



U.S.-AFRICA CLEAN ENERGY STANDARDS PROGRAM

Public Market Report: Mini-Grid Workshop: Regulatory Framework and Quality Assurance

Phase II Workshop No. 4 USTDA Activity No. (2015-11008A) and Contract No. (CO201511061)

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PUBLIC MARKET REPORT

Mini-Grid Workshop: Regulatory Framework and Quality Assurance

November 13 – 14, 2018

08:30 AM – 6:00 PM

Radisson Blu

Dakar, Senegal

BACKGROUND

As the seventh workshop under the U.S. Trade and Development Agency-sponsored U.S. – Africa Clean Energy Standards Program, this event focused on mini-grid standards, regulation, and quality assurance. Renewable energy mini-grids have long served as a means of electrifying rural areas in developing countries. Over 600 million people in sub-Saharan Africa do not have access to electricity, the majority of who live in rural areas that will not have access to national power grids in the foreseeable future. For example, in 2015, electricity access in urban areas of Senegal reached 90 percent while only 28 percent of the rural population had electricity access.²

Although Senegal's electrification rates are relatively high for sub-Saharan Africa providing access to approximately 55 percent of the population, rural electrification hovers around 30 percent.³ Based on these figures, the addressable rural market in Senegal can be estimated to cover approximately 4.8 million people. Based on responses from U.S. companies, U.S. content will make up between 50 and 85 percent of solar mini-grid components and related services for use by U.S. companies operating micro- and mini-grids across sub-Saharan Africa (SSA).

Renewable energy mini-grids have been recognized as a cost-effective alternative to extending the national grid into remote areas. This is particularly true in rural Senegal where expected electricity loads are relatively low and the transport cost of supplemental fuels, such as diesel, is high. These factors make renewable hybrid systems with an increasing share of renewable energy technologies cost-competitive. The Senegalese government has recognized this opportunity and the limiting impact of low electricity access, particularly in rural areas, by emphasizing energy policy aiming to diversify the country's energy mix by increasing the country's share of renewable energy and biofuels to at least 15% by 2020.⁴

While the Senegalese, and other regional governments, have emphasized the role of off-grid renewable energy, governments have yet to establish clear rules for the off-grid energy sector. For this reason, an enabling environment of technical standards and regulations is a critical prerequisite for the successful proliferation of renewable mini-grids across rural Senegal and West Africa. As government officials and regulators begin to create policies for the off-grid sector, U.S. participation helps to ensure that U.S. producers, implementers, and energy providers are not excluded from the Senegalese off-grid market.

² Power Africa (2015). *Power Africa in Senegal Country Factsheet*. Retrieved from https://www.usaid.gov/sites/default/files/documents/1860/SenegalCountryFactSheet.2016.09_FINAL.pdf

³ World Bank Group. (2017). *Lighting Africa: Senegal*. Retrieved from <https://www.lightingafrica.org/country/senegal/>

⁴ International Renewable Energy Agency. (2013). *Senegal: Renewables Readiness Assessment 2012*. Retrieved from <http://www.irena.org/DocumentDownloads/Publications/IRENA%20Senegal%20RRA.pdf>

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The objectives of this workshop were to promote an enabling environment for U.S. private sector investment by increasing investor understanding of the Senegalese and West African markets. The workshop led to further discussions of opportunities in the Senegalese market as well as crosscutting issues affecting other West African markets and beyond. This workshop brought together leading experts in both the public and private sectors and features presentations by the U.S. and African private sector as well as Senegalese regulators who had robust conversations that touched on challenges and opportunities in renewable mini-grid system development, including pricing models, quality assurance, and investment opportunities for mini-grids.

WORKSHOP SUMMARY

On November 13 - 14, 2018 the [U.S. Trade and Development Agency](#) (USTDA) hosted the "West Africa Mini-grids Workshop: Technological Advances, Regulatory Framework, and Quality Assurance" in Dakar, Senegal. The workshop was organized by the [American National Standards Institute](#) (ANSI) under the USTDA-funded [U.S.-Africa Clean Energy Standards Program](#) (CESP), and was co-hosted by the [Economic Community of West African States](#) (ECOWAS) [Centre for Renewable Energy and Energy Efficiency](#) (ECREEE) as part of [ECREEE's Sustainable Energy Forum](#).

Solar mini-grids are an increasingly viable solution for providing remote populations with affordable and reliable electricity access. Across West Africa, and in countries like Senegal where only 34 percent of the rural population has access to electricity, mini-grids present a promising alternative to traditional grid infrastructure. This workshop featured presentations by U.S. experts, as well as Senegalese and other African experts from both the public and private sectors to address quality assurance, system planning, energy storage systems, data management, metering, and other important aspects of mini-grid development.

The workshop attracted more than 100 participants, including attendees from seven African countries. The event provided a thorough background on Senegal's policy landscape for mini-grid development as well as detailed information on standards-related and technical solutions to support the viability and management of existing and future off-grid systems across West Africa.

The workshop featured 25 expert speakers from the U.S., Mali, Nigeria, and Senegal. These experts included 12 U.S. speakers from [Alpha Technologies](#), [FRAYM](#), [HOMER Energy](#), [Millennium Challenge Corporation](#) (MCC), [MRIGlobal](#), [National Renewable Energy Laboratory](#) (NREL), [Odyssey Energy Solutions](#), [Power Africa Transactions and Reforms Program](#) (PATPR), [PowerGen](#), [Princeton Power](#), [Renewvia](#), and [Schneider Electric](#). U.S. companies have unique technology and both hard and software that can help West Africa ensure electricity reaches everyone, even in the most remote locations.

Presentations and photos from the workshop are available on the CESP website: www.standardsportal.org/us-africacesp.

MARKET OPPORTUNITY

With a stable political and economic environment, including a stable currency and a strong annual GDP growth rate, Senegal is a good market for long-term investments. The Senegalese government began

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promoting private sector participation in the energy sector in 1998 when they adopted the “Electricity Law (98-29)”, which provides the opportunity for private sector involvement through a process of concessions and licensing, overseen by an independent regulator that was later established as the Commission de Régulation du Secteur de l’Electricité (CRSE). Today SENELEC, the national utility, generates approximately 63-percent of the country’s electricity, with the remaining 37% coming from IPPs.

Senegal has the potential to increase energy access through significant untapped solar resources and the use of off-grid systems. Currently, Senegal has an overall electricity access rate of approximately 60 percent in urban areas, and only 33 percent in rural areas. Recognizing that large-scale grid extension will not meet the needs of many remote communities, the Senegalese government seeks to promote off-grid solutions including mini-grids, solar home systems, and other decentralized solutions. These initiatives are termed Local Rural Electrification Initiatives (ERIL), which may be implemented by private companies, NGOs, and community groups. Additionally, the Senegalese government has put together a concessionary approach to private sector electricity generation in off-grid areas through the establishment of large-scale concession schemes that divide the country into ten Priority Rural Electrification Programs (Programmes Prioritaires d’Électrification Rurale).

Six of these concessions were awarded over the last few years to national and international companies for a period of 25 years, and the four remaining concessions were awarded this year (2018) to SENELEC, the Senegalese national utility company. A tariff system is in place that offers predictable long-term returns, giving private sector operators the potential for up to a 12 percent internal rate of return over a project life of 15 years. The urgency in the sector combined with a recognition of the social inequity in electricity prices between urban and rural populations has pushed the Senegalese government toward harmonization of tariffs with a substantial rural consumption subsidy. Existing concessionaires are working to build out their mini-grid footprint but often lack the technology, equipment, technical standards, and expertise to meet the demand in their concessions and thus could benefit from U.S. partnerships.

For U.S. companies, the primary customers should be electrical generation, transmission, and distribution utilities located across Africa. As those utilities and national governments continue to plan and deploy electrical systems, including to transmit electricity across borders and to connect millions of households and businesses to sources of electricity, quality and safe products are paramount. Additional customers include firms involved in engineering, procurement and construction of electric power facility infrastructure in the region. Taking into account the current annual level of U.S. exports of utility equipment to the WAPP, one can estimate the “addressable market” to be at least USD 211 million annually, while the market in Senegal can be estimated to be at least USD 4 million.

*A complete breakdown of the U.S. electrical exports by WAPP member is included in *Appendix A*.

Appendix A. Relevant U.S. Export History to ECOWAS Members

The range of electrical products needed for safe and reliable transmission, distribution and use of electrical energy is extensive. Years of experience has shown that at least the following list of products is included:

HTS number	Product description
7306.30	Non-insulated metallic conduit
7326.9085	Rods for electrical grounding
8501.61	AC generators (alternators): Of an output not exceeding 75 KVA
8501.62	AC generators (alternators): Of an output exceeding 75 kVA but not exceeding 375 kVA
8501.63	AC generators (alternators): Of an output exceeding 375 kVA but not exceeding 750 kVA
8501.64	AC generators (alternators): Of an output exceeding 750 kVA
8503.00	Commutators: Stators and rotors for motors and generators
8504.21	Liquid dielectric transformers: Having a power handling capacity not exceeding 650 kVA
8504.22	Liquid dielectric transformers: Having a power handling capacity exceeding 650 kVA but not exceeding 10,000 kVA
8504.23	Liquid dielectric transformers: Having a power handling capacity exceeding 10,000 kVA
8504.31	Other transformers: Having a power handling capacity not exceeding 1kVA
8504.32	Other transformers: Having a power handling capacity exceeding 1 kVA but not exceeding 16 kVA
8504.33	Other transformers: Having a power handling capacity exceeding 16 kVA but not exceeding 500 kVA
8504.34	Other transformers: Having a power handling capacity exceeding 500 kVA
8504.40	Static converters
8504.50	Other inductors
8504.90	Parts
8532.10	Fixed capacitors used in 50/60 Hz circuits, w/reactive power capacity of not < .5 kvar
8535.10	Electrical apparatus for switching or protecting electrical circuits, voltage > 1,000 V: Fuses for a voltage > 1,000 V
8535.21	Automatic circuit breakers for a voltage > 1kV but < 72.5 kV
8535.29	Other circuit breakers for a voltage > 72.5 kV
8535.30	Isolating switches and make-and-break switches
8535.40	Lightning arresters, voltage limiters and surge suppressors
8535.90	Other electrical apparatus for switching or protecting electrical circuits above 1000 V
8536.10	Fuses
8536.20	Automatic circuit breakers
8536.30	Other apparatus for protecting electrical circuits
8536.41	Relays, for a voltage not > 60 v
8536.49	Relays, 60 to 1000 V
8536.50	Switches
8536.61	Lamp holders
8536.69	Electrical connectors
8536.90	Boxes, raceway, terminals and others
8537.10	Panel boards, voltage not > 1,000 V
8537.20	Switchgear and assemblies for a voltage > 1,000 V
8538.10	Boards, Panels, consoles, desks, etc. for goods of 8537 w/out their apparatus

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8538.90	Molded and other parts for 8536 and 8537
8544.41	Electric conductors, fitted with connectors for voltage not > 80 V
8544.49	Electric conductors, fitted with connectors for voltage not > 80 V: Other, without connectors
8544.51	Electric conductors, fitted with connectors, voltage > 80 V but < 1,000 V
8544.59	Electric conductors, fitted with connectors, voltage > 80 V but < 1,000 V: Other, without connectors, of copper; other, not of copper
8544.60	Electric conductors, fitted with connectors, voltage > 1,000 V: Not fitted with connectors and of copper; Not fitted with connectors and not of copper
8544.70	Optical fiber cables
8546.10	Electrical insulators of glass
8546.20	Electrical insulators of ceramics
8546.90	Electrical insulators of other material
8547.90	Insulated metallic conduit
9028.30	Electricity meters
9028.90	Parts and accessories

The [U.S. International Trade Commission Interactive Tariff and Trade Database](#) provides direct access to trade data and allows users to create customized reports from queries created under "advanced searching" from a defined list of products. Using the list above a query was developed to determine the export of these products to countries in sub-Saharan Africa using the ECOWAS members defined list of countries. The table below shows the result of exports over the past three years to members of the Economic Community of West African States (ECOWAS). These data represent all of the products from the list above aggregated. It is possible to disaggregate the data into specific tariff lines if necessary for further analysis.

FAS Value							Edit Request	Save Request	Download Data
FAS Value									
U.S. Total Exports Annual + Year-To-Date Data from Jan - Sep									
Show Details									
	(In 1000 Dollars)								
Country	2015	2016	2017	2017 YTD	2018 YTD		Percent Change YTD2017 - YTD2018		
Benin	840.15	5,536.27	1,304.9	416.02	535.48		28.7%		
Burkina Faso	943.81	1,039.38	2,471	1,283.08	600.27		-53.2%		
Cape Verde	139.75	93.64	131.69	105.84	86.23		-18.5%		
Cote d'Ivoire	8,837.44	5,927.77	5,889.25	4,938.39	2,497.88		-49.4%		
Gambia	1,008.95	758.77	1,129.18	709.2	979.61		38.1%		
Ghana	48,480.84	46,894.43	124,910.49	119,050.33	16,211.51		-86.4%		
Guinea	1,392.05	1,794.37	1,635.88	789.1	1,585.34		100.9%		
<i>Guinea Bissau</i>	227.35	104.43	225.14	146.89	104.65		29.8%		
Liberia	8,240.05	4,497.97	2,675.38	2,123.17	7,135.32		236.1%		
Mali	4,163.42	6,203.93	4,748.5	3,659.37	2,809.97		-23.2%		
Niger	2,300.91	1,466.18	4,472.28	3,879.86	1,192.51		-69.3%		
Nigeria	97,233.92	75,331.27	55,394.82	37,589.77	56,277.4		49.7%		
Senegal	5,894.5	4,434.38	4,084.55	2,963.42	2,017.6		-31.9%		
Sierra Leone	1,657.1	1,632.22	1,427.79	1,200.53	799.8		-33.4%		
Togo	954.47	561.1	514.6	260.78	94.37		-63.8%		
Total:	182,314.7	156,276.1	211,015.47	179,115.75	92,927.94		-48.12%		

Note: DataWeb is optimized for modern web browsers, including [Chrome](#), [Firefox](#), [Safari](#), and [Edge](#).

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