OXFAM RESEARCH REPORT

TRACKING POWER AFRICA

LESSONS AND BEST PRACTICES IN ENERGY ACCESS

SIERRA CLUB

OXFAM

AUTHORSHIP AND ACKNOWLEDGMENTS

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

Significant financial investment is required to achieve universal energy access, particularly in sub-Saharan Africa where the problem is especially acute. Access to energy is essential in building livelihoods and economic opportunity across sectors such as agriculture, health, and education. The International Energy Agency (IEA) estimates that approximately $43 billion is required annually to provide electricity to the 1.1 billion people around the world presently lacking it. The majority of these energy-poor people are also most at risk to have their livelihoods impacted by climate change. There is, hence, increased urgency to reduce emissions from the energy sector, raising questions on the best forms of technology in achieving energy access and how best to finance them.

Power Africa is a US government-led public-private financing initiative with the goals to add more than 30,000 megawatts (MW) of "cleaner, more efficient electricity generation" and to increase electricity access by adding 60 million new connections in sub-Saharan Africa. Power Africa operates across multiple US government agencies and has employed most forms of conventional energy technologies in its four years of operation. This report presents an independent analysis of Power Africa's portfolio in order to inform the broader energy-access financing agenda.

PROCESS AND TOP LINE FINDINGS

The report's authors analyzed the entire Power Africa portfolio through March 2017, drawing from multiple agencies, including the US Agency for International Development's (USAID's) Power Africa Tracking Tool (PATT), a tool that tracks the first of three Power Africa goals, called "pillars": the generation of energy, measured in megawatts. (Power Africa's three goals are (1) generation,(2) connections, and (3) unlocking energy sector potential.) The report assesses four categories: the breakdown of projects across the different US government agencies, the technologies employed, the target countries, and the breakdown of spending for on- and off-grid investments.

The analysis considered 371 projects, amounting to more than 22,900 megawatts (MW) of generation potential and $52 billion total expected investment.[1] Information on what financing had been approved was only available for 178 projects, amounting to 3,500 MW of new generation potential and totaling $3.5 billion of approved US financing for $12.2 billion of anticipated investment.

WEALTHIER, LARGER COUNTRIES RECEIVE THE MAJORITY OF SUPPORT

The continent's wealthiest and largest countries, such as South Africa and Nigeria, have received the majority of the financing from Power Africa to date (Ethiopia being an exception; see Figures ES1a and ES1b). At an agency level, countries that receive support from the Millennium Challenge Corporation (MCC) are notable exceptions. These countries, such as Benin and Malawi, are some of the poorest in the world. Additionally, countries that receive the most support for distributed renewables, such as Kenya, have relatively mature mini- and off-grid markets, while other markets in their infancy are not as well supported.

FIGURE ES1A: GEOGRAPHIC SPREAD OF EXPECTED FINAL PROJECT INVESTMENTS

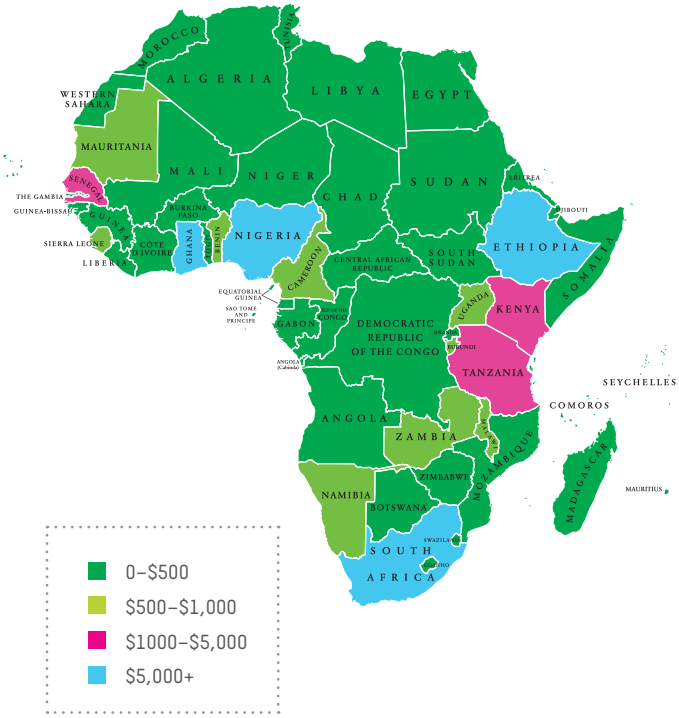
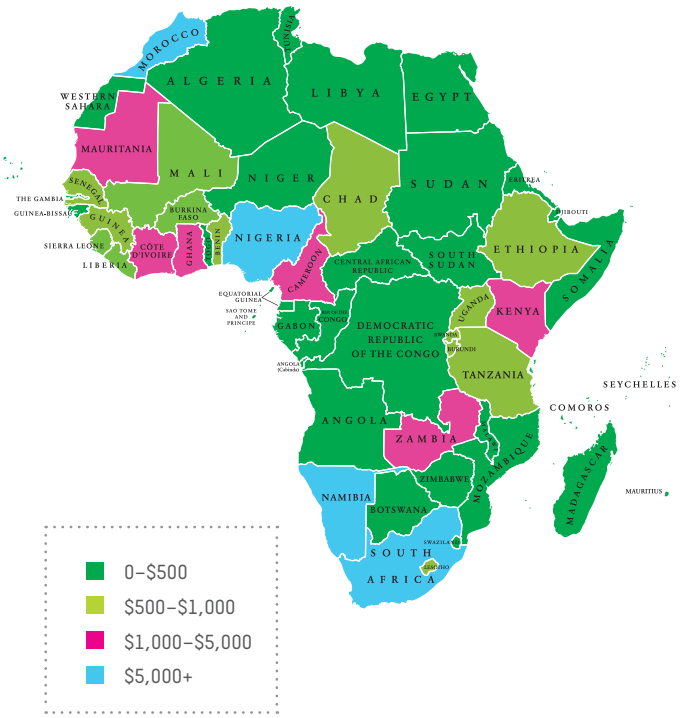


FIGURE ES1B: GROSS DOMESTIC PRODUCT PER CAPITA



SUPPORT FOR OFF-GRID PROJECTS STILL FALLS SHORT BUT IS TRENDING IN THE RIGHT DIRECTION

To achieve universality, energy access financing requires that the majority of financing—approximately 71 percent, according to the IEA—should support off-grid projects.[2] Overall, Power Africa is trending in the right direction with financing increasing over the years for off-grid projects. The Beyond the Grid subinitiative (BTG) was specifically established in order to achieve its connection goal of 60 million new connections. Aggregate information provided by Power Africa shows that, as a percentage, Power Africa has increased spending toward its connections goal, where it now represents approximately one-third of its budget. Of the 178 projects tracked in this report's analysis where approved financing data was available, off-grid projects only represent 10 percent of financing approved within the initiative so far. While much of the data was only available from projects for the megawatt goal (generation), it is clear that Power Africa should continue to increase funding toward off-grid projects.

High-risk projects with little development and access potential receive significant support. Projects that have high social, environmental, and climate risk while having a less direct impact on development and energy access—such as heavy fuel oil and natural gas—represent a major component of Power Africa's footprint. Africa has a significant generation gap, which the megawatts goal of the initiative is attempting to help address. However, adding more megawatts cannot be a goal unto itself, as many separate studies have shown that the development benefits of such projects for local communities are often difficult to track.

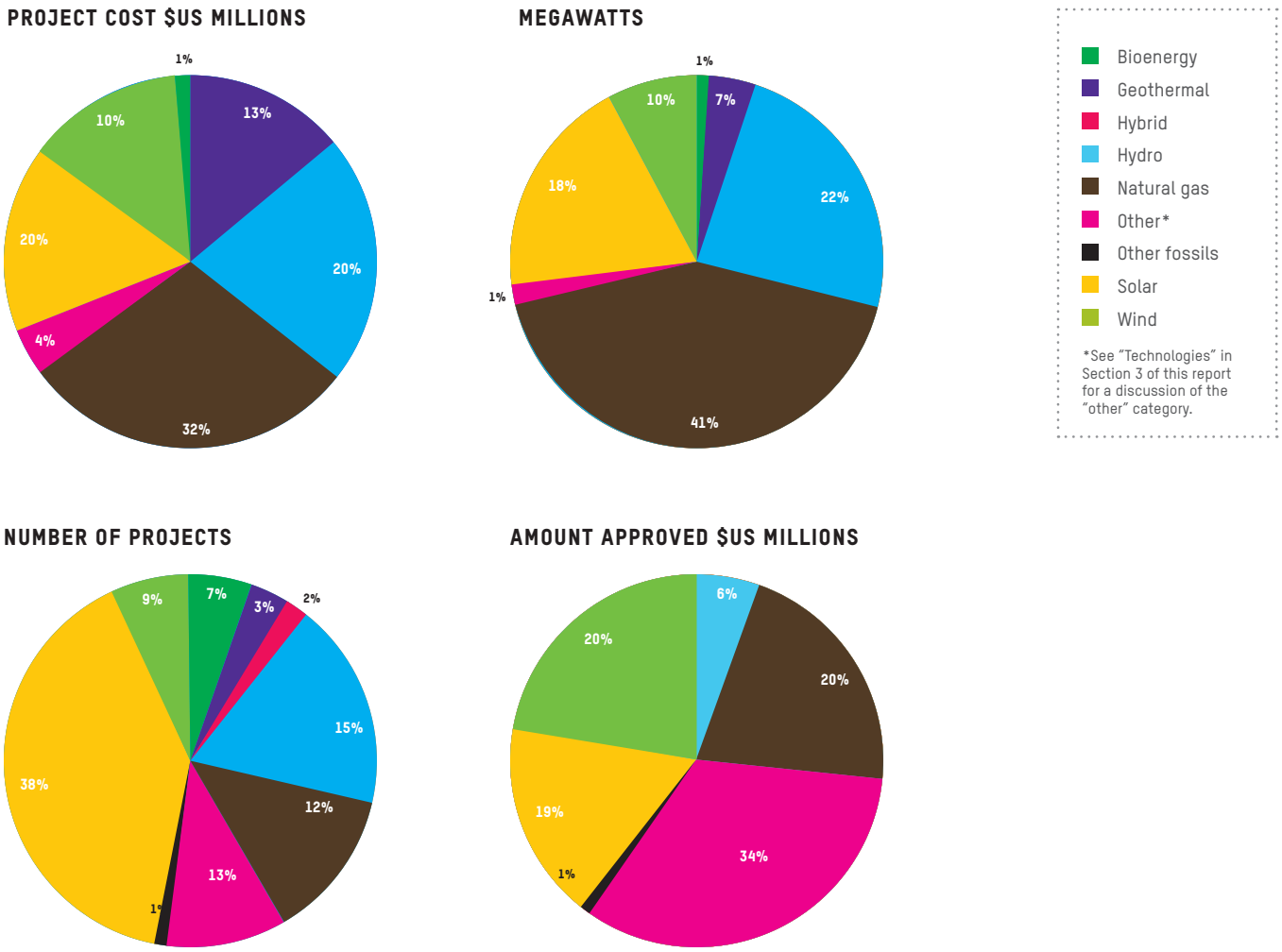
TECHNOLOGY BREAKDOWN: SOLAR AND NATURAL GAS LEADING THE WAY

Of the 371 projects tracked[3] that were included in this analysis, solar led with 140 projects. Measured in terms of the megawatts of the projects supported, natural gas was the leader. Natural gas was also the leader in terms of total amount of US government dollars committed (see Figure ES2 below).

COORDINATION AMONG AGENCIES AND PARTNERS IS ESSENTIAL TO POWER AFRICA'S SUCCESS

One key finding of this research is that coordination among agencies and participating partners is essential for the success of energy access initiatives. For Power Africa, USAID plays a coordinating role across agencies where participating partners may include different US government agencies, country governments, impacted communities, and private sector developers, financiers, and project sponsors. Coordination ensures the convening power of Power Africa to enable a better-integrated approach across agencies; without such coordination, various actors would be less inclined to participate and adhere to standards and best practices.

FIGURE ES2: BREAKDOWN ACROSS TECHNOLOGY CATEGORIES



INTRODUCTION

Power Africa is an initiative of the US government that facilitates transactions among host governments, donors, and private sector developers with an overarching aim of fighting the crippling energy access deficit plaguing sub-Saharan Africa.[4] As questions on the most appropriate technologies to end such energy poverty are revisited, it is especially timely to reflect on how one such energy financing platform is faring almost four years into its operation and what can be learned drawn from its experiences.

DEVELOPMENT FINANCE AND ENERGY ACCESS

The Sustainable Development Goals (SDGs), the Paris Climate Agreement, and the Addis Ababa Action Agenda on aid effectiveness have all shown how the world has collectively come together to try to better align development and sustainability agendas. These agreements show commitments to these causes from the highest levels of government and have resulted in a global conversation on how best to optimize increasingly limited financial flows for the sustainability agenda.

The challenge of sustainable energy access is especially acute in sub-Saharan Africa, where 600 million people lack access to electricity, with the majority of them living in rural areas. At the same time, the region is one of the most susceptible to climate change.[5] East Africa, in particular, is experiencing severe drought that is threatening the livelihoods and lives of millions. It is especially important that energy access needs are met with such sustainability needs in mind. Importantly, this knowledge has led to many of these institutions examining how public-private financing models can help scale up energy access financing.

Donor governments, recipient governments, and development finance institutions increasingly emphasize the role of the private sector to fill the shortfall in public development financing—and the role of governments in leveraging and informing private sector led initiatives. Such financing models have, however, come under scrutiny regarding their effectiveness in delivering development results that are environmentally and socially sustainable.[6]

STATE OF PLAY WITHIN THE UNITED STATES

The role of overseas development finance has generally been acknowledged as playing an important role in US influence around the world. Primarily for that reason Power Africa has benefited from strong bipartisan support in the United States. Recently, the US has taken steps toward promoting greater financing of overseas fossil fuels for development. For example, the Trump administration pushed for the 2017 G20 Communiqué to encourage the use of fossil fuels to improve energy access[7], and it reversed the Obama-era coal restrictions of the US "Treasury Guidance for US Positions on Multilateral Development Banks Engaging on Energy Projects and Policies."[8] These efforts represent a notable shift from the prevailing view of the donor community on the limited role that fossil fuels, in particular coal, have on meeting development needs.[9] Power Africa can serve as a case study to provide lessons learned on how shrinking aid money can be used most effectively, and it can highlight best practices based on its experience.

TABLE 1.1: PERCENTAGE POWER AFRICA COORDINATOR'S OFFICE FUNDING OBLIGATIONS TO USAID AT INCEPTION AND AT PRESENT, AS OF JUNE 2017

PERCENTAGE OF TOTAL OBLIGATIONS BY PILLAR	FY 2012	CURRENT
Pillar 1: Grid-tied transactions	100.0%	36.1%
Pillar 2: Grid expansion and off-grid		29.1%
Pillar 3: Policy reform		29.4%
Cross-cutting		5.4%

Source: Power Africa.

BACKGROUND ON POWER AFRICA

As it enters its fourth year, in 2017, Power Africa has goals of providing 30,000 MW of new, cleaner-generation capacity and 60 million new connections for homes and businesses in sub-Saharan Africa (deemed Pillar 1 and Pillar 2, respectively by the initiative).[10] Its operations continue to evolve as projects move toward completion and new development partners and governments come on board. Power Africa has also had a significant impact in bringing new players to the energy access scene in Africa, with its Beyond the Grid[11] subinitiative in particular playing a role in assisting off-grid entrepreneurs. As illustrated in Table 1.1, Power Africa started off with a heavy focus on generation (Pillar 1), but later began focusing more on connections and unlocking energy sector potential (Pillars 2 and 3, respectively). This shift coincides with the launch of the Beyond the Grid subinitiative in 2014, which seeks to add 25 million to 30 million new connections by 2030. The latest estimate by Power Africa is that it has brought 82 power projects to financial close that will result in the addition of 7,319 MW. Additionally, Power Africa has added 10.5 million new connections.[12] (See Section 3 for the financial flows associated with these projects.)

According to Power Africa staff, Power Africa is working with 98 companies on 131 different projects as part of the Beyond the Grid initiative. Through partnerships with private sector lenders and early-stage grant funding from US government agencies, Beyond the Grid seeks to source funding for off-grid power providers—including BBOXX, M-KOPA, and Off Grid Electric —at all stages of development. By advising governments on related policies, Power Africa also works to create enabling environments for the growth of the off-grid sector.

1.4 THE NEED FOR A DETAILED PORTFOLIO ASSESSMENT

In addition to its own reporting requirements, Power Africa would benefit from a detailed independent portfolio assessment to highlight potential gaps that could ultimately help strengthen it. While other organizations have reviewed Power Africa,[13] a deeper analysis of the totality of transactions would identify strengths and areas for improvement.

The initiative has taken some steps to create transparency with the release of the Power Africa Tracking Tool (PATT) application and the *Power Africa Roadmap*.[14] The Tracking Tool is a novel mechanism of disclosure covering a snapshot of many transactions, and was one data source used in evaluating the initiative in this report. However, the tool only captures the initiative's Pillar 1 objectives (its megawatt goals), and does not represent the connections goals (Pillar 2) or goals of creating enabling environments (Pillar 3).

Through the course of this research, it became apparent that information provided within PATT is limited and not always sufficiently up to date to make meaningful determinations on project-specific details. Similarly, the *Power Africa Roadmap*, which maps out the steps toward achieving the megawatt and connections goals, leaves little project-specific information available that communities can use to hold projects to account or that civil society can use to evaluate the overall initiative. This report's analysis aims to make recommendations toward improving the initiative's effectiveness, transparency, and accountability.

2. METHODOLOGY AND ASSUMPTIONS

DATA ACQUISITION

The acquisition of information on Power Africa's projects eventually totaled tens of thousands of data points, across numerous agencies. While the PATT tool provided an initial template presenting a snapshot in time of Power Africa's portfolio of its Pillar 1 projects, validating the data sets with each agency revealed many missing or incorrect transactions. While these findings raised questions regarding consistency of reporting, PATT ultimately allowed for a reasonably robust and comprehensive data set depicting Pillar 1 projects. The entire data set reflects the information that the agencies made available through March 2017.[15] The authors tried to reconcile and document any discrepancies where they occurred, with the full individual agency data sets available in the Appendix. The quantitative analysis of this report will, hence, almost exclusively focus on the Pillar 1 data as that is the majority of the data that was made available. Other data pertaining to Pillar 2 will be referenced where possible. Focusing only on Pillar 1 projects has the downside of offering only a partial view of the full range of Power Africa's activities, underscoring the need for greater transparency into Power Africa's Pillar 2 and 3 activities.

SPECIFIC DATA GAPS

One of the goals of the report was to provide total amounts of money that the US government has committed, spent, or lent to Power Africa projects. Measuring financial support proved difficult as agencies did not always provide complete information (for example, USAID did not provide any specific dollar amounts because the majority of its activities were time spent by staff assisting in transactional support). Consequently, this report provides an incomplete picture of the amount of money that the US government committed, spent, or lent, but offers an indicative picture across the different assessment categories.

While the PATT provided some of the estimated final project capital costs, a complete picture was not possible due to a variety of factors, ranging from business confidentiality limiting full disclosure to projects being in different stages of development. The use of financial intermediaries also led to a degree of opacity around project details and capital costs.

MEASURING ENERGY ACCESS

The authors were not able to determine how much of Power Africa's funding nor how many of its projects directly contributed to improving energy access[16] for several reasons, key among them that our main data sources were the PATT and supplemental project information provided by agencies. Neither the PATT nor the supplemental sources of information provided clear designations indicating whether or not a project supported energy access. As mentioned, the PATT is exclusively a tool for Pillar 1 (the megawatt generations goal), and in many cases there was insufficient project-specific information for the authors to independently make determinations on the specific impact on energy access of these generation projects.

As mentioned, Pillar 2 deals with connections (effectively one form of a direct measure of energy access). According to Power Africa, the majority the Pillar 2 connections come from the Beyond the Grid initiative. While some of the data compiled for this analysis made explicit reference to whether a project was from Beyond the Grid (including the PATT in some instances), there was little additional quantitative data available. In Section 4, which discusses the approximate

financing for off-grid technologies, this report attempts to show the proportion of the projects that supported off-grid technologies. As explained later, assessing the amount of financing approved for off-grid is a useful proxy for energy access—especially in sub-Saharan Africa where the majority of the population lives beyond the reach of the grid and can best have their access needs met by off-grid technologies.

TECHNOLOGICAL CATEGORIZATION

To the extent possible, this report attempts to reflect the categorization of the technologies groupings used by Power Africa (for example, in the *Roadmap* document); however, additional categorization was necessary, considering the significant number of projects that were softer interventions, such as sector reforms and technical advice. Where possible, it was important to distinguish these interventions from technological hardware projects. In addition to the groupings used by Power Africa, three additional categorizations were applied for this report:

- Other fossil fuels: The majority of fossil fuel projects are natural gas, while the other fossil fuel projects include diesel and heavy fuel oil.
- Bioenergy: The "bioenergy" category was a grouping of projects with a biogas, biodiesel, or biomass component;
- Renewable energy: In this report, renewable energy refers to solar, wind, geothermal, bioenergy, and picohydro.

This report also includes a category called "other," which consists of softer transaction-support activities, such as technical advice, reverse trade missions, institutional support, infrastructure and grid support, business operations support, and so on. "Other" includes most of the MCC compact work as well. A further breakdown of the "other" projects was conducted along these subcategories:

- Financial intermediaries*
- Fuel cells
- Smart grids
- Transmission and distribution
- Technical assistance—sector reform (all MCC compact-type interventions and projects that looked at reform of the power sector)
- Technical assistance—technologies (where technical advice was provided on specific technology development)

ASSUMPTIONS ON ASSESSING US GOVERNMENT FINANCING

The significant role of multiple US agencies in Power Africa transactions added a layer of complexity in analyzing data. "Amount approved" refers to the US government contributions approved or committed by federal agencies, but not necessarily the amount that the agencies have actually spent or lent. Additionally, where multiple agencies are listed as being involved in a project, the agency that provided the highest amount of US spending was attributed as the "lead" agency. The only instance where multiple agencies received credit for their contribution for the same project was where USAID provided transaction adviser assistance. The PATT listed an additional 73 projects for which no specifics on the details of US government involvement were available at the time when research was conducted for this report.

* Financial intermediaries are those projects where money is provided to another company or institution and no explicit description was given as to the type of subprojects that were being supported at the time of this report's analysis.

3. FINANCIAL FLOWS OF POWER AFRICA

The overall portfolio-wide findings of this report showed that, over the time period of the analysis up to and including March 2017, Power Africa supported 371 tracked projects—which includes prospective projects that may not reach financial close—for a total of 22,927 MW, for an expected final capital investment of projects totaling $51.9 billion.

BIG PICTURE: WHERE IS THE MONEY GOING ACROSS THE US GOVERNMENT?

HIGH-LEVEL VIEW OF THE AGENCIES

The overall agency breakdown across the number of projects, expected megawatts, project cost, and the amount of US government finance approved is shown below in Table 2.0 and Figure 3.1. Each agency provided very different types of financial support, ranging from direct financing to help for specific projects, to policy guidance and technical assistance, to support for regulatory reforms. The total finance flow assessments combine all the different types of financing streams (e.g., direct financing, loan guarantees, technical assistance, policy guidance) from the different agencies to give an aggregated total.

TABLE 3.1: AGENCY BREAKDOWN[17]

AGENCY	NUMBER OF PROJECTS	MW	PROJECT COST $US (MILLIONS)	AMOUNT APPROVED $US (MILLIONS)
Ex-Im	8	371	1,863	132
MCC	19	164	1,572	1,154
OPIC	50	1,780	6,532	2,325
Other/none*	73	4,019	8,308	0
USADF	68	5	9	7
USAID	94	15,166	30,792	0
USTDA	59	1,422	2,894	38.9
TOTAL	**371**	**22,927**	**51,969**	**3,657**

*This category refers to projects listed in the PATT tool that had no US government agency attributed to them, but other development partners. These are prospective projects that at the time of analysis for this report were only being tracked by Power Africa.

TECHNOLOGIES

The technology grouping used in this report was done by primary fuel source and included bioenergy, geothermal, hybrid, natural gas, other fossil fuels, solar, and wind. The aim is to show the difference in financial support for different technologies to see which technologies are receiving the greatest support. As mentioned, the "other" category encompasses projects without a clear primary fuel source identified, and it mainly includes infrastructure projects, such as transmission and distribution, and technical assistance projects such as feasibility studies and reverse trade missions.

The breakdown of technologies for all transactions is shown in Figure 3.1 and Table 3.2.

TABLE 3.2: BREAKDOWN OF POWER AFRICA PROJECTS ACROSS TECHNOLOGIES

TECHNOLOGY	NUMBER OF PROJECTS	MW	PROJECT COST $US (MILLIONS)	AMOUNT APPROVED $US (MILLIONS)
Bioenergy	26	181	423	3
Geothermal	12	1,575	6,585	2
Hybrid	8	15	83	2
Hydro	57	5,007	10,398	224
Natural gas	45	9,501	16,576	743
Other	49	216	1,949	1,244
Other fossils	2	90	123	17
Solar	140	4,061	10,461	694
Wind	32	2,281	5,370	728
TOTAL	**371**	**22,927**	**51,969**	**3,657**

FIGURE 3.1: AGENCY BREAKDOWN

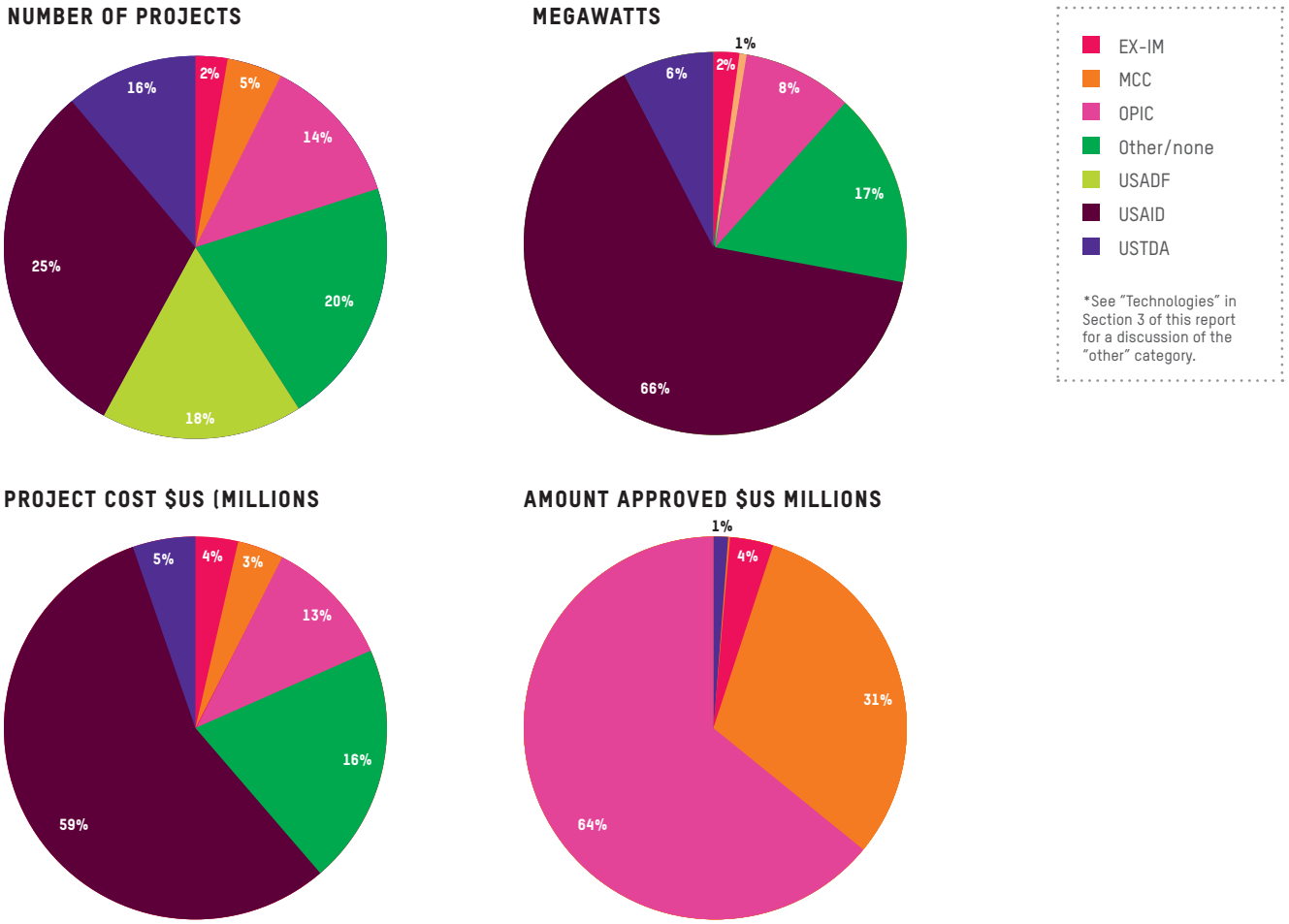
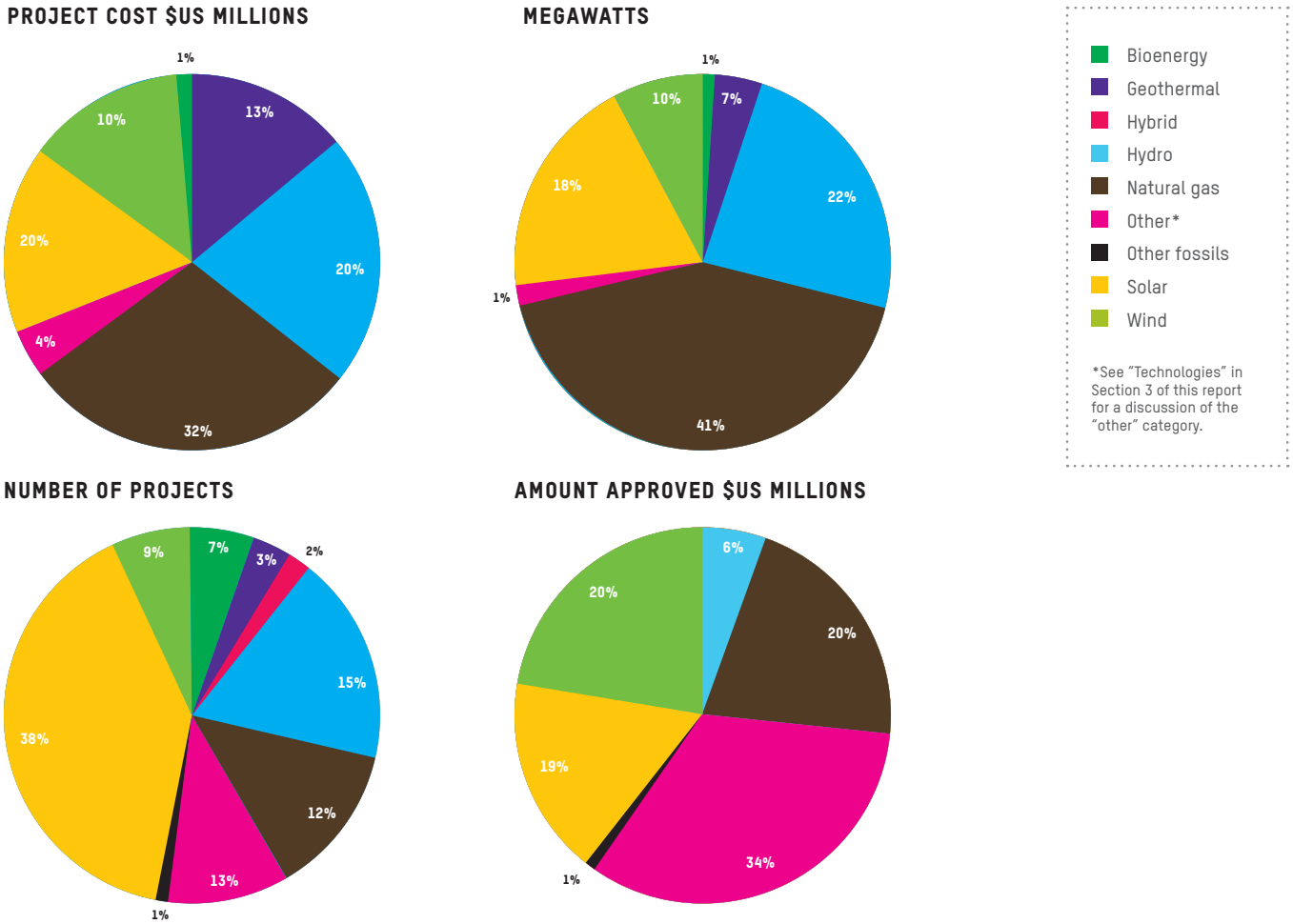


FIGURE 3.2: TECHNOLOGY BREAKDOWN



FUEL SOURCES

The US government provides more financing to natural gas—over $740 million—than to any other fuel source. The fact that the US government provides both the largest amount of financing as well as the largest amount of megawatts to natural gas demonstrates the US government's reliance on natural gas in meeting its Power Africa goals. There is very little evidence that natural gas development increases energy access. It is unclear that this or any other large centralized power plants actually improve the economic livelihoods of poor people, a stated goal of Power Africa. For example, the Azura-Edo natural gas power plant in Nigeria failed to connect the communities that resided closest to the plant, thus failing to provide them with any economic gains.[18] Moreover, natural gas is a much higher-risk project given that it contributes to climate change by releasing methane at every point in its life cycle—extraction, transportation, processing, and consumption.[19] Because methane is far more potent than carbon dioxide in terms of its warming potential,[20] some studies find it to be almost as bad, if not as bad or worse than coal.[21] Therefore, the support of these projects might not only fail to improve access to electricity, but might also increase the level of social, environmental, and climate risk. In addition to natural gas, the US government is providing $17 million for two other fossil fuel projects, which again come with high social, environmental, and climate risk categorizations. Especially concerning is the promotion of heavy fuel oil projects that pollute almost as much as coal, such as the OPIC-financed Cap des Biches heavy fuel oil power plant in Senegal.[22, 23] While there are claims that these power plants could be converted to natural gas, there are no requirements or assurances regarding if and when that would happen.

Wind and solar receive the second- and third-largest amount of financing, respectively, from the US government. Engagement with local communities in developing these projects is key, as large wind farms—such as the Kinangop project in Kenya—have not moved forward after failure to properly consult with project-impacted communities.[24] Solar dominates the number of projects with 140 (of the 371 total),

but provides less than half the amount of megawatts that natural gas does. Part of the reason for the discrepancy between high number of projects and low MW result is the number of distributed solar projects, including household solar and solar-powered mobile phone charging units, with low numbers of megawatts. Distributed solar has proven to be an affordable and sustainable technology that can more quickly provide energy than large centralized power plants. This is especially true because the majority of the population in sub-Saharan Africa without electricity is in rural areas far from the grid.[25] The spread of innovative payments systems, such as pay-as-you-go, have also opened up the market and added flexibility for people who cannot always afford to make electricity payments.

Hydropower also receives a significant amount of support—over $224 million, helping it maintain its dominance as a significant source of power on the continent. On a continent where some countries, such as Zambia, get over 90 percent of their power from hydro, it is not surprising to see the US government continue to support this technology. At the same time, this financial support includes large hydro projects that present a number of different concerns. First, the severe droughts that are occurring throughout Africa and are only likely to get worse have made large hydro an unreliable source of power. Last year, Zambia experienced dramatic load-shedding due to hydro's drastic reduction in output. Second, dams required for the creation of power contribute to climate change in tropical areas by producing large quantities of methane caused by bacteria feeding on plant material in the reservoirs, meaning that hydro helps worsen droughts and food scarcity.[26] Third, they require the capture of large areas of land that often displaces thousands of people and destroys ecosystems.[27] It should however be noted that the technology grouping of hydropower for this report does also include many small-scale hydro projects that avoid these negative impacts, such as USTDA grantee Amahoro Energy's 500 kW generator in Musanze District, Rwanda, that will electrify a remote hospital and community that has only used diesel generators heretofore.

OTHER FORMS OF ASSISTANCE

The US government emphasized technical assistance for specific technologies as well as policy advice for reforming the power sector in various ways. Some of these projects focused on exploring opportunities for much-needed technologies, such as renewable energy, energy storage, and smart grids. Feasibility studies improve an energy company's understanding of the potential for technologies, such as solar, energy storage, and smart meters. Reverse trade missions build the knowledge of these technologies by allowing the beneficiary country to learn from the innovations and experience in the US. This support is key to increasing the use and reliance of these technologies. Assistance focused on reform aims to make the sector more efficient and better able to handle the amount of electricity that is required to improve energy access. One aspect of this reform is creating and revising policies governing the power sector. While beyond the scope of this paper, understanding the details of most of these technical assistance projects is critical to ensuring effectiveness.

In addition to technical assistance, the US government spent $287 million on transmission and distribution projects. These projects can improve the efficiency of the grid, so that less power is lost from the power stations and so that the system is more reliable with fewer losses of power that are common in many sub-Saharan countries. The challenge with this, especially as it relates to Pillar 2's grid expansion, is that 80 percent of the sub-Saharan African population lacking access is in rural areas that will not be helped by the improvement and extension of the grid. Moreover, an important factor in access is affordability: often on-grid access is prohibitively expensive even for those communities that can reach the grid.

TABLE 3.3: OTHER FORMS OF ASSISTANCE

	NUMBER OF PROJECTS	MW	PROJECT COST $US (MILLIONS)	AMOUNT APPROVED $US (MILLIONS)
Financial lintermediary	5	0	948	340
Fuel cell	5	216	98	1
Smart grid	6	0	2	2
Transmission and distribution	12	0	62	287
Technical assistance—sector reform	18	0	525	613
Technical assistance—technologies	3	0	1	1
TOTAL	**49**	**216**	**1,637**	**1,244**

COUNTRIES

An analysis of which countries have benefited the most from US government support reveals that a shift—or at least an expansion or a redirection—in who is receiving the support is required. To date, many of the main beneficiary countries have been the wealthier and larger countries in sub-Saharan Africa. The countries that already receive the most investment from elsewhere also dominate the portfolio of Power Africa transactions, including South Africa and Nigeria.[28] Countries like Kenya and Tanzania, which have some of the most advanced distributed and grid renewables sectors, receive much of Power Africa's support for off-grid renewables, as evidenced by the large number of projects in those countries. Meanwhile, many other countries with strong potential but much more nascent distributed renewables markets are often overlooked. Investment from Power Africa could have a transformative effect in countries such as Burundi, Central African Republic, Democratic Republic of the Congo, and Mozambique.[29]

There are a variety of factors that influence these financing decisions, such as likelihood of mismanagement of funds, ability to improve the sector, political instability, level of existing relationships, and the project pipeline itself. While support to economies having a more advanced distributed renewable market is encouraged and should continue, public finance should also be increasingly provided in countries with more nascent renewables industries that need the support to attract companies and kick-start the industry. The only exception is for Millennium Challenge Corporation compacts that involve countries that do not typically receive much investment. MCC's Power Africa countries receive large amounts of US financial support, and they are countries in need, such as Benin (given its relatively small GDP).

FIGURE 3.3A: GEOGRAPHIC SPREAD OF EXPECTED FINAL PROJECT INVESTMENTS

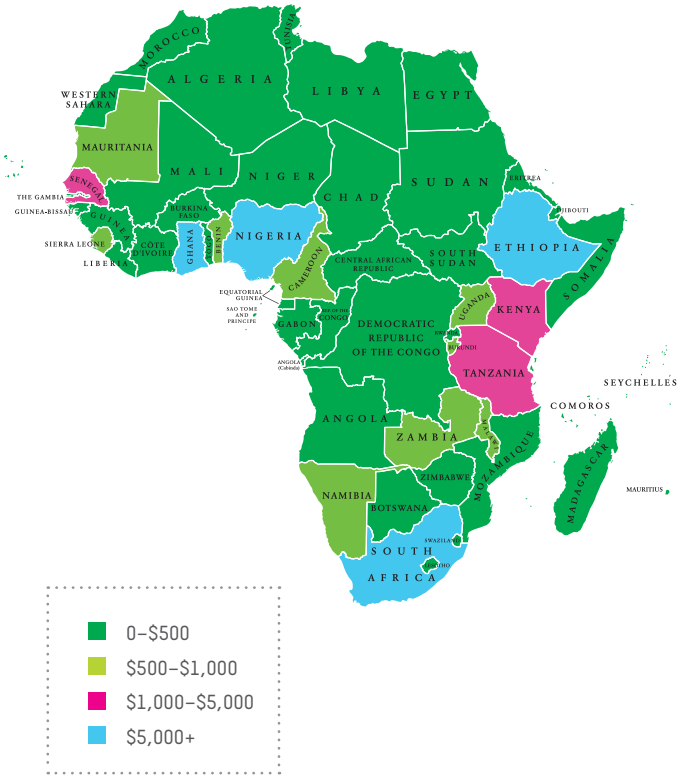


FIGURE 3.3B: GROSS DOMESTIC PRODUCT PER CAPITA

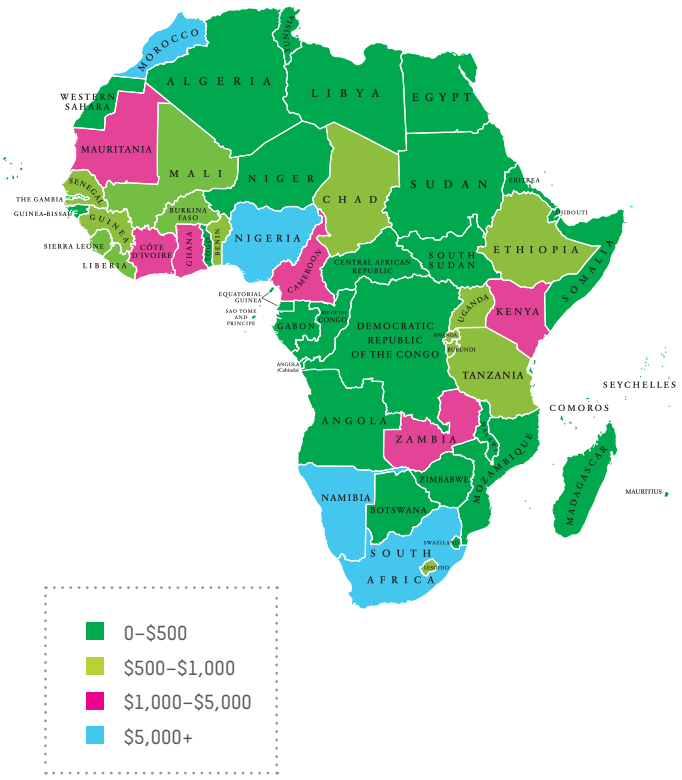
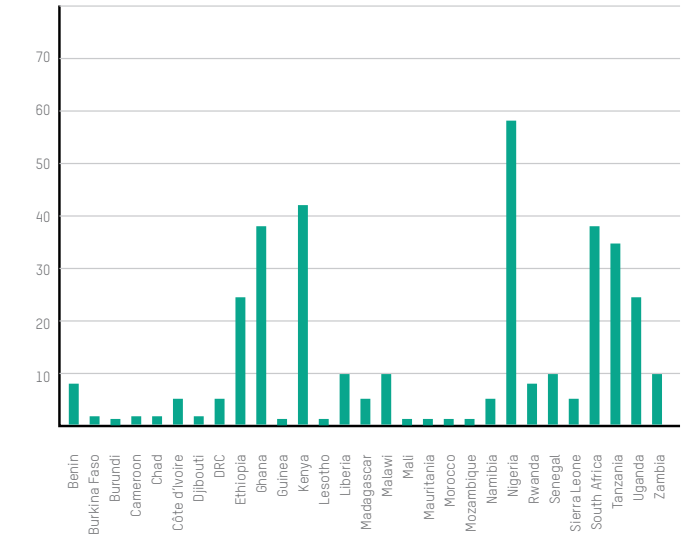
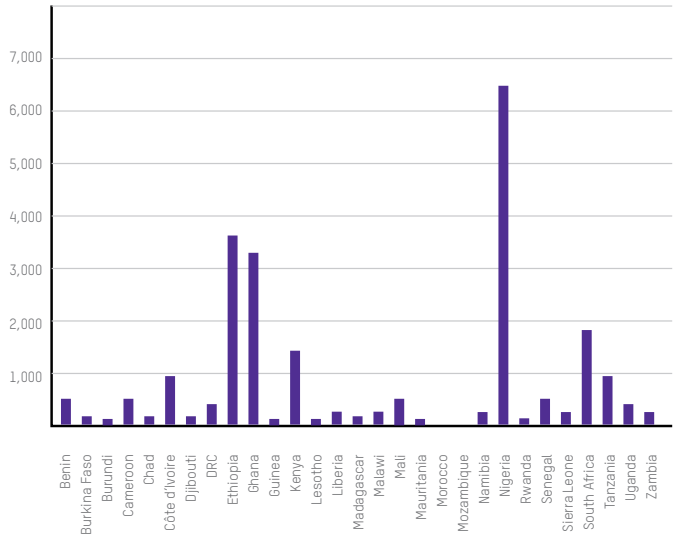


FIGURE 3.4: BREAKDOWN ACROSS COUNTRIES

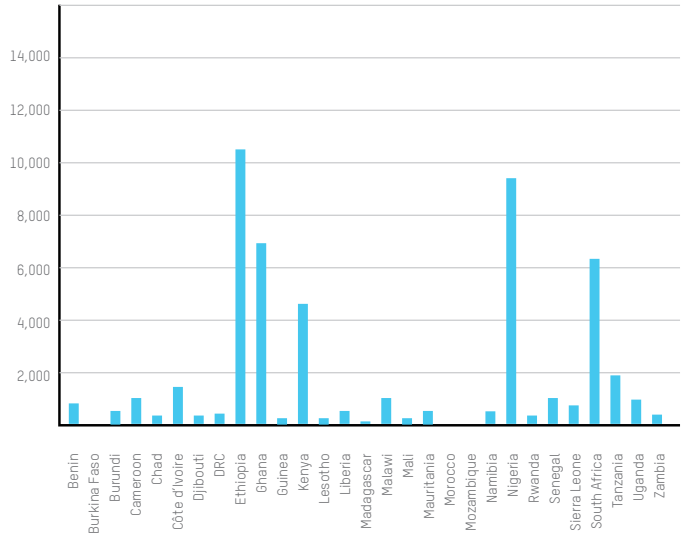
NUMBER OF PROJECTS



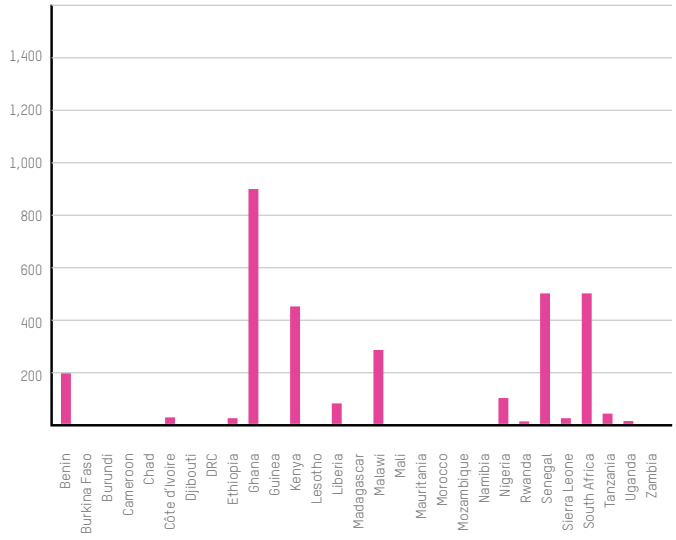
MEGAWATTS



PROJECT COST $US (MILLIONS)



AMOUNT APPROVED $US (MILLIONS)



Although there are some positive examples of energy access projects have been identified in the region's poorer countries, more financing should be distributed to countries in greater need. These countries need ecosystem development to address pre-commercial markets by, for example, developing quality standards and building capacity in the public, private, and civil society sectors.[30] In addition, early-stage project support, including feasibility studies and project preparation, is especially important in countries with large populations that lack access and live mainly in rural areas.

Training of local communities would increase employment opportunities and allow these countries to build products, such as residential solar systems, reducing the reliance on, and issues surrounding, imports of solar products. Small off- and mini-grid startups would be more willing to enter into these less developed markets if there was the potential for public support and local qualified employees. Moreover, the private sector is more likely to support projects in more developed countries, making public sector finance even more necessary in less developed countries. Without this support, these countries will fall further behind, and initiatives like Power Africa will fail to provide meaningful progress in improving access to affordable and sustainable electricity.

ON-GRID AND MINI-/OFF-GRID FINANCING

Initially, much of Power Africa's initial work focused on grid improvement and connecting people to the grid; now a growing emphasis of Power Africa is on off-grid, or beyond-the-grid, solutions (see Table 1.1, which shows a percentage breakdown by pillars of Power Africa's funding). It is worth noting that there appears to be a range of technologies—not just household solar and micro-grids—that qualify as beyond the grid. For example, a 3 MW fuel cell project in the Democratic Republic of Congo and a 15 kW hybrid project with solar and micro-hydro both met the criteria for Beyond the Grid consideration.

Noting the aforementioned methodological challenges of assessing the breakdown of on-grid and off-grid projects, our best estimate is that 32 percent of Power Africa projects supported off-grid energy,[31] and only 1 percent of Power Africa megawatts went toward off-grid projects. The number of projects and megawatts are not definitive indicators of how many people are served. Even such small levels of generation distributed to remote areas can make a big difference in people's lives. Advances in energy efficiency have allowed low amounts of electricity to power LED lights and highly efficient appliances.

The total amount of financing that supports off-grid projects, however, is a definitive indicator. In the 2017 International Energy Agency's *Energy Access Outlook*, the "Energy for All" scenario—in which universal energy access is achieved by 2030—71 percent of additional funding should go to off-grid and mini-grid solutions.[32] In total, of the 178 projects where data was available for the amount of US approved funds, $356 million went to off-grid projects, or about 10 percent of the total US commitment funds.[33]

DEEP DIVE INTO THE AGENCIES

Of Power Africa's 12 implementing agencies, the six below are the main funders and provided us with information about their financial support to Power Africa projects. The sections below detail their support for these projects.

MILLENNIUM CHALLENGE CORPORATION

Power Africa financing from the Millennium Challenge Corporation (MCC) is delivered primarily through compacts, a form of grant agreements, with country partners. The overall goal of MCC's partnership with countries is to reduce poverty by addressing constraints to economic growth and private sector investment. MCC's involvement in a country's power sector comes in response to evidence demonstrating that inadequate delivery of electricity is one of the country's binding constraints to economic growth. MCC aims both to provide the appropriate power infrastructure (whether generation, transmission or distribution) and address gaps and shortcomings in laws, policies, and regulation, so that countries are well-positioned to meet current and future power demand.

Compacts that are counted as part of Power Africa cover specific electricity generation and transmission projects as well as projects dealing with sectorwide policy reform and institutional strengthening. In order for a country to become eligible for an MCC compact, the country must first pass MCC's scorecard of 20 independent policy indicators broadly relating to economic freedom, investments in its people, and ruling justly. When countries come close to passing the scorecard, they may be eligible for MCC's smaller threshold program.

According to the analysis, MCC has committed approximately $1.15 billion to projects that support the goals of Power Africa, including compacts in Benin, Malawi, Liberia, and Ghana—and a threshold program in Sierra Leone focused on the power sector. When compacts were broken down by spending area, this amounted to a total of 16 projects related to Power Africa supported by MCC.

It is worth noting that MCC does not focus exclusively on generation. All of MCC's programs in the power sector provide support for electricity sector reform, which includes capacity building of key power sector actors such as regulators and utilities, as well as the provision of transmission and distribution infrastructure. For example, all of MCC's funding counted as Power Africa for its threshold program in Sierra Leone is dedicated to electricity sector reform. In the case of MCC's compact with Benin, $41.23 million of the compact's $375 million goes toward the Policy Reform and Institutional

Strengthening Project, with activities that include policy, regulation, institutional support, utility strengthening, and public information and education. Another $109.71 million goes toward the Electricity Distribution Project to strengthen the distribution grid in Benin. On the generation side, MCC is providing up to $42.08 million in funding in Benin for a PV solar activity expected to leverage private sector capital and generate up to 63.5 MW, $1.32 million for hydroelectric generation, and $80 million for on-grid photovoltaic generation.

MCC's three hydroelectric projects—in Benin, Liberia, and Malawi—amount to 101 MW of generation and rehabilitation. MCC funding for hydro projects amounts to a total of $198 million. Additional funding supports activities relating to "other" power distribution, off-grid electricity access, capacity building, and regulatory reform. Only one compact, with Benin, so far has included an activity supporting off-grid electricity access. The fact that MCC has made a large-scale investment into an off-grid activity could be a positive sign, that MCC may consider deploying more funds into off-grid solutions in the future. MCC determines the use of funding by weighing various trade-offs, including economic rate of return, beneficiary profile, and ability to implement.

TABLE 3.4: MCC BREAKDOWN

	NUMBER OF PROJECTS	MW	PROJECT COST $US (MILLIONS)	AMOUNT APPROVED $US (MILLIONS)
Hydro	3	101	615	198
Other	14	0	834	834
Solar	2	64	122	122
TOTAL	**19**	**164**	**1,572**	**1,154**

US TRADE AND DEVELOPMENT AGENCY

The US Trade and Development Agency (USTDA) helps companies create US jobs through the export of US goods and services for priority development projects in emerging economies. USTDA links US businesses to export opportunities by funding project preparation and partnership-building activities that develop sustainable infrastructure and foster economic growth in partner countries. The focus is on project preparation by providing grants for technical assistance, feasibility studies, and pilot projects. In addition, USTDA organizes reverse trade missions, in which foreign decision-makers visit the US to meet businesses and learn about the design, manufacture, and operation of products and services. Further, USTDA's analysis and preparation help projects attract financing. In support of the Africa Clean Energy Finance initiative and Power Africa, USTDA has increased funding for renewable energy ventures in sub-Saharan Africa. For example, nearly 80 percent of USTDA's financing in sub-Saharan Africa in fiscal year 2016 was for renewable energy feasibility studies, technical assistance, and pilot projects.

USTDA has supported 60 Power Africa projects, including 18 solar projects collectively capable of producing 830 MW; nine natural gas projects, capable of producing 375 MW; and seven hydro projects, capable of producing nearly 94 MW. Due to the number of reverse trade missions, feasibility studies, and technical assistance, the largest portion of USTDA finance—roughly 35 percent—fell into the "other" category. This assistance included general help for the power sector and related infrastructure, such as distribution, as well as technical advice for technologies such as smart meters and energy storage. USTDA's assistance has provided an important source of finance to mini- and off-grid projects, especially distributed solar projects.

TABLE 3.5: USTDA BREAKDOWN

	NUMBER OF PROJECTS	MW	PROJECT COST $US (MILLIONS)	AMOUNT APPROVED $US (MILLIONS)
Bioenergy	2	33	63	1
Geothermal	1	20	1	1
Hydro	7	94	140	5
Natural gas	9	375	1,319	5
Other	22	0	13	13
Solar	18	831	1,366	12
Wind	1	75	1	1
TOTAL	**60**	**1,427**	**2,904**	**39**

US AFRICAN DEVELOPMENT FOUNDATION

The US African Development Foundation (USADF) is a small US agency with an ambitious mission: it seeks to address development and foreign policy concerns in the poorest areas of Africa. Unlike agencies that have large tranches of money with which to work, USADF awards grants of up to $250,000 for technical assistance and local capacity building for organizations to help improve job creation, income levels, and social development. Under its Power Africa assistance, USADF has provided over $7 million in grants through its Off-Grid Energy Challenge in nine different countries. To be eligible for funding, a company or organization must be 100 percent African-owned and managed, and work to deploy off-grid renewable solutions to increase access to electricity. USADF has supported 68 projects, totaling 5 MW. These include 47 solar, 12 bioenergy, four small hydro, three hybrid, and two wind projects.

While insufficient to provide broad energy access on its own, USADF provides a good model for energy access financing. Other agencies have provided some financing for distributed renewables that meets rural needs, however, USADF has directed its entire Power Africa portfolio to support innovative and needed solutions that bring sustainable and affordable electricity to rural areas.

TABLE 3.6: USADF BREAKDOWN

	NUMBER OF PROJECTS	MW	PROJECT COST $US (MILLIONS)	AMOUNT APPROVED $US (MILLIONS)
Bioenergy	12	0.74	1.25	1.20
Hybrid	3	0.07	0.40	0.30
Hydro	4	3.48	1.90	0.40
Solar	47	0.66	5.25	5.00
Wind	2	0.02	0.20	0.20
TOTAL	**68**	**5.0**	**9.0**	**7.1**

US AGENCY FOR INTERNATIONAL DEVELOPMENT

With regard to Power Africa, USAID plays an important coordinating role for all 12 participating US government agencies. The Power Africa Coordinator's Office, housed in USAID, does not have the authority to control how participating agencies implement their policies and projects, but it does have the ability to provide guidance on policy design and project implementation.

The Coordinator's Office helps define Power Africa's approach in each country. In some cases, this assistance involves power sector reform and analysis of overall grid operability. Grids are often unreliable and poorly maintained in countries where Power Africa operates, and USAID's initial involvement may include helping countries conduct studies to determine the status of their grids and develop regulations that promote institutional strengthening and transparency. USAID may also help countries develop competitive and transparent procurement processes for new power generation. Other examples of Power Africa's enabling environment work include increasing a country's share of clean energy, supporting countries' efforts to implement cost-reflective tariff structures, and promoting gender equality and female empowerment. Power Africa also aims to drive policy reform that unlocks and advances energy project transactions.[34] Project transactions involve various types of assistance (financing, insurance, technical assistance, grant tools) from interagency teams and the employment of transaction advisers, based in-country.

Through its country missions USAID has experience operating in-country and has a unique ability for providing technical support with a lot of the implementation of projects being channeled through USAID missions. According to this report's analysis, USAID was involved in 118 different projects. The total estimated costs, not just USAID contributions, for these projects amounted to $34.05 billion. It was not possible to determine specific monetary contributions from USAID, with the values for amount approved shown in Table 3.7 coming from other agencies, which were deemed as the lead agency.

It should also be noted that in addition to coordination, USAID has a range of initiatives and programs that complement and contribute toward Power Africa's goals. These projects include Development Credit Authority, Powering Agriculture (an energy grand challenge for development), Scaling Off-Grid Energy (a grand challenge for development), Development Innovation Ventures, and the E3 Bureau, multicountry energy policy programs implemented by the US Energy Association and National Association of Regulatory Utility Commissioners.

TABLE 3.7: USAID BREAKDOWN

	NUMBER OF PROJECTS	MW	PROJECT COST $US (MILLIONS)	AMOUNT APPROVED $US (MILLIONS)
Bioenergy	7	107.49	240	0.0
Geothermal	11	1,555.00	6,585	0.9
Hybrid	1	0.25	2	0.0
Hydro	23	3,830.70	6,966	7.9
Natural gas	28	8,111.10	14,480	531.0
Solar	41	2,104.10	4,245	22.2
Wind	7	660.01	1,530	232.7
TOTAL	**118**	**16,369**	**34,049**	**794.6**

OVERSEAS PRIVATE INVESTMENT CORPORATION

The Overseas Private Investment Corporation (OPIC) is the development finance institution of the US. In Africa, much of its support for renewables has come through a five-year pilot program, the US-Africa Clean Energy Finance initiative (ACEF). ACEF, funded by the US State Department and jointly administered by OPIC and USTDA, seeks to catalyze early-stage private sector investment into renewable energy projects in Africa that may later be eligible for OPIC debt financing or political risk insurance.[35] In total, OPIC supported 50 projects, committing more money than any other agency.[36]

TABLE 3.8: OPIC BREAKDOWN

	NUMBER OF PROJECTS	MW	PROJECT COST $US (MILLIONS)	AMOUNT APPROVED $US (MILLIONS)
Bioenergy	3	9.4	31.5	0.0
Geothermal	1	70.0	329.7	0.9
Hybrid	2	1.3	24.0	2.0
Hydro	5	23.1	40.6	20.7
Natural gas	3	735.0	1,534.8	721.8
Other	8	0.0	948.3	340.0
Solar	22	298.0	1,531.5	513.7
Wind	6	643.7	2,092.0	726.5
TOTAL	**50**	**1,780**	**6,532.4**	**2,325.6**

EXPORT-IMPORT BANK (EX-IM)

The Export-Import Bank of the United States is the US's export credit agency, a government agency that provides guarantees, insurance, and loans to support the export of US goods and services in order to create and maintain US jobs and help the US economy. Ex-Im does not have a development mandate, so it does not consider poverty alleviation and sustainable development in its financing decisions. Two Ex-Im policies that are worth noting include its Supplemental Guidelines for High Carbon Intensity Projects, which include environmental guidelines related to the greenhouse-gas emissions of coal and other high carbon intensity power projects, and a requirement to charter-based mandate to promote renewable energy exports. While Power Africa originally anticipated that Ex-Im would contribute to a large number of projects, Ex-Im has lacked the ability to approve new projects in amounts over $10 million since 2015. Therefore, it has only supported eight Power Africa projects for a total of approximately $131.7 million and about 371 MW.

Considering that Ex-Im lacks a development mandate, we might have expected to see projects that trended toward large centralized fossil fuel projects, which compose the majority of Ex-Im's larger energy portfolio. So far, the projects Ex-Im has financed have been fairly evenly split, in terms of megawatts, between solar and fossil fuels. In terms of support provided, solar received about a third and fossil fuels a quarter of Ex-Im's overall financing, while one large distribution project received the rest of Ex-Im's support. EX-Im is currently considering a large liquefied natural gas project in Mozambique and a 400 MW liquefied petroleum gas power plant in Ghana. If both of these projects were approved and classified as Power Africa projects, they would dwarf the support that Ex-Im has provided for solar and move Ex-Im in the wrong direction.

TABLE 3.9: EX-IM BREAKDOWN

	NUMBER OF PROJECTS	MW	PROJECT COST $US (MILLIONS)	AMOUNT APPROVED $US (MILLIONS)
Natural Gas	2	130.0	17.4	16.7
Other fossils	1	40.0	17.0	16.7
Other	1	0.0	56.0	56.7
Solar	4	200.6	1,772.1	41.6
TOTAL	**8**	**370.6**	**1,862.5**	**131.7**

4. RECOMMENDATIONS FOR ENERGY ACCESS FINANCING

Power Africa has supported many important energy access projects and has contributed to the creation of enabling environments for renewable energy investment. At the same time, it continues to finance high-risk projects that have detrimental social and environmental impacts. As Power Africa continues to evolve and move forward, we recommend the following:

INCREASE FINANCING FOR DISTRIBUTED RENEWABLES

Despite trending upwards, Power Africa's funding for off-grid and mini-grid projects is still below the financing required to achieve universal energy access by 2030. Distributed renewables reach rural communities much faster, and the beneficiaries are more likely to be poor rural communities. They also have much lower levels of environment and social risk when compared with on-grid projects. For these reasons the overall portfolio of Power Africa needs to be rebalanced by further prioritizing off-grid projects.

> **EXAMPLE**: The vast majority of USADF's projects and financing is for mini- and off-grid solar projects. These projects include innovative technologies and business models for which other US institutions are not providing enough support. For example, while other agencies' financing of wind is primarily for large utility-scale wind farms, USADF is financing distributed wind projects, such as a micro-grid wind project in Ethiopia. In addition, USADF is financing a hybrid solar and pico-hydro project in Zambia that allows Zambia to take advantage of two renewable resources without the negative impacts of mega-dams.

INCREASE FINANCING FOR EARLY-STAGE ASSISTANCE TO PREPARE PROJECTS

Support for project preparation is an important means to support renewables. This early-stage assistance helps companies understand the potential of renewables and build a trained workforce. Without this financial backing in these preparatory phases, companies would not be able to proceed with many projects. Distributed renewable companies especially need this help because they are often companies in their infancy or they must overcome risks associated with being an early mover in a field. This support allows them to understand the feasibility of solar in a certain region, for instance, or to learn from the experience of others through reverse trade missions. This project preparation work also gives confidence to outside investors. We encourage more spending on early-stage assistance.

> **EXAMPLE:** USTDA has emphasized reverse trade missions, feasibility studies, and technical assistance that provides early-stage support to the power sector. These components lay the foundation necessary for projects to get off the ground. This assistance in the incubation stage helps renewable energy projects reach bankability, at times in high-risk marketplaces abroad.

USE LOCAL FINANCIAL INSTITUTIONS AND BUSINESSES TO DISBURSE FUNDS TO SMALLER PROJECTS

Financiers are generally hesitant to support distributed renewables because the transaction costs for smaller projects can often equal or exceed the costs of preparing much larger centralized power stations. On-the-ground partners and local financial institutions can serve as the "go-between," receiving larger portions of capital that they can then disburse to smaller mini- and off-grid renewable projects. This process can relieve foreign financiers of the administrative burden, while also increasing much-needed support for these funds. At the same time, these funds must be monitored so that they are not merely a means to mask financing for environmentally or socially harmful projects. Continued support is needed for local institutions that can disburse funding for small renewable projects with strong monitoring, transparency, and strict adherence to environmental and social due diligence.

> **EXAMPLE:** OPIC has supplied over $15 million to SunFunder, which has provided 97 loans to 31 borrowers for small-scale solar projects. Without SunFunder, OPIC would likely not have as much capability to support this level of off-grid renewables.

SHIFT SUPPORT TO AFRICA'S POOREST COUNTRIES

Support for energy projects in the name of development or economic growth often goes toward middle-income countries, rather than to the world's poorest countries. Power Africa mainly helps the continent's wealthiest and largest countries, such as South Africa and Nigeria, while leaving the poorest countries with relatively few funds. The risk of neglecting those most in need is further heightened with the predominance of on-grid projects where the contribution to access, and hence development impact, is harder to measure. In the distributed renewables space, Power Africa mainly sticks to the most proven markets, such as Kenya, rather than taking risks and encouraging investment in less developed markets where public support is needed the most. Donors like Power Africa need to be willing to take more risk by being the first to move into the harder-to-invest-in, poorer markets and those countries that have less developed clean energy markets.

> **EXAMPLE:** MCC focused on countries such as Benin and Malawi, which are poorer countries receiving very little other Power Africa investments. While the beneficial impact on electricity connections of earlier compacts warrants further scrutiny (for instance, Malawi failed to include a rural electrification component), the more recent Benin compact included an off-grid project that will have a greater chance of improving energy access.

REDUCE SUPPORT FOR PROJECTS WITH HIGH SOCIAL, ENVIRONMENTAL, AND CLIMATE RISK

Renewable energy projects compose over half of Power Africa's portfolio,[37] but the US government is still championing harmful projects, such as heavy fuel oil power plants, as part of the energy access solution. Power Africa is effectively putting more of its resources toward projects that have high social, environmental, and climate risk. Meanwhile, there is enormous potential to fund renewable projects that are lower in social, environmental, and climate risk—and are presently underfunded. On a continent that is disproportionately affected by the impacts of climate change and where large fossil fuel projects have a track record of causing significant local air and water pollution, renewables have significantly less social, environmental, and climate risk than fossil fuels. Thoughtful planning and less financing for such higher-risk projects are required to ensure Power Africa continues to connect poor communities to sustainable, reliable, and affordable electricity, rather than helping wealthy and industrial users.

> **EXAMPLE:** Ex-Im has placed restrictions on its financing for coal-fired power plants, which has made important progress toward recognizing the climate impact of public finance of energy projects. While these restrictions do not go nearly far enough, as they still allow support for some coal plants and related coal infrastructure—as well as all oil and gas projects—they provide an important first step.

IMPROVE TRANSPARENCY AND ACCOUNTABILITY OF FINANCE FLOWS

Internationally financed energy projects require a consistent high level of transparency. Getting a clear picture of how much financing is available and when it is disbursed is critical for communities to know about the nature of the project (such as what types of risks are associated with it). Providing an up-to-date, accessible list of the projects that financiers are supporting helps with external monitoring and accountability. Additionally, it helps communities that are interested in knowing the details of projects, including the funders involved, so that they may seek redress if needed.

> **EXAMPLE:** USAID's Power Africa Tracking Tool provides a user-friendly tool to see the locations of Power Africa's Pillar 1 projects, the technology used, and the number of megawatts to be generated. The PATT could be improved by covering all pillars (especially the breakdown of projects on- and off-grid), being regularly updated, and providing a clear understanding of the safeguards and standards applied.

ENSURE STRONG IMPLEMENTATION OF SOCIAL AND ENVIRONMENTAL STANDARDS CONSISTENTLY ACROSS AGENCIES

Each agency has its own specific requirements regarding social and environmental standards. Many of them, as well as their bilateral and multilateral partners, use international environmental or development standards such as the International Finance Corporation's (IFC's) Performance Standards on Environmental and Social Sustainability. While many private sector partners also use these standards, the level of monitoring and oversight is unclear. Another potential concern is that there are no strict requirements or harmonized standards governing the level of oversight and monitoring of implementation required to ensure social and environmental due diligence across all agencies. Power Africa staff note that partners go through a due diligence process to ensure their policies and procedures align with Power Africa's approach. However, it seems that it is Power Africa alone—with more third-party verification or community engagement needed—that assesses how effectively projects are implemented.

Private finance must be leveraged only with the confidence that the actors involved can deliver on environmental and social due diligence.

> **EXAMPLE:** OPIC has an *Environmental and Social Policy Statement*, which was last revised in January 2017.[38] OPIC uses the IFC's Performance Standards on Social and Environmental Sustainability and the IFC's Industry Sector Guidelines as a baseline for its Environmental and Social Policy, and updates these guidelines with its own revisions.[39]

CONTINUE A HIGH LEVEL OF COORDINATION AMONG AGENCIES, PARTNERS, AND SECTORS

Coordination among agencies, partners, and sectors allows for consistency and clarity among all parties involved in Power Africa interventions, including beneficiaries. Further, coordination provides an opportunity to ensure that activities support strategic priorities and can also highlight areas where more attention is needed. Recognizing the importance of coordination, the *Power Africa Roadmap* notes that "[t]hrough greater coordination, we will be able to leverage our diverse tools and expertise, ensure coherence, and avoid duplication of effort, maximizing our reach and impact across the continent."[40] Having a designated coordinating body for large initiatives is a best practice that should be duplicated.

> **EXAMPLE:** Power Africa has a designated Coordinator's Office, housed with USAID in Pretoria, South Africa, and in Washington, DC. This office provides administrative assistance and technical assistance, and coordinates activities among Power Africa's range of partners.

5. CONCLUSION

This analysis of Power Africa's overall portfolio revealed important lessons about energy access financing. While many global initiatives have been created to improve access to electricity, the goal of universal energy access remains elusive. Some findings and recommendations point to ways that universal access could be accelerated with the help of Power Africa and similar initiatives. Wealthier African countries such as South Africa and Nigeria are receiving the most financial support. While these countries still have energy access needs, many other countries on the continent have higher rates of energy poverty and, therefore, should be prioritized. By dollars committed and expected megawatts provided, natural gas was the technology most supported. By number of projects, solar was the technology most supported.

Although Power Africa has recognized the importance of mini- and off-grid renewables with increased financing for off-grid projects trending upwards, an even greater emphasis on such projects would improve the initiative's energy access goals. There is still significant support for projects with high levels of social, environmental, and climate risk, with these projects typically offering little to no benefit for development or energy access. A different model that moves away from rewarding large, polluting companies like ContourGlobal—responsible for the Cap des Biches project—and, instead, nurturing innovative, community-supported organizations is required.

The Power Africa initiative could benefit from additional areas of analysis. Limited data availability was a constraint in analyzing Power Africa spending. Greater transparency into Pillars 2 and 3 would allow for greater external assessment of the impact of these pillars. A resource that is comprehensive and up-to-date, such as the Power Africa Tracking Tool, would be useful in evaluating Power Africa spending. Future analysis could delve deeper into Pillars 2 and 3 and evaluate all three pillars across time. Another area for future analysis could be an assessment of the specific development impacts of Power Africa projects on communities.

NOTES

1 Note that this figure represents only estimated capital costs and not operating costs.

2 International Energy Agency (IEA), *Energy Access Outlook 2017: From Poverty to Prosperity* (2017), 53, figure 2.7, www.iea.org/publications/freepublications/publication/weo-2017-special-report-energy-access-outlook.html.

3 This report considers the different types of technologies supported by the subset of Power Africa projects examined (predominantly Pillar 1, clean energy generation). For generation projects, projects were categorized by fuel source (e.g., geothermal, natural gas, and solar). For technical assistance, projects were categorized by type of support (e.g., sector reform, feasibility studies, and advice on governance).

4 Power Africa includes the following US government agencies: US Agency for International Development (USAID), Millennium Challenge Corporation (MCC), Overseas Private Investment Corporation (OPIC), Export-Import Bank of the US (Ex-Im), US Trade and Development Agency (USTDA), US Department of State, US Department of Treasury, US Department of Energy, US African Development Foundation, US Department of Agriculture, and US Army Corps of Engineers.

5 World Bank, *Regulatory Indicators for Sustainable Energy: A Global Scorecard for Policy Makers* (2017), http://documents.worldbank.org/curated/en/538181487106403375/pdf/112828-REVISED-PUBLIC-RISE-2016-Report.pdf.

6 "Government Objectives: Benefits and Risks of PPPs," World Bank website, Public-Private-Partnership in Infrastructure Resource Center, last modified October 31, 2016, https://ppp.worldbank.org/public-private-partnership/overview/ppp-objectives.

7 See *G20 Leaders' Declaration: Shaping an Interconnected World*, a summary document of the July 7–8, 2017, meeting in Hamburg, Germany, of the Group of 20 (the countries of the European Union along with Argentina, Australia, Brazil, Britain, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Mexico, Russia, Saudi Arabia, South Africa, South Korea, Turkey, and the United States), paragraph 24, https://www.g20.org/Content/EN/_Anlagen/G20/G20-leaders-declaration.pdf?__blob=publicationFile&v=11.

8 "Treasury Guidance for US Positions on Multilateral Development Banks Engaging on Energy Projects and Policies," US Department of the Treasury website, Resource Center, last modified July 17, 2017, www.treasury.gov/resource-center/international/development-banks/Pages/guidance.aspx.

9 Overseas Development Institute (ODI), *Beyond Coal—Scaling Up Clean Energy to Fight Global Poverty* (2016), www.odi.org/sites/odi.org.uk/files/resource-documents/10964.pdf.

10 1The 2016 *Power Africa Roadmap* divided the initiative into three strategic pillars: Pillar 1—Getting to 30,000 MW; Pillar 2—Getting to 60 million connections; and Pillar 3—Unlocking energy sector potential. See USAID, *Power Africa Roadmap: A Guide to Reaching 30,000 Megawatts and 60 Million Connections* (2016), www.usaid.gov/powerafrica/roadmap.

11 "Power Africa's Beyond the Grid Increasing Access Through Small-Scale Energy Solutions," US Department of Energy website, June 3, 2014, https://energy.gov/articles/power-africa-s-beyond-grid-increasing-access-through-small-scale-energy-solutions.

12 Power Africa, "Key Power Africa Facts in One Place," Medium website, April 12, 2017, figures updated October 1, 2017, https://medium.com/power-africa/key-power-africa-facts-in-one-place-6470b4538f5c.

13 Todd Moss, *Grading Power Africa: A Preliminary Report Card on President Obama's Signature Electrification Initiative* (Center for Global Development, 2016), www.cgdev.org/publication/grading-power-africa.

14 USAID, *Power Africa Roadmap*.

15 Power Africa has a vetting process for considering which projects can be counted toward the initiative's goals. The Qualified Transactions Assistance Tool (QTAT) has 87 eligibility criteria. See the QTAT's Annex 0, March 30, 2016, draft, for key components, http://pdf.usaid.gov/pdf_docs/PA00M4NM.pdf.

16 Energy access here is as defined by the multi-tier UN Global Tracking Framework.

17 The agency overview does not reflect projects where multiple agencies were involved; instead, a lead agency is credited based on being the one that provided the most money. The one exception in this table is the NextGen/Kigoma—Solar project, which received majority funding from OPIC but some also from USTDA. The USTDA line does not show the 5 MW and $9.9 million of the project (instead, captured in the OPIC line).

18 Environmental Rights Action/Friends of the Earth Nigeria, "AZURA-EDO IPP," Field Report #352 (2014), www.ips-dc.org/wp-content/uploads/2014/05/ERA_FieldReport_HostCommunities_Azura-EdoProject.pdf. See also the letter on the topic of Azura Edo from Pacific Environment, Environmental Rights Action/Friends of the Earth Nigeria , Friends of the Earth US, and Oil Change International: Pacific Environment et al. to Elizabeth Littlefield, president and CEO of OPIC, April 22, 2014, http://www.ips-dc.org/wp-content/uploads/2014/05/NGO_Input_OPIC_Azura-Edo_EIA.pdf.

19 Some estimates put methane leakage from oil and gas production at 17 percent. Oliver Schneising et al., "Remote Sensing of Fugitive Methane Emissions from Oil and Gas Production in North American Tight Geologic Formations," *Earth's Future 2* (2014): 548, doi:10.1002/2014EF000265.

One study found that methane emissions in the United States are about 50 percent more than the EPA has estimated. See Adam R. Brandt et al., "Methane Leaks from North American Natural Gas Systems," *Science* 343 (2014): 733, 734, http://nature.berkeley.edu/er100/readings/Brandt_2014.pdf. Another study found that US methane emissions increased by more than 30 percent from 2002 to 2014, even though the EPA has estimated no significant increase: see Alexander J. Turner et al., "A Large Increase in US Methane Emissions Over the Past Decade Inferred from Satellite Data and Surface Observations," *Geophysical Research Letters* 43 no. 5 (2016), doi:10.1002/2016GL067987/.

Even at low leakage rates, any climate benefit from switching from coal to natural gas is offset by methane leakage, as well as by the displacement of renewables. See Christine Shearer et al., "The Effect of Natural Gas Supply on US Renewable Energy and CO2 Emissions," *Environmental Research Letters* 9, no. 9 (2014), doi:10.1088/1748-9326/9/9/094008. See also Steven J. Davis and Christine Shearer, "A Crack in the Natural-Gas Bridge," *Nature* 514 (2014): 436–437, www.nature.com/nature/ journal/v514/n7523/full/nature13927.html; See also, Haewon McJeon, "Limited Impact on Decadal-Scale Climate Change from Increased Use of Natural Gas," *Nature* 514 (2014), www.nature.com/articles/nature13837.

20 According to the Intergovernmental Panel on Climate Change (IPCC), methane is a greenhouse gas that is 87 times as potent as carbon dioxide over a 20-year time frame. Working Group 1 Contribution to the IPCC Fifth Assessment Report, *Climate Change 2013: The Physical Science Basis* (2013), www.climatechange2013.org/images/uploads/WGIAR5_WGI-12Doc2b_FinalDraft_All.pdf.

21 Robert W. Howarth, "A Bridge to Nowhere: Methane Emissions and the Greenhouse Gas Footprint of Natural Gas," *Energy Science and Engineering* 2, no. 2 (2014), doi:10.1002/ese3.35.

22 The Power Africa Tracking Tool and OPIC classify the Cap des Biches project as natural gas even though OPIC stated it was a heavy fuel oil power plant without any mention of its conversion to natural gas. OPIC, "OPIC Announces Commitment to ContourGlobal's Cap des Biches 33 Megawatt Expansion Project in Senegal," press release, September 21, 2016, www.opic.gov/press-releases/2016/opic-announces-commitment-contourglobal's-cap-des-biches-33-megawatt-expansion-project-senegal.

23 Volker Quaschning, "Specific Carbon Dioxide Emissions of Various Fuels," Statistics, Volker Quaschning website (2015), https://www.volker-quaschning.de/datserv/CO2-spez/index_e.php. This calculated 0.28 kilograms of carbon dioxide per kilowatt for fuel oil versus 0.34 kilograms for coal.

24 USAID supported the Kinangop wind project with technical adviser assistance, but the developer canceled the project. Daniel Cusick, "How a Huge Wind Farm in Kenya Could Transform Africa's Energy Landscape," *E&Enews*, October 11, 2016, www.eenews.net/stories/1060044075.

25 IEA, *Africa Energy Outlook: A Focus on Energy Prospects in Sub-Saharan Africa* (2014), https://www.iea.org/publications/freepublications/publication/WEO2014_AfricaEnergyOutlook.pdf.

26 International Rivers, *Dirty Hydro: Dams and Greenhouse Gas Emissions* (2008), www.internationalrivers.org/sites/default/files/attached-files/dirtyhydro_factsheet_lorez.pdf. Scientific studies have found that methane from hydropower is much greater than previously calculated. See Bobby Magill, "Hydropower May Be Huge Source of Methane Emissions," Climate Central website, October 29, 2014, www.climatecentral.org/news/hydropower-as-major-methane-emitter-18246.

Global methane emissions from dams could be up to 23 percent greater than methane emissions produced from burning fossil fuels. These methane emissions are especially important considering that methane is 87 times more potent than carbon dioxide over a 20-year period. Large hydro dams also contribute to climate change through the massive amount of cement required to build them, the diversion of waterways away from wetlands that serve as carbon sinks, and, in some cases, the massive deforestation that may result. See Gary Wockner, "Dams Cause Climate Change, They Are Not Clean Energy," EcoWatch website, August 14, 2014, www.ecowatch.com/dams-cause-climate-change-they-are-not-clean-energy-1881943019.html. Furthermore, an Oxford study found that 75 percent of dams studied ran over cost with an average cost of 96 percent higher than expected. See Atif Ansar, Bent Flybjerg, Alexander Budzier, and Daniel Lunn, "Should We Build More Large Dams? The Actual Costs of Hydropower Megaproject Development," *Energy Policy* 69 (2014), doi.org/10.1016/j.enpol.2013.10.069.

27 Allen F. Isaacman and Barbara S. Isaacman, *Dams, Displacement and the Delusion of Development: Cahora Bassa and Its Legacies in Mozambique, 1965–2007* (2013).

28 Beyond the Grid has 15 advisers working throughout the continent: East Africa Regional, Ghana, Kenya, Nigeria (three), Sub-Saharan Africa (three), Rwanda, Senegal, Southern Africa, Tanzania, Uganda, and West Africa Regional. Supplemental information provided to authors by Power Africa (on file with authors).

29 "GDP per Capita (Current US$)," World Bank website, accessed April 21, 2017, http://data.worldbank.org/indicator/NY.GDP.PCAP.CD?year_high_desc=true.

30 Renewable Energy Working Group (REWG), *Ecosystem Creation for Off-Grid Solar: Achieving Diffusion Across India* (2012), http://thecleannetwork.org/downloads/selco-ecosystem-development-nsm.pdf.

31 This data is based on information provided in the PATT and supplemental information from the agencies, which captures all publicly available data.

32 IEA, *Energy Access Outlook 2017*, 53, figure 2.7. The IEA figure of 71 percent is a global average where each country context will vary considerably. It does, however, provide a benchmark for guiding the appropriate balance of on- and off-grid financing that should be achieved. It is important to remember that donor support must be aligned with country plans to ensure a holistic process, including the aforementioned ecosystem planning.

33 This data is based on information provided in the PATT and supplemental information from the agencies, which captures all publicly available data.

34 "Power Africa's Transaction Model," How We Work, USAID website, last modified December 9, 2016, www.usaid.gov/powerafrica/howwework.

35 While the Africa Clean Energy Finance initiative (ACEF) is a very significant program that has contributed positively to the advancement of renewable energy in Africa, it does not represent OPIC's core offering of debt financing and political risk insurance. As such, ACEF projects are noted in this report, but are not counted toward OPIC's total spending. We did, however, count these projects when counting the total number of projects and the amount of megawatts supported by OPIC.

36 See the appendix for project descriptions.

37 This percentage is referring to the amount the US government has committed and includes direct support for renewable projects as well as technical assistance helping renewable projects.

38 OPIC, *Environmental and Social Policy Statement* (2017), www.opic.gov/ sites/default/files/files/final%20revised%20ESPS%2001132017(1).pdf.

39 International Finance Corporation (IFC), *Environmental, Health, and Safety Guidelines* (2016), www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines.

40 USAID, *Power Africa Roadmap*.

6. APPENDIX

FULL PROJECT LIST USED IN REPORT ANALYSIS

COMPANY/STUDY NAME	COUNTRY/ COUNTRIES	TECHNOLOGY	MW	AGENCY	AMOUNT APPROVED (WHERE AVAILABLE)
Azito—addition of condensing steam turbine, powered by exhaust heat from the existing gas turbines to increase electricity output by 50 percent with no incremental increase in gas consumption	Côte d'Ivoire	Natural gas	130	Ex-Im	$16,612,844
LeapEnergy Investment and Trade LLC	Nigeria	Natural gas	0	Ex-Im	$45,000
Rural electrification project, connecting 2,136 villages to the grid	Ghana	Other—Distribution	0	Ex-Im	$56,700,000
Dufil Prima Foods	Nigeria	Solar	0.575	Ex-Im	$648,000
Kaxu Solar One	South Africa	Solar	100	Ex-Im	$22,576,730
Xina Solar One	South Africa	Solar	100	Ex-Im	$17,357,726
Energyst—temporary independent power producers with efficient and low-emission diesel and gas-powered generators	South Africa, Angola, Mozambique	Other fossils—diesel and gas	40	Ex-Im	$16,743,302
Solar Suitcases	Various	Solar	0	Ex-Im	41,000,000
Mount Coffee Hydropower Plant Project	Liberia	Hydro	88	MCC	$164,900,000
Threshold: Infrastructure Development Project—Nkula A Refurbishment Activity	Malawi	Hydro	12	MCC	$31,620,690
Infrastructure Development Project—Transmission Network Upgrade Activity (part of Threshold)	Malawi	Other—T&D		MCC	$161,867,202
Infrastructure Development Project—T&D Upgrade, Expansion, and Rehabilitation Activity (part of Threshold)	Malawi	Other—T&D		MCC	$63,627,108
Environmental and Natural Resource Management Project (part of Compact)	Malawi	Other—resource management	0	MCC	$27,890,000
Power Sector Reform (part of Compact)	Malawi	Other—sector reform	0	MCC	$25,700,000
Off-Grid Electricity Access (part of Compact)	Benin	Other		MCC	$45,950,000
Policy Reform and Institutional Strengthening Project (part of Compact)	Benin	Other		MCC	$41,230,000
Access—barriers to legal connections (part of Compact)	Ghana	Other	0	MCC	$10,000,000
Electricity Company of Ghana Financial and Operational Turnaround (part of Compact)	Ghana	Other	0	MCC	$339,560,000
Energy efficiency and demand side management (part of Compact)	Ghana	Other	0	MCC	$25,400,000
Northern Electric Distribution Company—Financial and Operational Turnaround (part of Compact)	Ghana	Other	0	MCC	$54,190,000

FULL PROJECT LIST USED IN REPORT ANALYSIS

COMPANY/STUDY NAME	COUNTRY/ COUNTRIES	TECHNOLOGY	MW	AGENCY	AMOUNT APPROVED (WHERE AVAILABLE)
Power Generation Sector Impovement (part of Compact)	Ghana	Other	0	MCC	$16,330,000
Regulatory Strengthening and Capacity Building Project (part of Compact)	Ghana	Other		MCC	$5,000,000
Electricity Sector Reform Project (part of Threshold)	Sierra Leone	Other		MCC	$11,910,000
Electricity Sector Reform Project (part of Threshold)	Sierra Leone	Other		MCC	$5,630,000
Electricity Generation—hydroelectric generation activity (part of Compact)	Benin	Hydro	0.5	MCC	$1,319,000
Electricity Generation—photovoltaic generation activity (On-Grid Tranche) (part of Compact)	Benin	Solar		MCC	$80,000,000
Electricity Generation—photovoltaic generation activity (Tranche I) (part of Compact)	Benin	Solar	63.5	MCC	$42,080,000
NextGen/Kigoma	Tanzania	Solar	5	OPIC	$9,940,000
Amandi Energy	Ghana	Natural gas	190	OPIC	$459,800,000
Cummins Cogeneration Kenya Ltd	Kenya	Biomass	8.4	OPIC	
Akiira—Phase 1	Kenya	Geothermal	70	OPIC	$926,199.00
Mutunguru Hydroelectric Co. Ltd. Grid Connected Hydro	Kenya	Hydro	7.8	OPIC	
Kenergy	Kenya	Solar	30	OPIC	
Kipeto	Kenya	Wind	100	OPIC	$232,560,000
Azura-Edo	Nigeria	Natural gas	459	OPIC	$70,000,000
Meridiam Africa Investments SAS—Senergy 1	Senegal	Solar	29.49	OPIC	$2,025,124
Husk Power	Tanzania	Biomass	1	OPIC	
Off Grid Electric	Tanzania	Solar	50	OPIC	
PAMIGA	Benin, Burkina Faso, Cameroon, Kenya, Madagascar, Senegal, Tanzania, and Togo	Solar		OPIC	$4,750,000
d.Light	Kenya	Solar	15	OPIC	$5,000,000
Lake Turkana	Kenya	Wind	310	OPIC	$173,928,000
Nova Lumos/Txtlight Power Solutions Ltd.—Home Solar Kits	Nigeria	Solar	0	OPIC	$50,000,000
Gigawatt Global	Rwanda	Solar	8.5	OPIC	
Cap des Biches	Senegal	Natural gas	86	OPIC	$192,001,500
Taiba N'Diaye	Senegal	Wind	158.7	OPIC	$320,000,000
Firefly Investments	South Africa	Solar	60	OPIC	$34,000,000
Redstone Thermal	South Africa	Solar	100	OPIC	$400,000,000
Jumeme Rural Power Solar—Hybrid mini-grids in rural growth centers in Tanzania Phase 1 and Phase 2	Tanzania	Hybrid	0.4	OPIC	
Kilombero Hybrid	Tanzania	Hybrid	0.86	OPIC	$2,000,000
EA Power Ltd.	Tanzania	Hydro	10	OPIC	$7,075,000
Upepo Singida Wind	Tanzania	Wind	75	OPIC	

FULL PROJECT LIST USED IN REPORT ANALYSIS

COMPANY/STUDY NAME	COUNTRY/ COUNTRIES	TECHNOLOGY	MW	AGENCY	AMOUNT APPROVED (WHERE AVAILABLE)
Pembani Remgro Infrastructure Fund	Various	Other?		OPIC	$100,000,000
Sindila/Butama Mini-Hydropower	Uganda	Hydro	5.25	OPIC	$13,650,000
Standard Bank	Various	Other?		OPIC	$150,000,000
SunFunder	Various	Other?	0	OPIC	$15,000,000
Greenlight Planet	Various	Solar	0	OPIC	$5,000,000
African Finance Corporation	Various	Other?		OPIC	$75,000,000
Ten Merina Solar PV	Senegal	Solar		OPIC	$2,960,000
NextGen Solawazi Ltd.	Tanzania	Solar		OPIC	
KMRI Asset Company Tanzania Ltd.	Tanzania	Biomass		OPIC	
dVentus Technologies PLC	Ethiopia			OPIC	
GG Energy Holdings LLC	Morocco			OPIC	
SunFunder, Inc.	Africa regional			OPIC	
African Energy Corporation	Namibia			OPIC	
Virunga Power Kenya Ltd.	Kenya			OPIC	
Solar Mosaic Inc.	Africa regional			OPIC	
KMR Infrastructure LLC	Uganda			OPIC	
d.light Design Inc.	Kenya			OPIC	
Taiba N'Diaye Wind Park (Parc Eolien Taiba N'Diaye SA)	Senegal			OPIC	
KenGreen Energy Ltd.	Kenya			OPIC	
M-KOPA Kenya Ltd.	Kenya			OPIC	
PAMIGA Finance SA	Africa regional			OPIC	
Crossboundary Energy	Africa regional			OPIC	
Nova Lumos	Nigeria			OPIC	
Beacon Power Services	Nigeria			OPIC	
PEG Africa	West Africa			OPIC	
PowerGen Renewable Energy	East Africa			OPIC	
Achwa HPP	Uganda	Hydro	42	Other	
Aggeneys Solar PV	South Africa	Solar	45.1	Other	
Aries Solar PV	South Africa	Solar	10.752	Other	
Atlas Energy Solar PV—Solar	Malawi	Solar	40	Other	
Biomass mini-grids for palm-oil producing communities—Benin and Tanzania	Tanzania	Biomass	0.035	Other	
Brio Power Embedded Combined Cycle	Nigeria	Natural Gas	75	Other	
Bumbuna II HPP	Sierra Leone	Hydro	224	Other	
Chaba Wind Farm (WF Chaba EDF)	South Africa	Wind	21.53	Other	
City of David	DRC	Other—fuel cell	3	Other	
COEGA Wind Farm	South Africa	Wind	1.8	Other	
Dassiesklip Wind	South Africa	Wind	27	Other	

FULL PROJECT LIST USED IN REPORT ANALYSIS

COMPANY/STUDY NAME	COUNTRY/ COUNTRIES	TECHNOLOGY	MW	AGENCY	AMOUNT APPROVED (WHERE AVAILABLE)
Diaz	Namibia	Wind	44	Other	
Djermaya Solar Phase 1	Chad	Solar	30	Other	
Electrawinds Mpeketoni	Kenya	Wind	90	Other	
EleQtra Wind/Leona 50 MW	Senegal	Wind	50	Other	
Excelsior Wind	South Africa	Wind	32.5	Other	
First Independent Power/Elema	Nigeria	Natural gas	75	Other	
Golden Valley Wind	South Africa	Wind	120	Other	
Grassridge Wind Farm (WF Grassridge EDF)	South Africa	Wind	61.5	Other	
GWG 10 MW PV Parakou Benin	Benin	Solar	10	Other	
Hopefield Wind Farm	South Africa	Wind	66.6	Other	
JCM Capital Solar PV	Malawi	Solar	30	Other	
Jigawa II	Nigeria	Solar	50	Other	
Jigawa I	Nigeria	Solar	75	Other	
Kathu Solar Park CSP	South Africa	Solar	100	Other	
Kikigati	Uganda	Hydro	16	Other	
Klipheuwel Wind Farm	South Africa	Wind	2.41	Other	
KMRI Ndugutu Power Company	Uganda	Hydro	4.81	Other	
Kodeni Solar PV	Burkina Faso	Solar	17	Other	
Konkoonsies II Solar PV	South Africa	Solar	86	Other	
Konkoonsies Solar PV	South Africa	Solar	10.752	Other	
Kusini Energy/Mtwara	Tanzania	Natural gas	400	Other	
Kyambura	Uganda	Hydro	7.6	Other	
Letseng	Lesotho	Wind	35	Other	
Lubilia	Uganda	Hydro	5.4	Other	
Makay Hydro Project	Cameroon	Hydro	400	Other	
Mbalmayo	Cameroon	Solar	72	Other	
Mere Power Nzema /Blue Energy	Ghana	Solar	155	Other	
Mining and Smelting Project	DRC	Other—fuel cell	10	Other	
Muvumbe	Uganda	Hydro	6.5	Other	
Nkusi	Uganda	Hydro	9.6	Other	
Noblesfontein Wind Farm	South Africa	Wind	73.8	Other	
Nojoli Wind Farm	South Africa	Wind	88	Other	
Northern Energy	Kenya	Biomass	2.5	Other	
Nosy Be	Madagascar	Hybrid	8	Other	
Nyamagasani I	Uganda	Hydro	15	Other	
Nyamagasani II	Uganda	Hydro	5	Other	
Nyamwamba	Uganda	Hydro	9.2	Other	

FULL PROJECT LIST USED IN REPORT ANALYSIS

COMPANY/STUDY NAME	COUNTRY/ COUNTRIES	TECHNOLOGY	MW	AGENCY	AMOUNT APPROVED (WHERE AVAILABLE)
Pa Solar PV	Burkina Faso	Solar	17	Other	
Ruzizi III	Burundi	Hydro	145	Other	
Rwimi	Uganda	Hydro	5.5	Other	
Siginik Energy / CIG	Ghana	Solar	50	Other	
Siti I	Uganda	Hydro	6.1	Other	
Siti II	Uganda	Hydro	16	Other	
Solar-hybrid mini-grids in rural growth centers in Tanzania	Tanzania	Hybrid	5	Other	
SOMICO Mine	DRC	Other—fuel cell	3	Other	
Soroti I & II	Uganda	Solar	10	Other	
South KIVU / RDC	DRC	Other—fuel cell	200	Other	
Starsol Solar Phase 1	Chad	Solar	40	Other	
Symbion Kabale Peat	Uganda	Biomass	33	Other	
Symbion Mahajanga biomass	Madagascar	Biomass	5	Other	
Symbion Mahajanga solar plantsr	Madagascar	Solar	10	Other	
Symbion Mandroseza TPP Rehabilitation	Madagascar	Natural gas	40	Other	
Symbion Methane	Rwanda	Natural gas	50	Other	
Tè (Kipe) Power Project	Guinea	Other fossils—HFO	50	Other	
Tororo South & North	Uganda	Solar	10	Other	
Tsitsikamma Community Wind Farm Project	South Africa	Wind	95.33	Other	
Upwind Ayitepa (Mainstream/Actis) Phase 2	Ghana	Wind	75	Other	
Waainek Wind Farm Project (WF Grahamstown EDF)	South Africa	Wind	24	Other	
Waki	Uganda	Hydro	4.8	Other	
West Coast One Wind Farm	South Africa	Wind	94	Other	
Xaris	Namibia	Natural gas	200	Other	
Yiben	Sierra Leone	Hydro	66	Other	
Sun Transfer Tech PLC—sales and installation of home solar systems	Ethiopia	Solar	0.013	USADF	$150,000
Sky Power Enterprise PLC	Ethiopia	Solar	0.01	USADF	$100,000
Ethio Resource Group PLC—six wind turbine micro-grids	Ethiopia	Wind	0.006	USADF	$100,000
Ecovillage Community Improvement	Liberia	Solar	0.05	USADF	$100,000
Liberia Engineering	Liberia	Solar	0.025	USADF	$100,000
Watumia Umeme Cooperative Society	Tanzania	Solar	0.001	USADF	$100,000
GM Clean Energy	Ethiopia	Biogas	0	USADF	$100,000
Organization for Rehabilitation and Development in Amhara (ORDA)	Ethiopia	Biogas	0	USADF	$100,000
Alemu Assefa Solar Enterprise	Ethiopia	Solar		USADF	$100,000
Guraghe Development and Cultural Association (GDCA)	Ethiopia	Solar		USADF	$100,000

FULL PROJECT LIST USED IN REPORT ANALYSIS

COMPANY/STUDY NAME	COUNTRY/ COUNTRIES	TECHNOLOGY	MW	AGENCY	AMOUNT APPROVED (WHERE AVAILABLE)
NBK Electrical Consulting Engineers	Ethiopia	Solar		USADF	$100,000
Rensys Engineering and Trading	Ethiopia	Solar	0.01	USADF	$100,000
Green Scene Energy PLC	Ethiopia	Solar		USADF	$100,000
Kumasi Institute of Tropical Agriculture (KITA) Gasifier Plant	Ghana	Biomass	0.02	USADF	$100,000
Atlas Business and Energy Systems Ltd. (ABES)	Ghana	Solar		USADF	$100,000
Centre for Energy, Environment and Sustainable Development (CEESD)	Ghana	Solar	0.01	USADF	$100,000
NewEnergy—solar-powered system for water purification and irrigation	Ghana	Solar	0.005	USADF	$100,000
Solar Light Company Ltd.—solar-powered mobile charging units	Ghana	Solar	0.003	USADF	$150,000
Wilkins Engineering Ltd.—solar home systems and refrigeration	Ghana	Solar	0.026	USADF	$100,000
Kitui Industries Ltd.	Kenya	Biodiesel	0	USADF	$100,000
Afrisol Energy Ltd.—biogas digester powering electric generator	Kenya	Biogas	0.015	USADF	$100,000
SCODE Ltd.—sales and installation of hybrid solar/ cookstove systems	Kenya	Hybrid	0.011	USADF	$100,000
Magoya Konjra Hareka Self Help Group (MAKOHAA)	Kenya	Hydro	0.01	USADF	$100,000
Action in Community Environment in Africa, known as Ace Africa Kenya	Kenya	Solar	0	USADF	$100,000
Boma Safi Ltd.—distribution of affordable solar lanterns	Kenya	Solar	0.045	USADF	$100,000
Deevabits Green Energy	Kenya	Solar	0	USADF	$100,000
Mibawa Suppliers Ltd.—sales and installation of home solar systems	Kenya	Solar	0.003	USADF	$100,000
Rafode Ltd.—sale of solar fishing lamps and improved cook stoves	Kenya	Solar	0.001	USADF	$100,000
Renewable World East Africa	Kenya	Solar	0.048	USADF	100,000
Solar World—solar water pumping and energy kiosks	Kenya	Solar	0.007	USADF	$100,000
Sollatek Electronics Ltd.— 15 solar refrigeration centers	Kenya	Solar	0.007	USADF	$100,000
Ambalian Ltd.—local content components for wind turbines	Kenya	Wind	0.01	USADF	$100,000
Alternative Energy—solar mini-grid for off-grid community	Liberia	Solar	0.023	USADF	$100,000
Liberian Energy Network (LEN)	Liberia	Solar	0	USADF	$150,000
Ajima Farms and General Enterprises Nigeria Ltd.—biomass digester	Nigeria	Biogas	0.001	USADF	$100,000
Ginphed Nigeria Ltd. —bio-digesters producing electricity from livestock	Nigeria	Biogas	0.15	USADF	$100,000
Quintas Renewable Energy Solutions—biomass power plant	Nigeria	Biomass	0.5	USADF	$100,000
Afe Babalola University Ado-Ekiti (ABUAD)—mini-hydro plant feasibility	Nigeria	Hydro	1	USADF	$100,000
Arnergy Solar Ltd.	Nigeria	Solar	0	USADF	$100,000
GoSolarAfrica Ltd.	Nigeria	Solar	0.025	USADF	$100,000
GVE Projects Ltd.—solar mini-grid for household use	Nigeria	Solar	0.021	USADF	$100,000

FULL PROJECT LIST USED IN REPORT ANALYSIS

COMPANY/STUDY NAME	COUNTRY/ COUNTRIES	TECHNOLOGY	MW	AGENCY	AMOUNT APPROVED (WHERE AVAILABLE)
Havenhill Synergy Limited	Nigeria	Solar	0.019	USADF	$100,000
Kunak Development Foundation—solar mini-grid for market stalls	Nigeria	Solar	0.008	USADF	$100,000
Sky Resources Technology Nigeria—solar mini-grid development	Nigeria	Solar	0.025	USADF	$150,000
Sosai Renewable Energies Ltd.	Nigeria	Solar	0.02	USADF	$100,000
Topstep Nigeria Ltd.—solar-powered grain milling	Nigeria	Solar	0.011	USADF	$150,000
Trans Africa Gas and Electric Corporation PLC—solar-powered cold storage	Nigeria	Solar	0.008	USADF	$100,000
Dassy Gishwati Highlands Solar Milk Project	Rwanda	Solar	0.013	USADF	$100,000
RENERG Banda Smart Village	Rwanda	Solar	0.03	USADF	$100,000
Serve and Smile Solar Home System Project	Rwanda	Solar	0.021	USADF	$100,000
Tanzania Human Development Foundation (TAHUDE)	Tanzania	Biogas	0	USADF	$100,000
Ageco Energy Ltd.	Tanzania	Biomass	0.032	USADF	$100,000
SESCOM Limited—biomass micro-grid	Tanzania	Biomass	0.02	USADF	$100,000
Space Engineering hybrid biomass/solar 40 kW power plant	Tanzania	Hybrid	0.04	USADF	$100,000
Lung'ali Natural Resources Company—revolving loan fund for households	Tanzania	Hydro	2.4	USADF	$100,000
Nishati Associates Ltd.	Tanzania	Hydro	0.068	USADF	$100,000
Ensol (T) Ltd.	Tanzania	Solar	0.05	USADF	$100,000
Galaxy Energy Solutions Ltd.	Tanzania	Solar	0	USADF	$100,000
Jamii Power—expansion from 11 kW to 33 kW solar mini grid plus smart	Tanzania	Solar	0.02	USADF	$100,000
L's Solution Ltd.—installation and operation of a 12 kW solar micro grid	Tanzania	Solar	0.012	USADF	$150,000
Maasai Pastoralist Development Organization—solar micro-grids	Tanzania	Solar	0.001	USADF	$100,000
Green Heat Biogas Dairy Project	Uganda	Biogas	0	USADF	$100,000
GRS Ssese Islands Micro-Grid Project	Uganda	Solar	0.04	USADF	$100,000
OneLamp Mobile Solar Platform Project	Uganda	Solar	0.004	USADF	$100,000
SuperRich Micro Hydro Power Plant Project	Zambia	Hybrid	0.015	USADF	$100,000
Buntungwa Solarway Energy	Zambia	Solar	0.028	USADF	$100,000
Muhanya Solar Sinda Micro-Grid Project	Zambia	Solar	0.02	USADF	$100,000
Translight Energy Ltd.	Ghana	Solar		USADF	$100,000
Tindinyo	Kenya	Hydro	1.5	USAID	
Benedictine Sisters of St. Gertrud Convent	Tanzania	Hydro	0.317	USAID	$100,000
Aldwych Singida Wind	Tanzania	Wind	100	USAID	
Ngonye Falls	Zambia	Hydro	40	USAID	
WAPP Maria Gleta Regional Project (Benin)	Benin	Natural gas	450	USAID	

FULL PROJECT LIST USED IN REPORT ANALYSIS

COMPANY/STUDY NAME	COUNTRY/ COUNTRIES	TECHNOLOGY	MW	AGENCY	AMOUNT APPROVED (WHERE AVAILABLE)
Gao and Tayaboui	Côte d'Ivoire	Hydro	210	USAID	
Tahibli	Côte d'Ivoire	Hydro	20	USAID	
Tiboto	Côte d'Ivoire	Hydro	225	USAID	
Songon Power	Côte d'Ivoire	Natural gas	374	USAID	
Lac Assal/Fiale Caldera	Djibouti	Geothermal	20	USAID	
Grand Bara/Green Enesys Deutschland GmbH 50 MW Phase 1	Djibouti	Solar	50	USAID	
Sombwe IPP	DRC	Hydro	95	USAID	
Abaya & Tulumoya	Ethiopia	Geothermal	500	USAID	
Corbetti Geothermal Phase 1	Ethiopia	Geothermal	20	USAID	
Corbetti Geothermal Phase 2	Ethiopia	Geothermal	50	USAID	
Corbetti Geothermal Phase 3	Ethiopia	Geothermal	200	USAID	
Corbetti Geothermal Phase 4	Ethiopia	Geothermal	200	USAID	
Geothermal Site 1	Ethiopia	Geothermal	300	USAID	
Chemoga Yeda 1 and 2	Ethiopia	Hydro	280	USAID	
Tams Hydro Project	Ethiopia	Hydro	1700	USAID	
Metahara Solar Project—100 MW	Ethiopia	Solar	100	USAID	
Solar Project 1	Ethiopia	Solar	100	USAID	
Solar Project 2	Ethiopia	Solar	100	USAID	
Debre Birhan Wind Project	Ethiopia	Wind	100	USAID	
Iteya Wind Project	Ethiopia	Wind	150	USAID	
African Plantations for Sustainable Development (APSD)	Ghana	Biomass	60	USAID	
Kwamoka Biomass Generation Plant	Ghana	Biomass	6	USAID	
Bridge (Fast) Power/Ghana 300 Phase 1a	Ghana	Natural gas	144	USAID	
Bridge (Fast) Power/Ghana 300 Phase 1b	Ghana	Natural gas	50	USAID	
Bridge (Fast) Power/Ghana 300 Phase 2	Ghana	Natural gas	206	USAID	
CenPower Kpone	Ghana	Natural gas	350	USAID	
Ghana 1000 Phase 1A	Ghana	Natural gas	375	USAID	
Ghana 1000 Phase 1B	Ghana	Natural gas	375	USAID	
Kpone Independent Power Plant	Ghana	Natural gas	350	USAID	
WAPP Domunli Power	Ghana	Natural gas	450	USAID	
Bole Solar Project	Ghana	Solar	50	USAID	
Nzema Power Project	Ghana	Solar	155	USAID	
Upwind Ayitepa (Mainstream/Actis) Phase 1	Ghana	Wind	150	USAID	
AGIL-Longonot Phase 1	Kenya	Geothermal	70	USAID	
Menengai	Kenya	Geothermal	105	USAID	
Eldosol Energy	Kenya	Solar	40	USAID	
Kesses I	Kenya	Solar	40	USAID	

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COMPANY/STUDY NAME	COUNTRY/ COUNTRIES	TECHNOLOGY	MW	AGENCY	AMOUNT APPROVED (WHERE AVAILABLE)
Kogelo (MSOF)	Kenya	Solar	40	USAID	
Makindu	Kenya	Solar	30	USAID	
Radiant Energy	Kenya	Solar	40	USAID	
Kinangop	Kenya	Wind	60	USAID	
Kakata BWI—biomass energy center	Liberia	Biomass	0.06	USAID	
Sorlumba Biomass—agricultural feedstock	Liberia	Biomass	0.03	USAID	
Mein River—Hydro Run of the River (ROR)	Liberia	Hydro	1	USAID	
Gbarnway – solar PV home systems	Liberia	Solar	0.05	USAID	
Mbongozi Power	Malawi	Hydro	41	USAID	
ContourGlobal Markala	Mali	Hydro	10	USAID	
OMVS Manantali II T&D + HD	Mali	Hydro	500	USAID	
Banda Gas-to-Power	Mauritania	Natural gas	180	USAID	
Elephant Energy	Namibia	Solar	0	USAID	
Kainji Kainji	Nigeria	Hydro	540	USAID	
Kainji Jebba	Nigeria	Hydro	96.4	USAID	
Afam Power	Nigeria	Natural gas	350	USAID	
Century Power	Nigeria	Natural gas	495	USAID	
Egbin Power	Nigeria	Natural gas	220	USAID	
First Independent Power/Afam	Nigeria	Natural gas	180	USAID	
First Independent Power/Omoka	Nigeria	Natural gas	25	USAID	
Ikot Abasi Power	Nigeria	Natural gas	250	USAID	
Olorunsogo I	Nigeria	Natural gas	213.1	USAID	
OMA Power	Nigeria	Natural gas	500	USAID	
Omotosho I	Nigeria	Natural gas	74	USAID	
Proton Delta Sunrise	Nigeria	Natural gas	150	USAID	
Sapele Power	Nigeria	Natural gas	940	USAID	
Transcorp Ughelli Power	Nigeria	Natural gas	220	USAID	
Yellowstone IPP	Nigeria	Natural gas	350	USAID	
AMP Solar	Nigeria	Solar	27	USAID	
DuSable Capital / Motir	Nigeria	Solar	100	USAID	
LR Group—Solar	Nigeria	Solar	100	USAID	
Middle Band Solar (MBSO)	Nigeria	Solar	100	USAID	
Nigeria Solar Capital	Nigeria	Solar	100	USAID	
Nova Solar Power	Nigeria	Solar	100	USAID	
Pan Africa Solar	Nigeria	Solar	75	USAID	
Panyam Solar	Nigeria	Solar	70	USAID	

FULL PROJECT LIST USED IN REPORT ANALYSIS

COMPANY/STUDY NAME	COUNTRY/ COUNTRIES	TECHNOLOGY	MW	AGENCY	AMOUNT APPROVED (WHERE AVAILABLE)
Rook Solar Investment	Nigeria	Solar	100	USAID	
Biomass and Solar PV hybrid mini-grids for off-grid farming communities	Nigeria and Ghana	Hybrid—biomass, solar	0.25	USAID	
Senegal Scaling Solar Program I	Senegal	Solar	100	USAID	
Senegal Scaling Solar Program II	Senegal	Solar	100	USAID	
Kiwira River (East Africa Power Limited)	Tanzania	Hydro	10	USAID	
Mapembasi/Njombe	Tanzania	Hydro	10	USAID	
Tulila	Tanzania	Hydro	7.5	USAID	
Kinyerezi I	Tanzania	Natural gas	150	USAID	
EGG Energy	Tanzania	Solar	6	USAID	
Mayuge Sugar Bagasse	Uganda	Biomass	32	USAID	
Nyabuhuka-Mujunju SHP	Uganda	Hydro	3.2	USAID	
Nyamabuye SHP	Uganda	Hydro	7	USAID	
Kalahari GeoEnergy	Zambia	Geothermal	20	USAID	
Rural Clinic Rooftop Solar	Zambia	Solar	5	USAID	
Scaling Solar 1	Zambia	Solar	28	USAID	
Scaling Solar 2	Zambia	Solar	47.5	USAID	
Lamu Gas	Kenya	Natural gas	50	USTDA	$996,600
Luweya River	Malawi	Hydro	15	USTDA	$684,000
Abiba Solar/Quaint	Nigeria	Solar	50	USTDA	$992,968
Biomass to Power Feasibility Study	Ghana	Biomass	20	USTDA	$899,995
Floating LNG Storage and Regasification Unit Reverse Trade Mission	Ghana	Natural gas	0	USTDA	$214,752
ECG Smart Grid Applications Feasibility Study	Ghana	Other—smart grid	0	USTDA	$646,000
Aboadze-Domunli-Prestea Transmission Line Feasibility Study	Ghana	Other—transmission	0	USTDA	$655,000
Eastern Transmission Line Feasibility Study	Ghana	Other—transmission	0	USTDA	$645,000
NEDCo Management and Investment Planning Technical Assistance	Ghana	Other—Business operation	0	USTDA	$410,000
Greater Accra Wind Technical Assistance	Ghana	Wind	75	USTDA	$926,614
Nyakewere Hills 40 MW Solar Power Plant (Quaint) Technical Assistance	Kenya	Solar	40	USTDA	987,000
Renewable World East Africa 1.5 Megawatt Solar Microgrid Project Feasibility Study	Kenya	Solar	1.5	USTDA	600,000
Sunpower Isiolo 40 MW Solar Farms Feasibility Study	Kenya	Solar	40	USTDA	$356,630
Power Sector Opportunities Reverse Trade Mission	Malawi	Other—business opportunities	0	USTDA	$331,683

FULL PROJECT LIST USED IN REPORT ANALYSIS

COMPANY/STUDY NAME	COUNTRY/ COUNTRIES	TECHNOLOGY	MW	AGENCY	AMOUNT APPROVED (WHERE AVAILABLE)
Critical Electricity Transmission and Distribution Infrastructure Technical Assistance	Mozambique	Other—transmission	0	USTDA	$649,354
NamPower Electricity Generation and Transmission	Namibia	Other—transmission	0	USTDA	$199,990
Honeywell Group Flower Gate	Nigeria	Natural gas	50	USTDA	$455,000
Lagos State CNG Infrastructure Feasibility Study	Nigeria	Natural gas	0	USTDA	$494,000
Royal Power & Energy	Nigeria	Natural gas	275	USTDA	$667,000
Southwestern Nigeria Gas Pipeline Feasibility Study	Nigeria	Natural gas	0	USTDA	$446,000
Benin Electricity Distribution Modernization Technical Assistance	Nigeria	Other—distribution	0	USTDA	$630,000
Eko and Ikeja Distribution Modernization Feasibility Study	Nigeria	Other—distribution	0	USTDA	$1,258,527
Electricity Distribution Sector Reverse Trade Mission	Nigeria	Other—distribution	0	USTDA	$224,517
OSD Omuwo-Odofin Embedded Generation	Nigeria	Other—distribution		USTDA	$703,452
Spark Meter Port Harcourt Pilot Project Feasibility Study	Nigeria	Other—smart meter	0	USTDA	$560,532
Rwaza I & II	Rwanda	Hydro	3.6	USTDA	$525,000
US-ACEF Amahoro Energy Small Hydro	Rwanda	Hydro	4.5	USTDA	$675,000
5 MW Solar PV and 30 MW PV Hybrid Power Plants Feasibility Study	Sierra Leone	Solar/hybrid	35	USTDA	$856,386
Drakenstein Waste-to-Energy	South Africa	Biomass	12.6	USTDA	$580,000
Meerkat 18 Megawatt Small Hydropower Project Feasibility Study	South Africa	Hydro	18	USTDA	$681,000
Ibhubesi Offshore Gas Subsurface Field Development Plan Feasibility Study	South Africa	Natural gas	0	USTDA	$700,000
Natural Gas Project Planning Advisory Services Technical Assistance	South Africa	Natural gas	0	USTDA	$195,592
Development Bank of Southern Africa Clean Energy Advisor Technical Assistance	South Africa	Other	0	USTDA	$940,182
Energy Storage Technology and Market Assessment (IDC) Technical Assistance	South Africa	Other—energy storage	0	USTDA	$487,669
Industrial Development Corporation Clean Energy Project Planning Advisory Services	South Africa	Other—energy storage	0	USTDA	$1,360,147
Fuel Cell Applications for Telecommunications Towers (US-ACEF) Technical Assistance	South Africa	Other—fuel cell	0	USTDA	$872,000
Renewable Energy Grid Integration Reverse Trade Mission	South Africa	Other—grid integration	0	USTDA	$255,998
Ekurhuleni Smart Metering Feasibility Study	South Africa	Other—smart meter	0	USTDA	$695,000
Solafrica 100 MW CSP Plant	South Africa	Solar	100	USTDA	$800,000
Urban Solar Farms Feasibility Study	South Africa	Solar	200	USTDA	$810,093
Western Cape Rooftop Solar PV	South Africa	Solar	0.75	USTDA	$545,000

FULL PROJECT LIST USED IN REPORT ANALYSIS

COMPANY/STUDY NAME	COUNTRY/ COUNTRIES	TECHNOLOGY	MW	AGENCY	AMOUNT APPROVED (WHERE AVAILABLE)
Energy Storage Technologies Reverse Trade Mission	South Africa	Other—energy storage	0	USTDA	$293,925
Lukosi River	Tanzania	Hydro	20	USTDA	$600,000
Lake Victoria Minigrid Pilot Project	Tanzania	Solar	2	USTDA	$818,000
Shinyanga 60 MW	Tanzania	Solar	60	USTDA	$877,825
University of Dodoma 55 MW	Tanzania	Solar	55	USTDA	$600,000
Gas to Power Reverse Trade Mission	Various	Natural gas	0	USTDA	$548,863
African Leaders' Visit: Energy Reverse Trade Mission	Various	Other—energy storage	0	USTDA	$348,630
US-Africa Energy Sector Standards Cooperation Program Technical Assistance	Various	Other—infrastructure	0	USTDA	$401,868
Weldy Lamont Rural Electrification Project	Senegal	Other—distribution	—	USTDA	$900,000
Kalahari GeoEnergy 10-20 MW Geothermal Power Project	Zambia	Geothermal	20	USTDA	$741,620
Virunga Hydropower Project	Kenya	Hydro	15.7	USTDA	$897,192
Saigrene Energy Small Hydropower Projects	Kenya	Hydro	17	USTDA	$1,204,076
Siaya Solar Project Battery Storage Integration	Kenya	Solar	40	USTDA	$110,334
75 MW Power Plant in Free State Province	South Africa	Solar	75	USTDA	$1,099,579
Kano Grid Connection	Nigeria	Solar	100	USTDA	$301,600
Community Energy Nigeria MicroGrid	Nigeria	Solar	5	USTDA	$767,512
Standard Microgrid Initiatives Limited Deployment of 150 Microgrid Units	Zambia	Solar	1.6	USTDA	$746,200
Buipe Solar 20 MW Solar Power Plant	Ghana	Solar	20	USTDA	$861,300

COVER: Solar panels on an Oxfam solar-powered water pump in Waterloo, Sierra Leone. *Tommy Trenchard / Oxfam*

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