Energy Access Explorer

Hands-on 1: Using the EAE front-end interface

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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

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    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. Multi-criteria Analysis

1. Analysis 1
2. Analysis 2
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III. EAE Scenarios

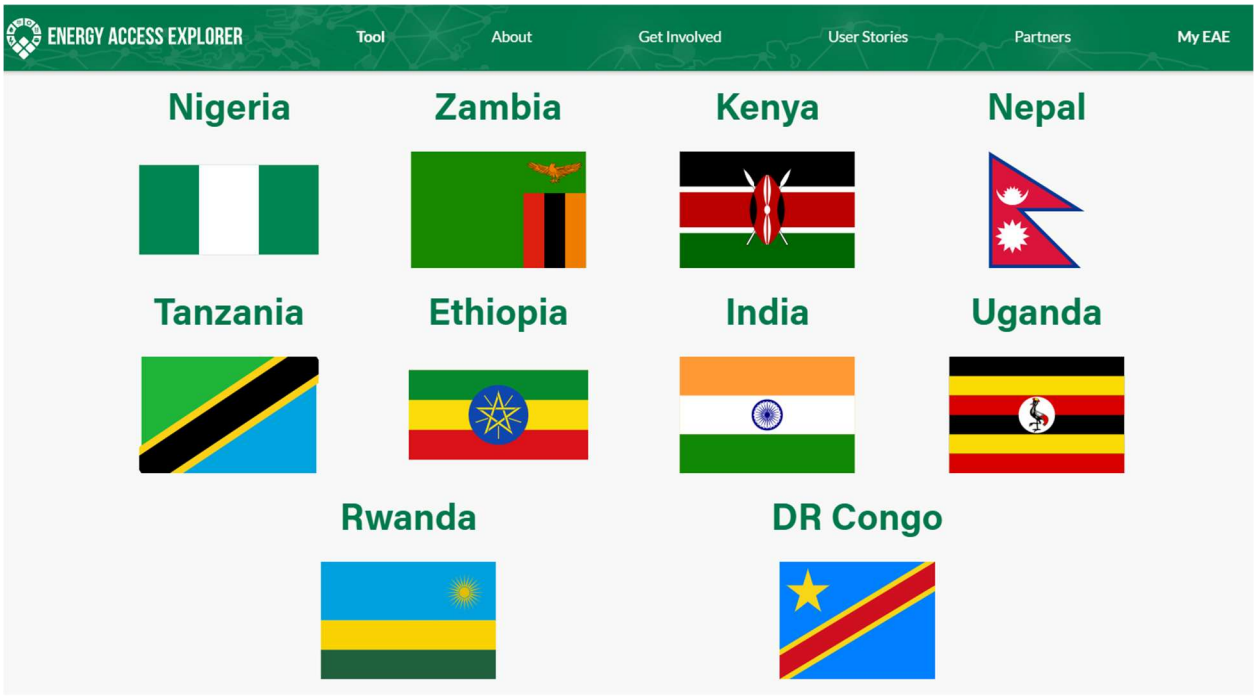
I. Introductory Exercises

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

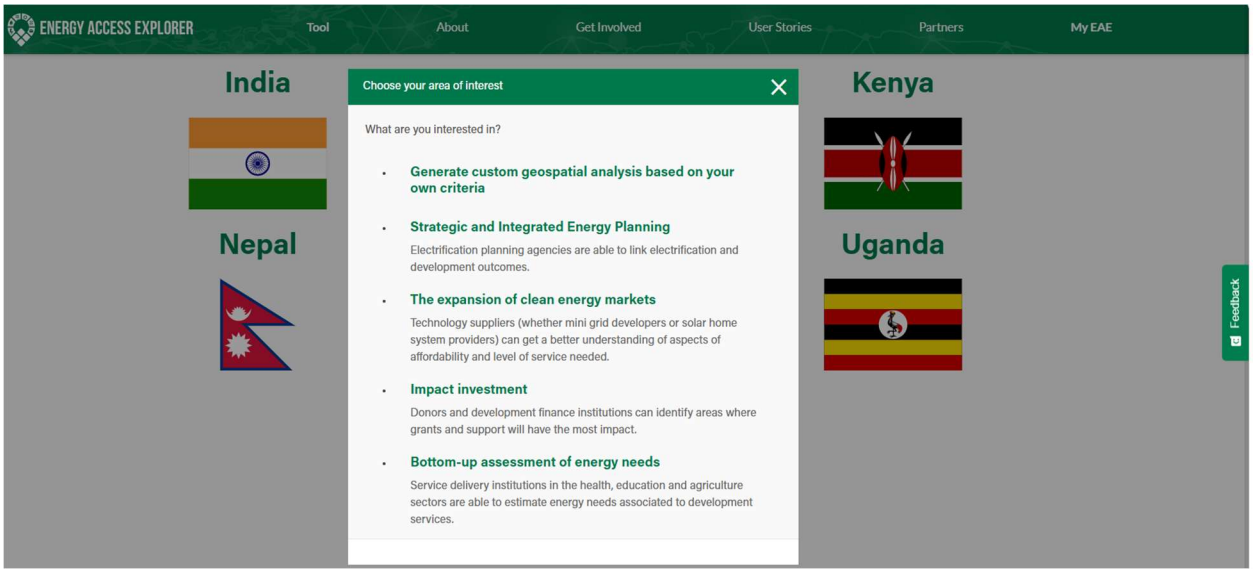
a) Households using solar for lighting % in Kasese District

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

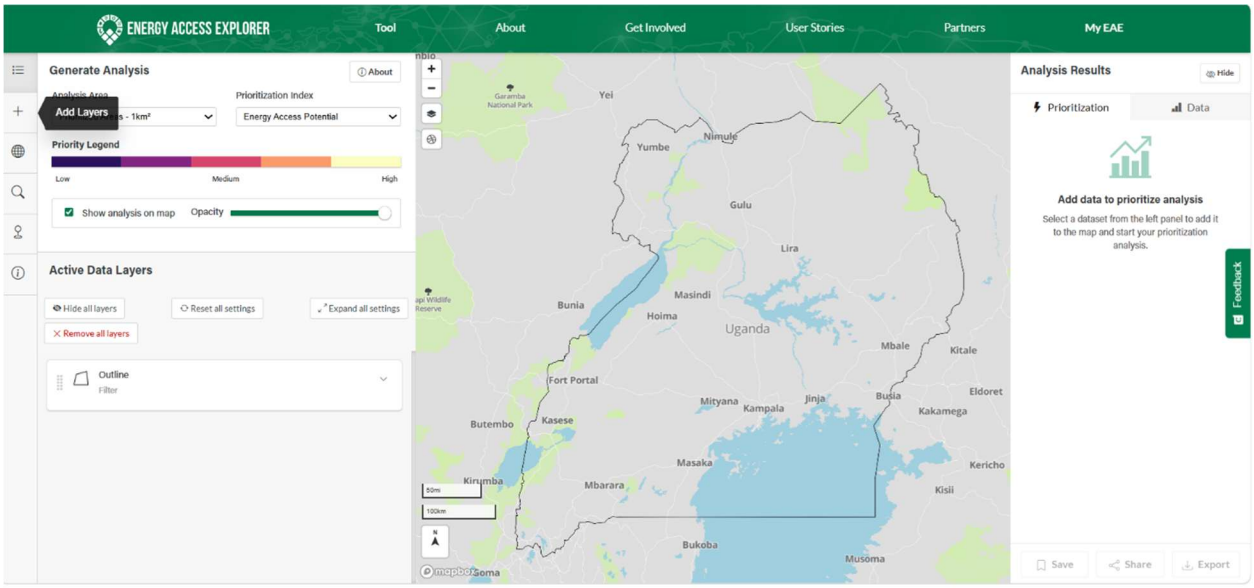
Select **Tool** then select **Uganda** from the geographies listed.



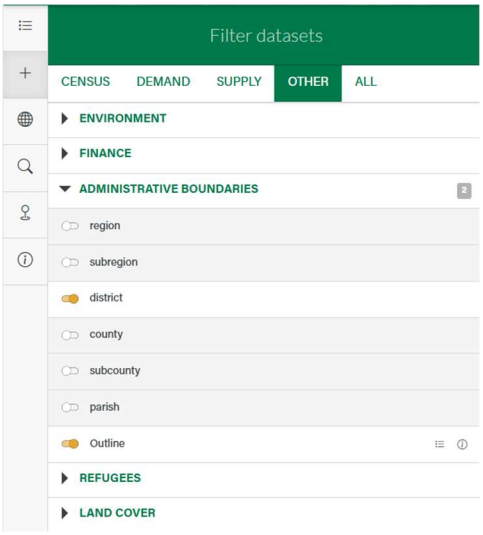
In the pop up that appears of '*Choose your area of interest*', select '*Generate custom analysis based on your own criteria*' (select OK if another pop-up message about display settings appears on your screen)



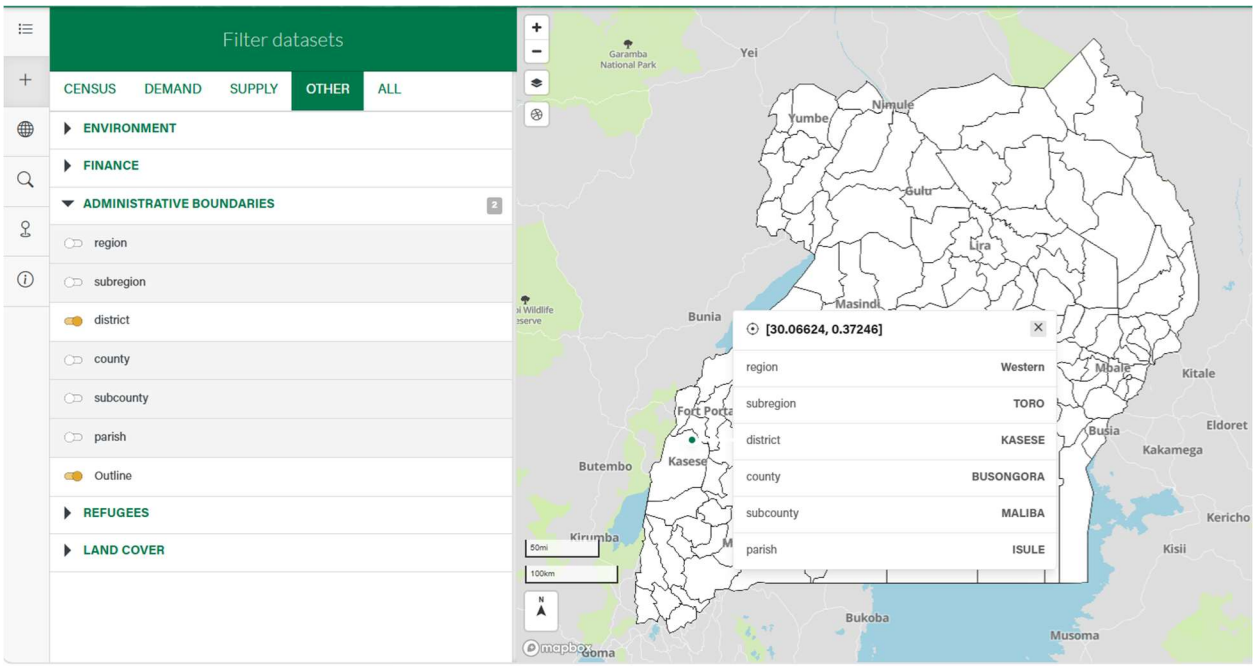
You can see the EAE interface for Uganda where the panel on the left shows the various functions to see active layers, add layers, change geography, search features, find top locations and search POIs. The Generate Analysis section shows the Analysis Area and Prioritization Index as well as the Active Data Layers. When data are selected and loaded to the map window it displays in the middle for visualizations and analysis. The Analysis section in the right panel shows areas for report generation, saving and sharing analysis, area and population share and analysis export.



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

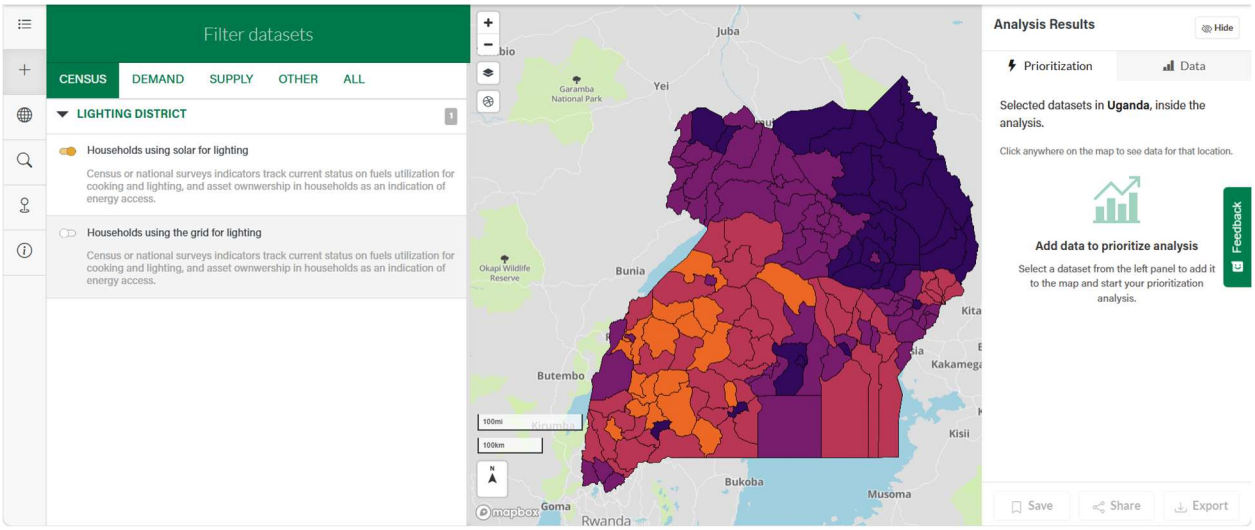


You can zoom and pan on the map till you spot Kasese District. Use the query tool and click on the districts in the southwest of Uganda until you find Kasese district.



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

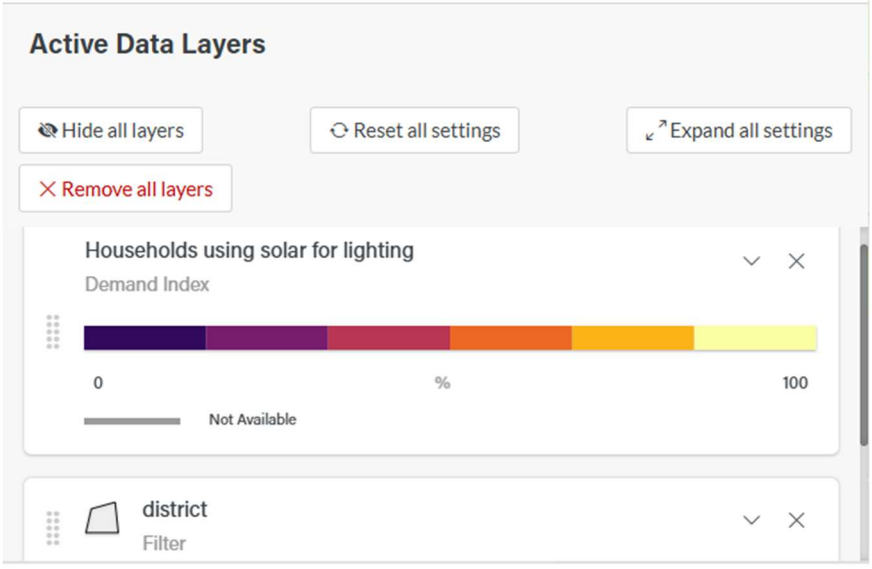
In the data panel, select **Census** category, then scroll down to Lighting District and select **Households using solar for lighting** to load it on the map.



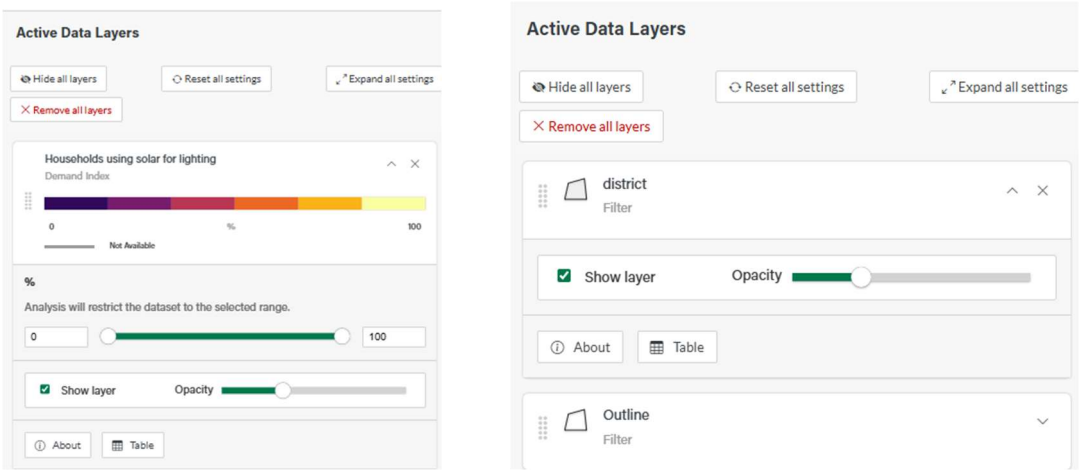
The map window now displays a map comparing household electricity access rate for lighting using solar at the district level in Uganda as per the census data.

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

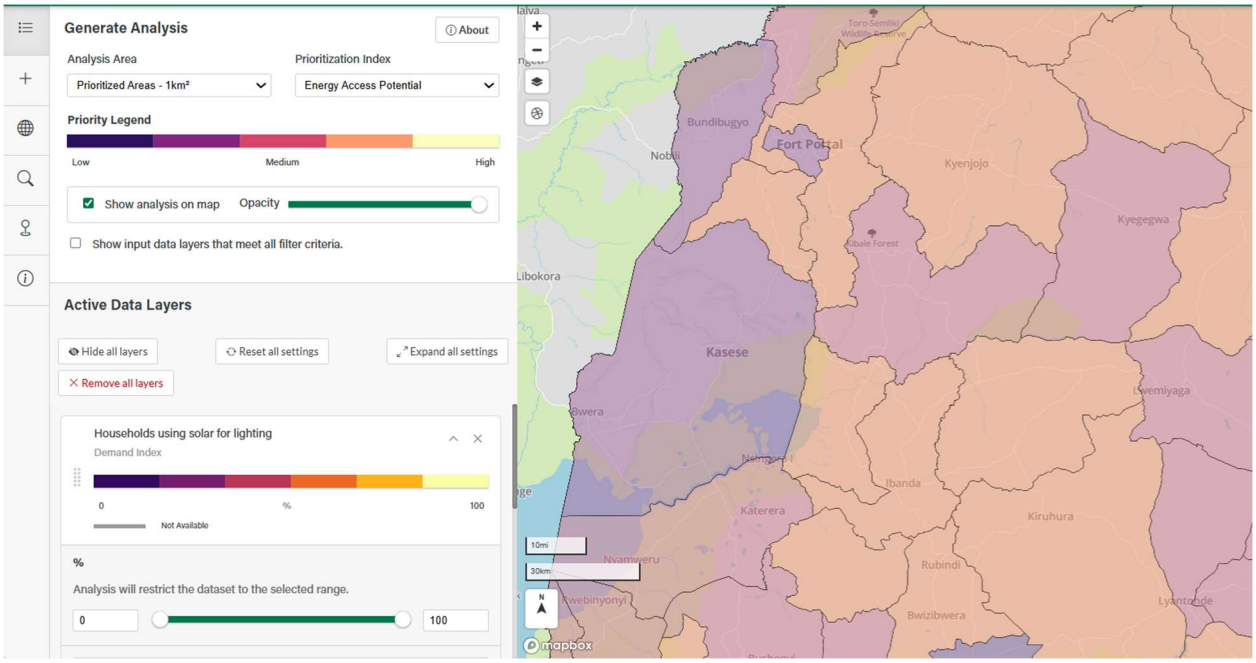
Use the 'Active 'Layers' tool on the top left panel to see which layers are active on the map.



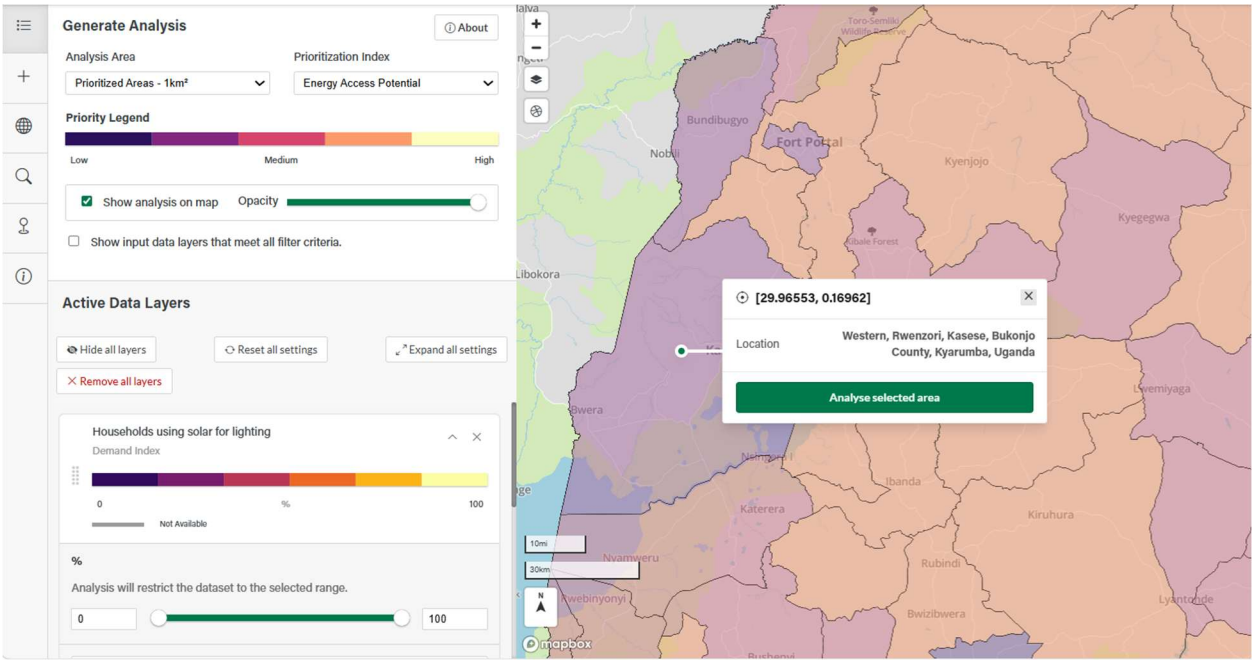
Now expand the **Households using solar for lighting** layer and use the Opacity slider button to adjust opacity to about 30% (at least a third). Also decrease the transparency of the district layer to 30% in the same way.



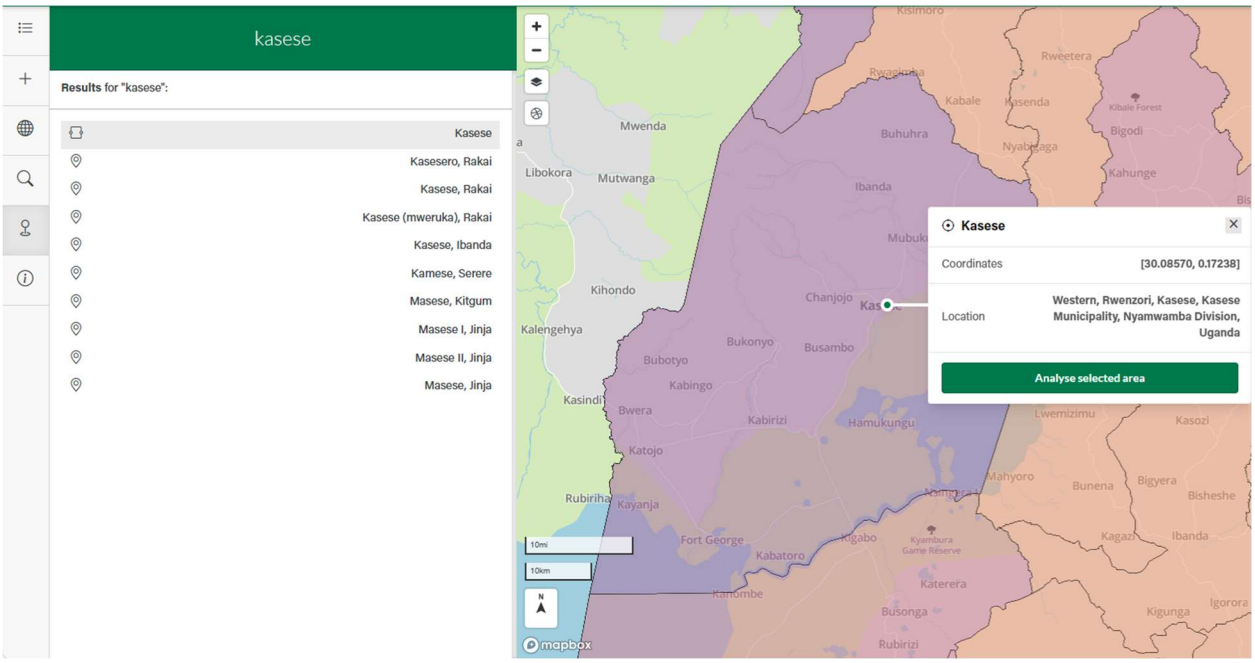
Make sure you can see Kasese outline from the District layer as well as from the Households using solar for lighting layer.



On the map window click inside the Kasese district. *(As shown below, a pop-up should appear showing the location information and Analyze selected area).*



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



Q: What is the percentage of Households using solar for lighting in Kasese district from the pop-up information *(HINT: Click on the Analyze selected area)*?

b. Households using the grid for lighting % in Wakiso District

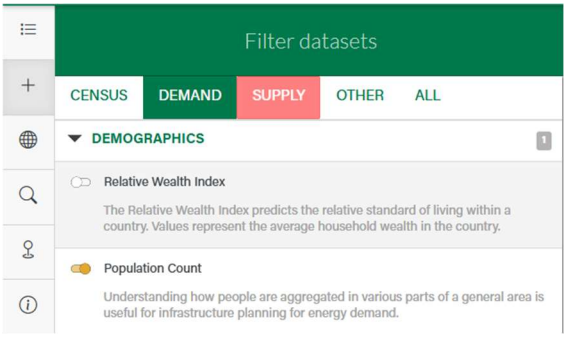
Using the same procedure as in (a) above, obtain the percentage of households using the grid for lighting in Wakiso district.

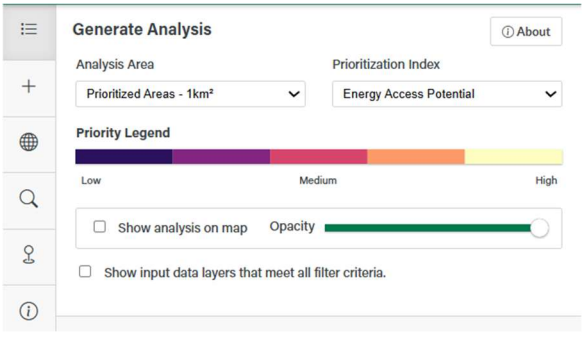
Once done Remove all layers from the Active Data Layers and proceed to the next step.

2. Add the following layers and identify:

a. Population Count

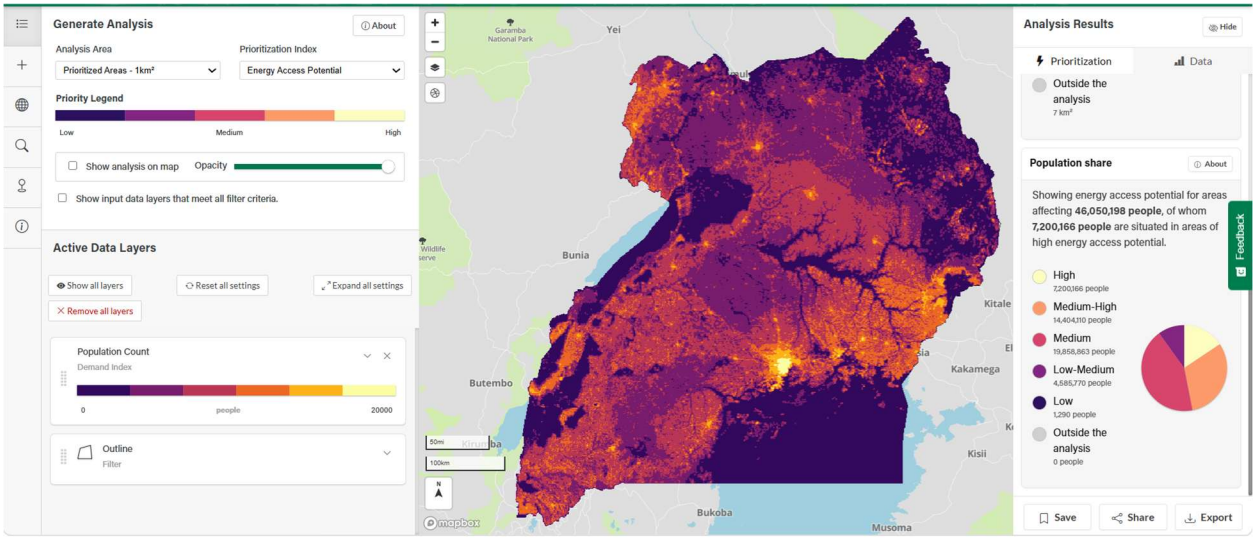
On the data panel, select **Demand** category, then under Demographics, select **Population count** to load this data. In the Active layer, unselect the box *show Analysis on map*





i. Locate areas with the highest population count.

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



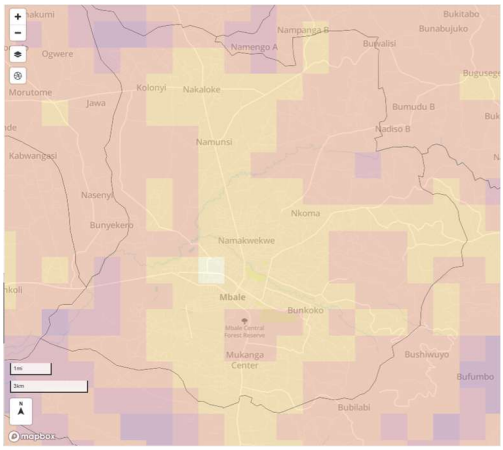
ii. Locate the town of Mbale.

To orient yourself with where Mbale town is, select **Other** category in the data panel, then select **District** under Administrative Boundaries group to load it to the map and reduce the opacity of both the Population and District layers in the Active Data Layers.

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

Zoom in to Mbale City (Eastern part of Uganda) and notice as you zoom in the names of towns appear.

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



iii. Locate other major urban centers within Mbale District

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

You can adjust the opacity of population layer till you can see the boundary of Mbale *(about 60% will do).*

Q: Pan the map and identify and list at least 7 towns you can spot within the boundary of Mbale then list them here:

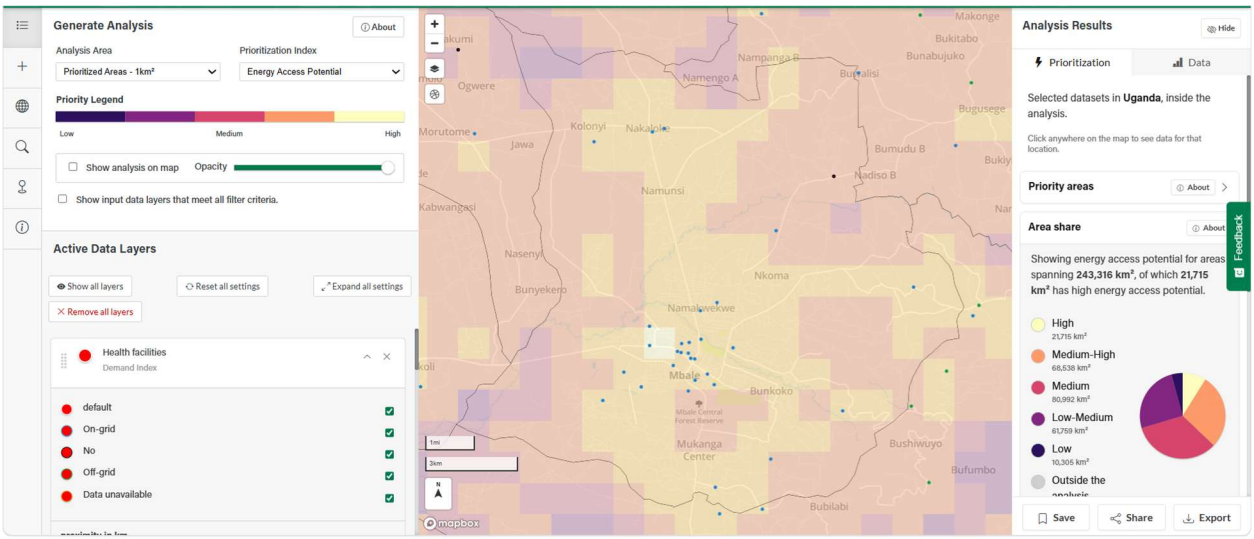
- Town 1:
- Town 2:
- Town 3:
- Town 4:
- Town 5:
- Town 6:
- Town 7:

b. Add Health Facilities

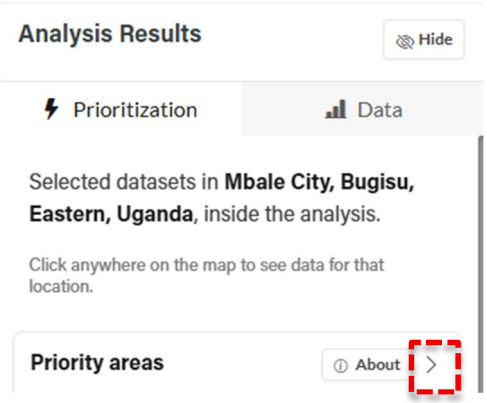
iv. Locate Health facilities in Mbale. Indicate attributes under Health Facilities.

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

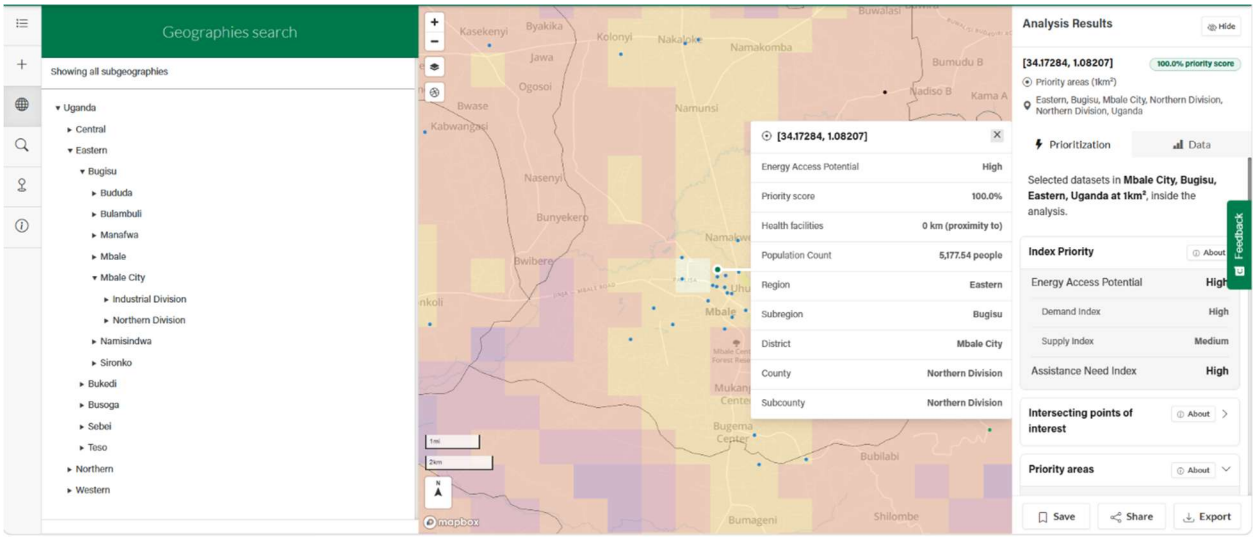
On the data panel on the left, select **Demand** category then **Health Facilities** under Productive Uses.



Once the health facilities load on the map, go to the health facilities legend on the left side. *The health facilities are colored differently based on their electrification status.* To see the characteristics of Health Facilities in Mbale, go to geographies in the left top panel, Eastern – Bugisu – Mbale City. Then, proceed to the right side of the panel, and click on the Priority areas (click on the arrow).



Then, click on the top priority location and analyze selected area.



Q: Click on the health facility identified in the data layer and list down the main attributes of the health facility. *(HINT: Make sure the name of the health facility in the top priority and the facility selected in the data layer are the same)* List them here:

On the Active Data Layers, click Remove all layers from the map display. *(You can also switch them off from the data panel).* Zoom the geography to the whole of Uganda.

c. Add Satellite base map and Global Horizontal Irradiation

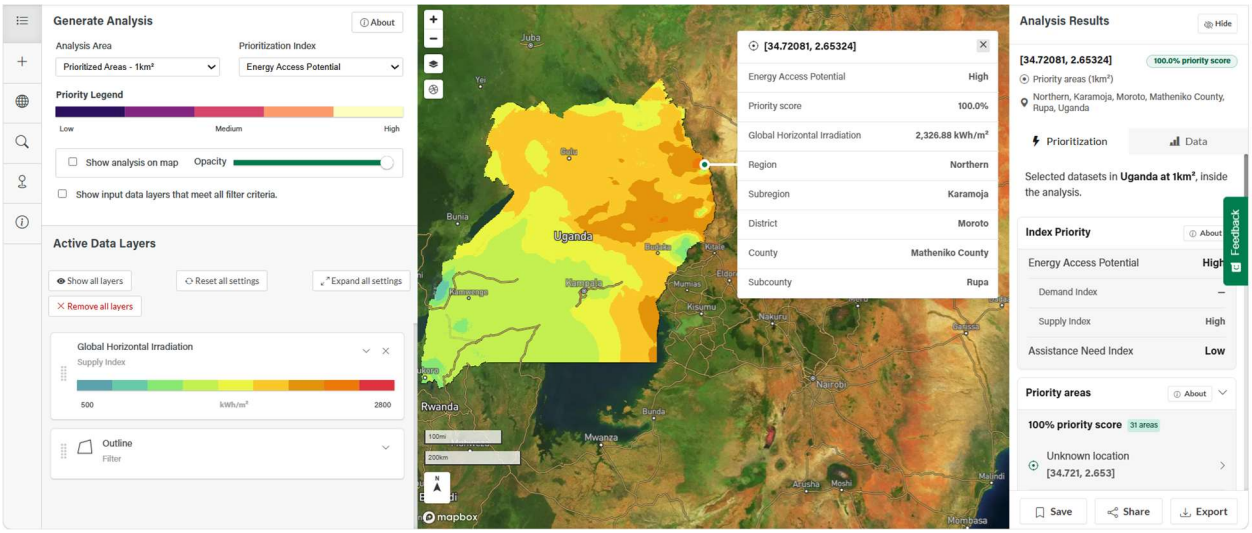
Use the basemap switcher button  on the map window to switch on the **Satellite** basemap.

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

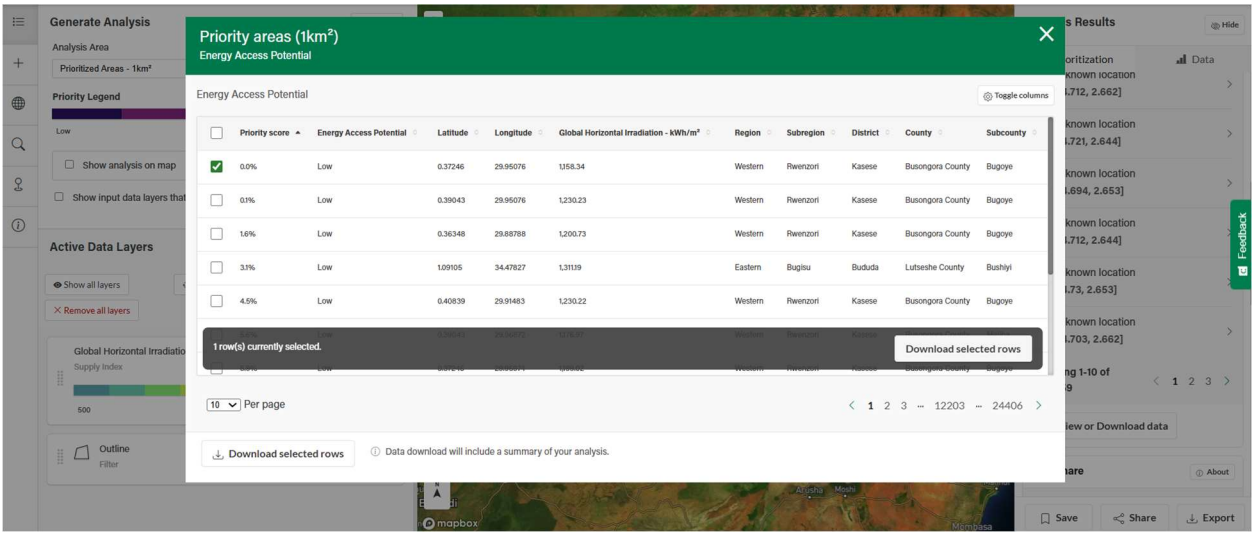
You can use the opacity slider on the GHI layer to compare with the satellite basemap below it. Once done put it back to 100% opacity.

v. What is the solar irradiance found in Moroto district?

Click on the darkest orange section of the GHI layer within Moroto District boundary to see the maximum solar irradiance value from the pop up that appears. Or you can go to the High priority areas and select the top location to analyze the data.



Q: Now click on the light blue section of the GHI to get the value of the minimum solar irradiance and list it here (Hint: you can also go to the View or download data under the High priority areas and when the table top up sort the priority score from low to high)



vi. What is the solar irradiance in Nakapelo?

Zoom in closer on the map till you can see the town names appear or use Search POIs

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:

Remove all layers before proceeding to the next activity.

3. Multi-criteria Decision Analysis

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

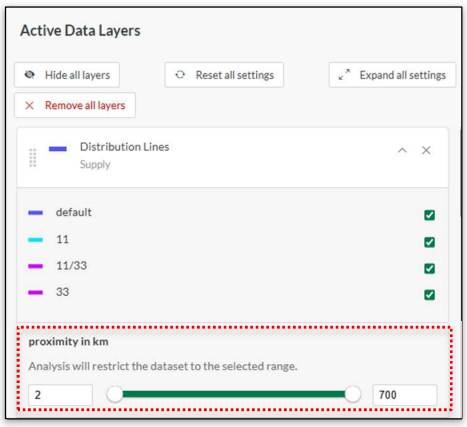
Add **Population count** layer (Demand category).

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

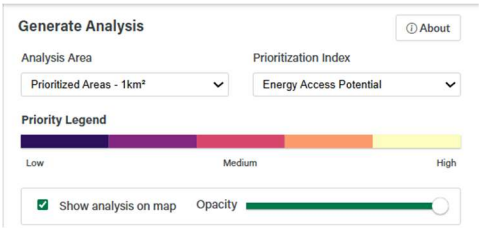
Make sure you are centered around Napak County (Search using POIs to locate it)

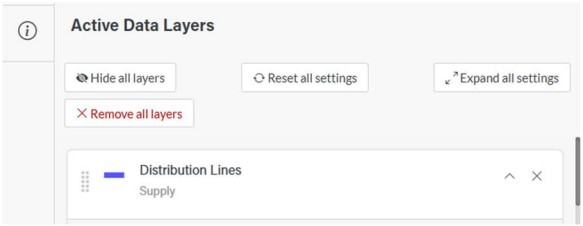
In the active layer, under the Distribution lines layer, you will see the proximity in km slider and boxes on both sides that show the minimum and maximum values of the filter you set. You will set values manually to filter the areas on the map at custom defined distances away from the distribution lines.

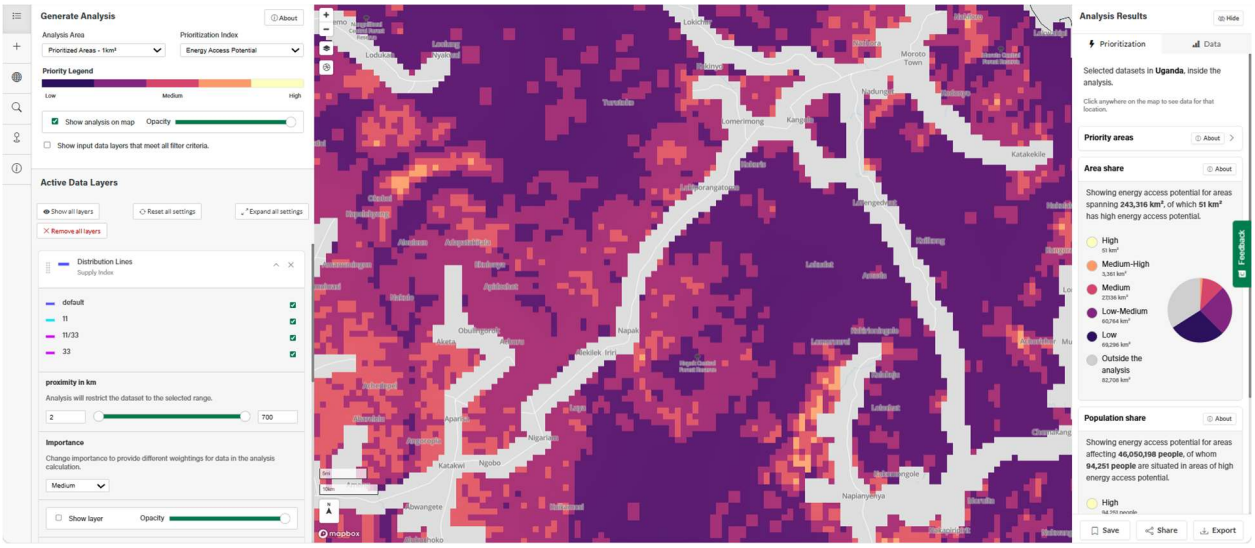
Type **2** for on the left box and leave the one on the right with its default value of 700. See below.



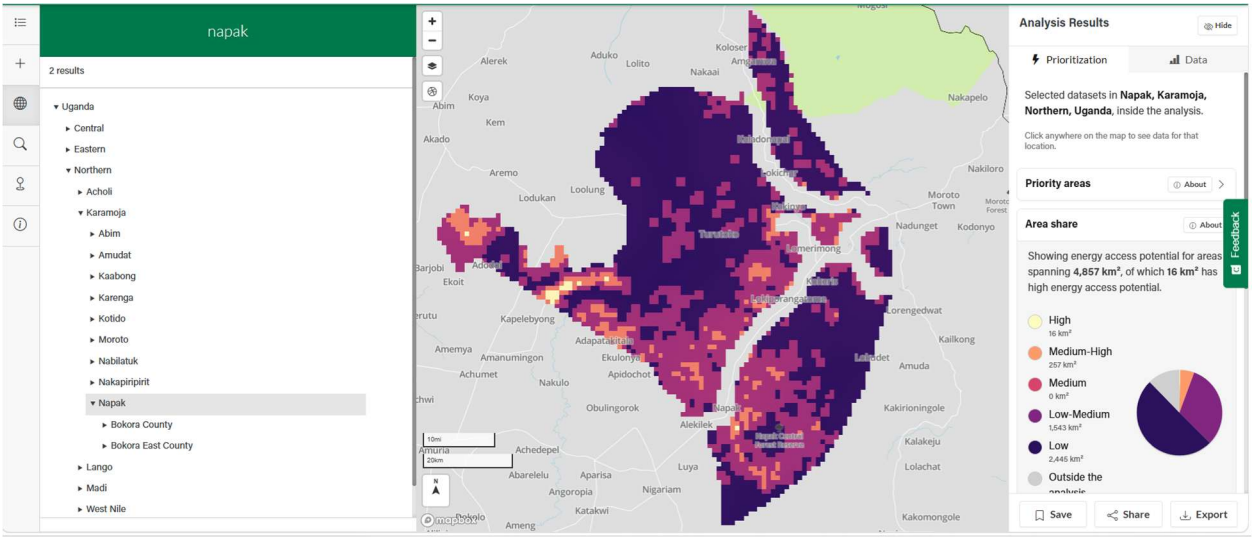
On the Active Layers, select *Show analysis on map* under Generate Analysis and unselect *Show layer* under both the Population density and Distribution lines layer to locate areas within Napak county that are at a distance of 2km and above away from the distribution lines (you can also hide all the layers at once by selecting Hide all layers under the Active Data Layers. You can toggle between the Hide and Show layers)







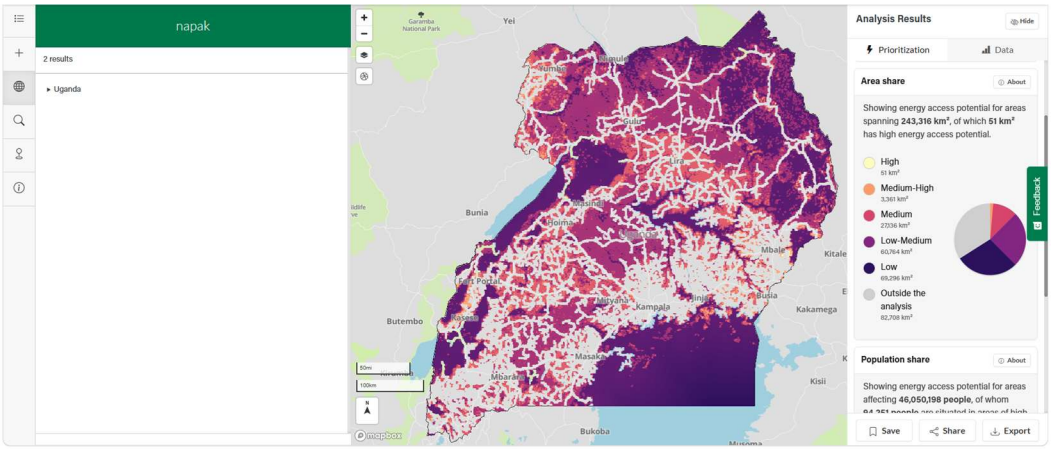
Select the Change geographies button & under Geographies Search, type 'Napak' to filter it out from the list & select it to only visualize results from Napak Town Council on the map.



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.

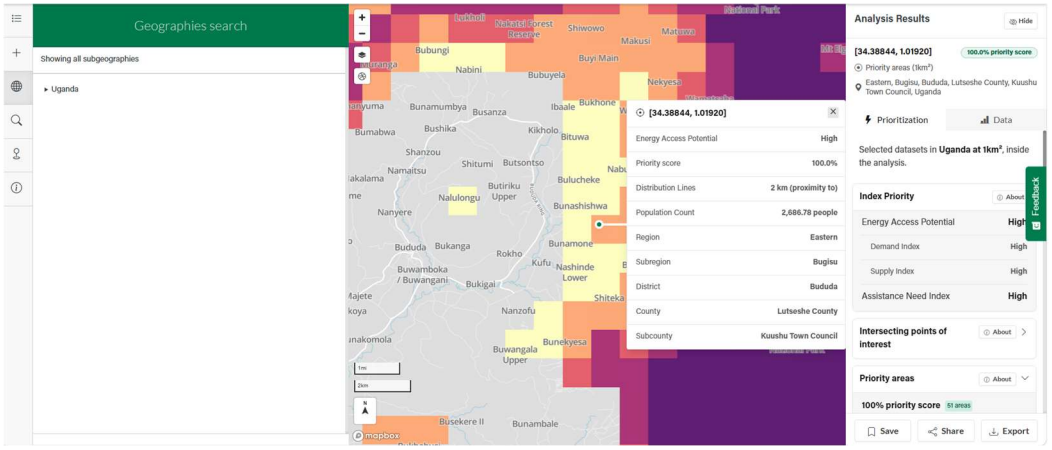
On the right panel, you can see the Area and Population share of the analysis as well as the High priority areas.



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 **High priority areas** to see the top locations that the system identifies with highest energy access potential and click some of them to zoom in the map to view their locations. Analyze selected area to get more info on these top locations.

Q: What is the total population count of the top priority location? (See panel on the right).



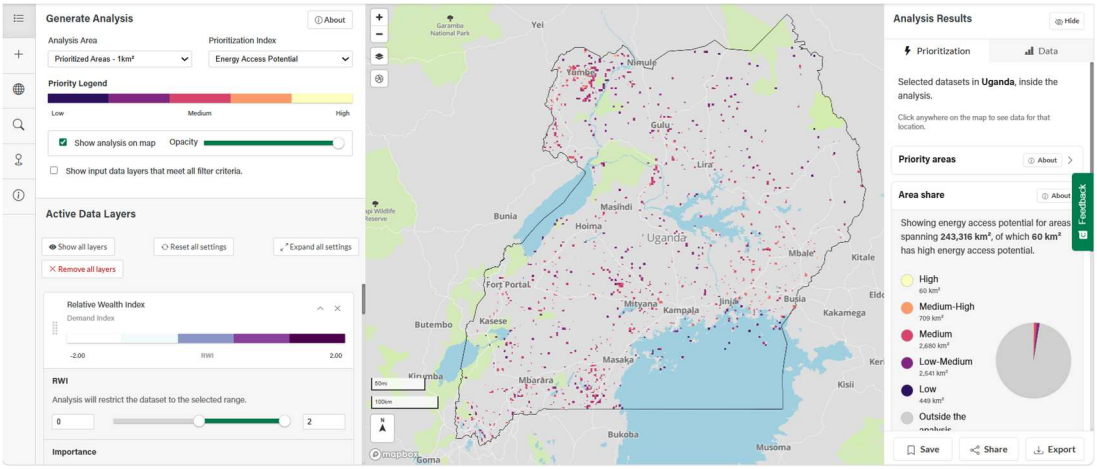
Add **Relative Wealth Index** data under Demand-Demographics

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 Active Layers, 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.

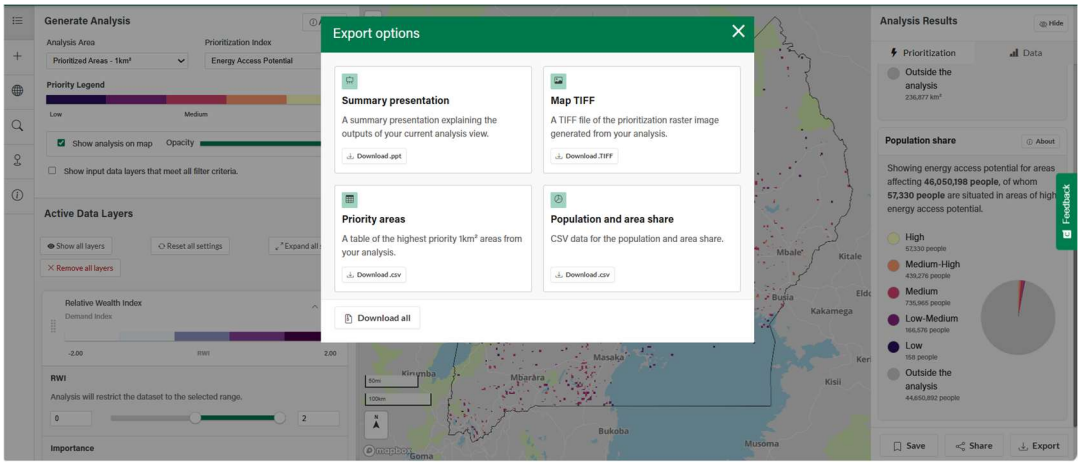
Hide all layers from the Active Data Layers



Q: What is the total population share (add high to medium) 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 Export to get a snapshot of the summary table and graphs for population and area share as well as export the presentation, high priority areas and the maps Tiff image (Requires login).



Then, close the export options and Remove all layers from the Active Data Layers.

II. Multi-criteria Analysis

Analysis 1

a) Add Population count and Healthcare Facilities

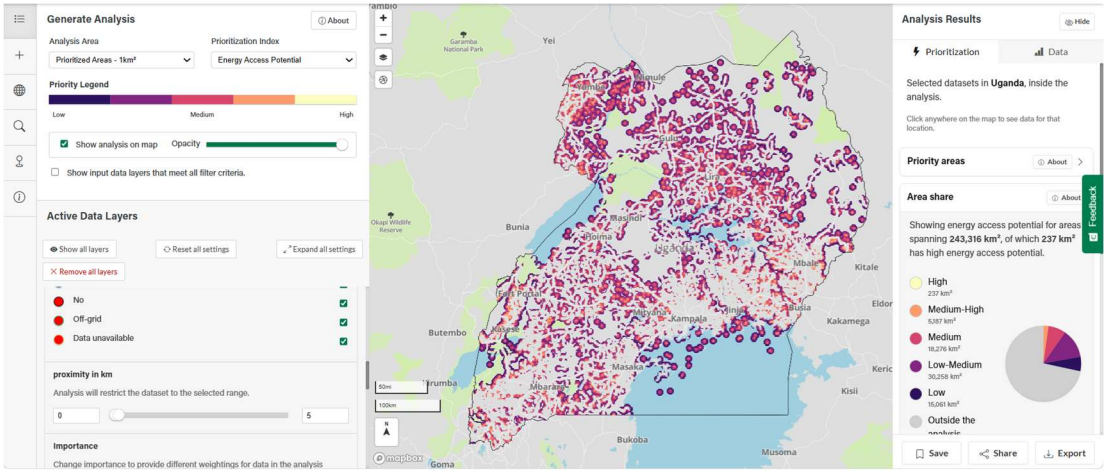
On the dataset panel on the left (Add Layers), and under **Demand** category, add **Population count** and **Healthcare Facilities**

Questions

i. 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**: Show analysis on map should be selected in the Generate Analysis section and Hide all layers from the Active Data Layers)*

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

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, make sure to Hide all layers from the Active Data Layers)*



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

v. Go to the View or Download data and Toggle columns to select the health facility that falls within the top location and indicate its ***name, electrification status*** *and current* ***electricity source*** from its attributes.

Remove all layers after completing this exercise

Analysis 2

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

Using Add Layers and under **Demand** category, add **Population count** layer to the map. Then select **Supply** category and add **Global Horizontal Irradiation**.

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, select Show analysis on map and Hide all layers)*

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

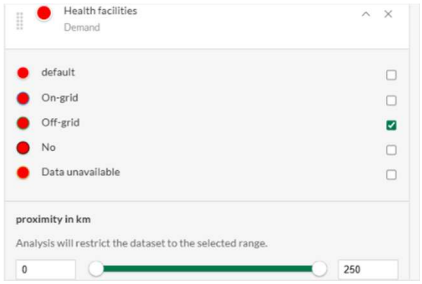
iii. Add a healthcare facilities dataset to the map. What is the solar irradiance potential in the areas where these healthcare facilities are located? Do you think solar can be a viable electrification option for them? (Hide analysis and show layers)

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

(***Hint:*** *On the tools panel in the left, open the Search Features 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 left, 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 High priority areas and indicate the **name, required power capacity (kW), daily elect. Requirement range (kWh), and annual electricity requirement (kWh)** of the health care facility from the View or Download data. *(You will notice only off-grid health facilities are displayed since we selected that in the previous step).*

- Remove all layers and zoom out to Uganda

Analysis 3

a) Add population count & Nighttime Lights.

Using Add Layers and under **Demand** category, add Population count layer to the map. Still under **Demand** category 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) (show analysis but hide all layers)*
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 use the 'Search Features' tool to search for **'Nadangira HC**

i. When the map zooms to its location, Analyze the data**.**

III. EAE Scenarios

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 development program.

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

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 may be located and validating collected data.

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

Scenario 3 – Prioritization of energy access investments

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

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

Scenario 4 - Service delivery institutions in the health sector

Suppose you work in a government agency supporting an electrification program for the health sector. You are interested in identifying areas with potential energy needs associated with healthcare facilities.

Task: Create a multicriteria analysis combining datasets from demand, supply and other to indicate high priority areas for healthcare electrification programs.

Scenario 5 - Service delivery institutions in the education sector

Suppose you work in a government agency supporting an electrification program for the education sector. You are interested in identifying areas with potential energy needs associated with education facilities.

Task: Create a multicriteria analysis combining datasets from demand, supply and other to indicate high priority areas for schools' electrification program.

Scenario 6 – Productive uses of energy in agriculture

Suppose you work in a government agency supporting an electrification program for irrigation in the agriculture sector. You are interested in identifying areas with potential energy needs associated with crop irrigation.

Task: Create a multicriteria analysis combining datasets from demand, supply and other to indicate high priority areas for providing electricity access for irrigation.

Scenario 7 – Expansion of clean cooking technologies

Suppose you are working to expand clean cooking technologies to areas where there is high dependence on traditional cooking methods that are creating a burden on human wellbeing and the environment.

Task: Create a multicriteria analysis combining datasets from demand, supply and others to indicate high priority areas for expansion of clean cooking technologies.