

TARGETING RESIDENTIAL AREAS FOR RETROFIT

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WARWICK
THE UNIVERSITY OF WARWICK

West Midlands
Combined Authority

PURE LEAPFROG



OBJECTIVES

West Midlands Combined Authority

- 33% reduction in carbon use across local transport, homes and businesses by 2026
- 100% carbon neutrality by 2041
- Evidence-based green urban planning and policy-making

Pure Leapfrog

- Combat climate change in a socially inclusive way, working with local communities and social enterprises

PROBLEM

- An evidence-based strategy is required to determine areas for retrofitting.
- Energy Performance Certificate (EPC) ratings can be used as an indicator and are only available for 40% of the 1.2 million homes in the West Midlands.
- The implications of installing solar panels and electric heat pumps on the electrical network are unclear.

GOALS

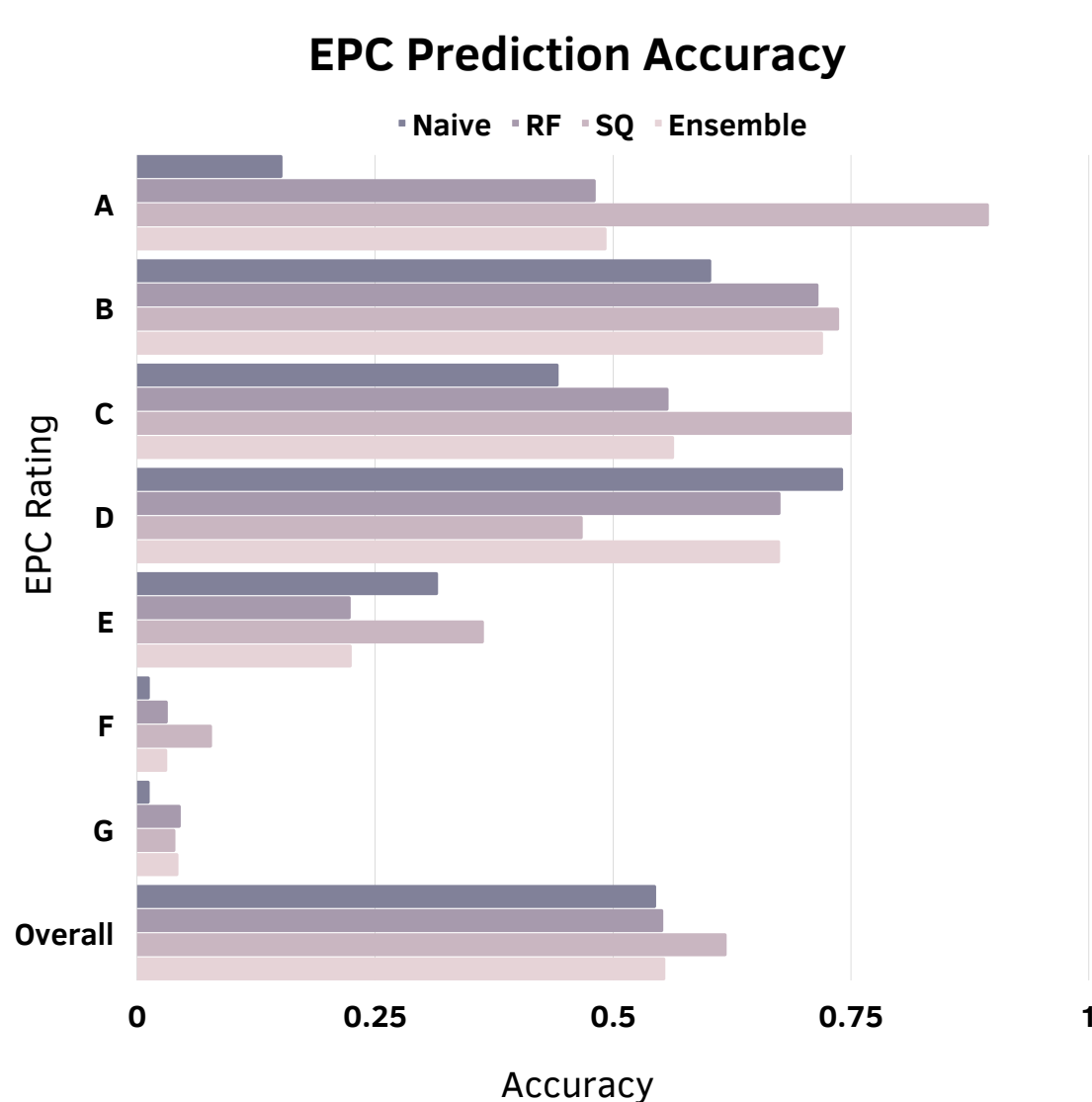
- Predict EPC ratings of the remaining 60% of houses in the West Midlands
- Identify solar panel-ready areas
- Determine the implication of switching to electric heating on the electrical network
- Deploy a tool for visualising and presenting insights

PREDICT EPC RATINGS

- Merged EPC, Ordnance Survey Master Maps (OSMaps), fuel poverty and electricity consumption data and trained several machine learning models.
- Each model was trained to predict the EPC rating and heating type of houses using data available for all homes (i.e. floor area, height, address).
- Selected best model on F-1 and accuracy score and better performance on lower rated houses.

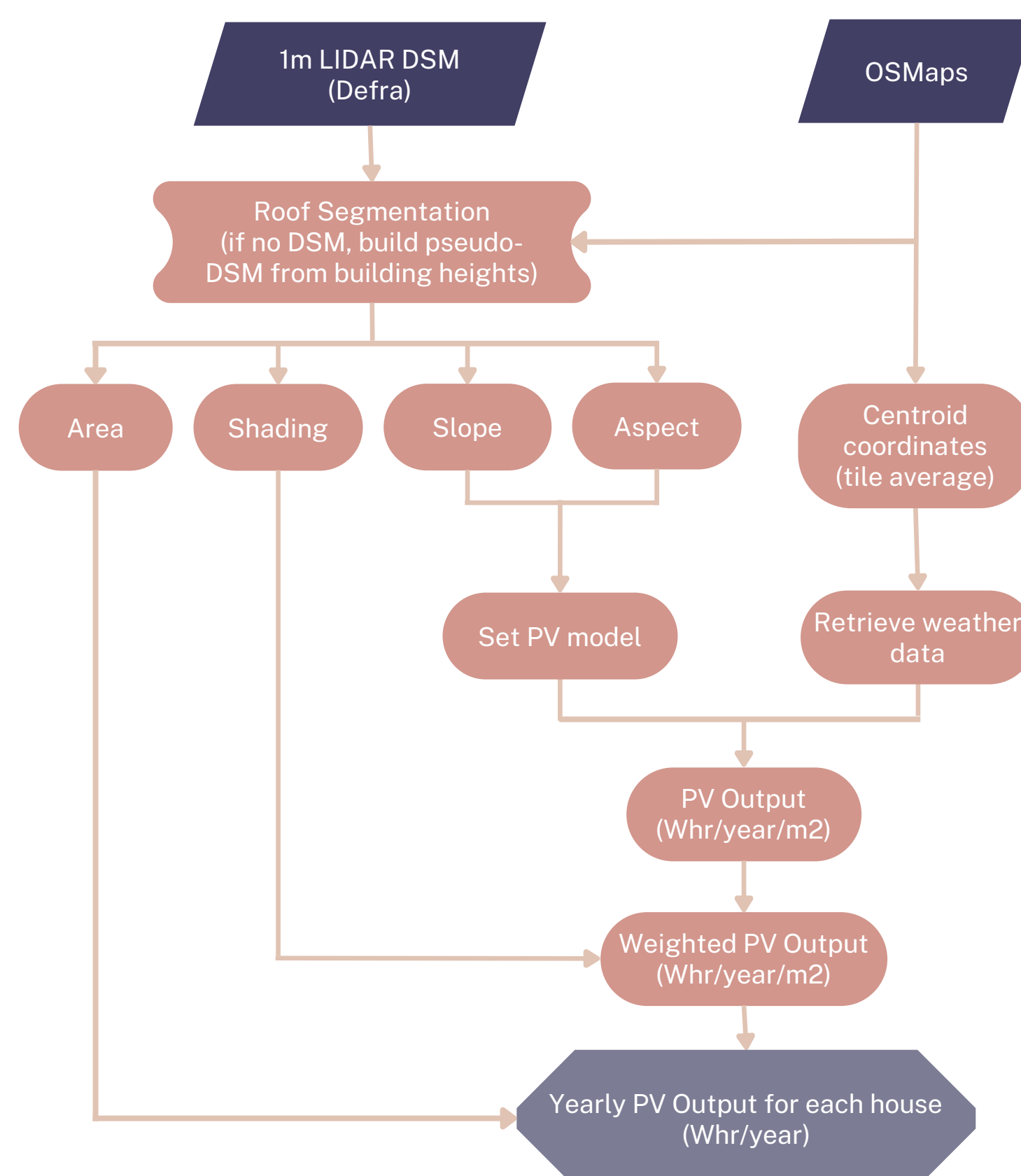
Results

- Improved prediction accuracy for all ratings compared to the baseline for random forest (RF) and similarity quantification (SQ) model.
- SQ model only works if a matching home is found, so it is combined with the RF model to cover homes without a match.



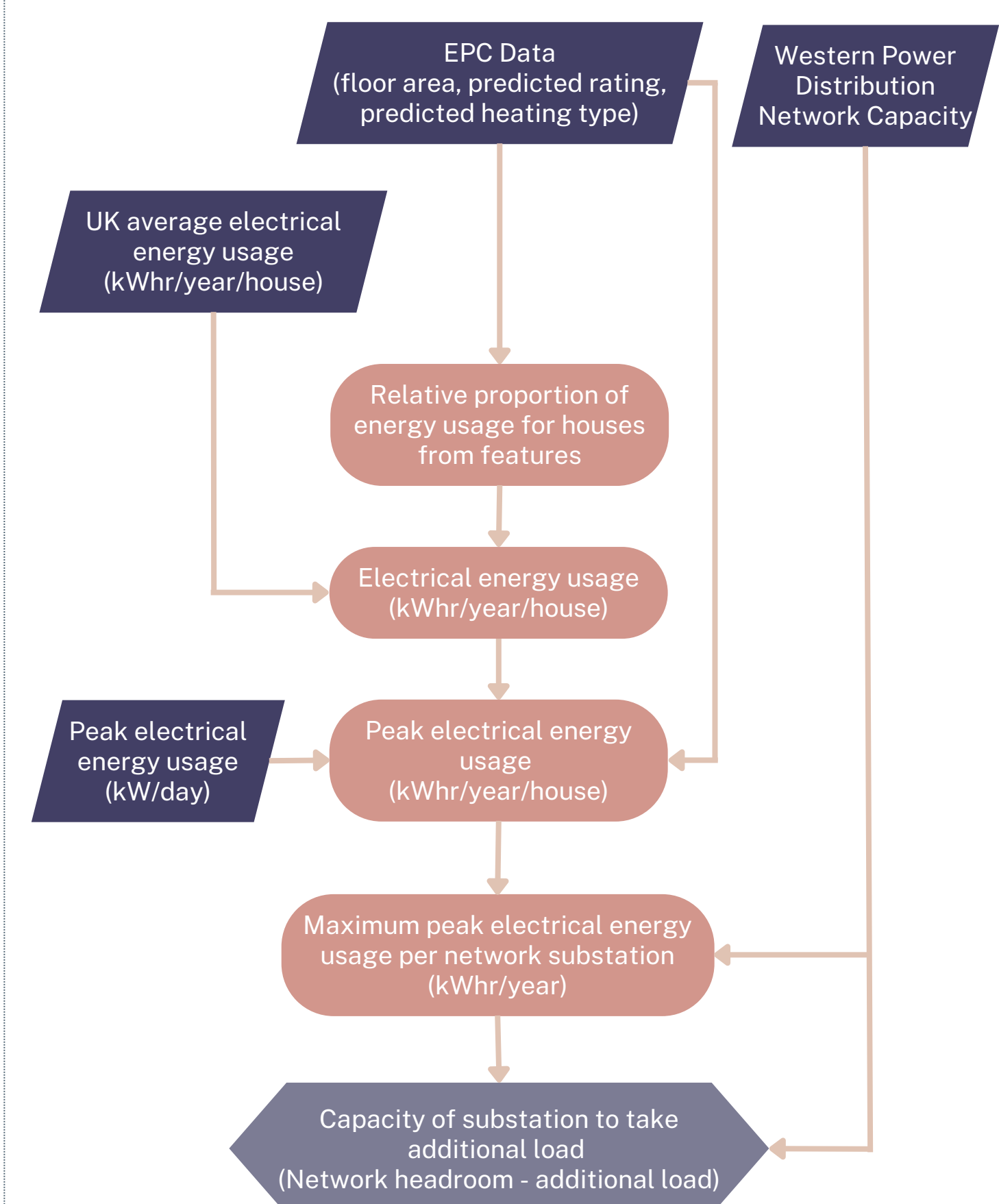
ESTIMATE SOLAR PV OUTPUT

- Segmented house roofs for areas with a DSM layer using Digital Surface Model (DSM) data and OSMaps.
- Estimated shading on roofs from other buildings, creating a pseudo-DSM where necessary.
- Calculated estimated solar PV output using the formula from the Microgeneration Certification Scheme (MCS).



ADDITIONAL NETWORK LOAD

- Using EPC predictions, national electricity consumption and regional network capacity data, we calculated the maximum additional load on the electrical network for homes switching to electric heating.
- Derived individual home energy usage from national energy statistics and estimated heating costs.



IMPACT

- UK city councils can identify areas with houses that should be targeted for retrofitting.
- Solar PV output estimations can guide policies for potential funding or subsidies to different areas.
- Energy capacity calculations can inform which areas might cause electrical grid issues during planning.

FUTURE WORK

We encourage other councils in the UK to adopt and improve on the open-source pipeline and visualisation tools we have developed, to guide evidence-based policy-making and urban planning.