



CATALYZING GLOBAL MARKETS FOR OFF-GRID ENERGY ACCESS

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Catalyzing Global Markets for Off-Grid Energy Access

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I. Executive Summary

In the way that mobile phones revolutionized global telecommunications, clean energy products are beginning to revolutionize access to electricity for the 1.2 billion people who still lack it. Several synergistic trends are making sustainable energy access for all a reality, such as the declining cost of renewable energy and storage technologies, the increasing efficiency of off-grid appliances, advances in information technology and smart mini-grid systems, and the proliferation of innovative business and financing models. For example, portable solar lanterns now use small solar panels paired with lithium-ion batteries and highly efficient LED bulbs, and customers in remote areas can use mobile technology to make small payments over time for new off-grid appliances.

The market for off-grid energy access appliances is expanding and has promise for substantial growth over the next few decades. Over 100 million people across the globe have benefitted from high quality solar lighting products.¹ Worldwide, over 20 million households are powered by solar home systems, and another 6 million are connected to renewables-based mini-grids or small wind turbines.² Improvements in renewable energy technology and product efficiency are catalyzing rapid growth in these markets. However, there are challenges that must be managed to realize the full market potential. Further development of energy efficient off-grid products is key to unlocking energy access goals, since highly efficient products maximize the deployment of energy services while minimizing the financial, social, and environmental costs of energy supply for off-grid areas.³ In addition to the availability of energy-efficient off-grid products, key drivers of future growth include declining costs, technology advances, access to finance, and quality assurance standards. There will also be an ongoing need to prevent market spoilage, which can occur when products are provided with blanket subsidies – conditioning consumers not to pay for them – or when buyers are unable to distinguish between poor and good quality products.

The U.S. Government has played a significant role in catalyzing global markets for low-carbon, low-cost solutions that offer high-quality energy access services. Programs that the U.S. Government has led or participated in, including the Clean Energy Ministerial’s Global Lighting and Energy Access Partnership (Global LEAP), Power Africa’s “Beyond the Grid” program, Sustainable Energy for All (SEforALL), the U.S.-Africa Clean Energy Finance Initiative, and the U.S.-India Promoting Energy Access through Clean Energy initiative, have addressed the challenges of off-grid energy access directly. Meanwhile, broader initiatives to accelerate clean energy development and promote appliance efficiency, such as Mission Innovation and the Clean Energy Ministerial’s Super-Efficient Equipment and Appliance Deployment (SEAD) initiative, can also bolster energy access efforts. By fostering global economic development while also reducing emissions and improving public health, the United States’ work to catalyze the market for off-grid energy access reaffirms that supporting development is not charity, but rather one of the smartest investments we can make in our own future.

¹ Lighting Global. 2016a. “Global Off-Grid Solar Market: Program Results As Of June 2016.” <https://www.lightingglobal.org/updated-lighting-global-program-impact-as-of-june-2016/>

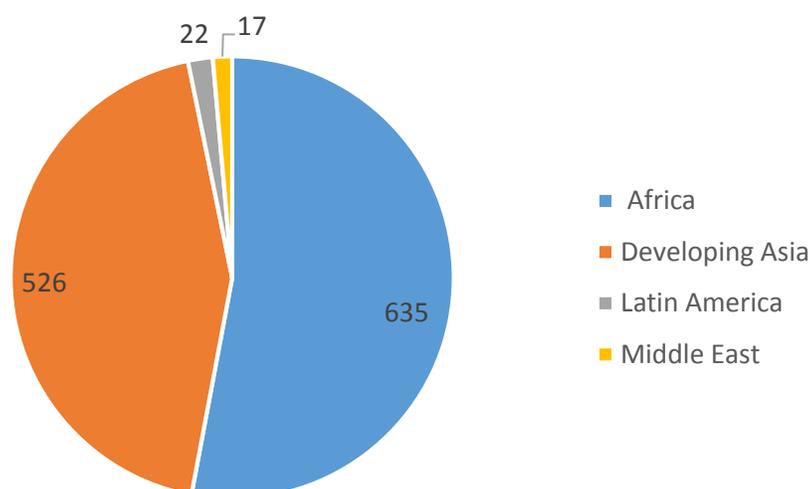
² International Renewable Energy Agency (IRENA). 2015. “Off-Grid Renewable Energy Systems: Status and Methodological Issues.” http://www.irena.org/DocumentDownloads/Publications/IRENA_Off-grid_Renewable_Systems_WP_2015.pdf

³ CLASP. 2015. “EA+EE: Using Energy Efficiency to Enhance Energy Access.” <http://clasp.ngo/en/Resources/Resources/Headlines/2015/EA-EE-Using-Energy-Efficiency-to-Enhance-Energy-Access>

II. Introduction

According to the International Energy Agency's (IEA) World Energy Outlook, approximately 1.2 billion people worldwide lack access to electricity – more than 95 percent of whom live in sub-Saharan Africa or developing Asia⁴ (Figure 1). An additional billion people lack access to consistent, reliable electricity and experience frequent losses of power.⁵

Figure 1: Global Population (Millions) without Electricity Access by Region (2013)



Source: IEA, World Energy Outlook 2015

For those without access to electricity, the primary sources of lighting are kerosene lamps and battery-operated flashlights.⁶ Most modern appliances that require electricity are out of reach, and women and children often spend between one and five hours every day collecting wood or other biomass for cooking and heating.⁷ Government and civil society have been supporting energy access efforts since the 1980s, and over the last decade, these efforts have benefitted from technology advances, falling prices, and more effective programs, which has contributed to an expansion of market-based activities delivering modern energy services for off-grid populations.

In September 2015, President Obama committed to meeting the U.N. Sustainable Development Goals, especially the seventh goal to ensure access to affordable, reliable, sustainable, and modern energy for all by 2030. Under the President's leadership, the United States has been working to ensure that developing countries and remote areas have effective tools at their disposal to achieve their low-carbon and resilient development objectives. Improving access to renewable energy solutions has direct positive

⁴ International Energy Agency. "Energy Poverty." Accessed Oct 2016. <http://www.iea.org/topics/energypoverty/>

⁵ IRENA, 2015

⁶ A.T. Kearney. 2014. "Investment and Finance Study for Off-Grid Lighting." *Global Off-Grid Lighting Association*. <http://global-off-grid-lighting-association.org/wp-content/uploads/2013/09/A-T-Kearney-GOGLA.pdf>

⁶ CLASP. 2015. "Clean Energy Access Program Overview."

⁷ World LP Gas Association. 2014. "Cooking with Gas: Why women in developing countries want LPG and how they can get it." http://energia.org/wp-content/uploads/2015/04/01.-WLPGA_-_Cooking_with_LP_Gas_Report_-_FINAL__PbP.pdf

effects on education and economic opportunities, while also reducing families' exposure to pollution, providing clean water access, and empowering farmers and families by providing them with the technology they need to stay connected and learn.

This report will briefly review the importance of energy access to achieving both development and climate goals. It will then examine the role that markets for off-grid energy solutions such as solar lanterns, solar home systems, and super-efficient appliances, which have expanded dramatically over the last decade, have played in improving access to modern energy services. Finally, it will highlight the role the U.S. Government has played in supporting these markets, and how particular initiatives can address key barriers to further market development.

III. Why Energy Access Matters

Economic Impacts of Energy Access

Access to high quality, reliable electricity results in greater productivity for everyone. Lighting alone is estimated to generate income gains of 5 to 16 dollars per month for poor households in developing countries.⁸ Energy access benefits in Bangladesh have been estimated to increase household income by up to 30 percent, with savings in the Philippines adding up to about 118 dollars per household per month.⁹ The economic benefits from energy access come from savings on expenditures such as lighting and mobile phone charging, as well as increased economic opportunities.

A significant part of the income gains from energy access is due to savings on kerosene. The United Nations Environment Programme (UNEP) estimates that consumers spend \$23 billion annually on kerosene for lighting and use a total of about 25 billion liters of kerosene every year. These numbers do not capture the full cost, as many governments subsidize kerosene, diverting funds from other critical government services. Though solar lighting tends to be more expensive upfront than kerosene lamps, UNEP estimates that these devices typically pay for themselves within a year.¹⁰ Moreover, many pay-as-you-go and consumer credit based sales models allow end users to buy pico-solar systems at a rate that is similar to their expenditures on kerosene and mobile phone charging.

Energy access can create jobs by enabling activities by small enterprises, such as mobile phone charging stations, and by allowing existing businesses to stay open in the evening to serve more customers. Evidence also shows that electrification increases the participation of women in labor markets.¹¹ Off-grid energy products, such as renewable energy powered water pumps – which can allow smallholder farmers to create irrigation systems and significantly increase their output and income – can transform lives and communities. Off-grid motors powered by small wind turbines or hydroelectric systems can run a variety of devices ranging from sewing machines and rice mills to drills and pumps, creating further economic opportunity. The educational benefits of energy access also increase economic opportunities: in Vietnam, electricity access was directly associated with a rise in schooling rates.

⁸ IRENA. 2012. "Renewable Energy Jobs & Access."

https://www.irena.org/DocumentDownloads/Publications/Renewable_Energy_Jobs_and_Access.pdf

⁹ World Bank. 2008. "Designing Sustainable Off-Grid Rural Electrification Projects: Principles and Practices."

<http://siteresources.worldbank.org/EXTENERGY2/Resources/OffgridGuidelines.pdf>

¹⁰ UNEP. 2013. "Sustainable Off- Grid Lighting Solutions Can Deliver Major Development and Climate Benefits." Accessed October 2015. <http://unep.org/newscentre/Default.aspx?DocumentID=2704&ArticleID=9407&l=en>

¹¹ *ibid.*

Productivity is boosted further with the health improvements created by modern energy access. Studies have found that burning kerosene is associated with an increased risk of asthma, allergies, cataracts, burns, and poisonings.¹² Severe burns resulting from structure fires and explosions of lighting fuel affect hundreds of thousands, killing approximately 24 percent of victims, and accidental ingestion of kerosene is the leading cause of child poisoning in Africa.¹³ Use of renewable energy technologies can reduce or eliminate the health risks associated with kerosene, biomass stoves, and diesel generators. Living with electricity also improves access to clean water and sanitation, and it can enable refrigeration of vaccines and use of medical equipment in rural health clinics.¹⁴

Climate Benefits of Energy Access

Increasing access to sustainable energy services has the potential to significantly cut greenhouse gas emissions and reduce the impacts of climate change. UNEP estimates that fuel-based lighting sources in developing countries produce 74 million tons of annual greenhouse gas emissions.¹⁵ However, this drastically underestimates the total global warming impact of fossil fuel-based lighting.

Kerosene lanterns and diesel generators also emit significant amounts of black carbon, a fine particulate pollutant with a powerful global warming effect. It is estimated that 270,000 tons of black carbon are emitted annually by kerosene lamps. Eliminating these emissions would be equivalent to eliminating five gigatons of carbon dioxide emissions over the next 20 years.¹⁶ In addition, replacing diesel-powered generators that supply power to off-grid areas with solar home systems or renewable energy-powered mini-grid systems also would provide significant climate benefits. Such systems would enable households to generate and store their own electricity while also enhancing community resilience by maintaining power during an extreme event.

The climate benefits of energy access are particularly important to note because development and protecting the climate are often framed as unavoidable tradeoffs. In fact, in the new landscape of energy access, there are more synergies than tensions. Without access to energy services (via a connection to the national grid, mini-grids, solar home systems, or solar lights), households will continue to use energy from inefficient biomass stoves, kerosene lamps, and diesel generators. Catalyzing and facilitating the market so that more people have access to modern energy services through efficient renewable-energy powered appliances can lead to local and global energy system shifts that will be better for the climate, as well as health and development. Scaling the market for distributed off-grid renewable energy systems and the highly efficient appliances that are best coupled with them may well lead to innovations and technological advancements with significant global climate benefits.

¹² Climate and Clean Air Coalition. 2014. "Scientific Advisory Panel Briefing: Kerosene Lamps & SLCPs." <http://www.unep.org/ccac/Portals/50162/docs/ccac/NOV2014-SAP%20Kerosene%20briefing.pdf>

¹³ United Nations Environment Programme (UNEP). 2014a. "Light for Life: Identifying and Reducing the Health and Safety Impacts of Fuel-Based Lighting."

¹⁴ IRENA, 2015

¹⁵ UNEP, 2013

¹⁶ Jacobson, *et al.* 2013. "Black Carbon and Kerosene Lighting: An Opportunity for Rapid Action on Climate Change and Clean Energy for Development." *The Brookings Institution*.

IV. Off-Grid Products are Scaling Up to Deliver Energy Access

The market for off-grid quality-assured products and off-grid energy solutions – such as solar lights, solar home systems, mini-grids, and off-grid compatible appliances – is growing rapidly, driven by efficiency gains and falling costs. U.S. Government initiatives and partnerships with institutions, such as the World Bank Group and the United Nations, have also played an important role in the development of this market.

Low-Cost Energy-Efficient Energy Access Solutions

A number of renewable energy-powered off-grid solutions provide access to a variety of energy services: from pico-solar products that provide lighting to a home, to larger solar home systems that can power several appliances, to technologies that assist with a particular process such as pumping water, to mini-grid systems that can power a small village with electricity comparable to or better than grid-provided power. Figure 2 below highlights some renewable off-grid technologies and their applications.

Figure 2: Examples of Off-Grid Renewable Energy Systems and Applications

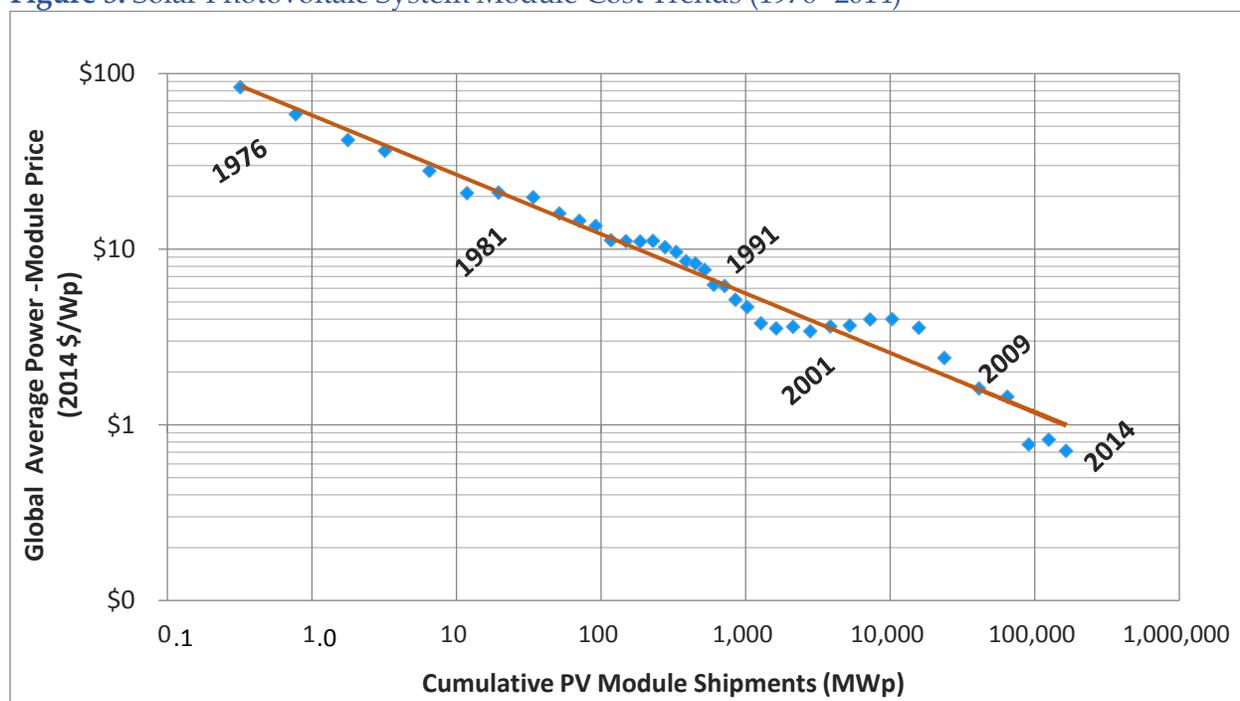
Type of Off-Grid Renewable System	Energy Service					
	Lighting	Appliances (refrigeration, fans, cooking, irons, etc.)	Communications (TVs, radios, phone, internet)	Heating & Cooling (Hot water, crop drying)	Process Power (Small Industry)	Water Pumping (Agriculture, drinking water)
<i>Pico-Solar Products</i>	X		X			
<i>Solar Home Systems</i>	X	<i>some</i>	X		X	
<i>Solar Thermal</i>				X		
<i>Solar Pumps</i>						X
<i>Small/Micro Hydro</i>	X	X	X			
<i>Small Wind Turbines</i>	X	X	X		X	X
<i>Biogas digesters</i>	X		X	X		
<i>Biomass Gasifier</i>	X	X	X	X	X	X
<i>Mini-grid Systems</i>	X	X	X	X	X	X

Source: IRENA, 2012

In recent years, the renewable energy technologies and battery storage systems that power off-grid systems have advanced rapidly toward increasing quality at decreasing costs. For example, solar panel prices have declined sharply over time, decreasing by more than 85 percent over the last decade. As a result, they now often account for less than one-quarter of the overall cost of an off-grid solar home system. The cost of lithium-based batteries has come down considerably in the past few years, and many off-grid energy companies are making a transition to this technology. Figure 3 below shows how solar photovoltaic module costs have decreased dramatically – costing one percent of what they did 38 years ago.¹⁷

¹⁷ Sunshot. 2015. “Q1/Q2 2015 Solar Industry Update.” U.S. Department of Energy

Figure 3: Solar Photovoltaic System Module Cost Trends (1976 -2014)



Source: Sunshot, 2015

Energy efficiency plays an important role in energy access by maximizing the provision of energy services (such as lighting, cooling, entertainment, or cell-phone charging) while minimizing costs of energy supply.¹⁸ Efficient products reduce the maximum load requirements on a system, which reduces the amount of renewable energy generation capacity needed to provide that service. Since investments in new energy supply account for the vast majority of energy access costs, the reduced need for power generation made possible by using energy efficient off-grid products results in an overall reduction in costs and the prices consumers face.¹⁹

Super-efficient technologies, such as LED lighting, already are fundamentally reshaping and accelerating global efforts to deliver modern energy services to under-served communities.²⁰ The benefits of energy efficiency can be seen in the cost of a solar home system, which has declined over time due to both lower solar panel and battery costs and more efficient appliances.

Common appliances used in households with a solar home system are lights, TVs, radios, fans, and mobile phone chargers. A recent analysis suggests that super-efficient appliances can reduce the total cost of providing off-grid electricity services by as much as 50 percent.²¹ Figure 4 below illustrates the decreasing cost trends in solar home systems and highlights how super-efficient appliances can further reduce the costs of providing energy services.

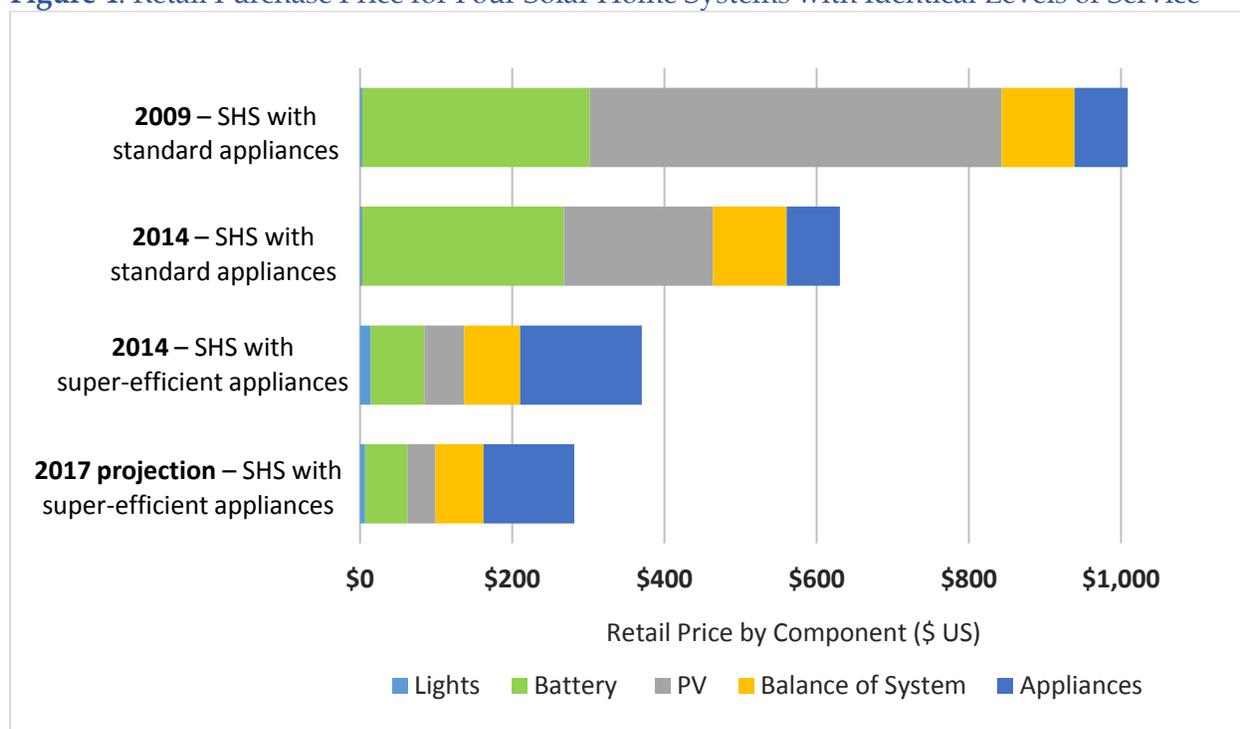
¹⁸ CLASP and World Bank. 2015, "EA+EE: Enhancing the World Bank's Energy Access Investments Through Energy Efficiency." <http://documents.worldbank.org/curated/en/2015/07/24819836/eeee-enhancing-world-bank%E2%80%99s-energy-access-investments-through-energy-efficiency>

¹⁹ CLASP, 2015

²⁰ Global LEAP. 2015a. "EA+EE: Clean Energy Access and Super-Efficient Off-Grid Appliances"

²¹ Global LEAP. 2015b. The Global LEAP Awards: Identifying the World's Best Off-Grid Appliances."

Figure 4: Retail Purchase Price for Four Solar Home Systems with Identical Levels of Service



Source: Phadke, A. et al., 2015

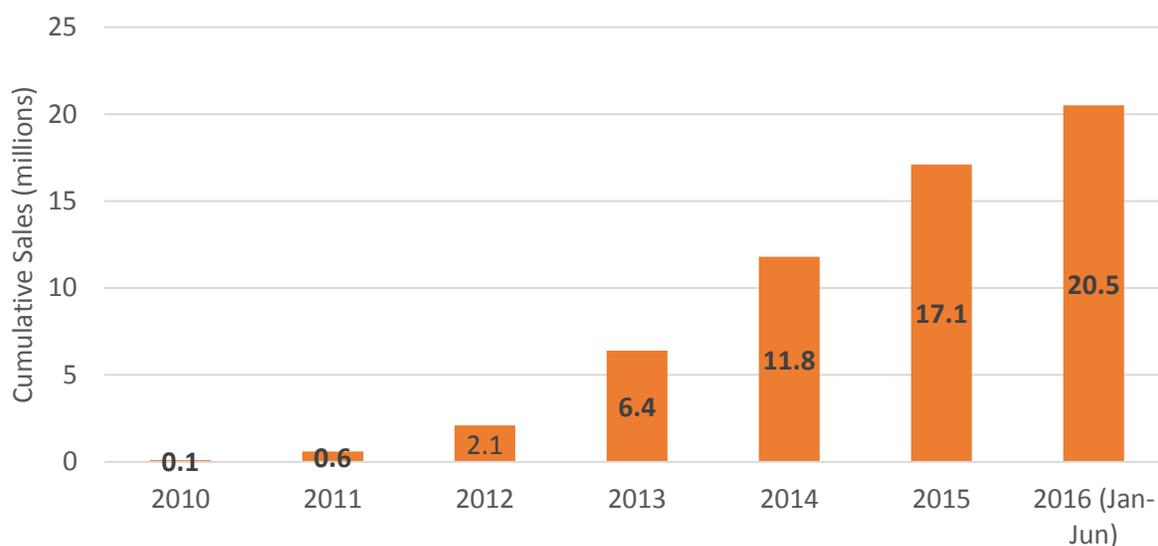
The different systems above would each power bright lighting for four hours; a 19-inch, color television for four hours; a small portable radio for six hours; and one charge of a basic mobile phone. The component specifications for the 2009 and 2014 systems with standard appliances are very similar, but the 2014 system is significantly less expensive due to the significant cost reduction in solar panels over the past several years. The difference in the component specifications between the 2014 systems with or without super-efficient appliances is significant – the number of watt-hours needed per day, the solar panel size, and the battery size are each almost five times smaller. Though the appliances and lighting are more expensive, due to being more advanced and efficient technology, the overall price of the unit is over 200 dollars less. In 2017, the price is projected to decline even more.

The Market for Efficient Off-Grid Products is Growing Rapidly

Thanks in large part to falling technology costs, the use of pico-solar products has grown rapidly in off-grid areas, with over twenty million quality-assured products sold since 2009.²² Pico-solar products are providing lighting to millions of people without electricity, including both portable solar lanterns that are charged with an attached solar panel and small solar panels that attach to a roof and power a few lights in a home. Increasingly, many of these products also have charging ports for mobile phones or other devices. Figure 5 below shows the rapid growth in Africa alone, where annual sales have more than tripled in the last few years.

²² Lighting Global, 2016a

Figure 5: Cumulative Sales of Quality-Assured Pico-Solar Products in Africa (2010-June 2016)



Source: Global Off-Grid Lighting Association, 2016²³

Pico-solar products are only the beginning of providing sustainable energy services to off-grid households. Larger solar home systems can provide households with enough energy to power a number of key appliances, provided those appliances are energy-efficient. Given the superior lighting and income-savings that pico-solar products provide, once families have access to and become comfortable with solar lanterns, they are likely to want to acquire additional appliances powered by solar home or mini-grid systems (Figure 6). The successful business models of solar home system companies operating in East Africa utilizing pay-as-you-go for customers to finance their solar home system and associated off-grid appliances, such as MKOPA and Off Grid Electric, support this link. These companies report customers upgrading their system and/or adding additional efficient appliances through additional financing once the initial system is fully paid for, which reinforces the importance of efficient off-grid appliances. The exceptional growth rate of solar lanterns likely foreshadows broader growth in the off-grid market, including efficient off-grid appliances.

Figure 6: An Example Path of Off-Grid Energy Access

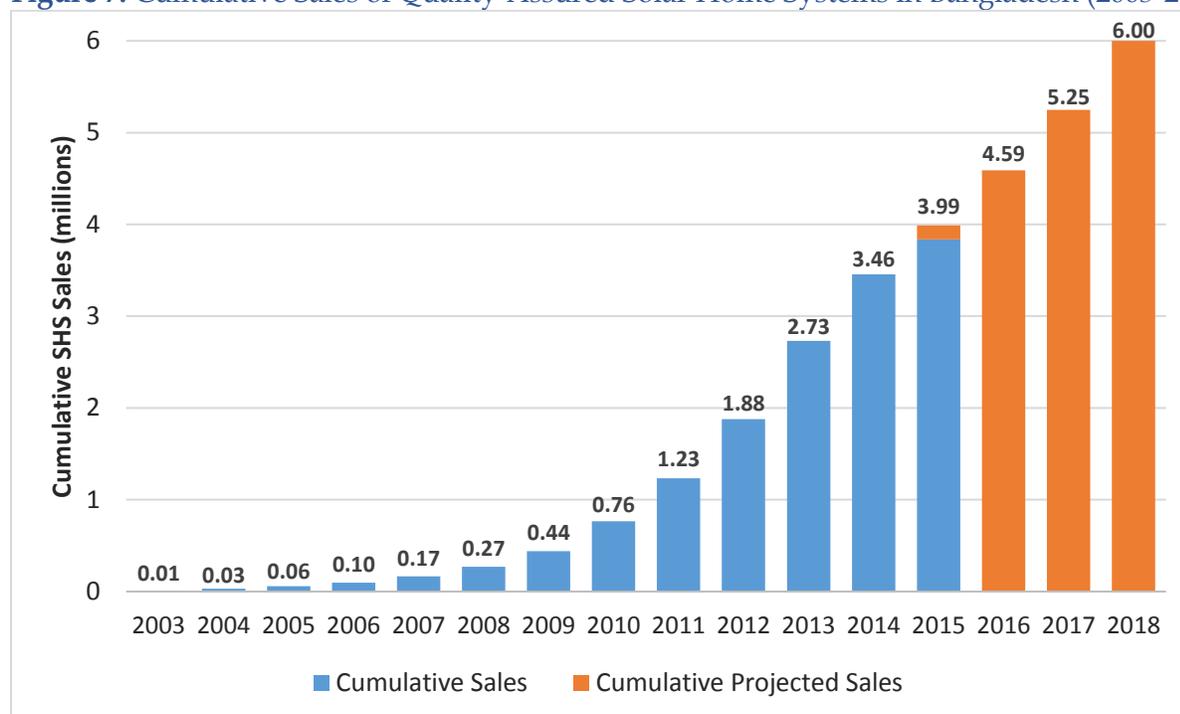


Source: Global LEAP, 2015

²³ Global Off-Grid Lighting Association. "Global Solar Off-Grid Semi-Annual Market Report, January-June 2016." October 2016. https://www.lightingglobal.org/wp-content/uploads/2016/10/global_off-grid_solar_market_report_jan-june_2016_public.pdf

In fact, we already are seeing rapid adoption of solar home systems, particularly in Bangladesh (Figure 7), where the Infrastructure Development Company Limited (IDCOL) began financing and promoting a solar home system program in 2003. Through IDCOL, the program establishes and enforces technical standards, certifies products and components, and authorizes companies that pass strict eligibility criteria. To date, approximately 4 million solar homes have been installed under the program, serving almost 18 million people.²⁴ The success of the Bangladeshi model highlights the importance of providing financing and enforcing quality assurance standards in tandem.

Figure 7: Cumulative Sales of Quality-Assured Solar Home Systems in Bangladesh (2003-2018)



Source: IDCOL, 2015²⁵

Additionally, there has been a recent trend towards the development of standardized, “plug-and-play,” solar home system kits, which can greatly reduce labor costs associated with system installation by reducing the need for technical assistance for most off-grid customers. This approach may not work effectively in all cases, but, where applicable, can provide measurable cost savings for many off-grid customers. Additionally, standardization and centralized production of complete systems can reduce component mismatch issues and enable better control of overall system quality.²⁶

The Future of the Off-Grid Products Market

For a preview of where the market for off-grid clean energy products and services might go over the next few decades, the mobile phone market provides insight. Technology improvements, falling costs, and new distribution models have allowed the mobile phone to hit more than 7 billion subscriptions

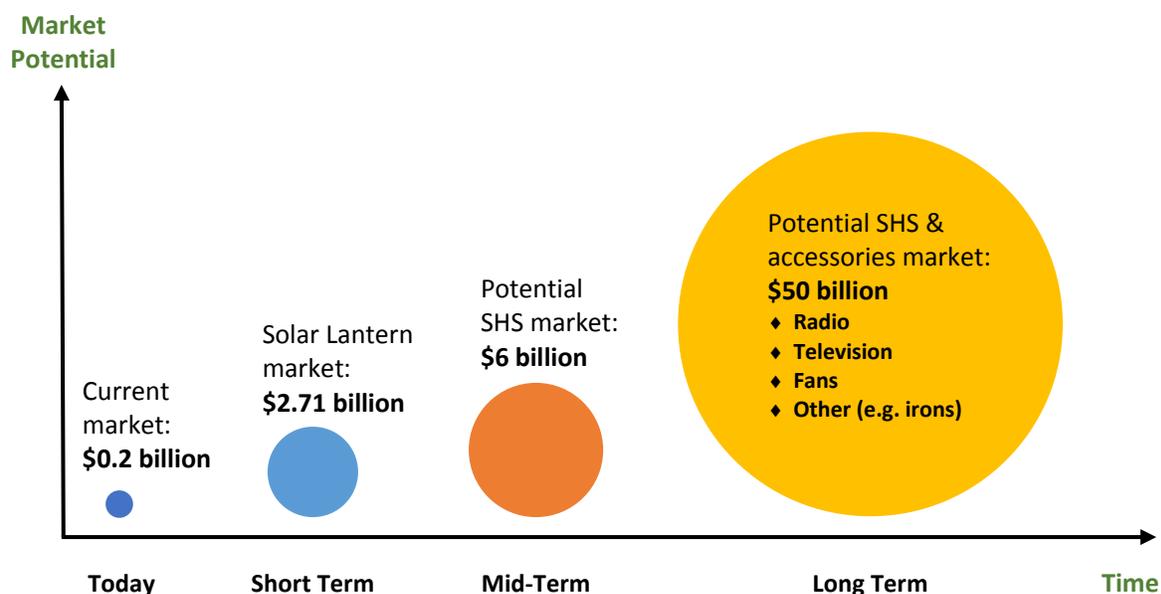
²⁴ IDCOL. “Solar Home System Program.” Accessed Oct 2016. <http://idcol.org/home/solar>

²⁵ Malik, Mahmood (Executive Director & CEO of IDCOL). 2015. Email message.

²⁶ Phadke, A., et al. 2015. “Powering a home on Just 25 Watts of Solar PV: Super-Efficient Appliances Can Enable Expanded Off-Grid Energy Service Using Small Solar Power Systems” *Berkeley National Laboratory*

worldwide.²⁷ These same drivers already are generating the rapid growth we have seen in the off-grid energy market. This growth is expected to continue, especially as people move up the energy staircase from solar portable lanterns to small off-grid systems that can power a few lights and a small radio to larger home and mini-grid systems that can power several efficient appliances. Figure 8 highlights the promising trends found in a report prepared for the Global Off-Grid Lighting Association, which projects a 30-fold increase in the market for solar lighting and basic solar home systems in the mid-term, with the long-term market for full-service off-grid systems reaching \$50 billion.²⁸

Figure 8: Market Potential for Off-Grid Solar Lighting, Home Systems, and Accessories



Source: A.T. Kearney, 2014

A market analysis commissioned by the U.S. Department of Energy, under the Global LEAP program, also found exciting results for future market growth in off-grid solar portable lanterns and solar home systems. The report concluded that combined global unit sales of solar lights and solar home systems would grow to over 64 million annually by 2024, up from 8.2 million in 2014. The revenue from these sales would grow to over \$2.1 billion in 2024 from \$538 million in 2014.²⁹

Additionally, the analysis found that the total off-grid market in the Asia Pacific region is expected to reach approximately \$990 million in 2024, with most of the revenue coming from solar home systems. Even larger are the projections for Africa's market, which is expected to reach \$1.1 billion in 2024, mostly due to growth in pico-solar products. However, Africa's market also will experience growth in solar home

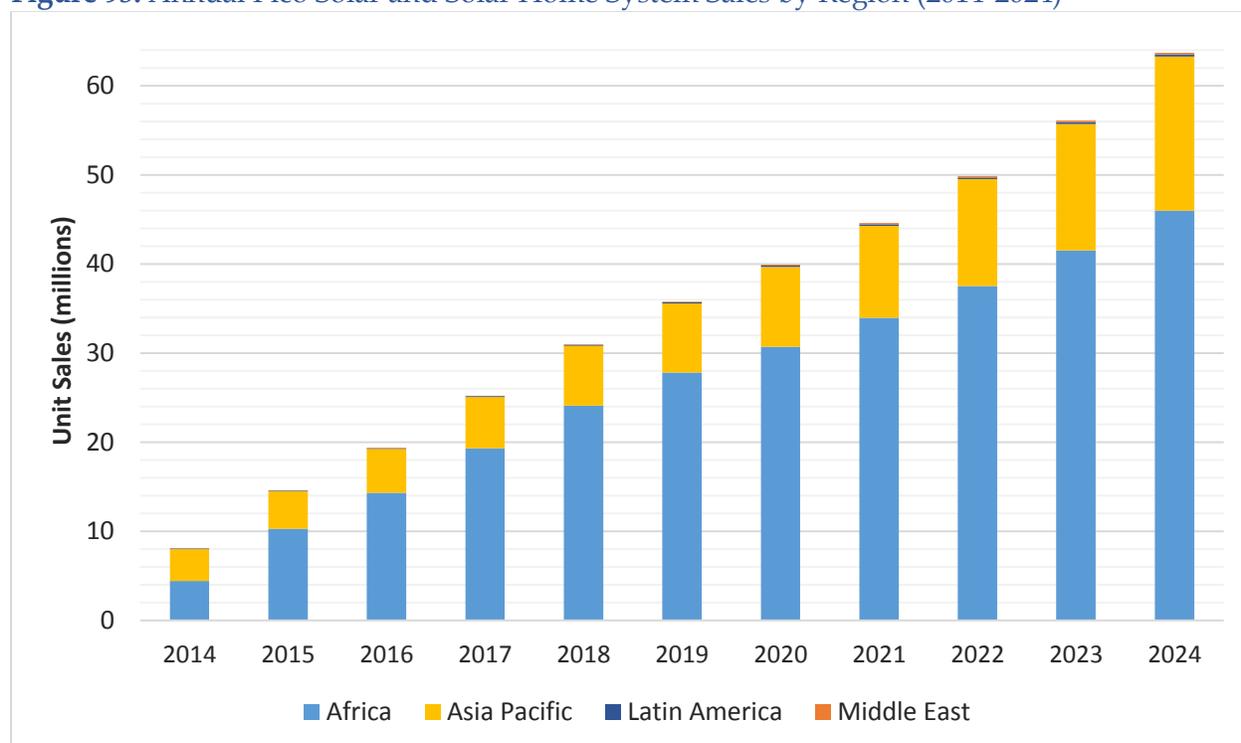
²⁷ International Telecommunication Union. "ICT Facts & Figures: The World in 2015." <https://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2015.pdf>
http://www.un.org/wcm/webdav/site/sustainableenergyforall/shared/Documents/SG_Sustainable_Energy_for_All_vision_final_clean.pdf

²⁸ A.T. Kearney, 2014

²⁹ Navigant Consulting and Clean Energy Ministerial (CEM). 2015. "Analysis of the Potential Future of the Lighting Global Quality Assurance Program." www.cleanenergyministerial.org/Portals/2/pdfs/Potential_Future_of_the_Lighting_Global_QA_Program.pdf

systems as people continue to move up the energy staircase.³⁰ Figure 9 depicts regional growth trend results from the report for annual pico-solar and solar home system sales.

Figure 93: Annual Pico Solar and Solar Home System Sales by Region (2014-2024)



Source: Navigant Consulting, 2015

Key Drivers and Challenges of Future Market Growth

Several drivers will continue to propel the market for super-efficient off-grid appliances, solar home systems, and standardized mini-grids. We believe the most critical drivers will be the cost of off-grid renewable energy and appliances; further technology advancements in renewables, battery storage, and appliance end-use efficiency; access to finance; and quality assurance. While trends for these market drivers are promising, they are not without challenges that must be addressed to ensure future market growth.

Falling costs and technology advancements. A key component behind the projected growth in off-grid energy systems is that the falling cost trends and technology advances of renewable energy and battery storage technologies discussed above are expected to continue, though they are not projected to decline at the same rapid rate. Even with falling costs, most of the cost of off-grid energy is still attributable to energy supply. Thus, another important driver for the off-grid market is the development of super-efficient off-grid appliances and standardized solar home and mini-grid systems that radically reduce the need for energy supply and the labor and after-market service costs of installing it. With less expensive energy supply, storage, and efficient appliances, the costs of off-grid energy services can be dramatically lowered, opening up vast new markets of consumers who could otherwise not afford them.

³⁰ Navigant Consulting and CEM, 2015

As efficient appliances are introduced into the market and deployed in off-grid areas, more households and businesses will begin the progression along the energy services spectrum. This upward momentum also will drive growth in the off-grid market, as more customers demand access to more services beyond the basics, such as air conditioning, electric cooking, or small business activities. Since customers are in the market for energy services, such as lighting and refrigeration, not the energy itself, they will prize off-grid products that maximize the amount of services provided at the least cost. Additionally, having a range of efficient appliances and off-grid systems creates the opportunity to market bundles of energy services that can be scaled to meet different consumer needs. This ability to maximize energy services with scalable solutions for home versus business use will attract more customers to the market, and drive the adoption of off-grid energy solutions. Standardized, scalable, off-grid package systems help ensure that the delivered systems include super-efficient appliances, thereby enabling manufacturers and retail buyers alike to capture the cost-saving benefits of appliance efficiency.³¹ The development of standardized or “plug-and-play” types of off-grid systems will also ease the installation process, cut overall costs, and reduce the technical skill requirements needed for operation and maintenance.

Access to finance. For consumers, the up-front costs of off-grid clean energy technologies often are larger than fossil fuel alternatives (e.g., the purchase price of a solar lantern is higher than for a kerosene lamp). Even when cleaner technologies create income gains in the long run, the upfront cost can be prohibitive. However, pay-as-you-go mechanisms, made feasible by mobile technology, make off-grid products significantly more affordable. Pay-as-you go systems often include microloans, paid off gradually over time, or monthly payment systems for an appliance purchase or energy used from a mini-grid. Though the upfront cost of off-grid energy is out of reach for many of the world’s poorest people, pay-as-you-go systems enable consumers to buy products that are affordable according to their weekly or monthly budgets. Money that would have gone to buy kerosene or charge mobile phones can go toward making payments. Additionally, pay-as-you go financing systems enable customers to upgrade their products after a few years, creating repeat customers who are moving up the energy staircase.³² The payment enforcement rules in some pay-as-you-go systems present new opportunities for remote monitoring to identify service needs and better understand user behavior.³³

Though pay-as-you-go systems have become more widespread, the idea of financing high upfront costs with incremental gains over the long run is still a challenge for many consumers. Furthermore, clean and sustainable products are not always cheaper in the end, particularly when fossil fuels are subsidized as kerosene is in many countries. Though switching to clean, modern energy has significant benefits, if fossil-fuels are subsidized enough, it may not be in their immediate financial interests to switch to cleaner energy sources. For example, if kerosene is subsidized at 50 percent, the payback time for solar replacement systems is effectively doubled.³⁴ Furthermore, free or subsidized off-grid products can spoil the market for businesses trying to sell the products at a competitive price, because even if consumers initially were willing to pay the market price, the availability of free products makes them less inclined to do so. This can discourage new businesses from entering the market, leading to less competition and innovation that would otherwise drive down prices and increase quality for consumers.

Furthermore, access to finance is crucial for suppliers, so that they can develop and sell off-grid products. SEforALL has reported that sources of financing for companies in this market are limited and often poorly

³¹ Phadke, A., *et al.*, 2015

³² Navigant Consulting and CEM, 2015

³³ Phadke, A., *et al.*, 2015

³⁴ UNEP, 2014b

coordinated. Smaller-scale projects have high transaction costs relative to their expected return, causing traditional investors to be less interested.³⁵ Additional impediments to producers entering the market include a lack of existing distribution channels, limited data on these markets, and scant availability of research and insight about the market potential. The recent declines in the cost of off-grid systems only have been possible due to large investments in research and financial incentives to bridge the risky, initial cost gaps for entrepreneurs. Consumers have reaped these benefits as well, and continued expansion of existing efforts to address financial challenges are critically important to ensure continuation of these trends.

Quality assurance. Since purchasing an energy system generally represents a large investment of very limited income for most people living and working in off-grid communities, consumers want to ensure their investment is worthwhile. Therefore, quality-assured products and standards are essential to the growth of off-grid energy markets because they help ensure that the energy service investments are delivered as promised. Experiences with inferior products and the companies selling them are quickly shared with others, decreasing consumer confidence and undermining efforts to build self-sustaining, robust commercial off-grid markets.³⁶ Market spoilage can occur if a large segment of consumers, who might have been interested in purchasing off-grid energy products, turn away from the entire market because of a bad experience with one product. Often, poor-quality products are sold to consumers who are either not aware of quality-assured products or who believe the low-quality product they are purchasing is quality-assured (e.g. counterfeits or lower-quality copycats).

As the market for efficient off-grid appliances expands, it has become increasingly attractive for manufacturers to enter the space, including those of counterfeits and low-quality products, who may be able to undercut quality-assured manufacturers on price and increase the risk of market spoilage.³⁷ Thus, in addition to creating quality-assured products, programs that set quality-assurance standards help increase consumer confidence in the products purchased and ensure that poor-quality products do not spoil the market for off-grid energy. However, countries vary with the extent to which their governments encourage the sale of efficient off-grid energy and quality-assured appliances, making it easier for quality-assured producers to operate in some regions than others. Engaging governments around import regulations and linking these to quality-assured products can help keep out poor quality or counterfeit products.

V. The U.S. Government's Role in Supporting Markets for Off-Grid Energy Solutions

The U.S. Government, in partnership with other governments, the World Bank Group, international institutions, the private sector, and civil society partners, has played an important role in catalyzing the rapidly growing market for efficient, quality-assured off-grid energy solutions. Through tens of millions of dollars in direct support for programs such as Global LEAP and activities such as early stage project preparation support, the U.S. Government has been able to leverage hundreds of millions dollars in debt financing from OPIC and private investors, and attract more than a billion dollars in commitments from partners.

³⁵ Ki-moon, Ban. 2011. "A Vision Statement by Ban Ki-moon, Secretary General of the United Nations – Sustainable Energy for All."

³⁶ Global LEAP, 2015b

³⁷ Navigant Consulting and CEM, 2015

Below are brief description of some of the many initiatives that the U.S. Government (USG) has led or supported; further details on these initiatives can be found in the Appendix.

Clean Energy Ministerial’s Global Lighting and Energy Access Partnership (Global LEAP):³⁸ Global LEAP works to catalyze the development of commercial markets for efficient, high quality, and affordable clean energy access solutions. It has supported the deployment of quality-assured products by, among other activities, developing and encouraging the adoption of the Guiding Principles and supporting the quality assurance framework of the World Bank’s Lighting Global initiative, which has helped enable the sale of more than 20 million quality-assured off-grid solar lighting products globally. Additionally, the Global LEAP Awards promote efficient off-grid appliances. Since 2009, the U.S. government has invested \$9 million in support of Global LEAP and related actions.

Lighting Asia/India: Lighting Asia/India is a market-transforming program with the objective of promoting both the value and presence of modern lighting for the off-grid population in rural India. The Department of State provided a \$3 million grant to the International Finance Corporation (IFC) in support of the Lighting Asia/India program as part of the larger Global LEAP initiative of the CEM.

Power Africa – “Beyond the Grid” Initiative: Power Africa: In June 2013, President Obama announced Power Africa — an innovative partnership to double access to electricity in sub-Saharan Africa. In recognition that Power Africa cannot meet its energy access goals through additional large-scale power capacity and grid extension projects, Power Africa launched “**Beyond the Grid**” in June 2014, a sub-initiative focusing on expanding off-grid and small-scale energy solutions across sub-Saharan Africa by unlocking investment in these markets. Beyond the Grid’s over 40 partners have committed more than \$1 billion to unlock investment and growth for off-grid and small-scale energy solutions for millions of households, businesses, and public facilities across sub-Saharan Africa.

Scaling Off-Grid Energy Grand Challenge: Power Africa and USAID's U.S. Global Development Lab, in partnership with the U.K. Department for International Development and the Shell Foundation, are launching Scaling Off-Grid Energy: A Grand Challenge for Development, an investment of \$36 million to empower entrepreneurs and investors to grow a market to connect 20 million households in sub-Saharan Africa that live beyond the reach of the electricity grid with modern, clean, affordable electricity.

Sustainable Energy for All (SEforALL): The U.S. Government has been a primary supporter and partner of the SEforALL initiative, which was launched by the UN Secretary General (SYG) on November 1, 2011 as part of the 2012 International Year of Sustainable Energy for All.

Silicon Valley Tech Challenge – Accelerating Access to Clean Energy Around the World: The U.S. Department of State has launched an initiative to engage the technology and innovation community on accelerating access to clean energy in emerging markets. The State Department is working with a number of companies and organizations to identify and launch projects to address key challenges to off-grid clean energy access; these partnerships, will develop new technology tools, financing mechanisms, and mentoring opportunities for promising clean energy start-ups in emerging markets.

³⁸ The Clean Energy Ministerial (CEM) is a high-level global forum to promote policies and programs that advance clean energy technology, share lessons-learned and best practices, and encourage the transition to a global clean energy economy. Global LEAP is the energy access initiative of the CEM: www.globalleap.org

U.S.-Africa Clean Energy Finance Initiative (ACEF): ACEF is an innovative financing program developed by the Overseas Private Investment Corporation (OPIC), the U.S. Government's development finance institution; the U.S. Department of State; the U.S. Trade and Development Agency; and the U.S. Agency for International Development. Its goal is to catalyze private sector investment in clean energy projects in Africa by providing support for early-stage project development costs. Through US-ACEF, USTDA and OPIC have approved funding for 33 clean energy projects in 10 countries throughout sub-Saharan Africa. That represents nearly \$1.5 billion in potential public and private capital and approximately 358 MW in new renewable power capacity.

Debt financing for off-grid projects: Since 2009, OPIC has supported 18 off-grid energy project providers in India, Sub-Saharan Africa, and Latin America through nearly \$155 million in debt financing commitments. OPIC has debt financing available to support strong off-grid and distributed energy providers that offer market-based consumer solutions like solar home kits, village-level mini- or micro-grids, or commercial and industrial solar rooftop systems.

U.S.-India Clean Energy Finance Initiative: OPIC and the Government of India have agreed to launch a \$20 million distributed solar facility in partnership with leading philanthropies. Known as the U.S.-India Clean Energy Finance initiative (USICEF), the facility will address a key financing gap in the Indian distributed solar market by funding early-stage project preparatory work. USICEF is anticipated to unlock up to \$400 million in long-term debt financing from OPIC and private sector investors.

Promoting Energy Access through Clean Energy (PEACE): The U.S. Government and India launched Promoting Energy Access through Clean Energy (PEACE) in September 2013 as an initiative of the U.S.-India Partnership to Advance Clean Energy (PACE). PEACE's four focus areas are building the off-grid ecosystem, mobilizing finance, innovation and quality assurance, and skills development. In September 2015, USAID/India launched a new public-private partnership that will work to mobilize \$41 million in finance to support clean energy entrepreneurs.

Benin Power Compact: The Millennium Challenge Corporation (MCC) is partnering with Benin through a \$375 million compact grant agreement designed to transform the West African country's power sector. The Benin Power Compact will fund infrastructure investments for both on- and off-grid users. The compact's Off-Grid Electrification Project is MCC's largest off-grid electrification effort to date and will support policy reforms as well as infrastructure financing through a grant matching facility.

Green Propensity Project: The MCC also has a \$600 million compact in Indonesia, designed to address critical constraints to economic growth while supporting the Government of Indonesia's commitment to a more sustainable, less carbon-intensive future. The compact's ambitious Green Prosperity Project is focused on increasing access to clean and reliable energy in rural areas. MCC is funding up to eight mini-grids with a total value of \$45 to \$50 million and a total capacity of 8.2 MW, as well as 22 separate grants that includes household solar systems, household biodigesters and pico-hydro plants.

Leveraging multilateral funds: The United States has contributed \$50 million to the Climate Investment Fund – Scaling up Renewable Energy Access in Low Income Countries Program which supports clean energy investments in low income countries with low levels of energy access. Altogether the fund has \$525 million in resources, and half of the investments will be focused on the off-grid and mini-grid space.

How USG & Partner Efforts Address Key Drivers and Challenges of Future Market Growth

While the programs listed above support off-grid energy services markets broadly, below are some of the ways the U.S. Government and partner organizations are specifically addressing the key challenges and drivers identified for the off-grid energy services market.

Falling costs and technology advancements. Efforts taken by the U.S. government to accelerate the development and lower the costs of clean energy broadly have benefits for energy access efforts, even when not directly targeted at the off-grid space. For example, Mission Innovation, a partnership of twenty countries and the European Union, aims to “accelerate the pace of clean energy innovation to achieve performance breakthroughs and cost reductions to provide widely affordable and reliable clean energy solutions that will revolutionize energy systems throughout the world over the next two decades and beyond.” Participating countries will seek to double their government-directed clean energy research and development investment over five years, focusing on transformational clean energy technology innovations that can be scaled to varying economic and energy market conditions. Additionally, technology advancements in energy efficiency are furthered by the market-shaping policy work of programs such as the Super-Efficient Equipment and Appliance Deployment (SEAD) initiative of the Clean Energy Ministerial and the International Partnership for Energy Efficiency Cooperation. SEAD aims to make it easier for governments and the private sector capitalize on the opportunity that appliance and equipment efficiency provides to reduce energy demand and carbon emissions while lowering energy costs, through activities such as standards and labeling, advancing best practices in public procurement of energy efficient products, and encouraging the production and sale of super-efficient products through an awards program.

Access to finance. The U.S. Government is actively engaging in programs and partnerships to address the issue of access to finance in off-grid energy services markets, such as the Global LEAP results-based financing program and the U.S.-India Clean Energy Finance Initiative. Additionally, Global LEAP, Energising Development, the International Finance Corporation, and CLASP created an innovative, results-based financing program to increase access to finance and promote the efficient energy off-grid appliance market. Through this program, solar home system companies in target regions that take the initiative to purchase and market large quantities of Global LEAP award winner or finalist appliances (selected for their energy efficiency, performance, and quality) will receive incentive payments. This program is expected to help catalyze the market for super-efficient off-grid appliances, enabling productive new partnerships between appliance manufacturers and off-grid companies, making it less risky for new manufacturers to enter the market, demonstrating the “bankability” of these purchases to commercial lenders, and more. Through partnership with Power Africa and the U.K. Department for International Development, Global LEAP will expand this program to East Africa. Power Africa is also addressing the issue of access to financing through the Scaling Off-Grid Grand Challenge, which will include new funding opportunities, as well as providing funding to grow existing financing mechanisms such as the African Development Bank’s Sustainable Energy Fund for Africa and the European Union’s ElectriFI. Finally, the U.S.-India Catalytic Solar Finance Program (CSFP) provides an example of an innovative financing model: it will raise and deploy up to \$40 million in high-impact catalytic capital, to be sourced equally from U.S. foundations and the Government of India, in support of investments into India’s solar market with a particular focus on the off-grid and solar rooftop markets. CSFP’s flexible capital will enable commercially-oriented capital to flow into new, innovative, and high-impact projects, and it is anticipated to mobilize up to \$1 billion in capital flows.

Quality assurance. Programs that set quality-assurance standards will both help create quality-assured products and increase consumer confidence in the products purchases and ensure that poor-quality

products do not spoil the market for off-grid energy. For example, the Lighting Global program requires its products to meet a set of quality standards that establish a baseline level of quality, durability, and truth-in-advertising to protect consumers.³⁹ Since being launched in 2009, the program has tested over 200 commercial off-grid solar products using its Quality Test Method, and 145 products have been found to meet the Lighting Global Quality Standards. Lighting Global also conducts market surveillance testing of products that have already met the program's standards to ensure that the products continue to perform as expected. Out of 57 products re-tested through the market surveillance effort, four have had their quality-assured status revoked based on the evaluation.⁴⁰ Government bureaus of standards in countries including Kenya and Ethiopia have adopted national standards that are harmonized with the Lighting Global Quality Standards, and a number of other countries are considering similar measures. Global LEAP has also been working to increase quality standards by sponsoring research and analysis related to the development of the Lighting Global Quality Assurance program and by supporting the development of the Global Off-Grid Lighting Association, an industry association that provides a framework for stakeholder engagement.⁴¹ Global LEAP is also leading efforts to develop a quality assurance framework for mini- and micro-grids in energy access contexts. The Global LEAP Guiding Principles, which address both quality assurance and other key market drivers, are on the next page.

³⁹ Lighting Global. 2015. "Quality Standards." Accessed Oct 2015. <https://www.lightingglobal.org/qa/standards/>

⁴⁰ Lighting Global. 2016b. "QA Statistics." Accessed Oct 2016. <https://www.lightingglobal.org/qa/statistics/>

⁴¹ CEM. 2015. "Global Lighting and Energy Access Partnership." Accessed Oct 2015. <http://www.cleanenergyministerial.org/Our-Work/Initiatives/Energy-Access/Activities>

Global LEAP Guiding Principles

- ✦ The goal of energy access for all by 2030 as articulated by the UN-led Sustainable Energy for All campaign is achievable; access to modern energy exists along a continuum that begins at the household level with basic energy services related to lighting, cooking, and communication, and also includes energy for economically productive agricultural and commercial activities.
- ✦ Affordable, quality-assured energy products and services are important to support socioeconomic development and improved quality of life for the more than one billion people worldwide who lack access to modern energy.
- ✦ Commercial markets offer an opportunity to complement public sector-led efforts at electrification because they leverage private investments and frequently offer quick and scalable means for improving access to energy.
- ✦ Delivery approaches should strive to be self-sustaining, which means that subsidies—when used at all—should be carefully tailored to focus on those markets or market segments that are not immediately commercially viable (e.g., the poorest and most remote areas) and designed to minimize distortions to commercial markets.
- ✦ There is a need for activities that address key market barriers, such as buyer access to information about product quality and access to finance across the supply chain, in order to bring more affordable products to market faster.
- ✦ There is a need to build capacity and to develop and evaluate alternative business models aimed at delivering modern energy access to a diverse set of end users.
- ✦ There is a need to integrate energy efficiency principles into the design and implementation of all projects, because the energy saved can reduce costs (thereby increasing the affordability of energy access) and free up additional energy for productive purposes.
- ✦ Quality assurance programs are generally most effective when implemented through performance-based approaches that are broadly harmonized and coordinated internationally. Programs should seek to ensure quality over the lifetime of the system and promote sustainability and longevity at all points along the supply chain.
- ✦ The creation of enabling environments for the private sector is a cost-effective way to complement government electrification programs by leveraging additional investments and catalyzing the development of diverse innovative solutions.

VI. Conclusion

Markets for clean off-grid energy products are at an inflection point. With the right catalytic market support, sales of high-quality low-cost devices can deliver the most critical energy services to hundreds of millions of people. As the off-grid market expands, so will opportunities to provide a range of energy services beyond basic needs.

However, the expansion of this market is not guaranteed. To prevent market spoilage that is caused by product quality problems, we recommend continued support for programs like the Lighting Global Quality Assurance program and IDCOL's solar home system program in Bangladesh.⁴² Quality-assurance standards for off-grid products beyond lighting, such as solar home systems, standardized mini-grids, and off-grid televisions, fans, and refrigerators, also should be considered. The successful ENERGY STAR program in the U.S. may provide a model for universal branding of products that meet certain efficiency and quality standards. To increase the competitive edge of quality-assured products, governments may want to consider options to provide tax or tariff incentives to quality-assured products. Consumer awareness campaigns for quality-assured products could also assist in their adoption.⁴³

To ensure the market is not spoiled by freely distributed or heavily subsidized products, we recommend that proponents of energy access ensure that delivery approaches are self-sustaining. It is key that subsidies are limited or only targeted at segments of the market that will take time to become commercially viable, such as the poorest communities or particularly remote areas.⁴⁴ While recognizing that special assistance for low-income communities may continue to be needed for some time, it is important that this assistance be provided in a way that supports the development of self-sustaining markets and avoids market distortions, with the goal of ensuring that quality products reach the largest number of households as quickly and efficiently as possible.

The same principle applies to fossil fuel subsidies. While these subsidies often were established with the intention of assisting communities in need, today they distort the market by favoring polluting technologies over cleaner and sustainable ones. SEforALL strongly recommends eliminating fossil fuel subsidies, noting that the funds currently going to these subsidies could be used to assist the poor in other ways.⁴⁵

Policies that promote energy efficiency will unlock the goals of energy access, even beyond off-grid solutions. Governments, multilaterals, and development organizations have an opportunity to multiply the positive impacts and reduce the costs of energy access efforts by accelerating the deployment of super-efficient appliances. Concerted efforts to structure projects, metrics, and finance approval processes in ways that prioritize energy efficiency could have a dramatic effect on the timelines, costs and environmental impacts associated with achieving universal energy access.

The U.S. Government is taking an active role in providing sustainable energy access for all through its many partnerships and programs dedicated to promoting research and market development on energy access and efficiency. By focusing in particular on continuing to advance technology while driving down costs, providing access to finance for both consumers and entrepreneurs, developing and adhering to

⁴² Navigant Consulting and CEM, 2015

⁴³ Jacobson, A. *et al.*, 2013

⁴⁴ CEM. 2012. "Global LEAP Guiding Principles." Accessed Oct 2015.

http://www.cleanenergyministerial.org/Portals/2/pdfs/Global_LEAP_overview.pdf

⁴⁵ Ki-moon, B., 2011

quality assurance standards, and avoiding market-spoiling activities such as blanket subsidies, we will continue to encourage the markets for off-grid energy access products to thrive and progress towards the goal of sustainable energy for all.

VII. Appendix: USG Programs

Clean Energy Ministerial’s Global Lighting and Energy Access Partnership (Global LEAP):⁴⁶ Led by the U.S. Department of Energy, Global LEAP works to catalyze the development of commercial markets for efficient, high quality, and affordable clean energy access solutions. Global LEAP member governments include Italy, Saudi Arabia, South Africa, the United Kingdom, and the United States, while partner organizations include The World Bank, International Finance Corporation, U.K. Department for International Development, the United Nations Foundation, and others. Over 120 private sector and civil society support Global LEAP’s Guiding Principles that promote self-sustaining markets for clean energy access solutions. Since 2009, the U.S. government has invested \$9 million and Italy has invested \$20.75 million in support of Global LEAP and related actions.

Global LEAP’s early focus was on supporting and expanding the quality assurance framework of the World Bank Group’s Lighting Global initiative. This has helped enable the sale of more than 20 million quality-assured off-grid solar lighting products globally. Building on this work, Global LEAP, with support from Power Africa, is supporting the expansion of this quality assurance work to larger solar home systems, as well as developing and implementing a quality assurance framework for mini- and micro-grids.

Global LEAP, together with its partners, is leading international efforts to foster a competitive global market for high quality, affordable, super-efficient off-grid appliances, equipment, and other end-use devices. Delivering energy services and social-economic impact beyond basic lighting and mobile phone charging, these super-efficient end-use technologies are the next frontier in clean energy access. Beginning with the 2013-14 Global LEAP Awards – an international appliance competition that identifies and promotes the world’s best, most efficient off-grid appliances – Global LEAP has led critical foundational efforts to spark the growth of this nascent off-grid appliance market and enable scale through a suite of innovative programs. Global LEAP has:

- Collaborated with the World Bank Group’s Lighting Global program to develop a quality-assurance framework for pico-solar products that has been adopted by the International Electrotechnical Commission (IEC). The framework has become the world’s most widely used quality assurance program for off-grid solar products.
- Developed the Guiding Principles to encourage governments, foundations, non-profits and for-profit firms to work together to scale up commercial markets for low-cost quality-assured off-grid devices.
- Established the first test methods for off-grid televisions and fans.
- Conducted business-to-business and business-to-investor matchmaking activities connecting supply and demand segments of the fragmented off-grid energy market.
- Joined ClimateWorks Foundation in launching an ambitious interactive off-grid appliance data platform.

⁴⁶ The Clean Energy Ministerial (CEM) is a high-level global forum to promote policies and programs that advance clean energy technology, share lessons-learned and best practices, and encourage the transition to a global clean energy economy. Global LEAP is the energy access initiative of the CEM: www.globalleap.org

- Implemented three rounds of the Global LEAP Awards, identifying the world's best performing off-grid lights, televisions, and fans. The 2016-17 Global LEAP Awards will include a competition for off-grid refrigerators through a new collaboration with Power Africa, USAID, and the U.K. Department for International Development's Ideas to Impact programme.
- Collaborated with Energising Development on an unprecedented program to drive Global LEAP Awards winning products into key off-grid solar markets through targeted bulk procurement incentives.
- Supported ground-breaking techno-economic analyses and market research to identify key opportunities and barriers in the off-grid appliance and equipment sector.
- Fostered collaboration among key donors and development partners to increase alignment, avoid duplication, and increase ambition in this space.
- Developed a Quality Assurance Framework (QAF) for Mini-Grids, to provide a flexible alternative to rigid top-down standards for mini-grids in energy access contexts, as well as promote technical and operational best practices in the sector.
- Led the Efficiency for Access (E4A) Coalition, launched at COP21 together with Sustainable Energy For All and other partners, which raised over \$11 million dollars during the E4A Year of Action in 2016 to support the development and deployment of super-efficient appliances and end-use technologies towards achieving universal energy access.
- Collaborated with Power Africa, USAID and the U.K. Department for International Development to launch an off-grid refrigeration prize, including establishing the first test methods for off-grid refrigeration technologies.

Lighting Asia/India: Lighting Asia/India is a market-transforming program with the objective of promoting both the value and presence of modern lighting for the off-grid population in rural India. The Department of State provided a \$3 million grant to the International Finance Corporation (IFC) in support of the Lighting Asia/India program as part of the larger Global LEAP initiative of the CEM. Lighting Asia/India aims to increase access to off-grid energy services to 2.5 million people in India by promoting the development of off-grid energy technologies and business models, addressing key market barriers that inhibit the development of innovative and sustainable delivery approaches and supporting commercial replication and scale-up of successful models.

Power Africa: In June 2013, President Obama announced Power Africa — an innovative partnership to double access to electricity in sub-Saharan Africa. One year later, President Obama tripled Power Africa's goals – to add 30,000 megawatts (MW) of new, cleaner electricity generation capacity and to increase electricity access by at least 60 million new household and business connections. In recognition that Power Africa cannot meet its energy access goals through additional large-scale power capacity and grid extension projects, Power Africa launched "**Beyond the Grid**" in June 2014, a sub-initiative focusing on expanding off-grid and small-scale energy solutions across sub-Saharan Africa by unlocking investment in these markets. Beyond the Grid utilizes Power Africa's innovative transaction-focused model to galvanize collaboration, engage in critical actions to accelerate transactions, and drive systemic reforms to facilitate investment for off-grid and small-scale energy solutions. Beyond the Grid's over 40 partners have committed more than \$1 billion to unlock investment and growth for off-grid and small-scale energy solutions for millions of households, businesses, and public facilities across sub-Saharan Africa. Beyond the Grid is providing field-based technical support to private companies, governments, investors and financiers, and non-profits to further accelerate investment in off-grid energy solutions. Power Africa already has supported projects that will add 2.9 million homes and businesses connections, with 2 million actual connections to date, which will benefit 10-15 million people.

In addition, in June 2016 Power Africa, USAID's U.S. Global Development Lab, Shell Foundation, and the U.K. Department for International Development announced the **Scaling Off-Grid Energy Grand Challenge**, a \$36 million investment to empower entrepreneurs and investors to connect 20 million households in sub-Saharan Africa to modern, clean, and affordable electricity. The Grand Challenge for Development will help build a vibrant market across sub-Saharan Africa by supporting the growth of innovative entrepreneurs that are making off-grid solutions affordable for rural families through profitable business ventures, and by catalyzing private investment to help these enterprises reach new markets. The Grand Challenge will also drive new technological innovation, and address constraints to market growth in specific countries.

Sustainable Energy for All (SEforALL): The U.S. Government has been a primary supporter and partner of the SEforALL initiative, which was launched by the UN Secretary General (SYG) on November 1, 2011 as part of the 2012 International Year of Sustainable Energy for All. It has three aspirational goals to be achieved by 2030:

- Ensure universal access to modern energy services
- Double the global rate of improvement in energy efficiency
- Double the share of renewable energy in the global energy mix

The SEforALL initiative was instrumental in creating the new Sustainable Development Goal 7 focused on energy access, and has been given the lead role for its implementation.

Silicon Valley Tech Challenge – Accelerating Access to Clean Energy Around the World: The U.S. Department of State has launched an initiative to engage the technology and innovation community on accelerating access to clean energy in emerging markets. In September 2016, the State Department convened key stakeholders from across Silicon Valley – including tech companies, investors, foundations, non-governmental organizations, government, and academia – to generate ambitious and impactful proposals to overcome energy access barriers, bringing together not just experts in renewable energy but also those on the cutting-edge of intersecting technology trends, such as expanding internet access, mobile payments and platforms, cloud storage, and data analytics. The workshop included clean energy entrepreneurs from across Asia and Africa to provide on-the-ground perspectives. The State Department is working with a number of companies and organizations to identify and launch projects to address key challenges to off-grid clean energy access, including Microsoft, X (formerly Google X), Facebook, Booz Allen Hamilton, Bloomberg New Energy Finance, Allotrope Partners, the U.S. National Renewable Energy Laboratory, and the University of California Berkeley. These partnerships, launching in 2016 and 2017, will develop new technology tools, financing mechanisms, and mentoring opportunities for promising clean energy start-ups in emerging markets.

U.S.-Africa Clean Energy Finance Initiative (ACEF): ACEF is an innovative financing program developed by the Overseas Private Investment Corporation (OPIC), the U.S. Government's development finance institution; the U.S. Department of State; the U.S. Trade and Development Agency; and the U.S. Agency for International Development. Its goal is to catalyze private sector investment in clean energy projects in Africa by providing support for early-stage project development costs. Through US-ACEF, USTDA and OPIC have approved funding for 33 clean energy projects in 10 countries throughout sub-Saharan Africa. That represents nearly \$1.5 billion in potential public and private capital and approximately 358 MW in new renewable power capacity.

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U.S.-India Clean Energy Finance Initiative: OPIC and the Government of India have agreed to launch a \$20 million distributed solar facility in partnership with leading philanthropies. Known as the U.S.-India Clean Energy Finance initiative (USICEF), the facility will address a key financing gap in the Indian distributed solar market by funding early-stage project preparatory work. USICEF is anticipated to unlock up to \$400 million in long-term debt financing from OPIC and private sector investors.

Promoting Energy Access through Clean Energy (PEACE): The U.S. Government and India launched Promoting Energy Access through Clean Energy (PEACE) in September 2013 as an initiative of the U.S.-India Partnership to Advance Clean Energy (PACE). PEACE's objectives is to harness commercial enterprise to bring clean energy to under-electrified communities. PEACE has four focus areas:

- **Building the Off-Grid Ecosystem:** In November 2014, USAID partnered with ICCo, GIZ, and the Shakhti Foundation to support a coalition of 10 leading organizations to catalyze the **Clean Energy Access Network**. CLEAN's value proposition is to deliver a range of services to help entrepreneurs enter the off-grid market, overcome operational barriers, and scale their businesses. It will provide a platform for policy dialogue, mobilizing finance, and accelerating innovation. Also, in September 2014, Prime Minister Modi and President Obama agreed to expand PEACE to include a new focus on mainstreaming super-efficient, high quality, and cost-effective appliances, so that energy access can support a broader range of services.
- **Mobilizing Finance:** In September 2015, USAID/India launched a new public-private partnership that will work to mobilize \$41 million in finance to support clean energy entrepreneurs. This effort, a partnership between New Ventures India, Insitor Management, the Global Social Business Incubator at Santa Clara University, and USAID/India, aims to help 1 million Indians gain access to electricity through off-grid clean energy solutions. Through related activities, including the Renewable Energy Microfinance and Microenterprise Program, USAID is also enhancing clean energy lending through microfinance, supporting the implementation of a state-level distributed renewable energy community fund, and supporting the development of an off-grid debt fund.
- **Innovation and Quality Assurance:** In June 2015, Upendra Tripathy, Secretary, MNRE and Richard Verma, U.S. Ambassador to India, signed an MOU establishing the "PACEsetter Fund," a new joint USD 7.9 million fund to accelerate the commercialization of innovative off-grid energy solutions. The PACEsetter Fund is the principal funding arm of the PEACE initiative. In August 2015, Ambassador Verma announced that up \$2 million in grants will be made available in the first funding round, with initial expressions of interest due October 16. More information is available at PACEsetterFund.org. Also, the U.S. Department of Energy and Global LEAP, with input from Indian experts and other global stakeholders, developed a quality assurance framework for mini-grids that (1) provides a common technical understanding of the quality, availability, and reliability of power required for different levels of energy services; and (2) provides a standard accountability framework through which customers, funders, and regulators can obtain trusted information about power delivery.
- **Skills Development:** The Clean Energy Access Network and the Solar Energy Training Network (SETNET) will both serve as platforms for skills development.

Millennium Challenge Corporation: The Millennium Challenge Corporation (MCC) is partnering with Benin through a [\\$375 million compact](#) grant agreement designed to transform the West African country's power sector. The **Benin Power Compact** will fund infrastructure investments for both on- and off-grid users. The compact's Off-Grid Electrification Project is MCC's largest off-grid electrification effort to date and will support policy reforms as well as infrastructure financing through a grant matching facility. With this investment, the gap in access to power for two-thirds of Benin's population will be addressed through project financing for renewable energy solutions for the poor. The facility will finance off-grid renewable electricity devices for individual families and communities, solutions to ensure continuity of service for critical public infrastructure, and energy efficiency measures nationwide.

In Indonesia, [MCC's \\$600 million compact](#) is designed to address critical constraints to economic growth while supporting the Government of Indonesia's commitment to a more sustainable, less carbon-intensive future. The compact's ambitious **Green Prosperity Project** is focused on increasing access to clean and reliable energy in rural areas. The Green Prosperity Facility, the project's centerpiece, is providing commercial and grant financing to support economic development projects in renewable energy and sustainable land use and natural resource management. In renewable energy, MCC is funding up to eight mini-grids with a total value of \$45 to \$50 million and a total capacity of 8.2 MW, as well as 22 separate grants that includes household solar systems, household biodigesters and pico-hydro plants.

White House Convening on Energy Access: In October 2015, the White House Council on Environmental Quality hosted a convening on increasing access to off-grid clean energy, bringing together U.S. Government representatives along with representatives from foreign governments, the private sector, and civil society to discuss solutions for providing access to clean energy. At this event, the U.S. Government announced new initiatives led by the Department of Energy, the U.S. Agency for International Development, the Overseas Private Investment Corporation, and the Millennium Challenge Corporation. Furthermore, nineteen companies and organizations announced new independent commitments, totaling over \$125 million to finance clean energy projects, such as the deployment of high efficiency solar equipment to reach millions of low-income customers in Sub-Saharan Africa and South Asia. The governments of Benin, Bangladesh, and Kenya also announced steps to increase access to off-grid energy efficient products, which will be powered by clean energy, and develop standards to ensure the quality of off-grid appliances.

Leveraging multilateral funds: The United States has contributed \$50 million to the Climate Investment Fund – Scaling up Renewable Energy Access in Low Income Countries Program which supports clean energy investments in low income countries with low levels of energy access. Altogether the fund has \$525 million in resources, and half of the investments will be focused on the off-grid and mini-grid space. The fund is blended with multilateral development bank funds as well as private sector and bilateral finance.