MOZAMBIQUE ROUTE-TO-MARKET TOOL (VERSION 5)

INSTRUCTIONAL USER GUIDE

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1 PURPOSE AND OVERVIEW

USAID Introduction Video – *An introduction to the RTM tool and the USAID SAEP project*

The Mozambique Route-to-Market (RTM) tool is a location suitability tool packaged within a KMZ file designed to help energy access companies (i.e. distributors of standalone solar systems and developers of mini- and micro- grids) located within Mozambique plan and manage their expansion and scale-up strategies using geographical demand forecasting to drive key business decisions on sales agent recruitment, sales and service center location management, etc.
The tool consists of a KMZ file which contains various layers of geographic information pertaining to Mozambique broken down by Posto (administrative posts). The user can click on the geography of interest to them and see the estimated amount of addressable households that are within the area, the current electrification status of the area, the percentage of the area covered by telecom companies, and the estimated household demand for electrification. By using a combination of these layers, energy access companies can then identify areas that are most ideal for expansion of their markets by searching for the areas exhibiting their business criteria for expansion. Energy access companies can also combine the usage of the Excel file (which contains the same information as the KMZ tool but in table format) to sort or filter the individual areas by their criteria scores.

2 MODEL ACCESS AND BASIC INSTRUCTIONS

USAID Google Earth and Excel Tutorial Video – *Overview of the functionality of Google Earth and Excel with context to how they could be used by energy access companies*

You will need to use Google Earth Pro to access the Mozambique RTM Tool. Download Google Earth Pro (for free) and open the KMZ or KML file that you want to use for the appropriate RTM tool. If your KMZ or KML file does not automatically open in the application Google Earth Pro, right click on the KMZ or KML file and click "Open With", then select Google Earth Pro.

Once Google Earth Pro is open, go to Mozambique on the map of the earth. Zoom in and out using the + and - buttons on the right-hand side or by scrolling up and down on your mousepad. You can navigate around the globe by using the arrow keys or by clicking and dragging with your mouse.

In order to get access to data layers of the model, go to the places section on the left-hand side, click on the "Temporary Places" arrow, Mozambique RTM Tool v5.kmz arrow, and then click the open box of the data layer that you would like to view. Please note that you can select multiple data layers at the same time, and they will overlay with each other.

Once a layer has been selected, you can see individual level 3 data by either hovering over or clicking on the area that you would like to see. This will display a data table for the selected area that, depending on the model and layer selected, will show information of the layer selected. Please note that it will show the information of the data layer "at the front" of the model. In order to see different layers of the model, you can unclick layers of data on the places tab on the left.

For additional tools in Google Earth Pro, please see the following links:

- User Guide for Google Earth
- University of Waterloo Tutorial
- Google Earth Pro Basic Features YouTube Video
- Google Earth Pro Advanced Features YouTube Video

3 MOZAMBIQUE RTM DATA

3.1 DATA FILES

The Mozambique RTM Tool consists of one KMZ file and one Excel sheet of data:

Name	Type	Download
Mozambique RTM Tool v5.kmz	Keyhole Markup Zip	Access File
Mozambique RTM Tool v5.xlsx	Excel	Access File

USAID Data Source Overview Video – *Provides context for the data that is used within the RTM tool*

3.2 DATA INPUTS

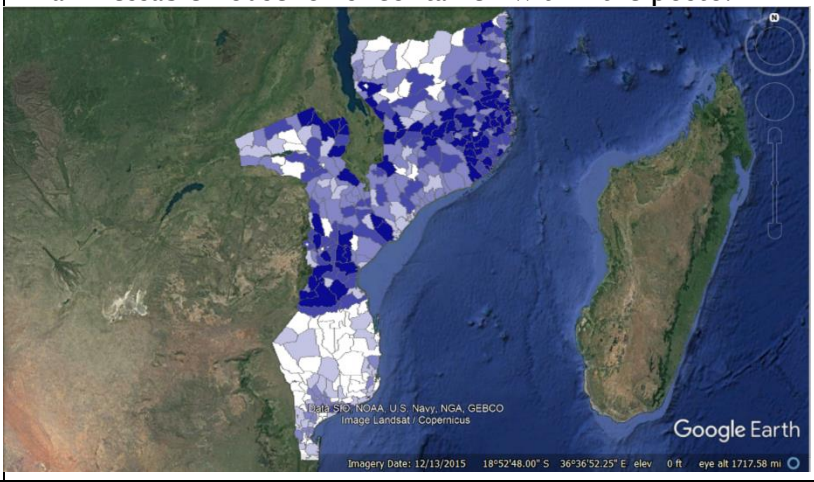
The developers of the Mozambique RTM tool used several data layers and sources in their analysis. To ensure that future users of this tool are aware of the sourcing and versioning of the inputs, included below is a list of all the data sources that went into making the Mozambique RTM tool.

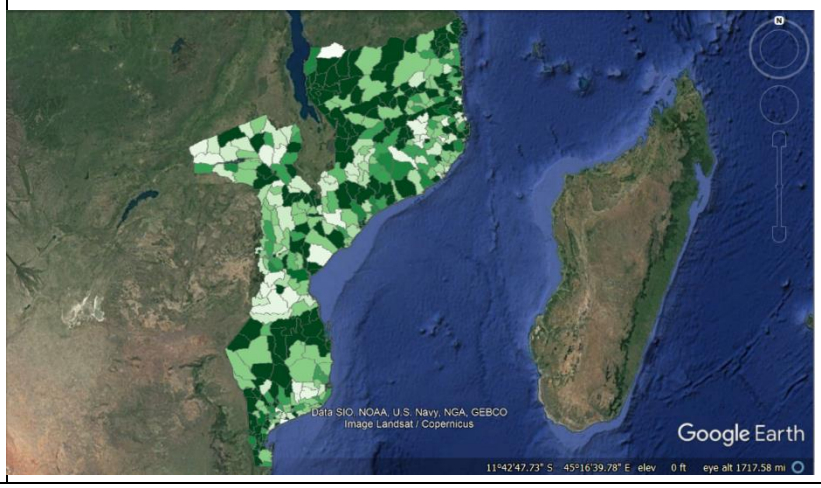
Dataset	Definition	Source, Link & Date Accessed
Administrative boundaries	Gives the Province, District, and Posto boundaries as DBF, PRJ, SHP, SHX, and CPG files	Humanitarian data exchange, http://www.diva-gis.org/gdata, (2015)
Urbanicity	Geographic location of cities within the country	GHS-SMOD, https://ghsl.jrc.ec.europa.eu/download.php?ds=smod, (2015)
Population (2015)	Population estimate from CIESIN. Provides population counts, household numbers, and consumption data	CIESIN, https://www.ciesin.columbia.edu/data/hrsl, (2015)
Population census 2017	Government population survey data showing population locations within the country.	INE Mozambique, http://www.ine.gov.mz/, (2017)

Dataset	Definition	Source, Link & Date Accessed
Night lights	Shows the electrification of regions by displaying satellite imagery of night lights	NASA VIIRS, https://earthobservatory.nasa.gov/features/NightLights/page3.php, (2017)
Roads	The map of the country's roads. Connections were made for the purpose of route mapping.	Open Street Maps, https://data.humdata.org/dataset/hotosm_moz_roads, (2017)
Transmission lines	The energy transmission lines for Mozambique as of 2017	Energy Data, https://energydata.info/dataset/Mozambique-electricity-transmission-network-2017, (2017)
Economic activity	Economic consumption, production, and demographic data by Province.	Open Data for Africa, https://mozambique.opendataforafrica.org/, (2019)
Schools	The location of schools at a level 3 specificity	WFP-Mozambique (2019)
Health Centers	The location of health centers at a level 3 specificity	WFP-Mozambique (2019)
Settlement Names	Names of settlements within Mozambique with corresponding geography	Humanitarian data exchange, https://data.humdata.org/dataset/mozambique-settlement-shapefiles, (2017)
Telecom Towers	Location of towers and corresponding coverage area	FUNAE Mozambique
Rivers and Stream Network	Geographic location of bodies of water within the country	National Cartography and Tele-detection Centre, Mozambique (CENACARTA), https://data.humdata.org/dataset/mozambique-rivers-and-stream-network, (2017)
Affordability	Survey data on affordability of Solar products within the country	USAID SAEP Mozambique Consumer Affordability Survey 2019

3.3 DATA OUTPUTS

The data inputs were geospatially processed and the output includes a posto layer, a layer for major cities, telecommunications towers, transmission lines and substations, and telecom coverage by posto. These layers are outlined below and defined in greater detail in the appendix.

Output Layer	Definition
Postos	• At the posto level of geography, the user will be able to view data aggregated to this level of geography for a number of variables, including general geographic variables (place name, latitude, area, etc.), demographic variables (population, HHS, HHS per SqKm, etc.), electrification variables (electrified population #/%, unelectrified households in geography), and various other economic and market variables (health centers, schools, markets, household savings statistics, phone ownership, agricultural statistics, etc.). For a full list of the variables within this layer, please see the "Data Output and Variable List" in the appendix. • The postos are color coded by the number of addressable households contained within the posto. 
Cities	• The Cities layer of the tool displays the 12 largest cities within the country, their district and province name, their population, and their latitude and longitude coordinates.
Telco Towers	• Shows the location of telecommunication towers within the country and an 18.5-kilometer (km) radius. The telecom towers are not comprehensive. There are additional locations in other parts of the country.
Transmission Lines and Sub-Stations	• The location of electrical grid substations and connecting transmission lines

Output Layer	Definition
Mobile Coverage *[New Update for Version 5]*	• Shows the percentage of mobile coverage for a given posto. The layer is color coded by coverage with darker green representing higher coverage rates. Coverage is also summarized by district and province based on household-weighted posto coverage rates. 

4 SAMPLE USE CASE

In addition to the below sample use case study, numerous additional examples of how the tool can be used to make key business decisions for energy access companies can be found below:

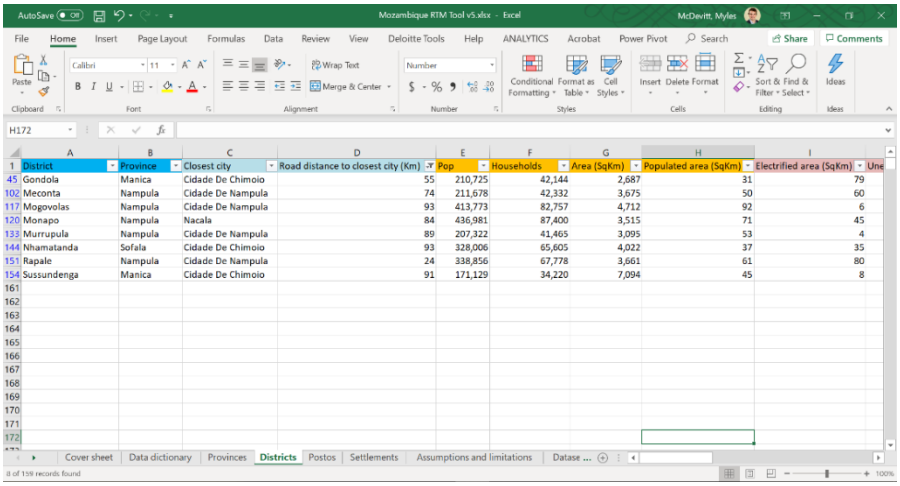
USAID Case Study Video – *Shows several use cases for the RTM tool*

Background

A solar home system (SHS) company based in Mozambique wants to find the best city to open a small sales hub with settlements near the city to hire new sales agents. The company want to prioritize districts and cities that have a high addressable market, high mobile coverage, and are located relatively close to a major city.

Targeting a city in which to open a new sales hub

The company starts their analysis by going to the Excel sheet titled "Districts" and sorting for Districts that have 10,000 or more addressable households. Next, because the SHS company needs to base its new hub near a city, they filter for districts that are less than 100 km away from the closest city. This leaves them with the districts of Monapo, Mogovolas, Rapale, Nhamatanda, Murrupula, Meconta, Sussundenga, and Gondola.



	District	Province	Closest city	Road distance to closest city (Km)	Pop	Households	Area (SqKm)	Populated area (SqKm)	Electrified area (SqKm)
45	Gondola	Manica	Cidade De Chimoio	55	210,725	42,144	2,687	31	79
102	Meconta	Nampula	Cidade De Nampula	74	211,678	42,332	3,675	50	60
117	Mogovolas	Nampula	Cidade De Nampula	93	413,773	82,757	4,712	92	6
120	Monapo	Nampula	Nacala	84	436,981	87,400	3,515	71	45
133	Murrupula	Nampula	Cidade De Nampula	89	207,322	41,465	3,095	53	4
144	Nhamatanda	Sofala	Cidade De Chimoio	93	328,006	65,605	4,022	37	35
151	Rapale	Nampula	Cidade De Nampula	24	338,856	67,778	3,661	61	80
154	Sussundenga	Manica	Cidade De Chimoio	91	171,129	34,220	7,094	45	8

Given that the SHS company utilizes a mobile payment provider to facilitate repayment for products sold on credit (a large majority of sales), they also decide to prioritize mobile coverage. They filter for districts that have greater than or equal to 50% mobile network coverage. After sorting for addressable households and mobile coverage, the company finds that the majority of districts are located in Nampula province, with the closest major city being Cidade De Nampula.

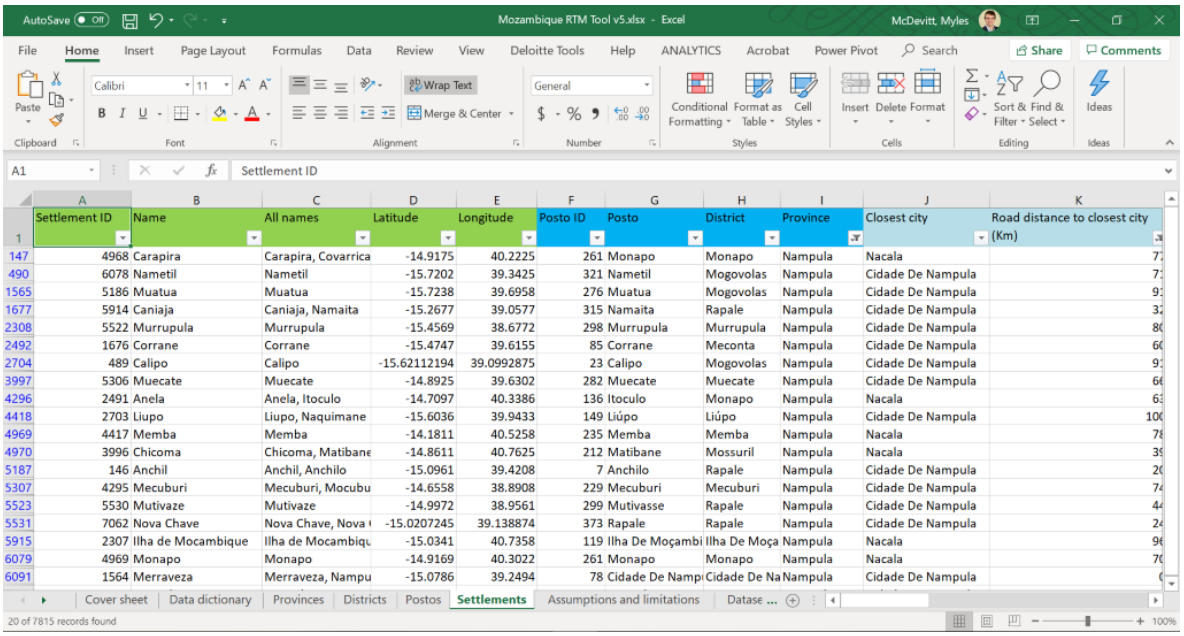
The company switches to the Google Earth Pro map and uses the search tool in the upper left corner to select "Nampula Province". Going to the map, the company identifies that the city of Nampula is located at the center of several intersecting roads. Putting down a pin in Google Earth, the company demarcates where the new selected hub will be – in Cidade De Nampula.

Targeting settlements for hiring new sales agents

The company then goes back to the Excel document, this time to the "Settlements" tab. They select only settlements that are in the district of Nampula. Given that the new sales hub will be in Nampula city, they can use the "road distance to closest city" column to filter out every settlement that is more than 100 km from Nampula.

The company wants to select settlement locations for their recruitment efforts that have a high urban density and a large addressable market. They filter the selected settlements by "Urbanicity Type", only selecting "City or Large Settlements" or "Dense Towns". Finally, the company sorts the settlements by addressable market. They also filter for locations that have health centers.

At the end of their analysis, the SHS company is left with 20 settlements. All are urban, close to Nampula, and contain health centers. Selecting the highest addressable market settlement, the company decides to hire new sales agents in the settlements of Carapira, Nametil, and Muatua.



	A	B	C	D	E	F	G	H	I	J	K
1	Settlement ID	Name	All names	Latitude	Longitude	Posto ID	Posto	District	Province	Closest city	Road distance to closest city (Km)
147	4968	Carapira	Carapira, Covarrica	-14.9175	40.2225	261	Monapo	Monapo	Nampula	Nacala	7
490	6078	Nametil	Nametil	-15.7202	39.3425	321	Nametil	Mogovolas	Nampula	Cidade De Nampula	7
1565	5186	Muatua	Muatua	-15.7238	39.6958	276	Muatua	Mogovolas	Nampula	Cidade De Nampula	9
1677	5914	Caniaja	Caniaja, Namaita	-15.2677	39.0577	315	Namaita	Rapale	Nampula	Cidade De Nampula	3
2308	5522	Murrupula	Murrupula	-15.4569	38.6772	298	Murrupula	Murrupula	Nampula	Cidade De Nampula	8
2492	1676	Corrane	Corrane	-15.4747	39.6155	85	Corrane	Meconta	Nampula	Cidade De Nampula	6
2704	489	Calipo	Calipo	-15.62112194	39.0992875	23	Calipo	Mogovolas	Nampula	Cidade De Nampula	9
3997	5306	Muecate	Muecate	-14.8925	39.6302	282	Muecate	Muecate	Nampula	Cidade De Nampula	6
4296	2491	Anela	Anela, Itoculo	-14.7097	40.3386	136	Itoculo	Monapo	Nampula	Nacala	6
4418	2703	Liupo	Liupo, Naquimane	-15.6036	39.9433	149	Liúpo	Liúpo	Nampula	Cidade De Nampula	10
4969	4417	Memba	Memba	-14.1811	40.5258	235	Memba	Memba	Nampula	Nacala	7
4970	3996	Chicoma	Chicoma, Matibane	-14.8611	40.7625	212	Matibane	Mossuril	Nampula	Nacala	3
5187	146	Anchil	Anchil, Anchilo	-15.0961	39.4208	7	Anchilo	Rapale	Nampula	Cidade De Nampula	2
5307	4295	Mecuburi	Mecuburi, Mocubu	-14.6558	38.8908	229	Mecuburi	Mecuburi	Nampula	Cidade De Nampula	7
5523	5530	Mutivaze	Mutivaze	-14.9972	38.9561	299	Mutivasse	Rapale	Nampula	Cidade De Nampula	4
5531	7062	Nova Chave	Nova Chave, Nova	-15.0207245	39.138874	373	Rapale	Rapale	Nampula	Cidade De Nampula	2
5915	2307	Ilha de Mocambique	Ilha de Mocambiqu	-15.0341	40.7358	119	Ilha De Moçambi	Ilha De Moça	Nampula	Nacala	9
6079	4969	Monapo	Monapo	-14.9169	40.3022	261	Monapo	Monapo	Nampula	Nacala	7
6091	1564	Merraveza	Merraveza, Nampu	-15.0786	39.2494	78	Cidade De Nampı	Cidade De Na	Nampula	Cidade De Nampula	

5 DATA OUTPUT VARIABLE LIST & DEFINITIONS

Field:	Description:
Settlement ID	Settlement numeric identifier (no real names could be assigned yet)
Name	Most likely name of the settlement
All names	List of all possible candidate names for the settlement name
Latitude	Latitude
Longitude	Longitude
Posto ID	Posto numeric identifier
Posto	Posto name
District	District name
Province	Province name
Closest city	Closest city from settlement (see list of cities in sheet called "cities")
Road distance to closest city (km)	Road distance in kilometers to closest city (see list of cities in sheet called "Appendix A -Cities")
Pop	Total population
Households	Total households, where 1 household = 5 people
Area (SqKm)	Area in square kilometers
Pop density (pop per SqKm)	Population density measured in people per square kilometer
Household density (HHS per SqKm)	Household density measured in households per square kilometer
Electrified area (SqKm)	Area in square kilometers of electrified areas
Electrified area (%)	Percentage of area in square kilometers that is electrified
Unelectrified pop	Population living in unelectrified areas
Unelectrified households	Households located in unelectrified areas
Province monthly energy expenditure (USD)	Average household expenditure in energy per month measured in US dollars
Province poverty rate (%)	Percentage of people whose monthly price-adjusted total household consumption per capita is below the poverty line in the corresponding year and region
Province affordability percentage (%)	Percentage of households that can afford SHS systems
Addressable market (HHS)	Estimation of total households that can afford SHS systems, calculated as unelectrified households multiplied by affordability percentage
Schools	Number of schools inside geography
Health centers	Number of health centers inside geography

6 VIDEO TUTORIAL

USAID SAEP has developed a four-part video tutorial to show SHS companies how to use the data and visualization tool and provide the opportunity for users to develop use case scenarios to identify new markets and make other business decisions. To view the videos:

- Part I: Introduction (click **here**)
- Part II: Tool overview and demo (click **here**)
- Part III: Use cases (click **here**)
- Part IV: Closing and references (click **here**)

7 GLOSSARY

Data Layer – A piece of information that is contained at an area level for each area within the tool

KML/KMZ – Keyhole Markup Language is a way of displaying information in Google Earth. Keyhole Markup Zip files are a conglomeration of different KML or Excel files