Energy Access Explorer Front End Exercise

Hands-on 1

Please use the following citation for:

- **This exercise:** Sahar, T., Stockman, J., Sinclair-Lecaros, S., Mentis, D., 2023. "Energy Access Explorer. Lesson 4: EAE Front-End, Hands-On Exercises." World Resources Institute.
- **EAE Platform:** "Mentis D., Odarno L., Wood D., Jendle F., Mazur E., Qehaja A., Gassert F., 2019" "Technical Note: Energy Access Explorer - Data and Methods"

Learning outcomes

By the end of this exercise, you will learn how to:

1) Learn to navigate EAE's front end interface

2) Visualize various combinations of datasets on energy demand and supply

3) Conduct multi-criteria decision analysis to identify high-priority areas

Contents

I. Introductory Exercises

1. Census data. Locate the following data for Kasese District.

a Lighting: Subcounty Lighting Electricity % in Kyondo Subcounty.

b) Lighting: Subcounty Lighting Electricity % in Muhokya Subcounty.

2. Add the following layers and identify:

a) Population density

b) Add Health Facilities

c) Add Satellite base map and Global Horizontal Irradiation

d) Add Hydropower potential - small scale

3. Multi-criteria Decision Analysis

II. Activity 1 - Analysis

1. Analysis 1

2. Analysis 2

3. Analysis 3

III. Activity 2 – Case Scenarios

1. Scenario 1 – Strategic integrated energy planning

2. Scenario 2 - Expansion of clean energy markets

3. Scenario 3 – Prioritization of energy access investments (Donors and Development Finance Institutions)

4. Scenario 4 - Service delivery institutions in the health sector

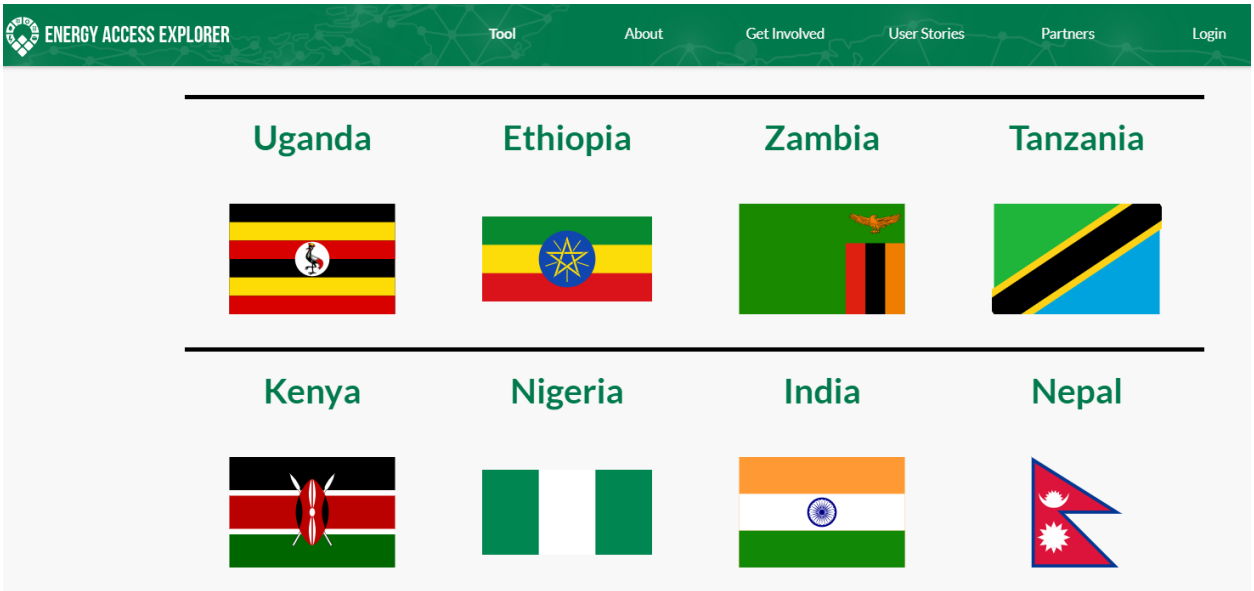
I. Introductory Exercises

1. Census data. Locate the following data for Kasese County

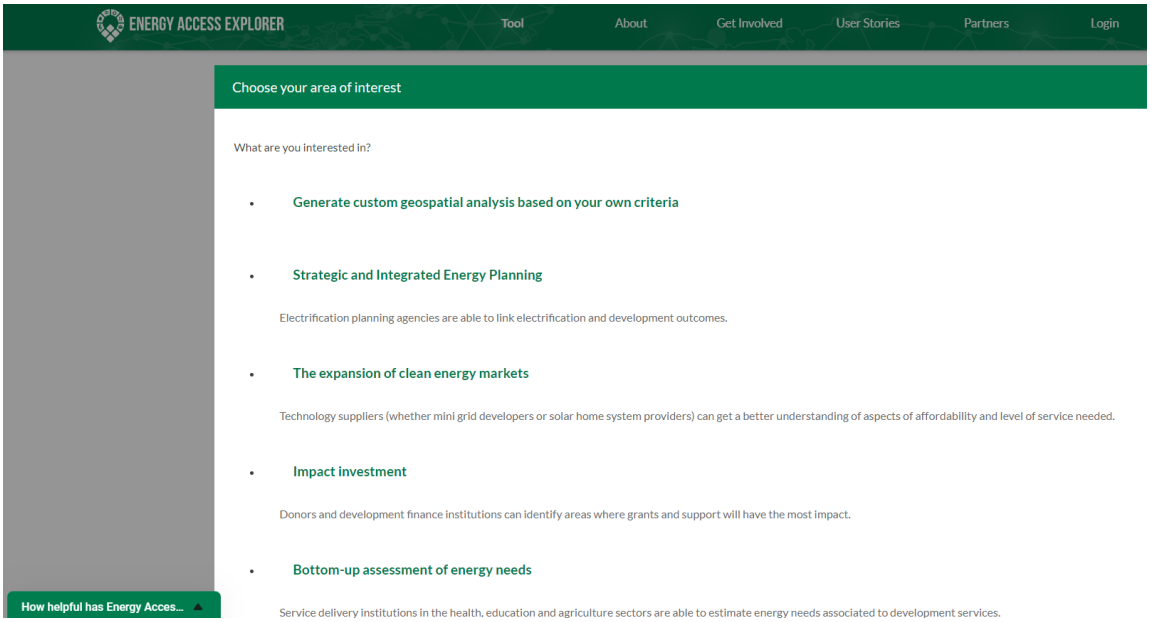
a) Lighting: Subcounty Lighting Electricity % in Kyondo Subcounty.

On a browser, open Energy Access Explorer using this link:
https://www.energyaccessexplorer.org/tool/s/

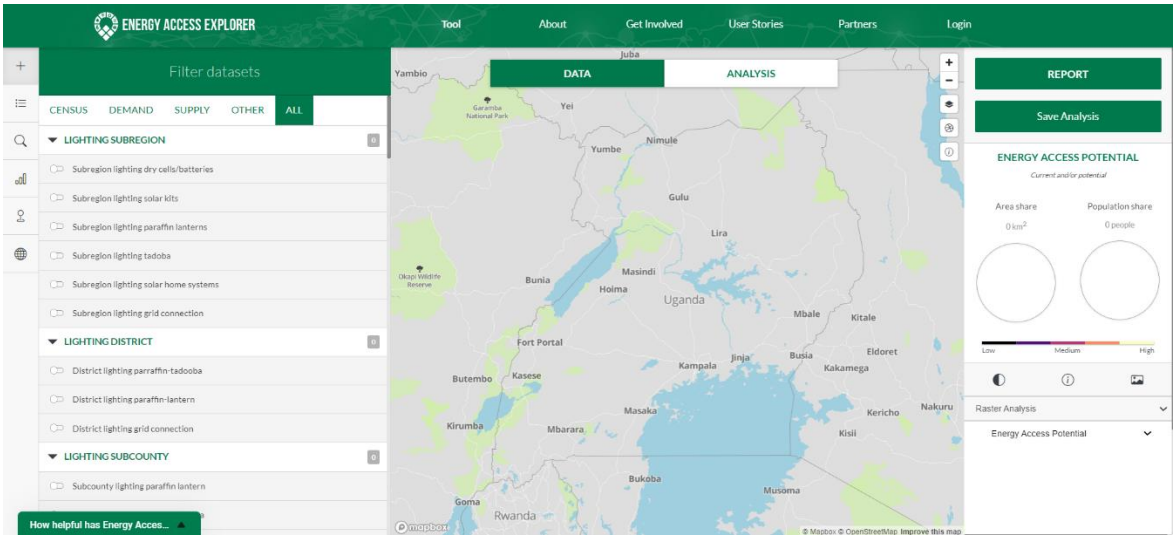
Select **Tool** then select **Uganda** from the geographies listed.



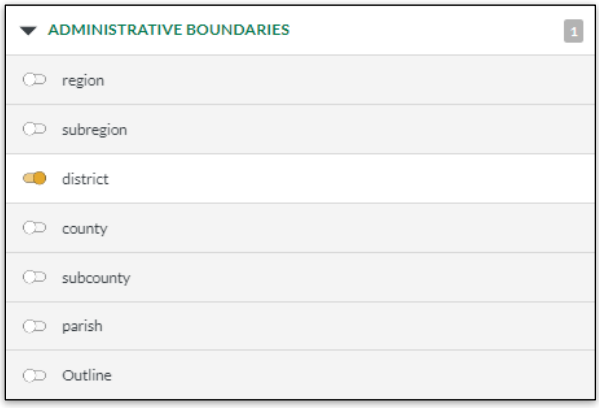
In the pop up that appears of '*Choose your area of interest*', select '*Generate custom analysis based on your own criteria*' then close the 'Welcome to Energy Access Explorer' pop up.



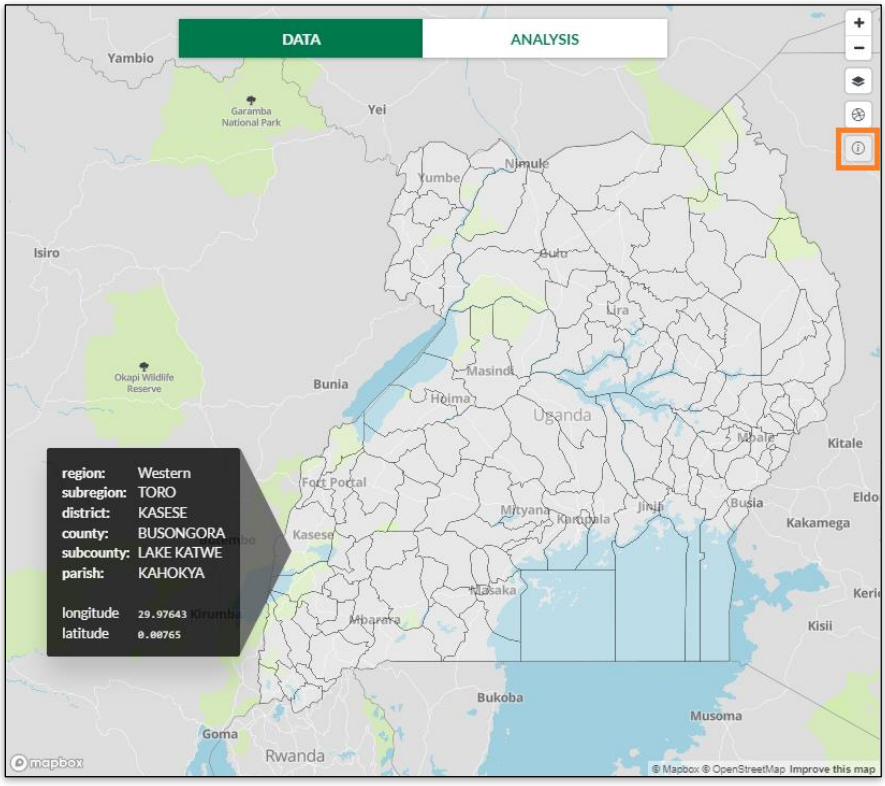
You can see the EAE interface for Uganda where the panel on the left shows the various categories of datasets for both demand, supply and other that can be selected and loaded to the map window in the middle for visualizations and analysis.



To orient yourself with where Kasese is so as to flag out Kyondo, select **Other** category in the data panel, then select **District** under Administrative Boundaries group to load it to the map.

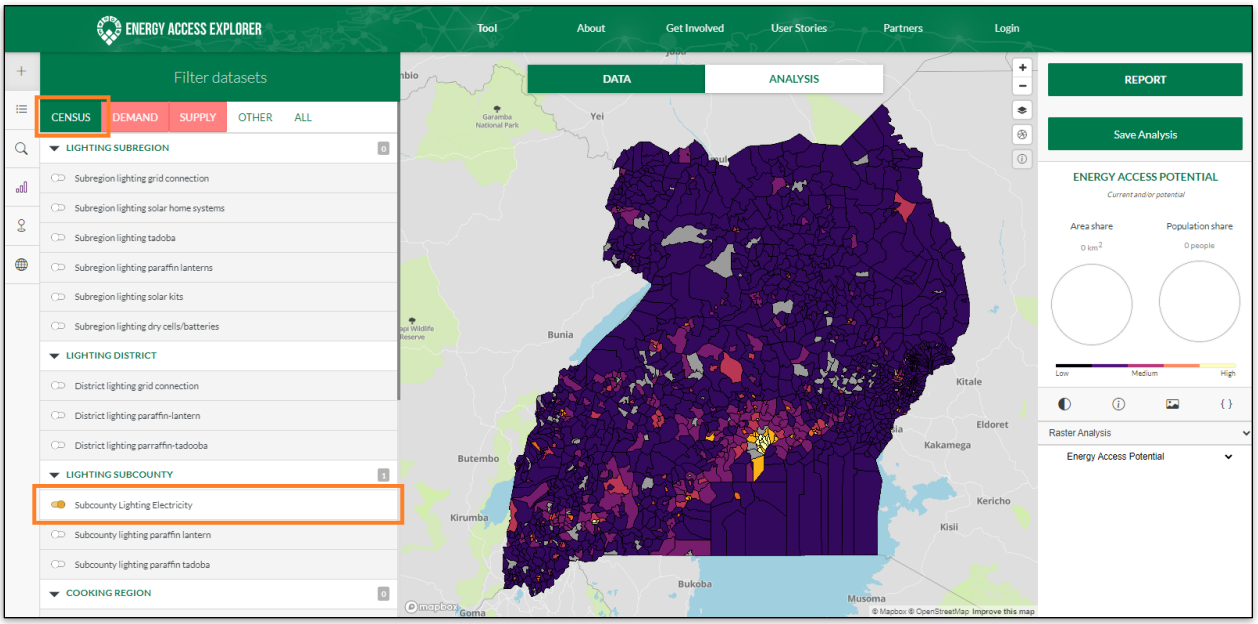


You can zoom and pan on the map till you spot Kasese County. Use the query tool on the top right side of the screen and click on the districts in the southwest of Uganda until you find Kasese district.



Note: *You can also use the search icon in the tools panel on the left to search for Kasese.*

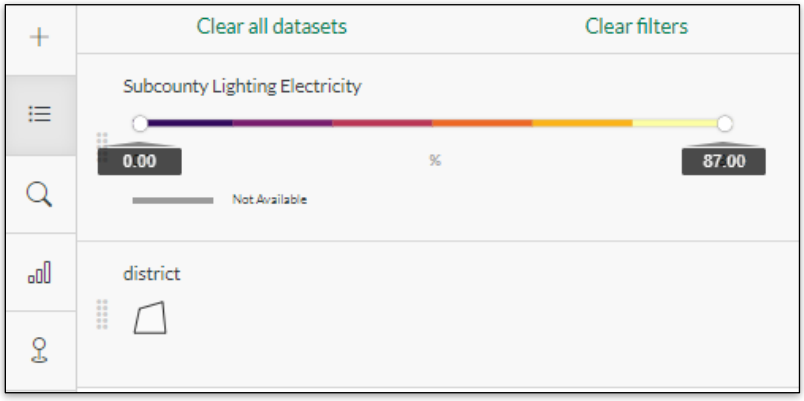
In the data panel, select **Census** category, then scroll down to Lighting District group and select **Subcounty Lighting Electricity** to load it on the map.



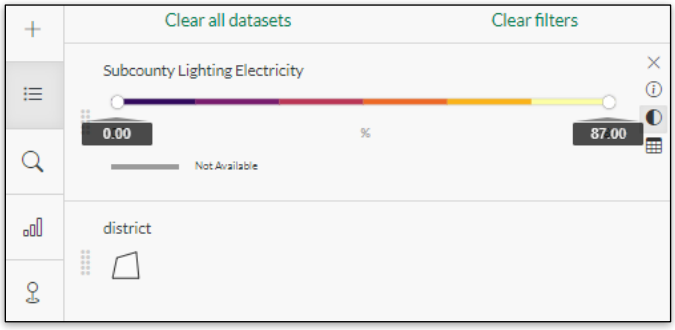
The map window now displays a map comparing household electricity access rate for lighting at the sub-county level in Uganda as per the census data.

Zoom on the map till Kasese County is the center focus on the display.

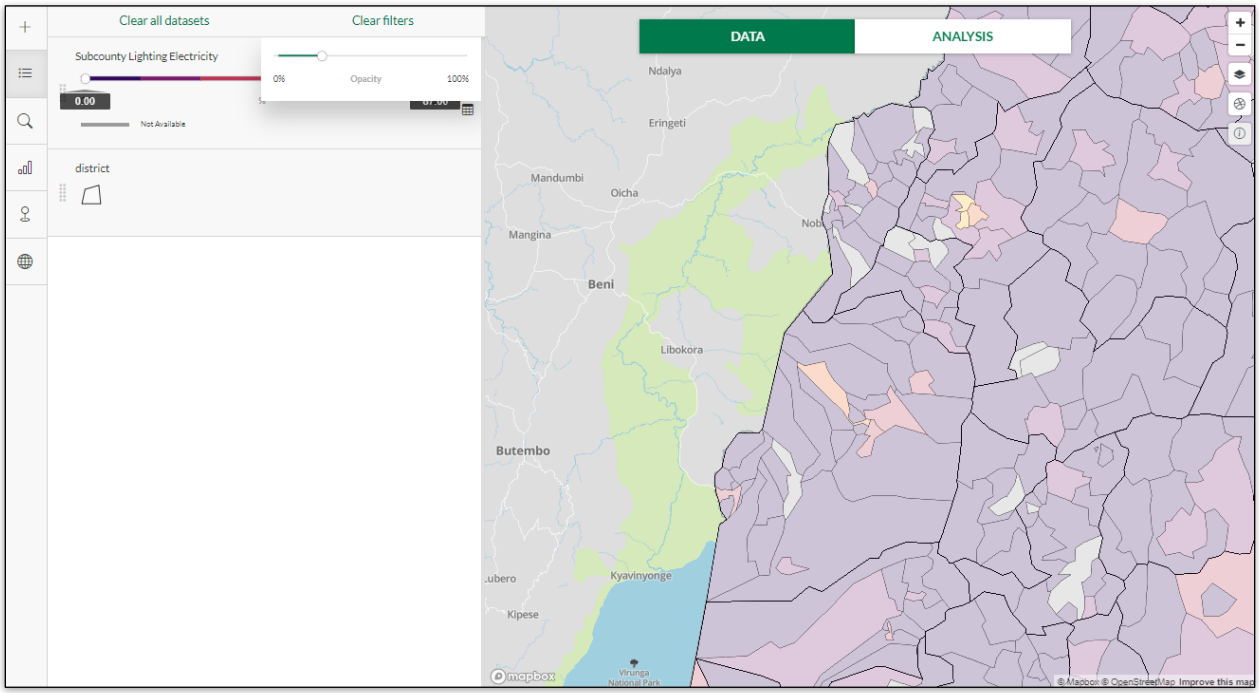
Use the 'Active 'Layers'  tool on the top right panel to see which layers are active on the map.



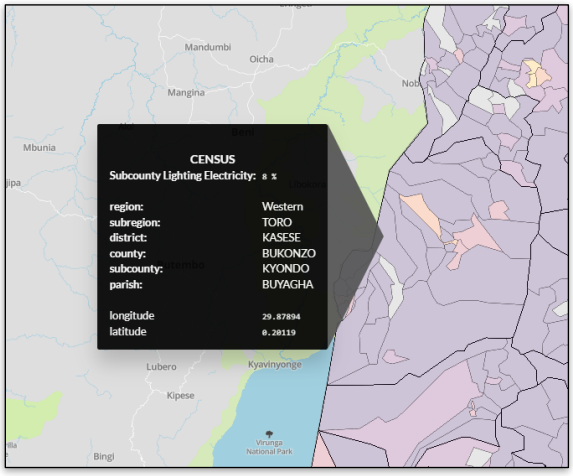
Now pan your cursor to the right side of the active layer and use the transparency slider button to adjust opacity of the Subcounty Lighting Electricity layer to about 30% (at least a third). Also increase the transparency of the counties layer to 100% in the same way.



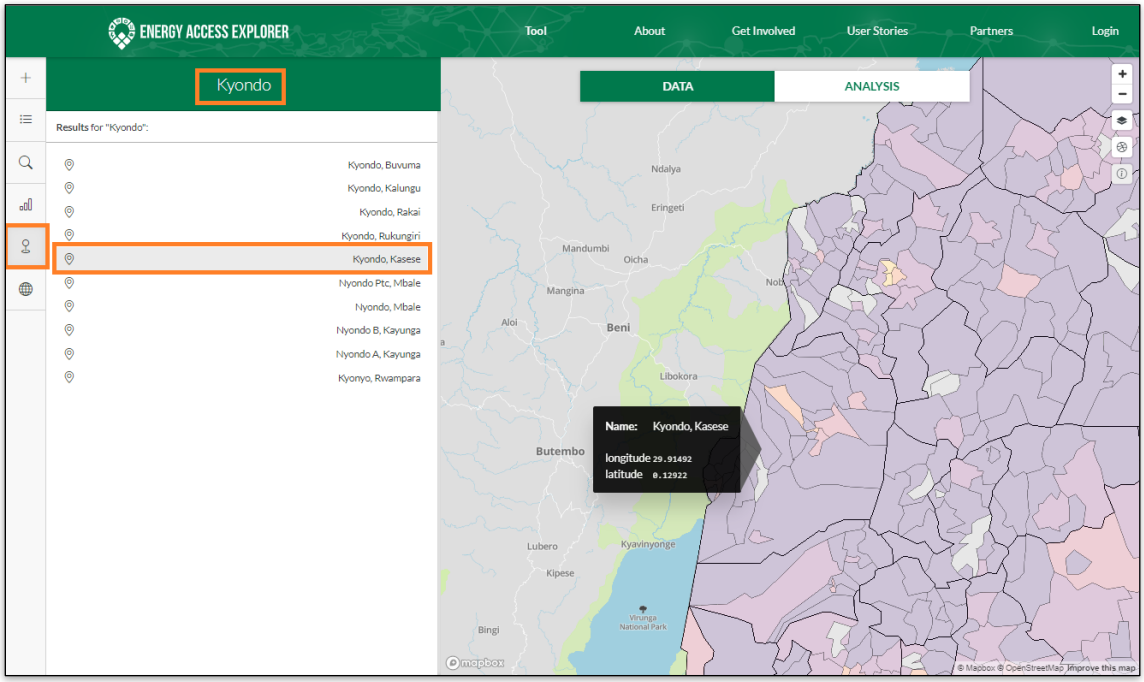
Make sure you can see Kasese county outline from the counties layer as well as the distinct sub-counties boundaries within Kasese from the radio ownership layer.



On the map window, use the query tool  on the top right side of the screen and click randomly on the sub-counties in the Kasese district on the map till you identify Kyondo subcounty. *(As shown below, a pop-up should appear showing the name of the sub-county and the Subcounty Lighting Electricity percentage.*



You can also use the Search POI's tool to locate Kyondo.



Q: What is the Subcounty Lighting Electricity percentage in Kyondo from the pop-up information?

b. Lighting: Subcounty Lighting Electricity % in Muhokya Subcounty.

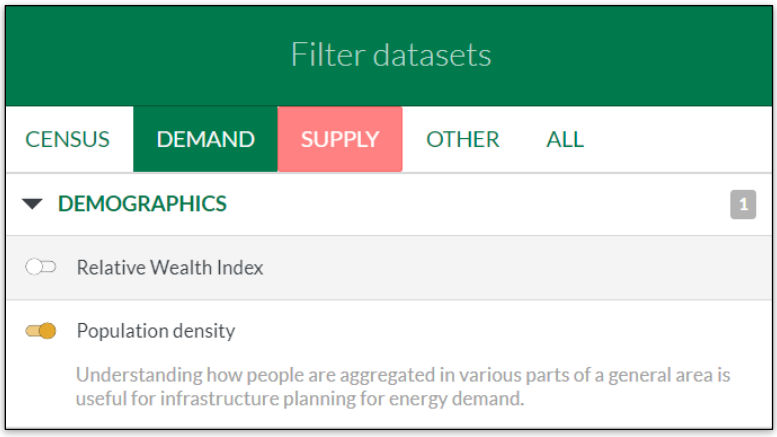
Using the same procedure as in (a) above, obtain the percentage of households using electricity for lighting in Mukhoya subcounty in Kansese district.

Once done turn off all the layers and proceed to the next step.

2. Add the following layers and identify:

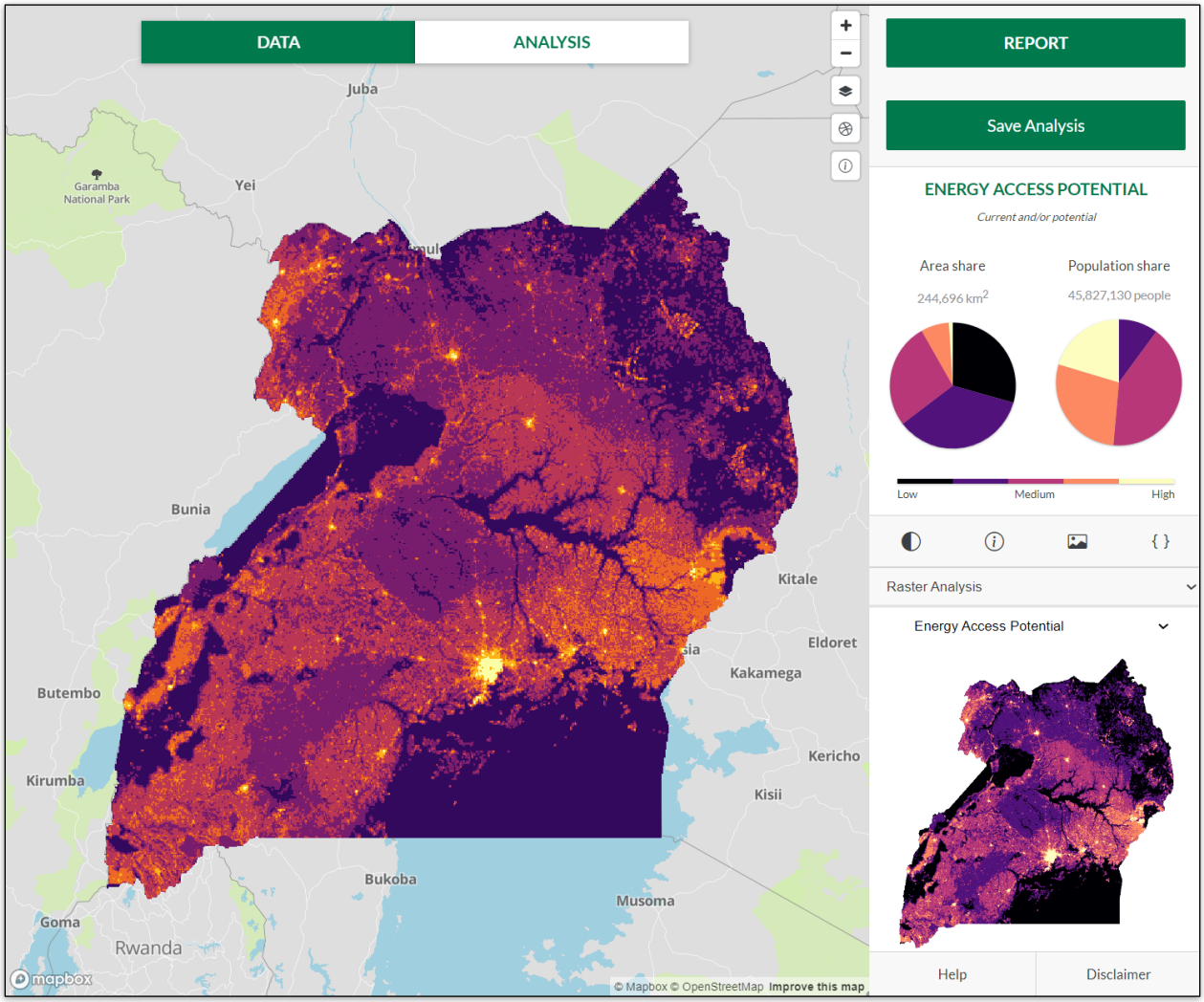
a. Population Density

On the data panel, select **Demand** category, then under Demographics, select **Population density** to load this data.



i. Locate areas with the highest population density.

On the map window, try to spot the areas with the highest population densities (light-yellow in color).



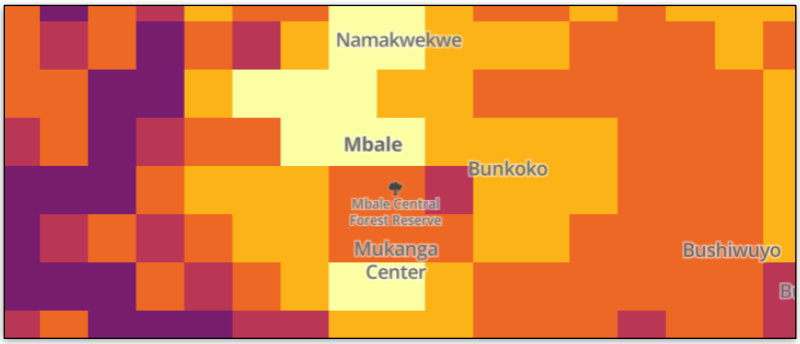
ii. Locate the town of Mbale.

To orient yourself with where Mbale town is, select **Other** category in the data panel, then select **County** under Administrative Boundaries group to load it to the map.

Note: *You can also use the search*  *icon in the tools panel on the left to search for Mbale.*

Zoom in to Mbale County and notice as you zoom in the names of towns appear.

Once you spot the name 'Mbale' you can drag the population density layer above the counties layer in the legend *(top right).*



iii. Locate other major urban centers within Mbale County

Zoom in a bit closer to see other major towns labels appear on the map.

You can adjust the opacity of population density layer using the transparency slider button till you can see the boundary of Mbale County *(about 60% will do).*

Q: Pan the map and identify and list at least 5 towns you can spot within the boundary of Mbale County then list them here:

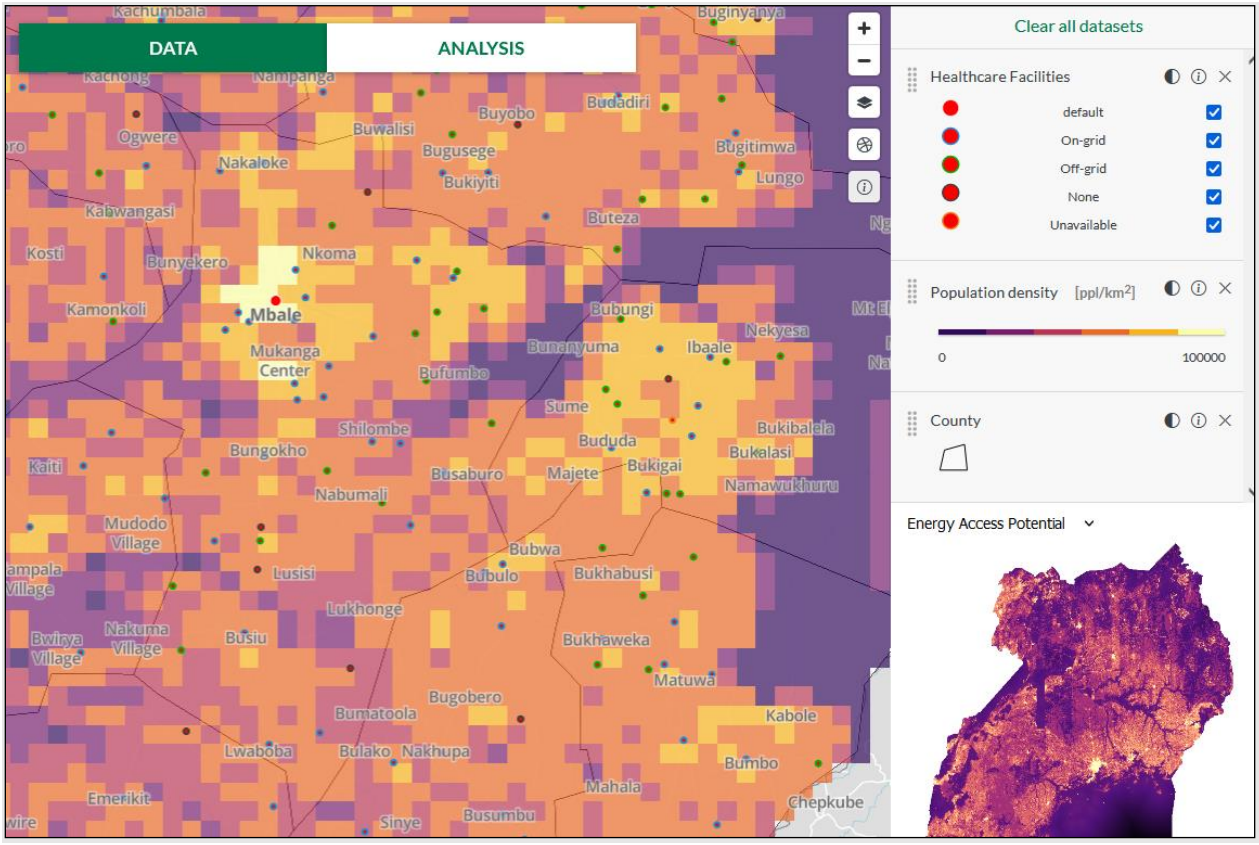
- Town 1:
- Town 2:
- Town 3:
- Town 4:
- Town 5:

b. Add Health Facilities

iv. Locate Health facilities in Mbale County. Indicate attributes under Health Facilities.

Leave the map still on the same display scale where you can see the Mbale County boundary.

On the data panel on the left, select **Demand** category then **Health Facilities** under Productive Uses.



Once the health facilities load on the map, use the ⓘ identify button to click on a health facility in the map within Mbale county. You can zoom in a bit closer to identify and click one health facility at a time. *The health facilities are colored differently based on their electrification status. See the right panel.*

Q: You should see a pop up with attributes of the health facility. List them here:

On the legend, click the cancel ✕ buttons to remove all the layers from the map display. *(You can also switch them off from the data panel).*

c. Add Satellite base map and Global Horizontal Irradiation

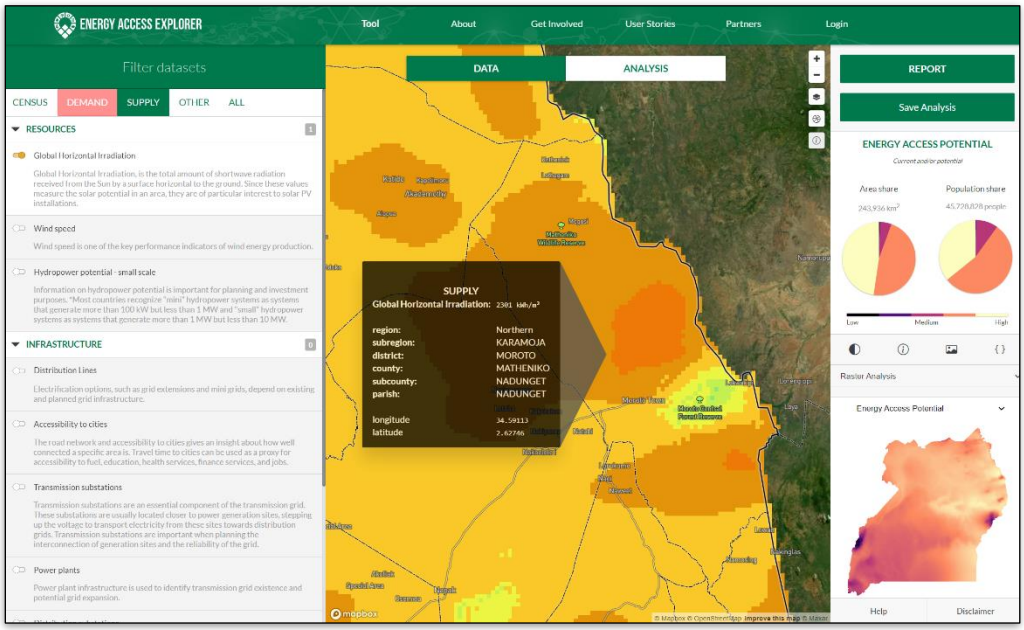
Use the basemap switcher button  on the map window to switch on the **Satellite** basemap.

On the data panel, select **Supply** then **Global Horizontal Irradiation** under the Resources group.

You can use the transparency slider to on the GHI layer to compare with the satellite basemap below it. Once done put it back to 100% opacity.

v. What is the solar irradiance range (max-min) found in Moroto County?

Select the identify button on the map window and click on the darkest orange section of the GHI layer within Moroto County boundary to see the maximum solar irradiance value from the pop up that appears.



Q: Now click on the light green section of the GHI to get the value of the minimum solar irradiance and list it here:

vi. What is the solar irradiance in Nakapelo?

Zoom in closer on the map till you can see the town names appear.

Q: Locate 'Nakapelo' town on the map *(should be around where the highest GHI value in Moroto is)* and click on it to see the solar irradiance value and note it here:

d. Add Hydropower potential – small scale

On the data panel, click Supply category and select **Hydropower potential - small scale** under the Resources category to add it to the map.

vii. Provide a summary of small-scale hydropower available in Napak County.

Zoom out till you can see the boundary of Napak County *(towards the left of Moroto).*

Q: Count the number of potential small-scale hydropower points you can see within Napak County and list the value here:

Q: Click on one point and list the potential hydropower capacity in MW here:

Turn off all the layers on the map.

3. Multi-criteria Decision Analysis

Here you will do an analysis to identify areas in Napak County that are not within the range of the grid and estimate the population (nationally) also far from the grid.

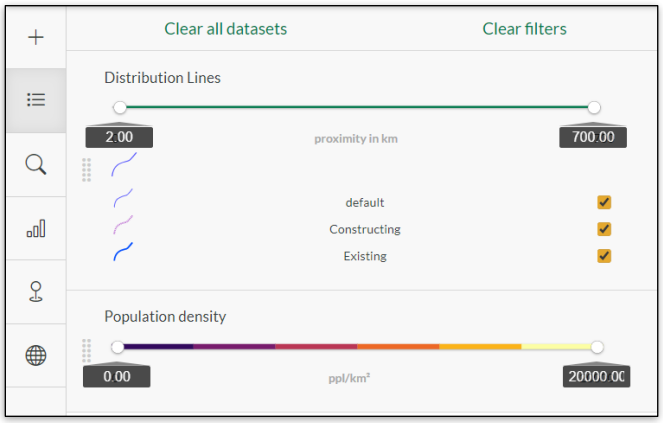
Add **Population density** layer (Demand category).

Now under Supply/Infrastructure, add **Distribution lines** layer to the map.

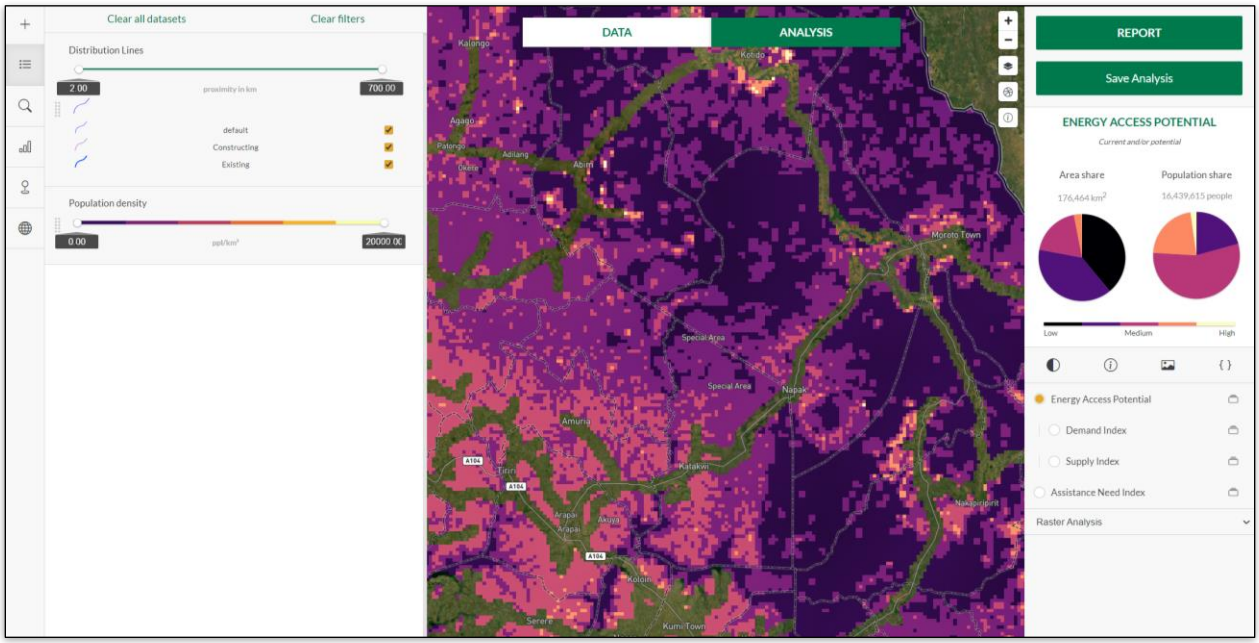
Make sure you are still centered around Napak County.

In the data panel, under the Distribution lines layer, you will see the proximity in km slider and boxes below it that show the minimum and maximum values of the filter you set. You will set values manually to filter the areas on the map at custom defined distances away from the distribution lines.

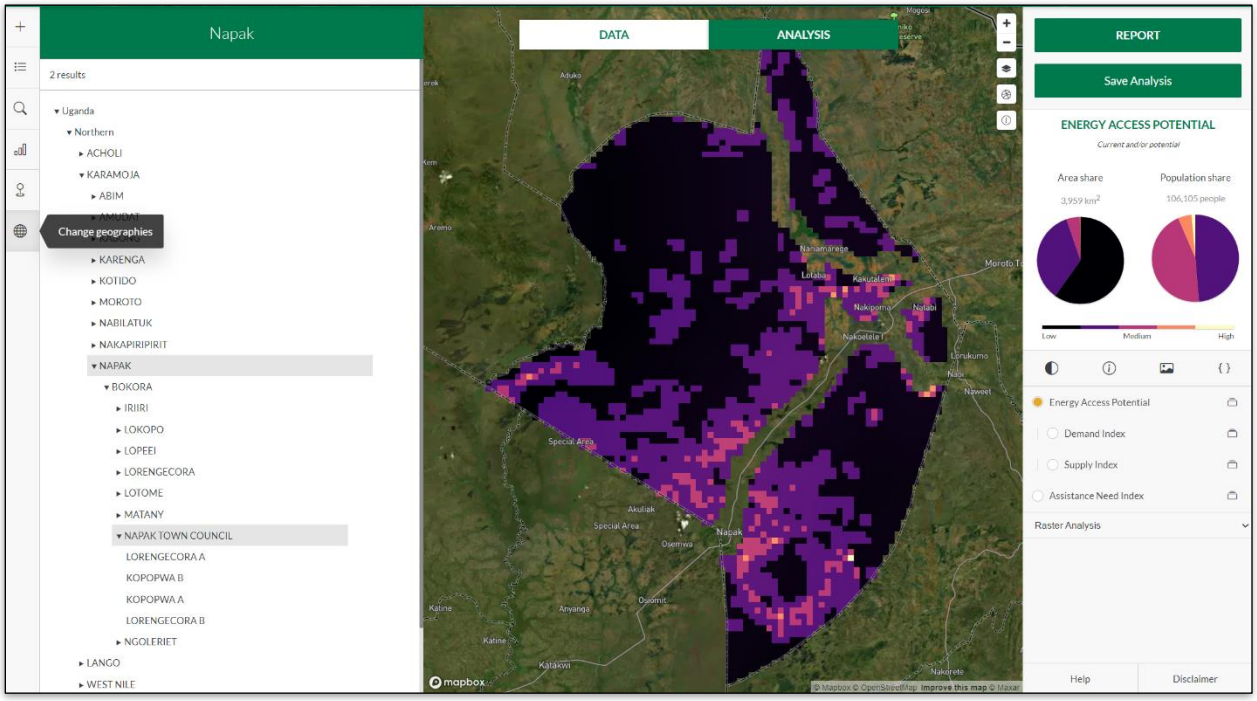
Type **2** for on the left box and leave the one on the right with its default value of 700. See below.



On the map window, switch from **Data** to **Analysis** view to locate areas within Napak county that are at a distance of 2km and above away from the distribution lines.



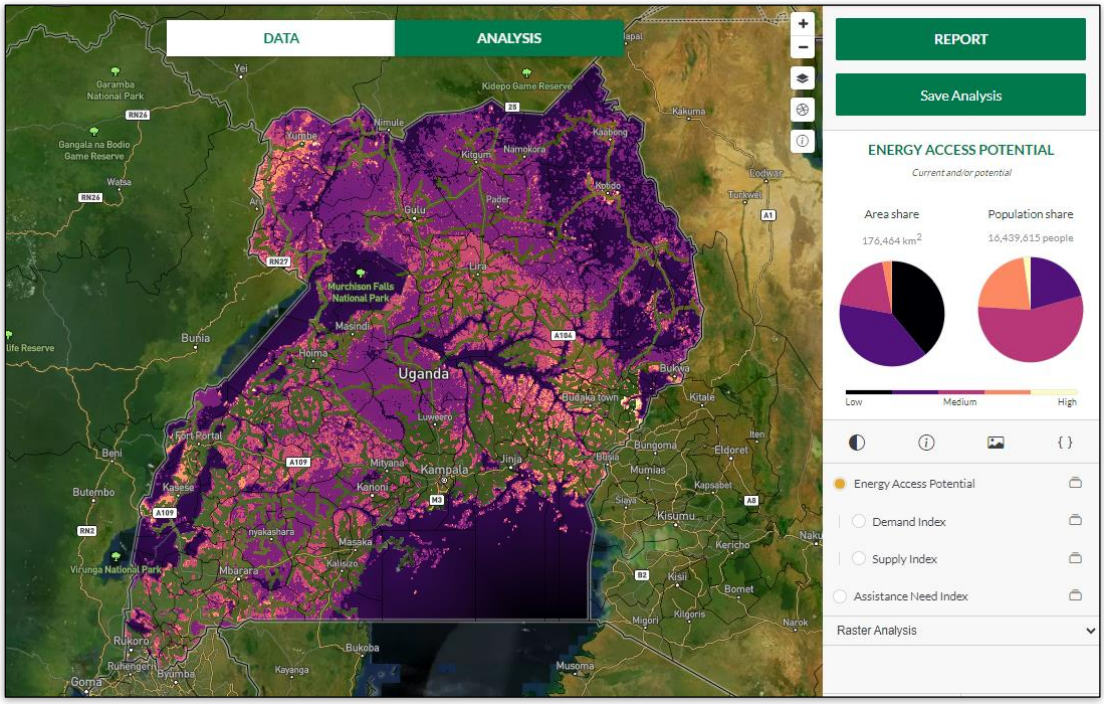
Select the Change geographies button and under Geographies Search, type ‘Napak’ to filter it out from the list and select it to only visualize results from Napak on the map.



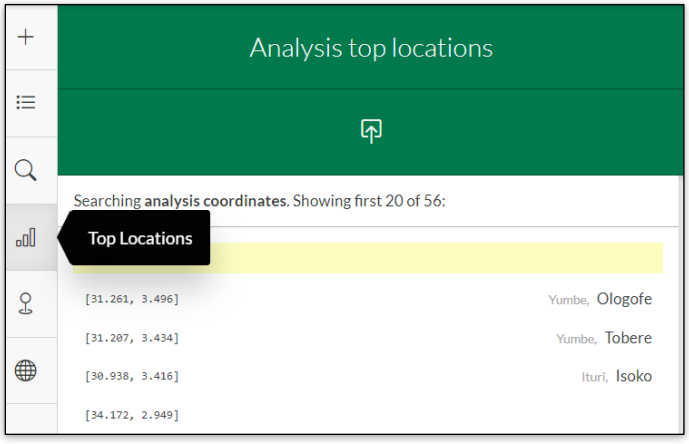
Q: Which areas seem to have high population density and are far from the distribution lines?

In the Change geographies window, click on ***Uganda*** to zoom out the map and see analysis results of the whole of Uganda.

On the right panel, you can see the Energy Access Potential indicated as either Low, Medium and High as well as additional statistics on Area and Population share.



Q: Locate some areas where the energy access potential is high i.e., where population is high (demand) and not too far from the distribution lines (supply). You can use the top locations button to see the top 20 locations that the system identifies with highest energy access potential and click some of them to zoom in the map to view their locations. Use the identify button to click and get more info on these top locations.

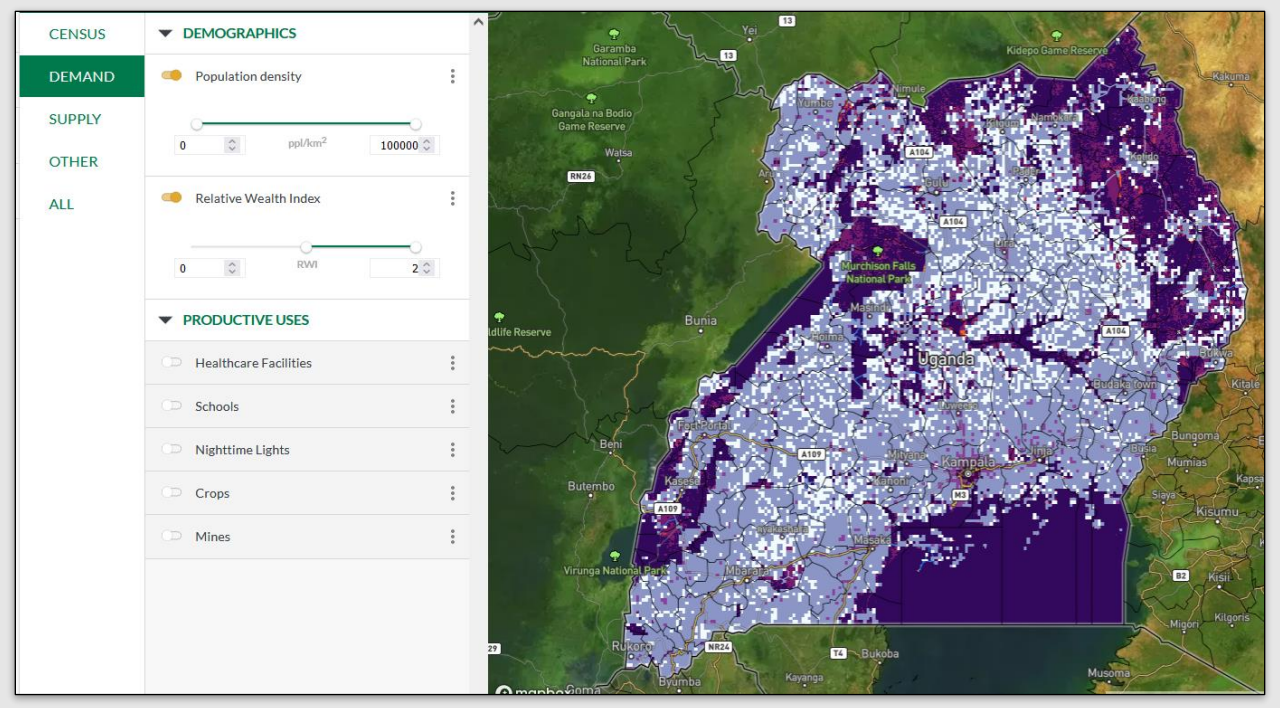


Q: What is the total population and area listed for Uganda which is located above 2km away from the distribution lines? (See panel on the right).

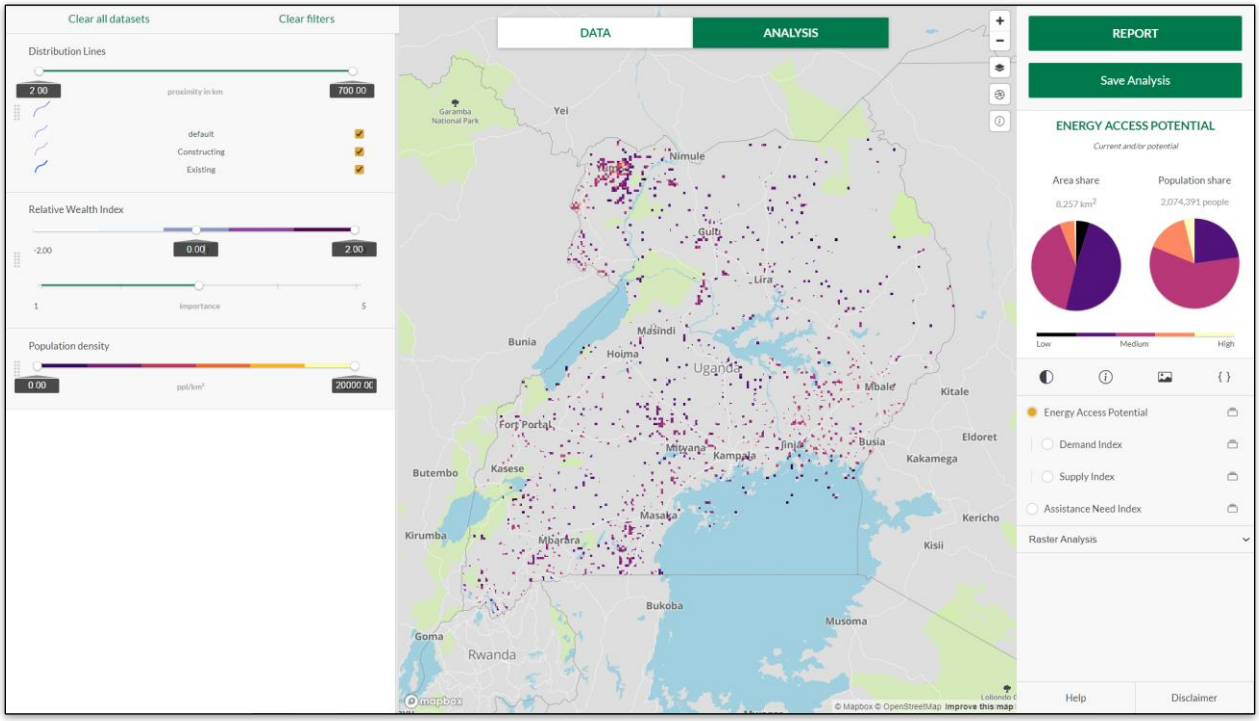
Add **Relative Wealth Index** data under Demand-Demographics

The Relative Wealth Index predicts the relative standard of living within a country. It is built using digital connectivity, satellite data, and other indicators. Values range from -2 to 2, with 0 representing the average household wealth in the country.

Below the Relative Wealth Index data in the data panel, type **0** on the left box and leave the one on the right with its default value of 2.



The map now displays areas in Uganda with populations living 2km away from the distribution lines and are living above the average household wealth in the country, thus have potentially ability to pay for energy services supplied to them.



Q: What is the total population living 2km away from the distribution lines and are living above the average household wealth in Uganda?

You can change the values of the Relative Wealth Index filters to a maximum of 0 and minimum of -2 to see the populations living below the average household wealth. These populations would likely require assistance to acquire energy services.

Click on Snapshot and go through the summary graphs, visualize the summary table and export and review the pdf and csv reports.

II. Activity 1 – Analysis

Analysis 1

a) Add Population density and Healthcare Facilities

On a browser, open Energy Access Explorer using this link: https://www.energyaccessexplorer.org/tool/s/

Select **Uganda** from the geographies listed.

On the dataset panel in the left, and under **Demand** category, add **Population density** and **Healthcare Facilities**

Questions

i. In the Analysis view of the EAE. Are there any areas that appear with a high energy access potential (lightest color)? Choose one of these areas and explain why this could be high. *(**Hint**: switch from data to analysis view in the map window)*

ii. Estimate the total population near one of the areas with high energy access potential. *(**Hint**: use identify tool).*

iii. Locate the areas near healthcare facilities but not within range of the grid. *(**Hint**: Add distribution lines and set filters of your choice for distance away from grid e.g., min:2km away, but close to the healthcare facilities e.g., max:5km nearby)*

iv. Get the top 20 locations that meet these criteria and select the first location to view where it is located on the map *(Hint: use top locations tool on the left panel)*

v. Switch from analysis to data view and select the health facility that falls within the top location and indicate its ***name, electrification status*** *and current* ***electricity source*** from its attributes.

Analysis 2

a) Add Population density and GHI. Locate areas with high global horizontal solar irradiance.

On a browser, open Energy Access Explorer using this link:
https://www.energyaccessexplorer.org/tool/s/

Select **Uganda** from the geographies listed.

On the dataset panel in the left and under **Demand** category, add **Population density** layer to the map from the Demographics group. The select **Supply** category and add **Global Horizontal Irradiation** under Resources group.

Questions

i. What is the total area in Uganda with high solar irradiation? (Above 2,000 kWh/m^2)
*(**Hint:** Use the filters on the GHI layer and check the Energy Access Potential panel in Analysis view)*

ii. What is the total population in Uganda within this area of high solar irradiation? (Above 2,000 kWh/m^2)

iii. Add a healthcare facilities dataset to the map. What is the solar irradiance potential in the areas where these healthcare facilities are located? Do you think solar can be a viable electrification option for them?

- Arute HC II:
- Nakiloro HC II:
- Kateta HC III:

*(**Hint:** On the tools panel in the left, click the tool*  *to open the search POI window and search for the above healthcare facilities then use identify tool to click on the healthcare facility when zoomed in).*

iv. Zoom out to see the entire extent of Uganda. On the panel to the right, see the symbology of all the layers loaded in the map.

v. Under the Health Facilities data, uncheck all the other points to see only the ones that are Off-grid and see their locations on the map.



vi. Click the 'Change geographies' tool and select one of the options there. When the map zooms in to your selected extent, click on one of the health facilities and indicate its **name, required power capacity (kW), daily elect. Requirement range (kWh), and annual electricity requirement (kWh)**. *(You will notice only off-grid health facilities are displayed since we selected that in the previous step).*

Analysis 3

a) Add population density & Nighttime Lights.

On a browser, open Energy Access Explorer using this link: https://www.energyaccessexplorer.org/tool/s/

Select **Uganda** from the geographies listed.

On the dataset panel in the left and under **Demand** category, add Population density layer to the map from the Demographics group. Still under **Demand** category then add **Nighttime Lights** under Productive Uses group.

Questions

i. What is the population with nighttime calibrated radiance of below 20? *(Hint: Use filters calibrated radiance. Min=0, Max=20)*

ii. What is the area occupied by the population above?

b) Add distribution lines.

Hint: From **Supply** category.

Questions

i. What is the population distant from the grid? *(**Hint:** Use filters, Distribution lines > 2km)*
ii. What is the population in proximity to the grid? *(**Hint:** Use filters, Distribution lines < 2km)*

c) Add Health Facilities data.

Hint: From **Demand** category.

Switch to Data tab and and use the 'Search Features' tool to search for **'Nadangira HC III'.** When the map zooms to its location, select it and list its **load factor, catchment population** and **allocated number of beds.**

III. Activity 2 – Case Scenarios

Choose any of the scenarios below. Consider how you would implement it and then attempt the scenario.

On a browser, open Energy Access Explorer using this link:
https://www.energyaccessexplorer.org/tool/s/

Scenario 1 – Strategic integrated energy planning

Suppose you are an analyst at the Ministry of Energy and would like to indicate high priority areas where access to energy could be expanded by extending the grid network to target a healthcare electrification program.

Task: Create a multicriteria analysis combining at least 5 datasets from demand, supply and other to indicate high priority areas where the grid should be expanded.

Hint: You could begin by locating areas close to healthcare facilities, not connected to the grid but where grid coverage is close enough to extend it

Scenario 2 - Expansion of clean energy markets

Suppose you are a solar home system developer searching to expand clean energy markets by identifying where potential customers in healthcare sector may be located and validating collected data.

Task: Create a multicriteria analysis combining at least 5 datasets from demand, supply and other to indicate high priority areas where the markets should be expanded.

Hint: *Areas with good solar potential far away from grid, with healthcare facilities close and enough population. You can also consider the ability to pay.*

Scenario 3 – Prioritization of energy access investments (Donors and Development Finance Institutions)

Suppose you are an analyst in a development finance institution interested in identifying areas where assistance is most needed for healthcare electrification & investment could have a greater impact.

Task: Create a multicriteria analysis combining at least 5 datasets from demand, supply and other to indicate high priority areas where investments could have the greatest impact.

Hint: *High energy demand for healthcare electrification, low economic activity/ability to pay, and low access to grid infrastructure and resources*

Scenario 4 - Service delivery institutions in the health sector

Suppose you work in a government agency supporting an off-grid electrification program for the health sector. You are interested in identifying areas with potential energy needs associated to health care but too far for grid extension.

Task: Create a multicriteria analysis combining at least 5 datasets from demand, supply and other to indicate high priority areas for this off-grid electrification program.

Hint: *Location of healthcare far from grid with good potential for RE technologies*