleaner cooking fuels. Companies that are able to monitor long-term repayment behavior gain invaluable consumer insights, and are using that data to provide additional financing or financial services. M-KOPA, the leading PAYGo solar provider, has:

- Sold over 500,000 solar home systems in three countries,
- Extended 150,000 follow-up loans to good-paying customers, becoming one of the leading financiers of clean cookstoves in the process, and
- Reported over 250,000 credit scores (92 percent positive!) through the Central Bank of Kenya's Credit Information Sharing system.[72]

The financing of stand-alone energy products could very well prove to be the gateway to a deeper and ongoing financial relationship, providing digital payments and digital financial services to consumers including small business loans that can open up significant new economic opportunities and sources of economic growth.

BOX 6

PEG Africa

PEG Africa is an asset-finance company operating in Ghana and Cote d'Ivoire, licensing M-KOPA's technology. And although both markets have fast-growing mobile money deployments, they have a long way to go to catch up with East Africa, where over 80 percent of PAYGo solar units have been sold. PEG does not have the luxury of waiting for that day; instead, they are signing customers up to mobile money at the point of sale, and providing extensive customer education on how to use mobile money. According to their CEO, Hugh Whalan, "The cost of collecting small amounts of cash regularly from low density populations is simply too great without digital payment infrastructure. Digital payments also allow for real time understanding of far flung business operations, and this transparency enhances customer service."

This approach seems to be delivering positive initial results, with almost 20,000 units sold in the last two years. Their impact goes beyond electrification: In a project recently conducted with The Consultative Group to Assist the Poor (CGAP), PEG was able to show mobile money operators that its users generate substantially more mobile money revenue than the average customer. By providing a routine use case, PEG is helping to build the digital payment rails on which its revenue travels.

C. FACILITATING PRIVATE INVESTMENT AND PUBLIC SUBSIDIES TOWARD CLEAN ENERGY ACCESS

Energy access is a capital-intensive sector. Solar home systems, micro-grids, and large-scale generation require upfront investments that are recovered over one, 10, or even 20 years. Unfortunately, the sector has been limited in the amount of private capital it has been able to attract, with only 18 percent of 2013 investment coming from private sources. This financing gap represents the largest single barrier to viable companies reaching scale. In the PAYGo sector, Bloomberg New Energy Finance estimated in 2015 that US$1-2 billion would be needed in debt financing in order to sell 15 million pay-as-you-go solar home systems by 2020, against only US$122 million raised at the time.[73] If customer preferences trend toward larger systems, as seems likely, the financing requirements will only grow.

Digital payments are unlocking investment into energy access by securing receivables and therefore ensuring a reliable return on investment. Investors are wary of the opaque collection methods and avenues for leakage which characterize cash-based business models. By choosing to invest in companies whose revenues are collected digitally, investors can easily monitor cash-flows and verify that their investment is generating revenue at expected or acceptable levels.

There are a number of examples of this in the energy access:

- In 2014 M-KOPA worked with the Gates Foundation and Commercial Bank of Africa (CBA) to structure a $10 million syndicated commercial debt facility. CBA actually held M-KOPA's paybill account on M-Pesa as collateral, ensuring that all receivables would reach CBA and only be passed through to M-KOPA once repayment targets were achieved.[74]

BOX 7

SteamaCo

SteamaCo is a company that manages distributed assets, its main class of asset being renewable mini-grids in sub-Saharan Africa. SteamaCo's software allows it to track supply, distribution, usage, and billing for 32 micro-grids throughout Kenya.

SteamaCo's business model "would not have been possible without the advent and uptake of mobile money services in Africa," according to Dr. Sam Duby, co-founder and Chief Technical Officer. The electricity service is prepaid and automated. This removes the burden of physical meter reading, billing, and collection and provides the grid owners and investors with added security.

In a notable example, Vulcan Impact Investing wanted to demonstrate the viability of a mini-grid electricity service model. They contracted PowerGen to build 10 micro-grids in Kenya, then brought SteamaCo in to manage the system. Although SteamaCo is monitoring and facilitating payments, all cash is routed directly to Vulcan's paybill account.[75] Mini-grids can take anywhere from one to 12 years to achieve system payback, and so investors need security if they are going to make a long-term investment.[76]

This model has the potential to reach millions of customers in the next five years. A key criterion for SteamaCo when evaluating new markets? The presence of an effective digital payment platform to ensure certainty of revenues and return on investment.

- Bboxx is another example. In December of 2015, together with Persistent Energy Capital, Bboxx created the first securities backed by off-grid receivables: a bundle of 2,400 solar home system loans transformed into Distributed Energy Asset Receivables (DEARs) and valued at $300 per loan. The securitization was only possible because the receivables come in via a digital channel, and so can be easily monitored and passed through to investors [77].

For the same reasons that investors prefer digital payments – including transparency, efficiency, and scalability – governments in emerging markets are turning to digital payment in order to facilitate direct benefit transfers (DBTs) related to energy use.

Energy consumption is considered by many governments to be a critical sector for public support. Unfortunately, this support often takes forms that are economically regressive and climatologically unsustainable. Globally, the IEA estimates that governments spent US$493 billion on fossil fuel subsidies globally in 2014, against $135 billion in renewable energy subsidies[78]. These subsidies, although often meant to assist lower-income households, are quite regressive: A 2010 IMF report showed that the top 20 percent of households by income captured 43 percent of the subsidies given out in 20 selected countries, compared to only 7 percent in the bottom quintile[79].

Some countries (such as India; see Box 8) are using digital payments to facilitate a shift toward more targeted subsidies. The hope is that by moving away from regressive carbon subsidies, it will be possible to realize broad benefits for energy access and climate action.

BOX 8

Reforming LPG Subsidies in India

India had a long-standing dual market in LPG canisters. Residential households were able to purchase a single canister at a subsidized price, while commercial entities were expected to pay in full. This created enormous incentives for fraud. In 2013 the Indian government decided to digitize the transfer and link it to the recipient's biometric identification, using the Aadhar National Identification System.

Within a year the government was able to shift 130 million households receiving the subsidy onto digital payments. Transfer leakages fell 24 percent, mostly due to the elimination of ghost recipients, which could save the government as much as $2 billion annually going forward.[80] The LPG direct benefit transfers became the largest financial inclusion initiative in history: The program saw over 200 million accounts created in just under a year, "a massive expansion of India's payment grid in support of the subsidy reform effort," according to Daniel Radcliffe of the Bill & Melinda Gates Foundation.[81]

Providing access to modern energy for cooking is expected to reduce final residential energy use by 2030 by between 31 and 46 percent. This is because LPG stoves are approximately four times more efficient than biomass stoves, and hence, require less input energy.[82]

Enabling subsidies to be paid directly into citizens' accounts will provide for greater efficiency and transparency, and each transaction is recorded in detail, making fraud and leakage much easier to detect and harder to commit.[83]

INDIA AND UTTAR PRADESH

The energy sector represents a major drain on the economy in India, where national losses in 2011 amounted to US$14 billion, or 0.7 percent of total GDP. A heavy driver of these losses was rural electrification, where utilities lost US$0.06-.08 on every kilowatt hour sold. Only three states recorded an after-tax profit.[84]

Uttar Pradesh, the largest Indian state by population, accounted for over 40 percent of transmission and distribution losses on its own.[85] Losses for 2013-2014 exceeded US$200 million,[86] and access has not kept pace with population growth over the last decade, meaning the overall electrification rate has fallen. Only one in every three poor households has access to electricity.[87]

Digital payments have the potential to address these challenges, when combined with other reforms. In a state like Uttar Pradesh, where over 75 percent of the population lives in rural areas,[88] a combination of digital payments and prepaid metering could drastically improve the financial position of the energy sector and its negative impact on public finances. Uttar Pradesh's electricity company's website already advertises M-Pesa and PayTM as billing partners. With the recent licensing of payments banks in India, mobile wallets have become a much more attractive value proposition. With several states already experimenting with prepaid meters, this could be a way for Uttar Pradesh to find its way to profitability.

The off-grid market is growing as well, with Simpa Network distributing pay-as-you-go solar home systems to over 20,000 homes in Uttar Pradesh,[89] and Mera Gao Power installing affordable, efficient mini-grids in over 500 villages.[90]

BANGLADESH: BUILDING ON OFF-GRID SUCCESS

Bangladesh is in the midst of a shift to an industry- and service-led, high-growth economy, with per capita purchasing power growing 4 percent annually for the last 20 years on average.[91] Modern energy is a foundation of such an economy, but while access has increased from 48 percent of the population in 2010 to 74 percent in 2015,[92] the actual power being supplied is highly unreliable, with more than 60 outages per month on average.[93]

As one strategy of improving rural electrification, the state-owned Infrastructure Distribution Company Limited (IDCOL) began subsidizing financed solar home systems in the early 2000s. To date over 4 million systems have been distributed by partner organizations (POs) which service the loans and maintain the products.[94] Those POs receive buy-down grants directly from IDCOL that encourage lower financing rates for customers. POs are also able to refinance their consumer loans through IDCOL, which lends the PO 70-80 percent of the credit extended to the customer at a rate of 6-9 percent for approximately six years. But with the home systems being financed at a rate of 12 percent a year to the consumer, for three years, the PO is able to easily recoup its costs and turn a profit.[95] Concerns of moral hazard (that is, POs installing units in households that cannot afford them) are mitigated by IDCOL's authority to suspend POs should repayment rates fall or service issues become apparent.

The electronic transfer of subsidized finance has been an enabler of program growth. IDCOL as a financial institution has eliminated the use of cash. POs register each sale with IDCOL, then immediately receive a transfer, which they can reinvest to grow the program. This has allowed IDCOL to not only make its transfers seamlessly and rapidly, but also to build a robust tracking platform for portfolio health and program growth.

However, there are also barriers to greater uptake of digital payments as a way to drive further program usage and growth. At present, end-users can make their loan repayments via mobile money. Bangladesh has more active mobile money agent outlets than any other country, with upwards of 150,000. However, less than 1 percent of Bangladeshis had paid a utility bill using a mobile phone in 2014, according to Findex.[96]

IDCOL's financing partners have established a digital payments portal, however it has gone primarily unused. This is partly because mobile money in Bangladesh is still largely an over-the-counter, peer-to-peer transfer product: In 2015 only 13 percent of Bangladesh mobile money users had performed an "advanced" function – saving money, acquiring a loan, or paying a bill – compared to 61 percent in Kenya and 49 percent in Tanzania. However, for Bangladesh this represents a rapid improvement, up from only 2 percent of users in 2013.[97] As the IDCOL program winds down and private SHS financiers take its place, digital payment providers in Bangladesh may look to solar as a potential use case, particularly for rural areas.

ETHIOPIA

With a rural population of over 80 million, and only one in eight of those having access to electricity, Ethiopia has the 2nd largest rural off-grid population of any country in the world. The Ethiopian government has plans to rapidly change this situation, with an ambitious target of 100 percent access by 2025.[98] With the Grand Renaissance Dam scheduled to come online in 2017, providing six gigawatts of generation capacity when fully operational, Ethiopia is expected to be able to meet demand.

However with only 18 percent of the rural population having an account of any kind, mobile money services such as m-Birr and HelloCash still in their nascent stages, and one of the poorest populations anywhere in the world, Ethiopians will struggle to finance electricity connections, let alone pay for electricity on a regular basis. As Ethiopia looks to rapidly modernize its infrastructure and develop a digital payments system (symbolized by its entry to the Better Than Cash Alliance), there will be opportunities to link access to electricity with payments. Power Africa and the United States Energy Association have jointly recommended that Ethiopia embrace mobile money as its primary payment mode for new households.[99]

By helping newly electrified households to register for mobile money or another digital payment instrument, the Ethiopian government can provide its citizens with modern energy as well as a gateway to other digital payment use cases and digital finance products that can drive economic opportunity and growth. For the 70 million Ethiopians in rural, off-grid areas, access to electricity could be just the beginning.

6. STAKEHOLDER ACTIONS

Digital payments are fundamental to any energy access agenda. They reduce the cost of basic service provision, enable new business models such as PAYGo solar, secure revenue streams, and provide an efficient and transparent channel for public and private actors to direct energy subsidies and investments.

To fully leverage the power of digital payments to drive both energy access and climate action, governments and businesses can target existing payment flows within the energy sector for digitization, and then build on that initial digital instrument to provide additional services. The rationale and tactics for digitizations are not radically different in the energy sector than for any other. But by taking the actions specified below within this one sector, the following actors can see immediate returns on investment, achieve important development goals, and lay the groundwork for more ambitious digitization of payments and services.

Large-scale utilities looking to grow their customer base:

- Prioritize the digitization of receivables, initially as a means of improving collections efficiency
- Adopt prepaid meters tied to digital payments in order to dramatically improve cash flow position and allow lower-income households to access electricity
- Explore means of financing connections and allowing households to pay over time

Private energy service companies bringing modern energy to frontier customers:

- Embrace digital payments as a means of lowering operational costs and facilitating investment by securing revenue streams
- Leverage the customer data produced by digital payments to offer additional energy products and services, and potentially other digital financial services that have the capacity to expand economic opportunities

Governments:

- Facilitate collaboration between digital payment providers, utilities or energy service companies, regulators, and other stakeholders
- Emphasize off-grid, renewable solutions as a means of achieving universal access
- Explore the digitization of direct benefit transfers as a way of achieving more precise targeting around subsidies for cleaner fuels and lower-income customers
- Work with regulators, the private sector, the development sector, and other stakeholders to foster digital financial services

Digital payment providers (primarily MNOs or financial institutions):

- Recognize that the digitization of routine bill payments (as described in the Better Than Cash Accelerators report) has the potential to onboard new users to digital payment platforms and transform potential or passive users into active users
- Support utilities and energy service companies by providing adequate network, cash-in points, billpay integration, and technical support

Social and impact investors looking to achieve maximum impact and return on investment:

- Provide risk capital to energy service companies that want to integrate digital payments into their business model
- Encourage potential investees and existing portfolio companies to adopt digital payments as a means of securing investments

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The Better Than Cash Alliance case studies seek to highlight specific examples of shifts to digital payments by governments, companies, and international organizations. Each case study aims to provide insights for a wide audience on the factors that have helped or hindered the digitization process, and also present key results and benefits of the transition away from cash. We hope that readers will be able to adapt the lessons from these cases to their own contexts and local conditions.

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About CleanStart

UNCDF CleanStart is a global programme focused on getting low-income households and micro-entrepreneurs a jump-start on using clean energy. By 2020, CleanStart aims to have over 500,000 households and micro-entrepreneurs make the switch to clean energy, which translates into 2.5 million people benefiting altogether. To this end, CleanStart promotes access to finance across the energy value chain from customer to enterprise by investing in early stage, innovative business ideas from SMEs that have the potential to make a step-change in improving the accessibility, affordability, and reliability of modern energy for people, especially those at the last-mile. CleanStart contributes to achieving SDG 7 on affordable and clean energy for all.

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The Better Than Cash Alliance is a partnership of governments, companies, and international organizations that accelerates the transition from cash to digital payments in order to reduce poverty and drive inclusive growth. Based at the United Nations, the Alliance has over 50 members, works closely with other global organizations, and is an implementing partner for the G20 Global Partnership for Financial Inclusion.

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