



Readyboard Solutions for Jamaica – Build or Buy Analysis USAID Readyboard Electrification Demonstration (RED) Project

Introduction

Jamaica, like many other countries, has struggled with non-technical losses in low-income, inner city communities for many years. To help with this issue, USAID is partnering with the utility company to provide a new technology solution (i.e. a readyboard) that can legally electrify sub-standard households, and help the company better understand the readyboard's impact on energy consumption and common electricity usage.

As part of this Readyboard Electrification Demonstration (RED) project, USAID will fund the readyboard devices for installation in dwellings that cannot be legally wired for electricity in the Majesty Garden community in fall 2015. This memo represents an analysis for the utility company on the factors that have an impact on the two options available to procure the readyboards: (1) build the readyboards on the island from standard certified house wiring components, or (2) buy the readyboards as manufactured devices from the international market and ship them to Jamaica.

This “build or buy” analysis included test outreach to international readyboard manufacturers, initial research into in-country cost of components, stakeholder interviews with appropriate government counterparts, estimates for different levels of the assembly labor, and an analysis of the ease by which a foreign manufactured device can be imported and approved for use in Jamaica. It also includes a detailed component list for both options.

International Market for Readyboard Appliances- Manufacturers and Suppliers

Market research indicates that manufactured readyboards have only been produced for the sub-Saharan African market and other 240 Volt, 50 Hz jurisdictions, which are based on European Distribution Standards. For the most part, the readyboard manufacturing, wholesale, and retail market is based in the Republic of South Africa. Only one manufacturer could be located in South Africa (CBI¹), along with a number of supply houses, which all sell basically the same or similar type of device. One Chinese manufacturer (Yueqing Aowei Electric Co., Ltd²) was found that manufactures readyboards for the African market, but requires a minimum order of 10,000 units.

The readyboard concept has its roots in providing electricity to residents of informal settlements in dense urban environments in South African cities. The use of readyboards has spread to other African countries such as Uganda, Zambia, Tanzania, Liberia, Kenya, and, more recently,

¹ <http://www.cbionline.co.za/collections/ready-boards>

² <http://www.alibaba.com/showroom/ready-board-specifications-west-nile.html?spm=a2700.7724857.35.4.yKw2Lg>

to the island of Vanuatu under a World Bank Global Partnership on Output-Based Aid (GPOBA) grant. The device is generally used in informal communities as a means of providing electricity access to sub-standard dwellings that cannot be safely provided a normal electric utility connection with the required internal wiring. Readyboards have not been manufactured previously to meet North American distribution standards (120 Volt 60 Hz), and market research could not identify readyboards, or the concept, being employed yet in the Western Hemisphere.

It is important to note that wiring standards, voltage, frequency, receptacles, and electrical equipment, in general, are different between European, Asian, and African countries and North America and many parts of Central and South America and the Caribbean. This defines fundamental characteristics of electrical devices in each market. Jamaica is currently in the late stages of transition to North American standards from the former British Standard.

Inquiries to suppliers and manufacturers in South Africa related to readyboard manufacturing and distribution and concerning the availability of a manufactured devices that would be compliant with North American Standards did not yield any response.³

Readyboards manufactured for the African market have generally been low capacity for very poor communities and typically comprise one outlet and one light as shown below in Figure 1.



Figure 1: Readyboard used for seven slum areas in Monrovia, Liberia

Higher capacity readyboards are now available (shown below in Figure 2) and are also used in the African market for outbuildings and storage/garage buildings rather than providing the wiring for internal reticulation. They have not yet been introduced in the Western Hemisphere for this

³ The question posed to manufacturers: Would you be able to provide a readyboard compliant with North American Standards for a pilot project for Jamaica with an initial quantity of 200 pieces at a minimum capacity of 30 A, 120/240 Volts?

purpose. To utilize them in that context would require tailoring of the local electrical codes for acceptance for common use.



Figure 2: Readyboard commonly used in the African market for outbuildings

Off-shore Manufacturing and Certification

If a manufacturer could be found to produce a relatively small quantity at a reasonable price, the appliance would need to meet a number of local requirements to be acceptable for import and use in Jamaica including:

- a minimum Jamaican service supply capacity requirement of 30 amps;
- manufactured to be compliant with low voltage distribution in Jamaica; and
- certification by an internationally recognized testing laboratory.

In an interview with the Jamaican Government Electrical Inspectorate (GEI), the inspectorate noted their office would only be able to accept an appliance that had been certified by the Jamaica Bureau of Standards (BOS).

Certification typically takes considerable time for new electrical devices and would require advanced submission of test samples/prototypes to a recognized testing facility. Testing capabilities do not exist in Jamaica for electrical appliances or equipment. Furthermore, as in other smaller Western Hemisphere countries, Jamaica's BOS would most likely require a UL, CSA, or another acceptable standards association certification to allow import and use. If a manufacturer could be found with the capability to design and manufacture a unit for the North



American market, they would have to incur significant investments for certification of the devices for a small pilot project with no assurance of larger future market opportunities.

Additionally, in order to utilize a certified manufactured product as a substitute for standard wiring materials and devices, the Jamaican Electricity Code may require changes or an exception to allow for direct utility connection to a manufactured electrical device.

Local Purchase and Assembly

An alternative option is to build the readyboard in Jamaica with standard, certified house wiring components. The readyboards can be assembled locally using readily available, certified wiring materials and assembled according to the Jamaican Electrical Code with requisite supervision and subject to inspection and approval by the GEI.

All wiring materials can be sourced locally from Jamaican electric supply houses that carry reputable manufacturers' components commonly used in the North American market for standard house wiring. In meetings with JPS and the GEI related to the demonstration project, the readyboard design and specifications were discussed and the GEI provided JPS the required parameters for the assembly that would be acceptable to meet existing Jamaican electrical code. From initial market research and stakeholder interviews, there appears to be no known public or regulatory barrier to local assembly and installation.

JPS is strongly in favor of a locally assembled readyboard to create local employment and generate positive economic impacts from local procurement. While these impacts are relatively small for the demonstration project, continuation of the program past the initial demonstration would have greater sustained economic benefits that would not be realized through an off-shore procurement of readyboards.

Risks

The "buy" option has a number of timing, import, and cost risks that could create challenges for implementation. These risks involve:

- Additional research and effort to find a reputable manufacturer willing to incur the costs of industrial design activities, retooling, material procurement, manufacturing prototypes, and testing and certification costs for a small demonstration project with no assurance of a future expanded market.
- The risk that UL/CSA certification cannot be obtained.
- The risk that BOS will not accept the certified device for importation.
- The risk that even if a manufactured certified device is accepted for use in Jamaica by BOS, changes or an exception may be required under the existing Jamaica Electricity Code to allow for direct utility connection to the device.

The "build" option helps avoid the above risks, and also generates positive economic impacts for the community as well as enhanced stakeholder acceptance of the demonstration project



due to the use of local labor for the readyboard assembly. There are limited risks with the “build” option, mainly related to the assembly, oversight, and introduction of a new device to the Jamaican market.

Cost Comparison – Build or Buy

The most significant variable is the imported cost of a manufactured readyboard appliance, assuming that the risks listed above can be mitigated and a willing manufacturer could be found.

An imported cost of \$75.00 has been used for the cost comparison based on published online ordering cost of readyboards within South Africa at US \$50.00, including mounting accessories.⁴ Additionally, the analysis assumed a 50% increase in cost to account for shipping, handling, duties, and no volume discounts. This results in an estimated \$148.34 cost for the materials associated with the “buy” option for manufactured readyboard installation.

The local assembly option will involve costs for the certified electrical components of the readyboard and labor associated with assembly. The cost comparison generated an estimated cost of \$138.88 for the total materials and \$10.50 per unit for unskilled assembly labor for a total of \$149.38 associated with the “build” option, given input prices in the local Jamaican market.

For a detailed list of cost components for both the buy and build options, see Annex 1.

Conclusion

Using the estimated cost of the “buy” readyboard at \$75.00, there is no significant cost difference between the local assembly option or the international procurement, however the “buy” option carries with it a number of cost and schedule risks, where-as the “build” option has little or no cost and schedule risks and creates economic activity in the local market.

⁴ <http://www.allbro.com/download-catalogue/Enclosures/ready-boards.pdf>
<http://www.cbionline.co.za/collections/ready-boards/products/ready-board-with-bulkhead-light>

Annex 1⁵

This section lays out the costs associated with both readyboard “build” and “buy” options for JPS. Given all the inputs, total costs for the two options are similar. The prices have been collected from market research, standard industry pricing, cost estimates provided by JPS, and publicly available information from both international and national suppliers.

“Build” Option Costs⁶

Material List	J\$ Unit Price	FX Rate	US \$ Unit Price	Quantity Per Household	Total USD Per Household	Number of Dwellings	Total Quantity	Total USD
Back Board Material (Plywood Or Suitable Laminate)	950.00	0.00857	\$ 8.14	1	\$ 8.14	1	1	\$ 8.14
125 Amp 4 way Panel (With Panel Cover Door)	1950.00	0.00857	\$ 16.71	1	\$ 16.71	1	1	\$ 16.71
20 Amp Single Pole Breaker	560.00	0.00857	\$ 4.80	2	\$ 9.60	1	2	\$ 9.60
30 Amp Double Pole Main Breaker	984.43	0.00857	\$ 8.44	1	\$ 8.44	1	1	\$ 8.44
GFCI Duplex Receptacle	1363.05	0.00857	\$ 11.68	1	\$ 11.68	1	1	\$ 11.68
Standard Duplex Receptacle	233.37	0.00857	\$ 2.00	1	\$ 2.00	1	1	\$ 2.00
PVC box for two duplex receptacles	169.02	0.00857	\$ 1.45	1	\$ 1.45	1	1	\$ 1.45
PVC box for light switch	71.18	0.00857	\$ 0.61	1	\$ 0.61	1	1	\$ 0.61
Light Switch	125.70	0.00857	\$ 1.08	1	\$ 1.08	1	1	\$ 1.08
Double duplex Receptacle Raised Cover	64.37	0.00857	\$ 0.55	1	\$ 0.55	1	1	\$ 0.55
Double duplex Receptacle Cover	68.15	0.00857	\$ 0.58	1	\$ 0.58	1	1	\$ 0.58
Switch Cover	54.37	0.00857	\$ 0.47	1	\$ 0.47	1	1	\$ 0.47
Weatherproof Light Fixture (PVC Conduit Direct Entry)	1040.60	0.00857	\$ 8.92	1	\$ 8.92	1	1	\$ 8.92
Half inch PVC Conduit 10 foot lengths including Mast and Ground Wire Protection	127.98	0.00857	\$ 1.10	2	\$ 2.19	1	2	\$ 2.19
PVC Half inch conduit fitting (LB)	501.75	0.00857	\$ 4.30	1	\$ 4.30	1	1	\$ 4.30
#14 RW 90 Black Solid Cu Wire (2.5 mm) (per meter)	43.16	0.00857	\$ 0.37	1.5	\$ 0.55	1	1.5	\$ 0.55
#14 RW 90 White Solid Cu Wire (2.5 mm) (per meter)	43.16	0.00857	\$ 0.37	1.5	\$ 0.55	1	1.5	\$ 0.55
#14 RW 90 Green Solid Cu Wire (2.5 mm) (per meter)	43.16	0.00857	\$ 0.37	1.5	\$ 0.55	1	1.5	\$ 0.55
PVC Connectors for Panel	15.90	0.00857	\$ 0.14	4	\$ 0.55	1	4	\$ 0.55
PVC Cement (Pint)	1590.22	0.00857	\$ 13.63	0.1	\$ 1.36	1	0.1	\$ 1.36
Angle Iron for Masts (Estimated)	933.49	0.00857	\$ 8.00	1	\$ 8.00	1	1	\$ 8.00
#10 RW 90 Black Stranded Cu Wire (6 mm) (per meter)	86.35	0.00857	\$ 0.74	8	\$ 5.92	1	8	\$ 5.92
#10 Bare Stranded Cu Wire (6 mm) (per meter)	79.00	0.00857	\$ 0.68	4	\$ 2.71	1	4	\$ 2.71
Weather Head	193.10	0.00857	\$ 1.65	1	\$ 1.65	1	1	\$ 1.65
Two Hole Straps	10.60	0.00857	\$ 0.09	4	\$ 0.36	1	4	\$ 0.36
Miscellaneous Hardware	200.00	0.00857	\$ 1.71	1	\$ 1.71	1	1	\$ 1.71
Copper Clad 5/8" Ground Rod (Residential 4 ft.)	1060.15	0.00857	\$ 9.09	1	\$ 9.09	1	1	\$ 9.09
Ground Rod Clamp	178.24	0.00857	\$ 1.53	1	\$ 1.53	1	1	\$ 1.53
Ground Wire #6 stranded Bare Cu (10 mm) (per meter)	197.64	0.00857	\$ 1.69	3	\$ 5.08	1	3	\$ 5.08
Reinforcement Lumber (Preserved 2"x 6") (per foot) (estimated)	152.86	0.00857	\$ 1.31	16	\$ 20.96	1	16	\$ 20.96
4" PVC Pipe for ground rod connection 10 ft. lengths	1840.00	0.00857	\$ 15.77	0.1	\$ 1.58	1	0.1	\$ 1.58
Total "Make" Material Costs					\$ 138.88			\$ 138.88
Options								
10 foot extension cord 3/14	844.00	0.00857	\$ 7.23	2	\$ 14.47	1	2	\$ 14.47
25 foot trouble lite	1689.25	0.00857	\$ 14.48	1	\$ 14.48	1	1	\$ 14.48
LED 11 Watt Bulb with two year warranty	1980.00	0.00857	\$ 16.97	2	\$ 33.94	1	2	\$ 33.94
Total for Options					\$ 62.88			\$ 62.88
Grand Total Materials including Options					\$ 201.76			\$ 201.76
Contingency as a percent of Total Costs					0%			0%
Contingency					\$ -			\$ -
Grand Total Including Contingency					\$ 201.76			\$ 201.76
Labour Component								
Ready Board Assembly (Hourly Rate) unskilled labour	408.40	0.00857	\$ 3.50	3	\$ 10.50	1	3	\$ 10.50
Mast Fabrication and Installation (Hourly Rate) Contractor	933.49	0.00857	\$ 8.00	2.00	\$ 16.00	1	2	\$ 16.00
Structural Reinforcement (Hourly Rate) Contractor	933.49	0.00857	\$ 8.00	2.00	\$ 16.00	1	2	\$ 16.00
Service Entrance Conduit and Wiring (Hourly Rate) Contractor	1166.86	0.00857	\$ 10.00	1.00	\$ 10.00	1	1	\$ 10.00
Readyboard Mounting (Hourly Rate) Contractor	1166.86	0.00857	\$ 10.00	1.00	\$ 10.00	1	1	\$ 10.00
Total Labour Costs								\$ 62.50
Combined Labour and Material Costs including Material Contingency Allowance								\$ 264.26

⁵ These Material Lists resulted from a series of discussions with the JPS Co. Ltd engineering team on the standard components of a readyboard and was tailored by the JPS team to the Jamaican market and company requirements.

⁶ Price quotes were sourced from reputable local Jamaican electrical vendors, in particular the Electrical Depot Ltd.



“Buy” Option Costs⁷

Material List	J\$ Unit Price	FX Rate	US \$ Unit Price	Quantity Per Household	Total USD Per Household	Households	Total Quantity	Total USD
30 Amp four outlet ready board with lamp, shipping and duties	\$ 8,751.46	0.00857	\$ 75.00	1	\$ 75.00	1	1	\$ 75.00
Back Board Material (Plywood Or Suitable Laminate)	950.00	0.00857	\$ 8.14	1	\$ 8.14	1	1	\$ 8.14
Half inch PVC Conduit 10 foot length - Mast and Ground Wire Protection	127.98	0.00857	\$ 1.10	2	\$ 2.19	1	2	\$ 2.19
PVC Connectors for Ready Board to Weatherhead	15.90	0.00857	\$ 0.14	2	\$ 0.27	1	2	\$ 0.27
PVC Half Inch conduit fitting (LB)	501.75	0.00857	\$ 4.30	1	\$ 4.30	1	1	\$ 4.30
PVC Cement (Pint)	1590.22	0.00857	\$ 13.63	0.05	\$ 0.68	1	0.05	\$ 0.68
Angle Iron for Masts (Estimated)	933.49	0.00857	\$ 8.00	1	\$ 8.00	1	1	\$ 8.00
#10 RW 90 Black Stranded Cu Wire (6 mm) per meter	85.55	0.00857	\$ 0.73	8	\$ 5.87	1	8	\$ 5.87
#10 Bare Stranded Cu Wire (6 mm) per meter	79.00	0.00857	\$ 0.68	4	\$ 2.71	1	4	\$ 2.71
Weather Head	193.10	0.00857	\$ 1.65	1	\$ 1.65	1	1	\$ 1.65
Two Hole Straps	10.60	0.00857	\$ 0.09	4	\$ 0.36	1	4	\$ 0.36
Miscellaneous Hardware	200.00	0.00857	\$ 1.71	1	\$ 1.71	1	1	\$ 1.71
Copper Clad 5/8" Ground Rod (Residential 4 ft.)	1060.15	0.00857	\$ 9.09	1	\$ 9.09	1	1	\$ 9.09
Ground Rod Clamp	178.24	0.00857	\$ 1.53	1	\$ 1.53	1	1	\$ 1.53
Ground Wire #6 stranded Bare Cu (10 mm) per meter	197.64	0.00857	\$ 1.69	3	\$ 5.08	1	3	\$ 5.08
Reinforcement Lumber (Preserved 2"x 6") per foot estimated	152.86	0.00857	\$ 1.31	16	\$ 20.96	1	16	\$ 20.96
4" PVC Pipe for ground rod connection 10 ft. lengths	1840.00	0.00857	\$ 15.77	0.05	\$ 0.79	1	0.05	\$ 0.79
Total "Buy" Material Costs					\$ 148.34			\$ 148.34
Options								
10 foot extension cord 3/14	844.00	0.00857	\$ 7.23	2	\$ 14.47	1		\$ 14.47
25 foot trouble lite	1689.25	0.00857	\$ 14.48	1	\$ 14.48	1		\$ 14.48
LED 11 Watt Bulb	1980.00	0.00857	\$ 16.97	2	\$ 33.94	1		\$ 33.94
Total					\$ 62.88			\$ 62.88
Grand Total including Options					\$ 211.22			\$ 211.22
Contingency as a percent of Total Costs					0%			0%
Contingency					\$ -			\$ -
Grand Total Including Contingency					\$ 211.22			\$ 211.22
Labour Component								
Mast Fabrication and Installation (Hourly Rate) Contractor	933.49	0.00857	\$ 8.00	2.00	\$ 16.00	1	2	\$ 16.00
Structural Reinforcement (Hourly Rate) Contractor	933.49	0.00857	\$ 8.00	2.00	\$ 16.00	1	2	\$ 16.00
Service Entrance Conduit and Wiring (Hourly Rate) Contractor	1166.86	0.00857	\$ 10.00	1.00	\$ 10.00	1	1	\$ 10.00
Readyboard Mounting (Hourly Rate) Contractor	1166.86	0.00857	\$ 10.00	1.00	\$ 10.00	1	1	\$ 10.00
Total Labour Costs					\$ 52.00			\$ 52.00
Combined Labour and Material Costs Including Material Contingency Allowance								\$ 263.22

⁷ The price quotes were sourced from available public markets for readyboards in South Africa and through online vendor quotes. Costs for these inputs were in line with international leading practice for standard electrical devices.