**Appendix A**

ArcGIS Commands for method to select suitable roofs for minimum size PV installation:

1. Preparation: Subtract Environment Agency digital terrain (DTM) LiDAR from the digital surface model (DSM) to obtain building height above ground level. Delete pixels with a lower height than 2 m. This removes rogue values whilst allowing for low eaves.
2. Cut out buildings only. Prepared LiDAR DSM-DTM grid and buildings from OS Mastermap Topography layer as inputs: ArcToolbox > Spatial Analyst > Extraction > Extract by Mask.
3. Spatial Analyst > Surface > Slope/Aspect. Create integer rasters to enable mode to be computed in the next step.
4. Spatial Analyst Tools > Zonal > Zonal Statistics > Mean
5. Spatial Analyst Tools > Zonal > Zonal Statistics > Mode
6. Mode may be in the north, so carry out some swaps:
   1. Swap mode raster values by 180:

Raster calculator:

* + 1. Values between 90 and 270 are alright:

Con((“aspectmode” ≤ 270) & (“aspectmode” ≥ 90), “aspectmode”, 0)

* + 1. Values between 0 and 90:

Con((“aspectmode” ≤ 90) & (“aspectmode” ≥ −1), (“aspectmode” +180), 0)

* + 1. Values between 270 and 360:

Con((“aspectmode” ≤ 360) & (“aspectmode” ≥ 270), (“aspectmode” −180), 0)

* + 1. “PVMode” = “Con1” + “Con2” + “Con3”
  1. Optionally, switch by 90 east to west for 4-plane houses:

Con ((“Con4” ≥ 90) & (“Con4” ≤ 160), (“Con4” +90), “Con4”)

* 1. If the west mode generates a bigger polygon than the east, take that.

1. Standard Deviation Bands: Spatial Analyst Tools > Zonal > Zonal Statistics > Std

Con ((“intaspect” ≥ “PVMode” − “StdAspect”/2) & (“intaspect” ≤ “PVMode” + “StdAspect”/2), 1, 0)

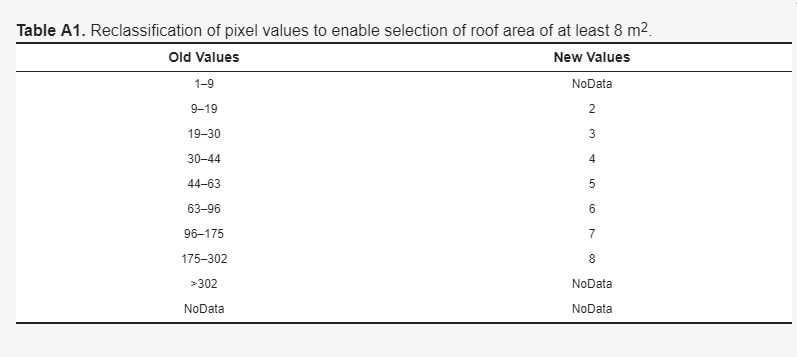
This makes a 1,0 raster of cells half std around the mode.

1. Connectivity: ArcToolbox > Spatial Analyst Tools > Generalisation > Region Group

Four neighbours (for edges only, Rooks Case), Cross—exclude zero (“0”).

1. Select Large Enough Areas

From Count because 1 × 1 m pixels. Reclassify as in [Table A1](https://www.mdpi.com/1996-1073/11/12/3506/htm#table_body_display_energies-11-03506-t0A1) below and discard highest number which is areas not suitable for PV.



1. Clean: Spatial Analyst Tools > Generalisation > Boundary Clean

No sort, run twice.

1. Measure Roof Patch with homogeneous aspect (azimuth):

Zonal statistics sum points in raster.

(Add all the “1”s, not zeroes because “1”s are 1 m squares).

1. To calculate a more accurate area allowing for the roof tilt:

Slope distance = horizontal distance/cosine(Tilt in degrees)

E.g., Slope distance = 21.2 m/cos [32°]