ACTIVE BUILDING CENTRE RESEARCH PROGRAMME

IHP - POBL Parc Eirin
Summary of Energy Performance Data

July 2022 - Robert Nash

INDUSTRIAL STRATEGY

UK Research and Innovation

Summary of performance based on received data

The Active Building Centre Research Programme (ABC-RP) have received in-use performance data from SERO for 106 homes on the Parc Eirin Site. Energy performance evaluation has been undertaken on group of 47 homes which had a coinciding 12month period of data. Home sizes range from 72m^2 to 110m^2.

Parc Eirin data has been received and analysed as part of the ABC-RP's role as a data processor for Welsh Government to evaluate building performance on WG's IHP and ORP programmes.

Summary of performance based on received data

Overall Performance Summary

The received data from Parc Eirin has allowed ABC-RP to estimate the overall energy efficiency of study homes, as well as a measure of NET energy demand following contribution from on-site renewables.

The data indicates that Parc Eirin homes achieve levels of whole home energy efficiency on average 45% better than typical UK new build homes, with PV generating on average 67% of annual energy demand.

Some homes achieve annual NET energy neutral operation by generating more than 100% of their annual energy needs. The ability to achieve this on all homes is dependant on available PV array size and occupant energy behaviours.

While some homes generate more than they consume within a given year, they will require some of this energy to be exported to grid during the summer months, while importing grid energy during the winter months, due to the practical limitation of electrical battery sizes.

Intra-day control of energy, from self-consumption of PV energy, charging and discharging of electrical and thermal stores, to management of import and export during favourable tariff periods, has a large impact on real world energy costs and carbon emissions.

Data on battery energy flows and grid import and export were not available to understand how energy was has been managed over the monitored period. Further data will be sought to provide further operational insights in due course.

Summary of performance based on received data

Overall Energy Consumption

Overall energy consumption, including regulated and unregulated energy, across the 47 study homes was compiled and compared.

This data was compared with typical energy consumption figures for existing UK housing stock provided by OfGEM, adjusted for space heating and hot water delivery from heat pumps.

This initial benchmark indicated lower than typical energy consumption of around 5150kWh per annum, which is around the typical energy consumption of a 1-2 bedroom flat (5080kWh), despite a number of study homes being 2-4 bedroom houses.

Summary of performance based on received data

Energy Efficiency

Data indicates that on average, homes achieve levels of energy efficiency 45% better than that of typical new homes built to current building regulations. (including typical performance gap)

Parc Eirin homes on average achieve levels of energy efficiency 23% better than that of theoretical estimates provided by building regulation compliant energy modelling, which is rarely achieved in reality.

As a breakdown of regulated energy usage and space heating generation is not available, the contribution to energy efficiency from fabric thermal performance, and efficient heating system performance cannot be determined.

Summary of performance based on received data

Renewable Energy Generation

Electricity generation from roof mounted PV arrays varies across homes, as expected due to varying array sizes and orientations.

Average annual generation, and the average contribution towards energy consumption for the different home types are summarised in the table below:

Home Size	Average PV generation per annum	Avg contribution of PV towards total energy demand (Regulated + unregulated)
72m^2	5174 kWh/a	127%
77m^2	2927 kWh/a	81%
90m^2	3496 kWh/a	80%
104m^2	1864 kWh/a	37%
110m^2	3945 kWh/a	57%

3 of the studied homes do not have PV data. Averages have excluded those homes.
Variations in generation across homes can be seen in the PV generation graph on the following slides.

Summary of performance based on received data

Unregulated Energy Consumption

While unregulated energy does not directly relate to the performance of homes, it is useful to understand the variance in energy consumption between different households living in the same homes, as well as comparing it to typical UK domestic energy consumption.

Higher levels of unregulated energy consumption also reduce the % of energy demand met by renewables.

Unregulated energy consumption varied from between 3.7 and 64 kWh/m2

The average unregulated energy consumption across study homes was ~23kWh/m^2 per annum. This is slightly below the estimated average range of typical unregulated energy consumption in the UK.

The range of unregulated energy consumption across study homes can be seen in graphs on the following slides.

Parc Eirin – Available Data

- Data received from 106 homes
- Onboarded between Oct 2020 – Apr 2022
- Available data fields:
  - Regulated Energy Consumption
    - Heat Pump, Immersion Heater, Lighting, Fans, Doorbell etc
  - Unregulated Energy Consumption
    - Sockets, Cooker & Hob
  - PV Generation Energy
  - Temperature
  - Relative Humidity
  - CO2
  - Hot Water Usage

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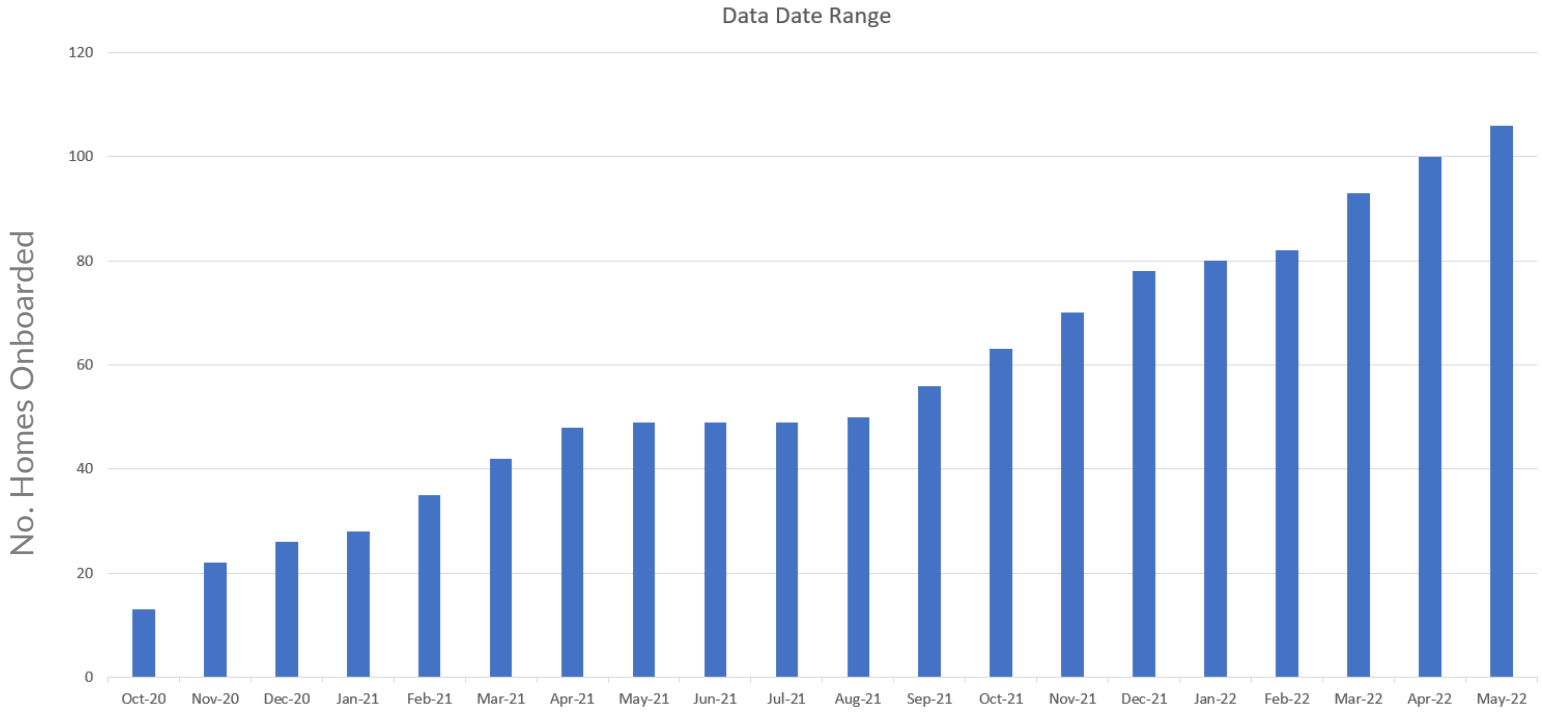

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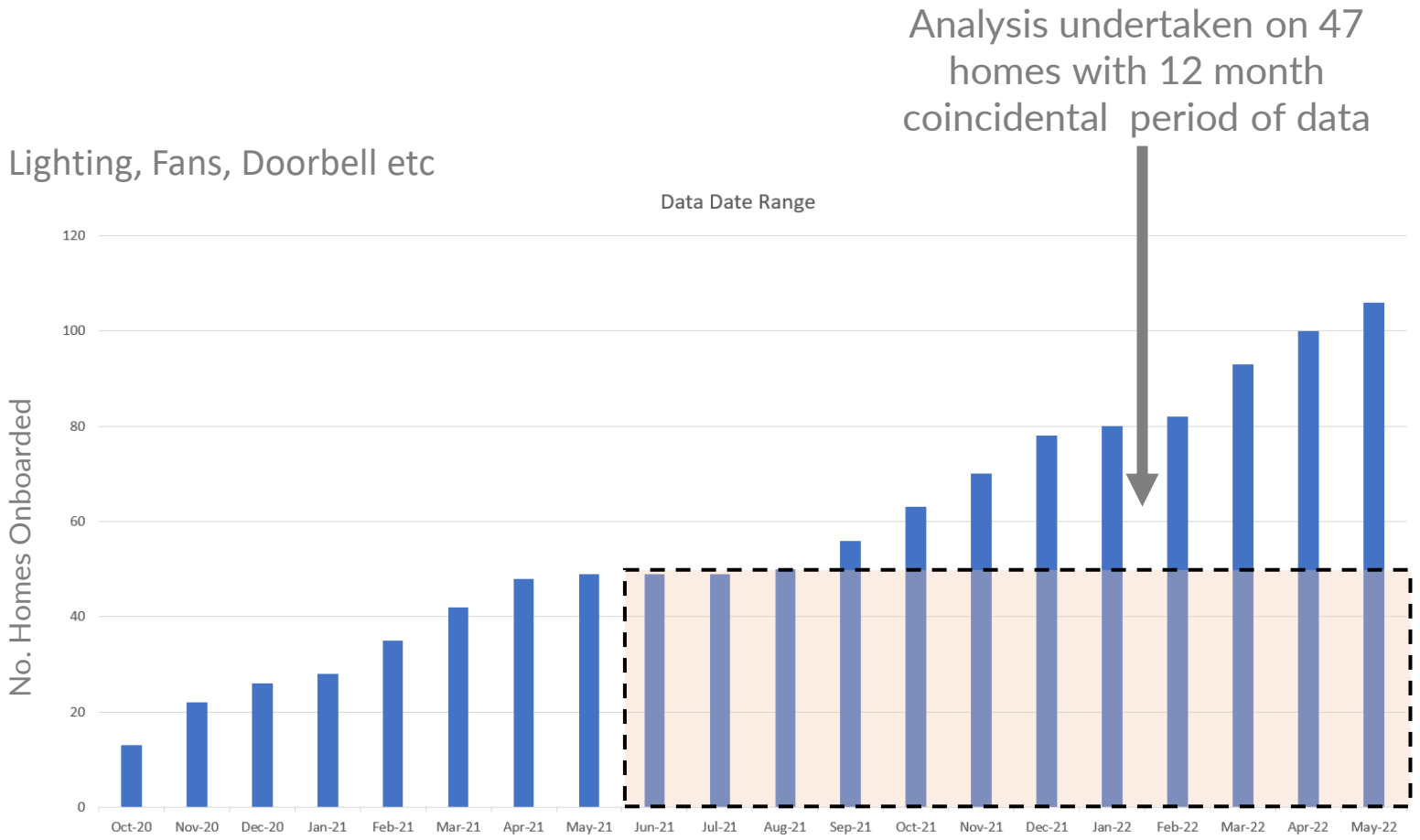
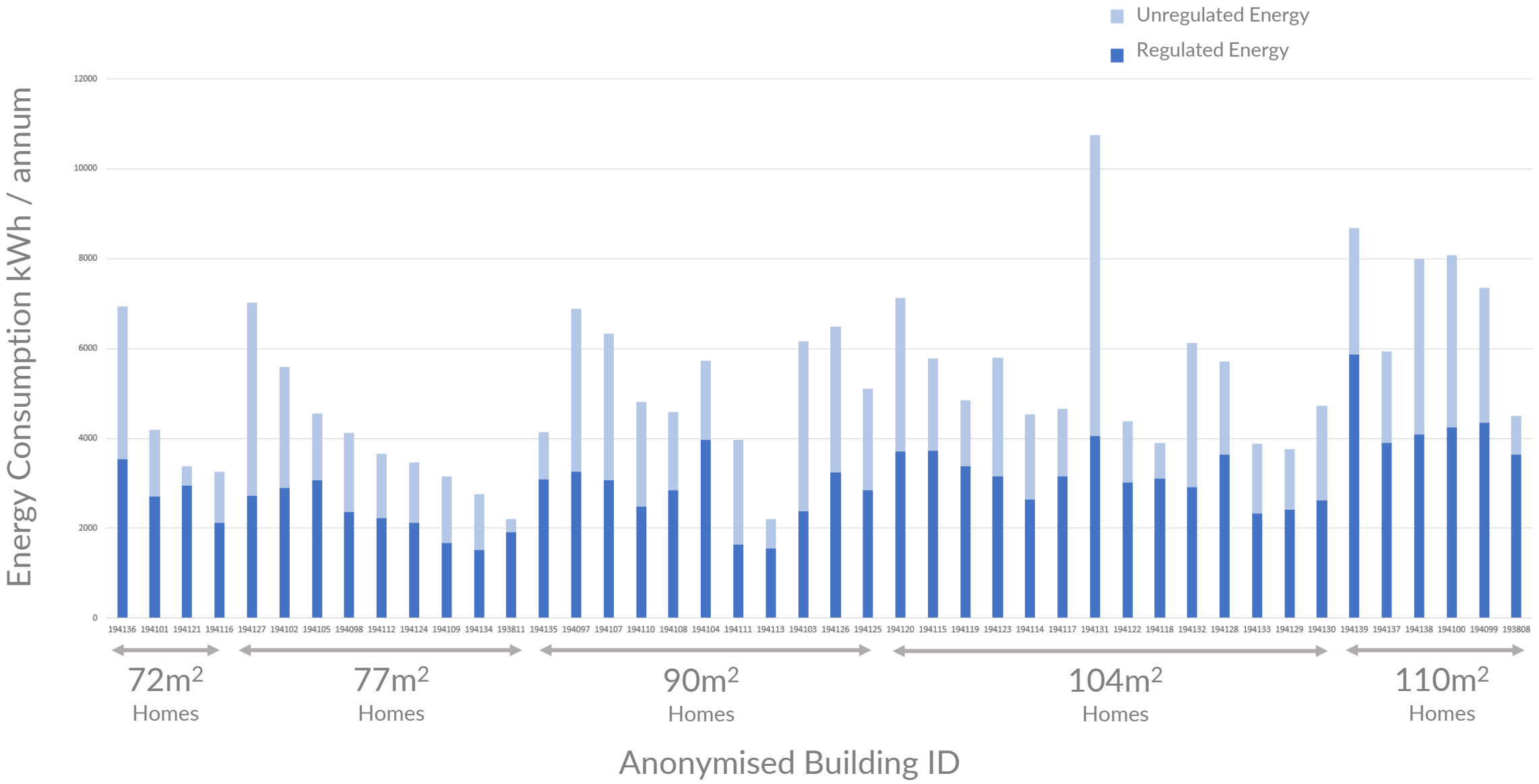


Parc Eirin –Overall Energy Consumption



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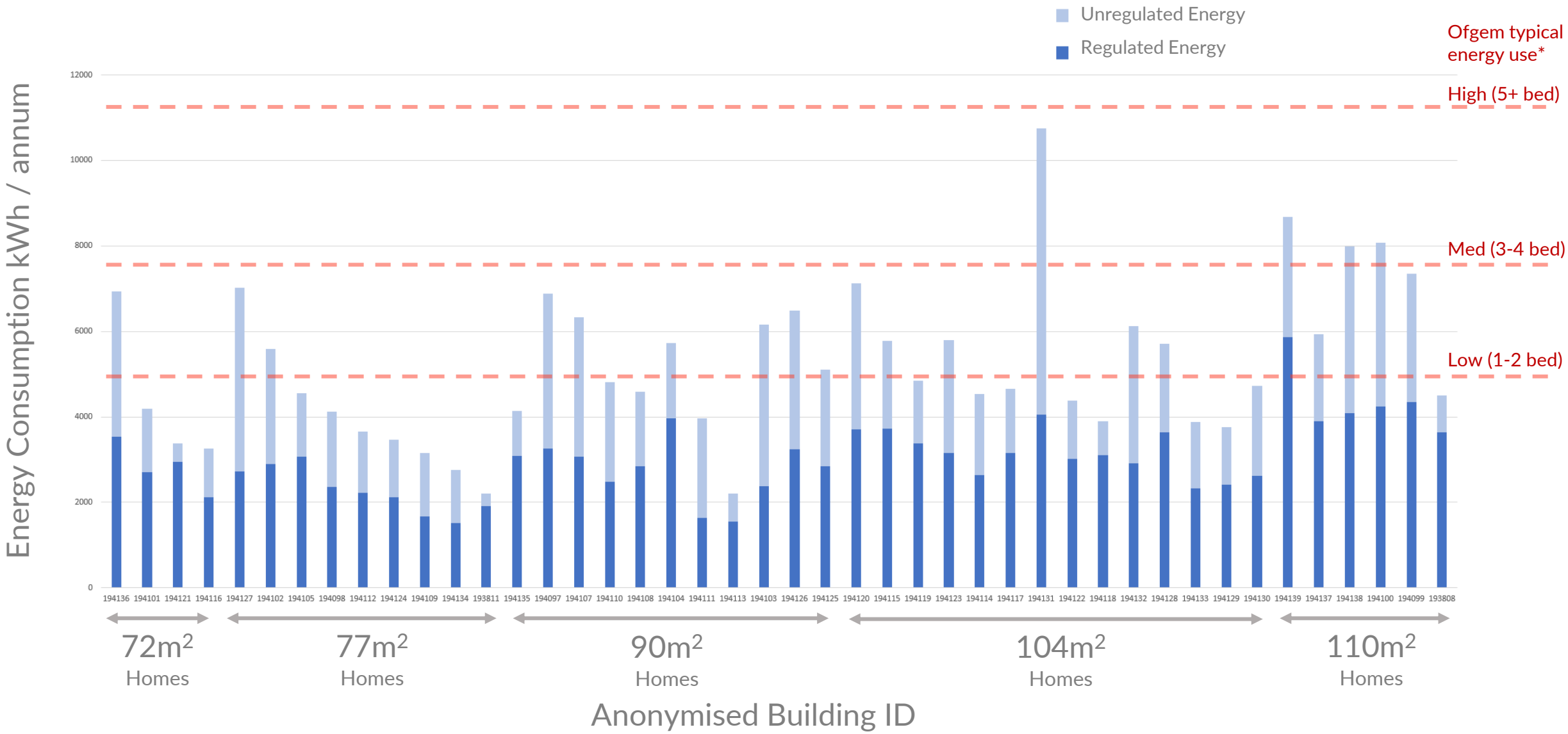
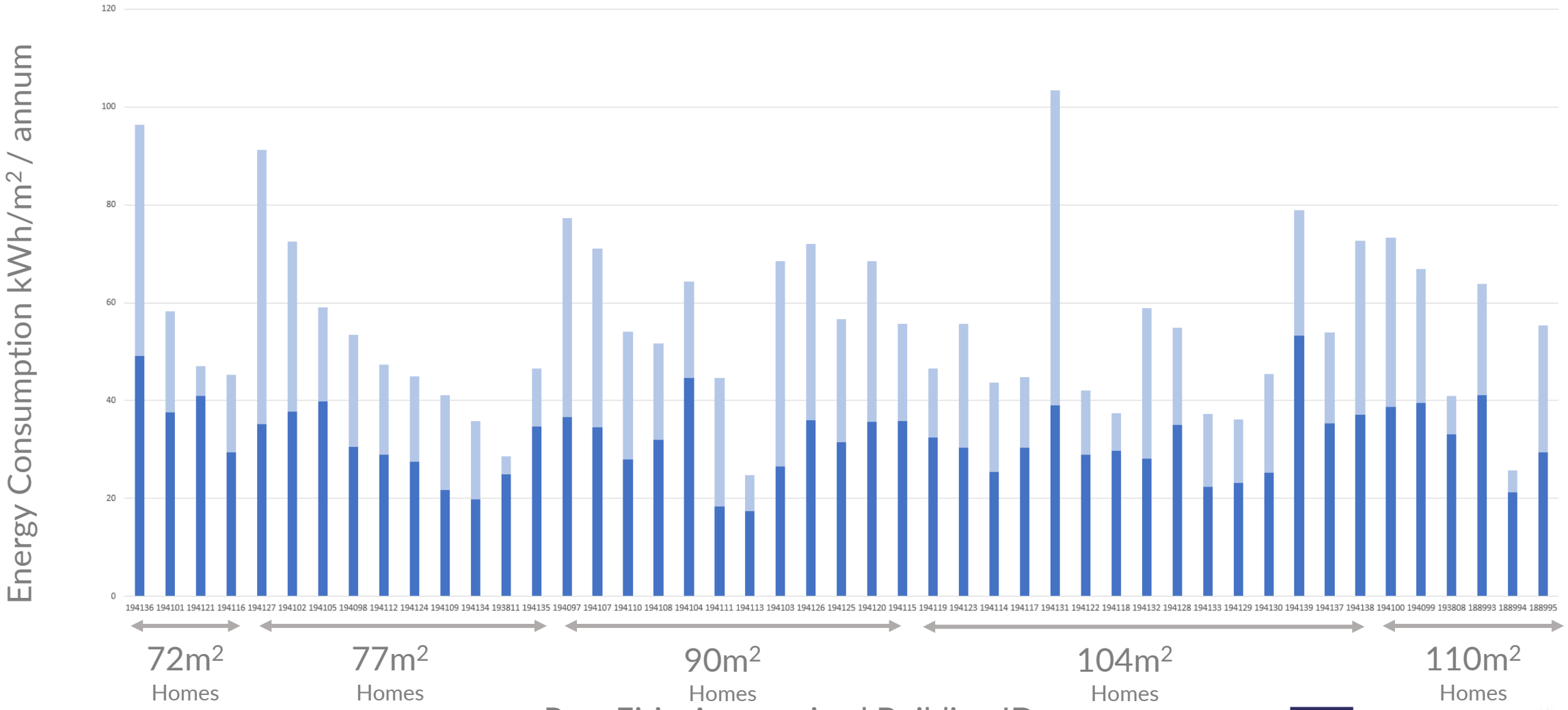


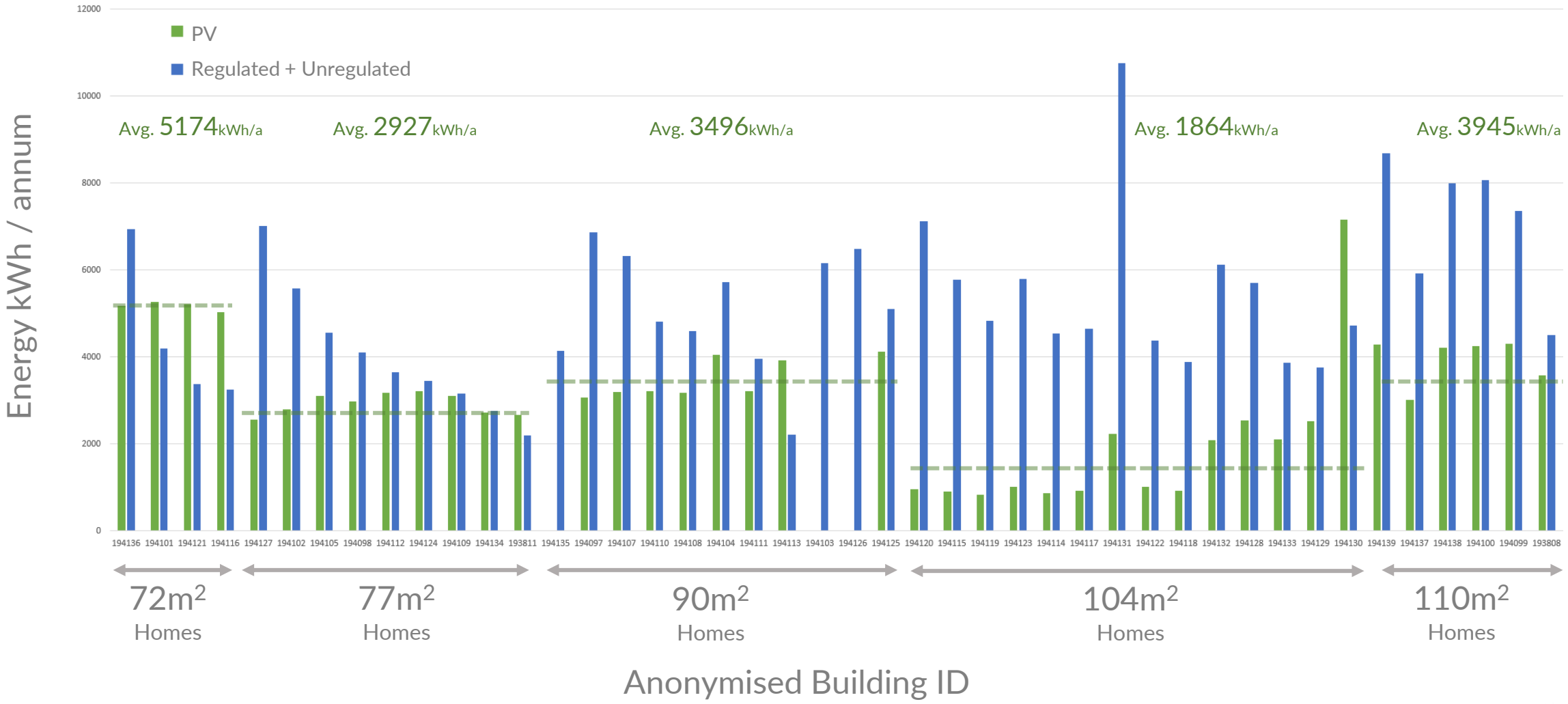
*Figures derived from Ofgem typical domestic consumption values (TDCV2021), adjusted for all-electric heat pumps.
Assuming: typical boiler eff = 82% and typical ASHP SCOP = 2

Parc Eirin –Overall Energy Consumption **per m²**

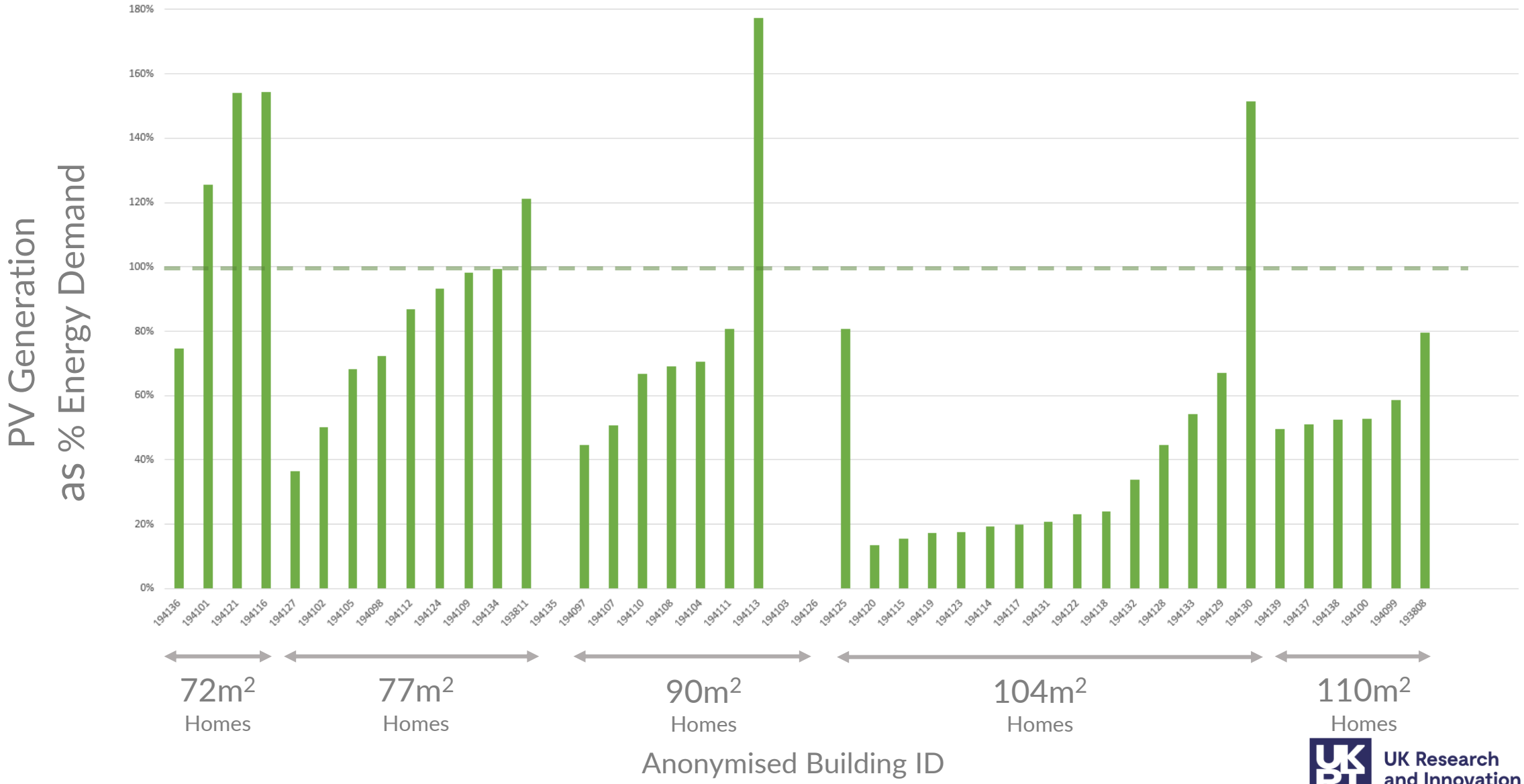
Energy consumption converted to kWh **per m2**, to allow comparison between buildings of different sizes as well as comparison with industry benchmarks



Parc Eirin –PV Generation vs Energy Consumption



Parc Eirin – PV Generation as % of Demand

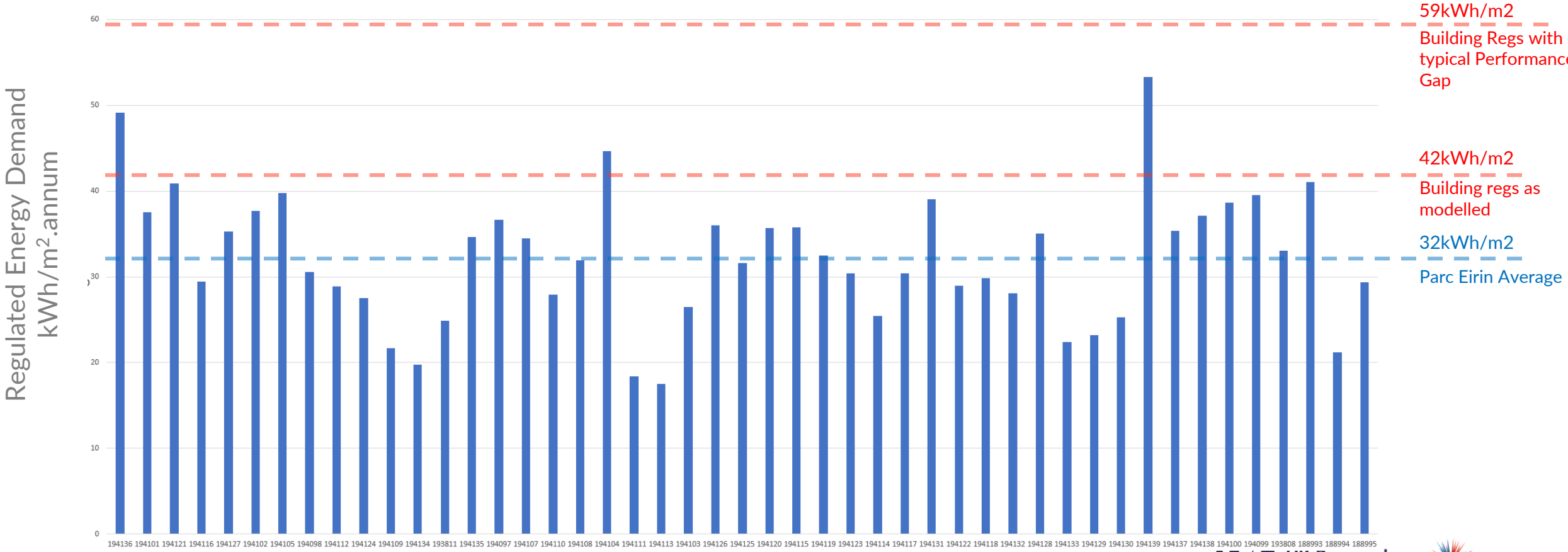


Parc Eirin – Focus on Regulated Energy

Regulated energy includes energy used for Heating, hot water production, lighting, ventilation and other building systems such as UFH manifolds and doorbells, and is useful for comparing the relative energy efficiency of homes, discounting energy used by occupants for appliances and plug loads..

Regulated energy for Parc Eirin study homes are illustrated below and have been compared with anticipated demand for new-build homes built to current building regulations, using AHSP's. Figures for building regulations compliant homes are shown with and without typical real-world performance gaps.[1]

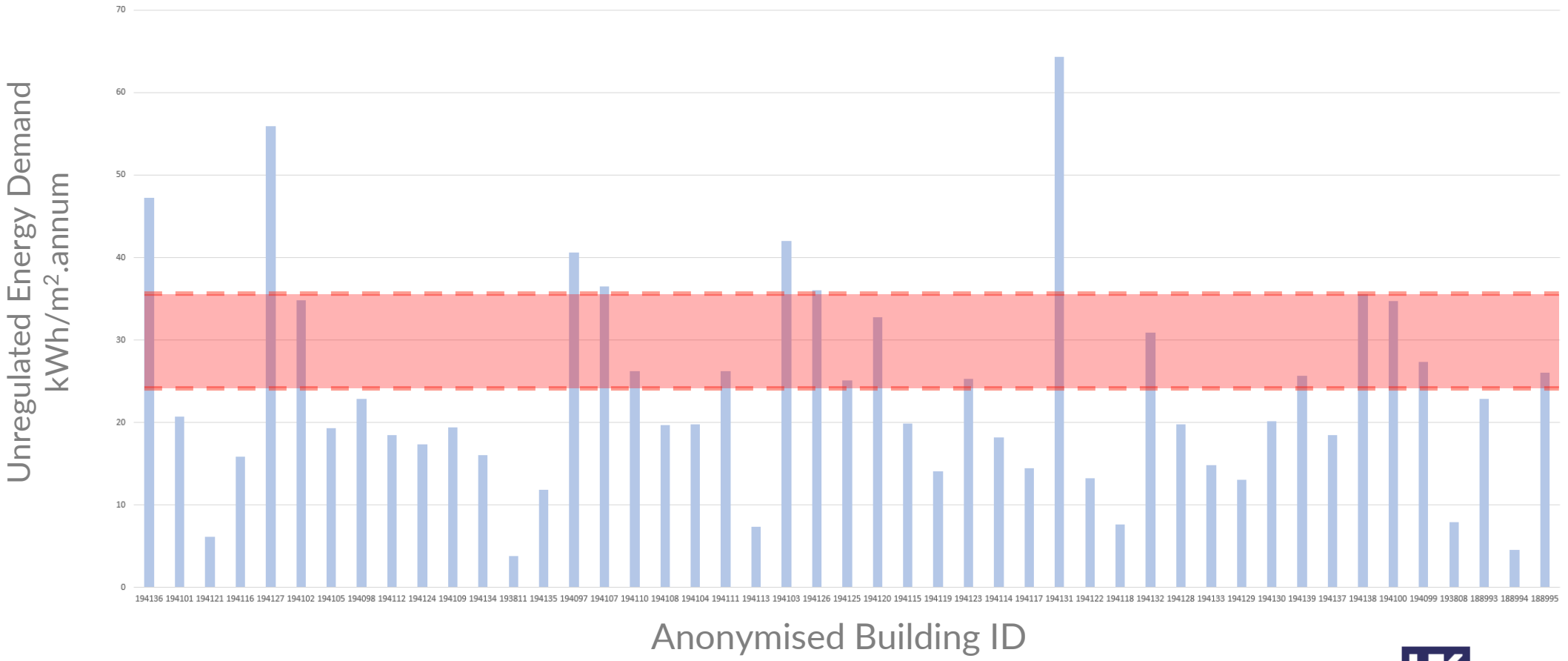
As regulated energy includes energy consumed to generate hot water, this figure can vary between households based upon numbers of occupants and their water usage behaviour.



1. PassivHaus Trust. Pasivhaus: The Route to Net Zero

Parc Eirin – Focus on Unregulated Energy

Unregulated energy refers to energy consumed by occupants through cooking equipment and socket outlets. This energy does not relate to the performance of the house, though does provide an overview of the variety in energy consumption habits between residences.



Estimated average range of typical unregulated energy consumption in UK