north west
net zero hub

Rooftop Solar Potential Analysis - GIS Mapping

Instructions Pack

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Version / Final

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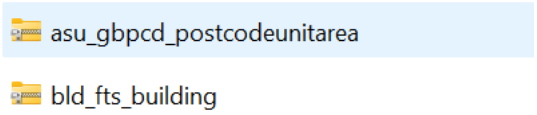
This document sets out the methodology used by the North West Net Zero Hub to undertake rooftop solar analysis. It is based on ESRI's solar rooftop analysis methodology and has been further adapted and developed to meet the Hub's specific requirements and use cases. The methodology is provided as a reference resource for other organisations and should be reviewed and applied in the context of local data availability, assumptions, and project objectives. For further information or clarification, please contact the Hub.

Software and data requirements

1. ESRI ArGIS software
2. Council boundary data to download OS data
3. LIDAR data
4. Postcode and ward boundaries data for the council
5. OS building footprints data for the council

Process

1. ESRI Documentation link: Estimate solar power potential | Documentation
2. Download OS buildings data (**use the below 2 files)** through the OS data portal [for all building types] Workspace | Data | OS Data Hub -Solar- Stage 1 Package
    a. **Downloads** (left hand side)
    b. **Data packages**
    c. **Select area**
    d. **Download the below 2 individual files**



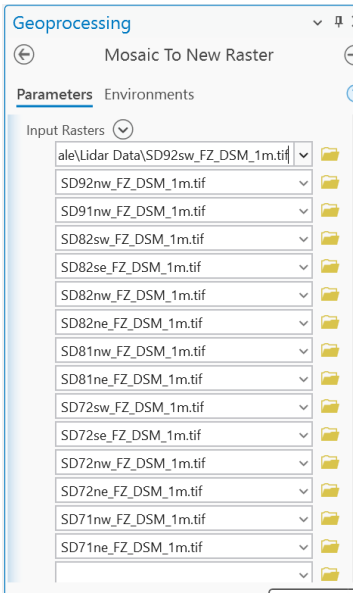
LIDAR:

3. To download LIDAR tiles Defra Survey Data Download: Draw polygon of LA area (doesn't have to be too accurate as the whole tile is downloaded even if only part of it is selected), select Product '**Lidar Composite First return DSM'**, Year- '**2022**' and Resolution '**1m**'. Download the tiles & save in the computer. Then 'extract' all the zip files.

4. Merge the LiDAR Tiles for the selected area: 2 options to Merge it- ArcGIS or QGIS

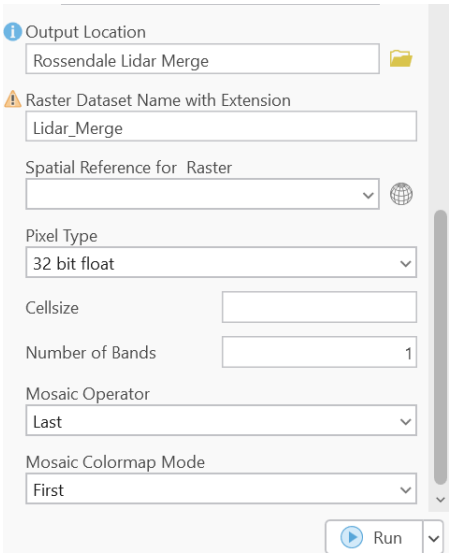
- **Merging in QGIS**:
    a. Open QGIS and load your LiDAR tiles (.Tif file type) by going to Layer > Add Layer > Add Raster Layer.
    b. Merge the Tiles:
    c. Go to Raster > Miscellaneous > Merge.
    d. In the Merge dialog, select your input LiDAR tiles.
    e. Choose an output folder where the merged data will be saved in the computer
    f. Adjust any advanced parameters if needed, such as the output data type. It should .tif file type.
    g. Click Run to start the merging process. Double check if the merged lidar file has all the individual tiles combined in the final output.
    h. Close the project

- **Merging in ArcGIS**
    - Open ArcGIS and load Lidar tiles by going to Add Data and then selecting all Lidar .tif files
    - Go to Analysis tab, in Geoprocessing window search for "mosaic to new raster"
    - Fill in gaps:



    - **Input rasters:** Select the folder icon and select all .tif files from the computer
    - **Output Location**: Select what folder to save it to
    - **Raster data set name**: *LA Name*_LidarMerge.tif

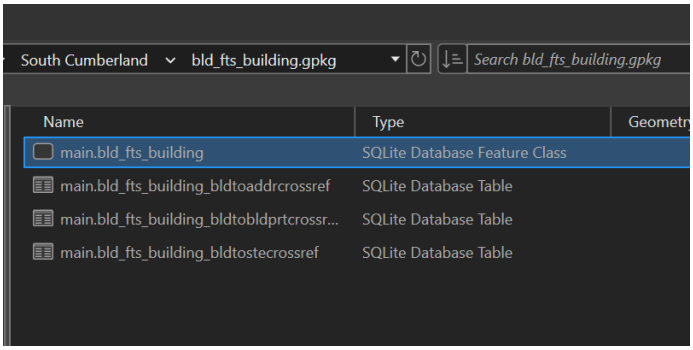
- **Pixel Type**: 32bit float (to find this out right click on the individual Lidar tile on the contents window (far left), select properties > source > raster information)
- **Number of bands**: 1



- Run
- Save
- This is your DSM layer

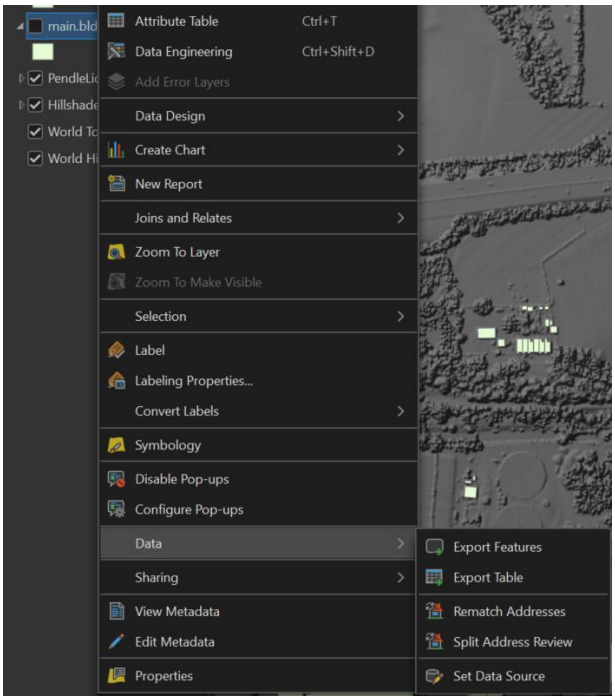
Open a new ArcGIS project

5. Follow the documentation. Estimate solar power potential | Documentation
    a. First **add data –** add **bld_fts_building** (this is the OS building footprints layer) and the **lidar merge** (lidar merge layer is the DSM layer talked about in the process doc.) which you just made in the previous step.



    b. Filter the buildings to specific **building use categories** as required for council. Use field- *buildinguse_osbuildingusetiera*. *Use 'Select by attributes' function when you open the attribute table for this layer to perform this step. Usually,* we take all except residential buildings. And then export features by right clicking the buildings layer in next step.

c. Right click- **bld_fts_building** from to Export Features. Keep 'Use Selected features' on. Save with a different name in the same project location. Go to the ArcGIS project and add this new file. Once the new file is added, delete the initial **bld_fts_building** file.



6. Step 1- Hillshade (5 minutes)- *realistic shading effect to depict elevation*.
7. Step 2- Solar radiation for building footprints (This step can take time ranging 2.5-4 hours)- *Gives Solar radiation for all area within building footprints for the year of 2025.* – ***run this step overnight – recommended for LA's with more than 50k buildings***
    - For time zone, select '**UTC'.**
    - For **Start Date and Time**, click the calendar button, choose 1/1/2026, and click **Date**.
    - For **End Date and Time**, click the calendar button, choose 12/31/2026, and click **Date**.

Screening criteria - Suitable rooftops for solar

- Suitable rooftops should have **a slope of 45 degrees or less**, as it is difficult to install solar panels on a steep roof. To determine rooftop slope, you must create a slope raster layer.
- Suitable rooftops should receive **at least 800 kWh/m²** of solar radiation. You can assess this criterion using your solar radiation raster layer.
- Suitable rooftops **should not face north**, as north-facing rooftops in the northern hemisphere receive less sunlight. To determine rooftop orientation, you must create an aspect raster layer. Except flat ones with <10 deg. slopes

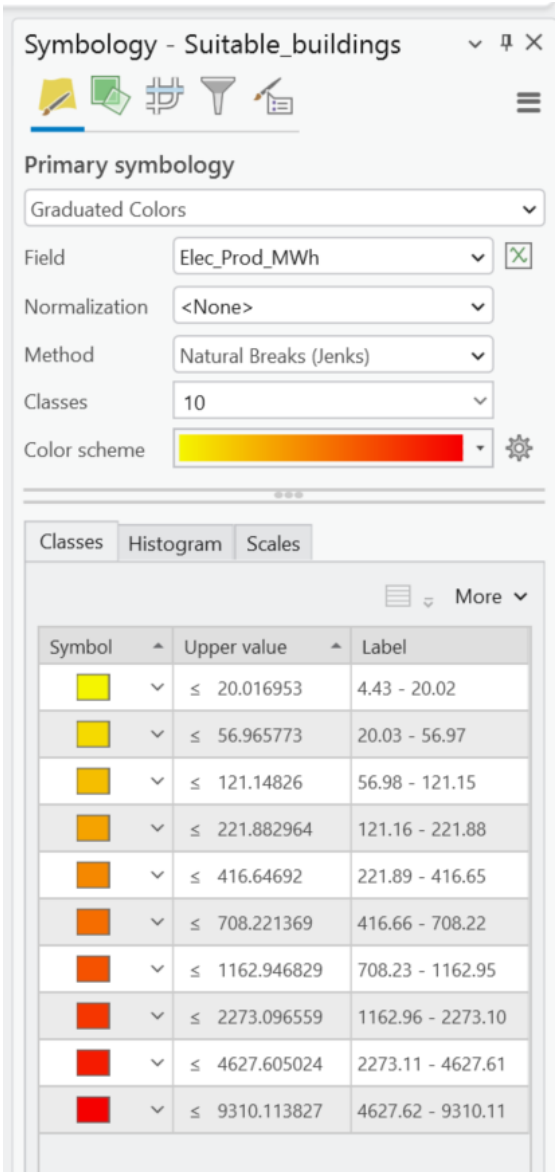
8. Step 3- Slope layer -Geo processing tools: Surface parameters.

9. Step 4- Aspect layer - Geo processing tools: Surface parameters.

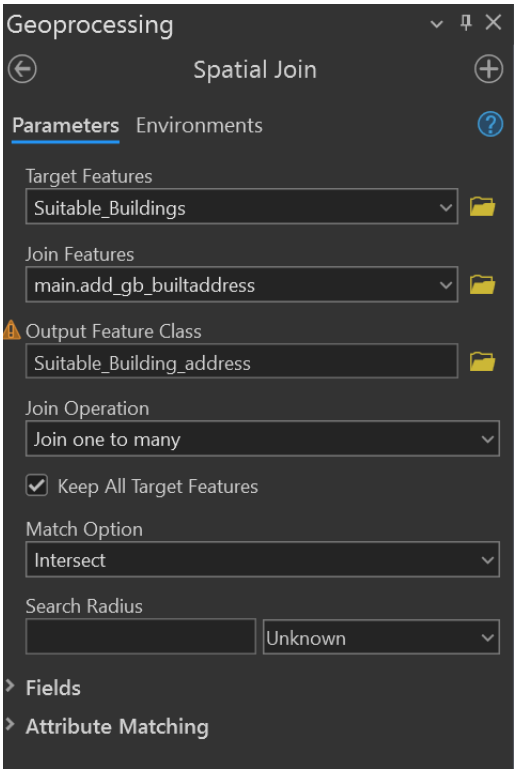
10. Remove- Slopes >45
11. Remove radiation <800
12. Remove North facing roofs except flat ones with <10 deg. slopes
13. Calculate Mean Radiation/sq.m- **Mean** to determine the average solar radiation per square meter for each building – for **'Zone field'** instead of **'Buildings_id'** as used in the process document, use **'osid'**
14. Identify suitable buildings- You will consider that if a building has less than *30 square meters* of suitable roof surface, it is generally not suitable for solar panel installation, as it is not worth the installation investment. You'll select buildings that have enough suitable roof surface.

    (A close assumption made by EST mentioned here: The average solar panel system is around 3.5 kilowatt peak (kWp). The kWp is the maximum amount of power the system can generate in ideal conditions. A 3.5kWp system typically covers between 10 to 20m^2 of roof surface area, using between six and 12 panels. - *Energy Savings trust*)

15. Join mean table to building footprints table
16. Add field to add- solar radiation per building. Use formula to calculate field- '(!AREA! * !MEAN!) / 1000'
17. Add field for Power output- You'll use the values of 21.6 percent efficiency and 83 percent performance ratio.
18. When changing symbology of "**Suitable buildings**", go to symbology, change **single symbol** to 'Graduated colours', **Field** 'Elec_Prod_MWh', **Classes**: I used 7 but can be any value, change colour scheme to yellow & red



19. Save
20. Validate results with Solar Wizard online tool.

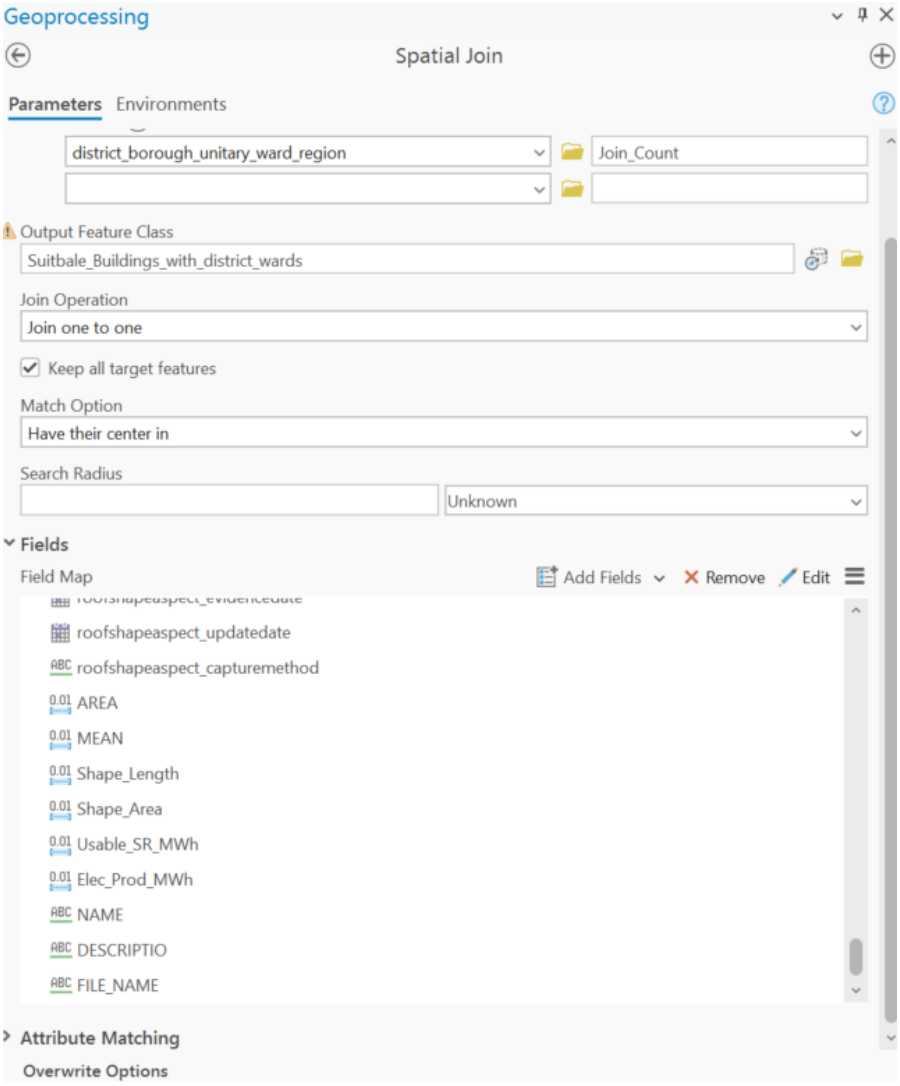


21. After final step. Select 'Table to Excel' from tools to get excel file of the same.

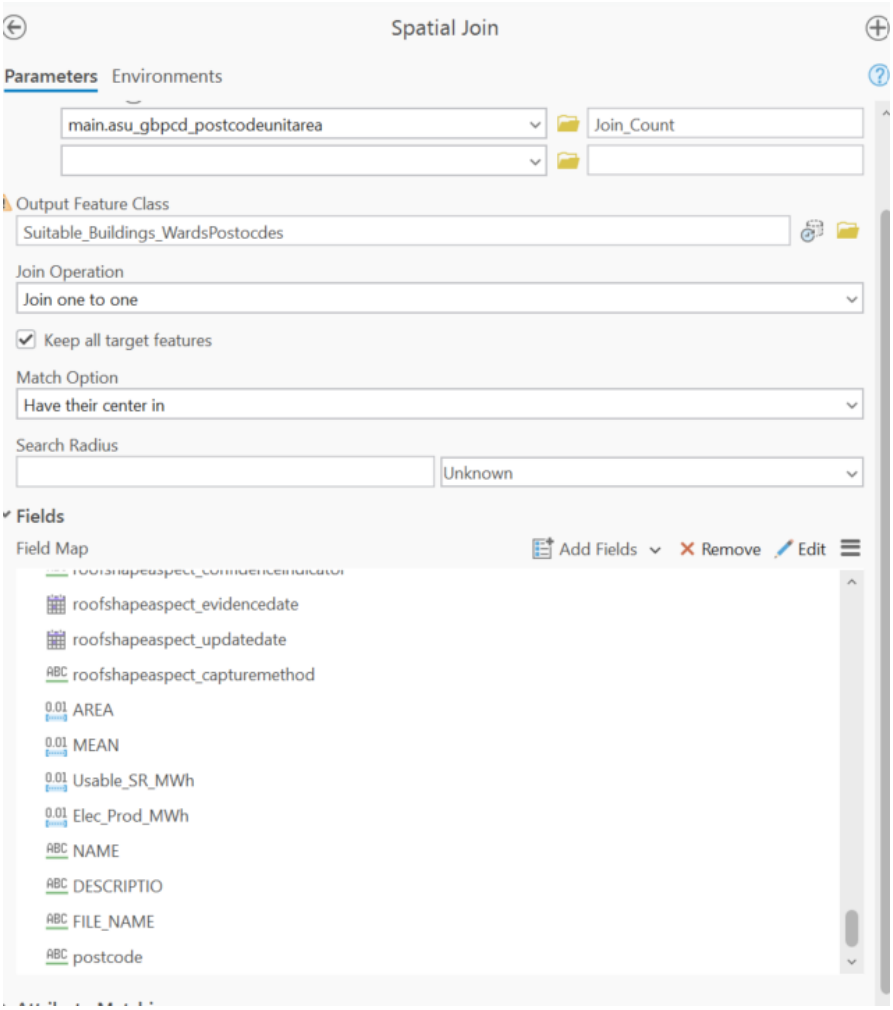
22. If the output is required in MW instead of MWh, add a column **'Power_MW'** next to '**Elec_Prod_MWh**' **use the formula below:**

    Power (MW) = 'Elec_Prod_MWh' / generation hours over the year

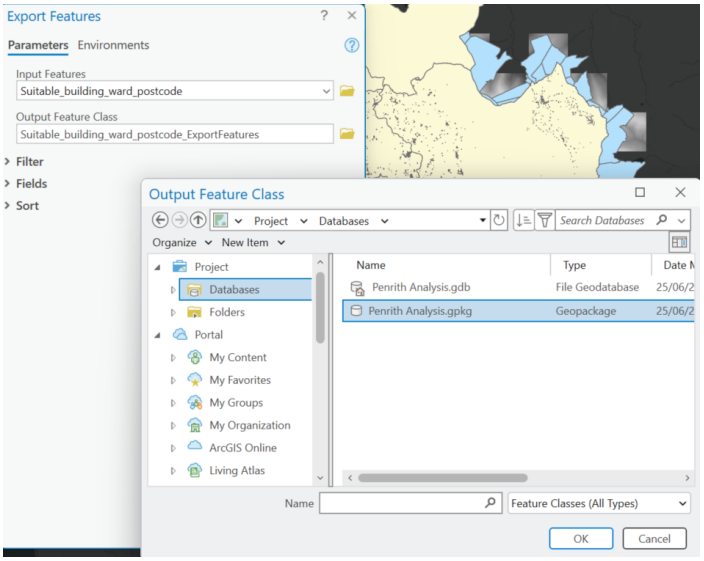
23. **Joining Wards and Postcode data**
    a. Import *Wards* data layer (Location: Q:\Team Folders\NW Net Zero Hub\Solar Stage 1 package data)
    b. Import *postcodeunitarea* file as downloaded in Step 2.
    c. First perform a 'Spatial Join' between S*uitable buildings* and *Wards* data as per the screenshot below. For Fields section, keep all fields from *Suitable Buildings* file and remove all fields from the *wards* file **except for the last three (Name, Description, File Name) shown in screenshot.** Those three fields will be added to the output of spatial join.



d. Perform a 'Spatial Join' between S*uitable_buildings_with_district_wards* and *Postcode* data as per the screenshot below. For Fields section, keep all fields from S*uitable_buildings_with_district_wards* file and remove all fields from the *Postocde* file **except for the last one (postcode) shown in screenshot.** That field will be added to the output of spatial join.



e. The output received shall be the final output.
   - It should be exported to Excel using right click on the layer and then Data> Export to Excel.
   - Also create Geopackage file from the Catalog pane of ArcGIS inside the project folder and then export this final output to that Geopackage.
     i. Catalog Pane- Right click Project folder > New > Geopackage.
     ii. Contents Pane-Right click the final layer > Data > Export Features> Go to Output Feature class and open it. Select on the Geopackage file created in step i, and name the file at bottom with a .gpkg extension and click Ok.



- The geopackage can be then shared with the councils which has the final GIS layer and its attributes.

24. Filtering buildings

Either we can export this to excel and filter there. Easier but map won't get updated with this. Useful just for numerical insights.

Or

Filter attributes in GIS using different filter rules to display only certain type of buildings.