PEOPLE POWERED RETROFIT

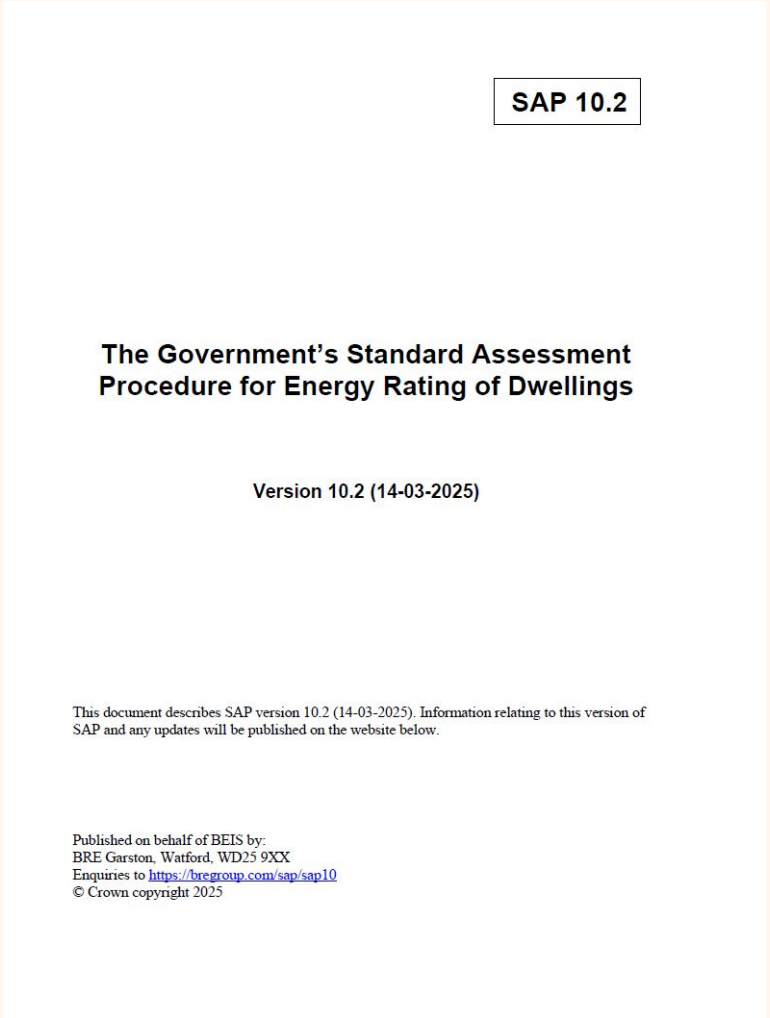
Introduction to the Home Energy Model

Marianne Heaslip

Eco Home Lab

March 2026

Why and how do we model homes now?



SAP 10.2

The Government's Standard Assessment Procedure for Energy Rating of Dwellings

Version 10.2 (14-03-2025)

This document describes SAP version 10.2 (14-03-2025). Information relating to this version of SAP and any updates will be published on the website below.

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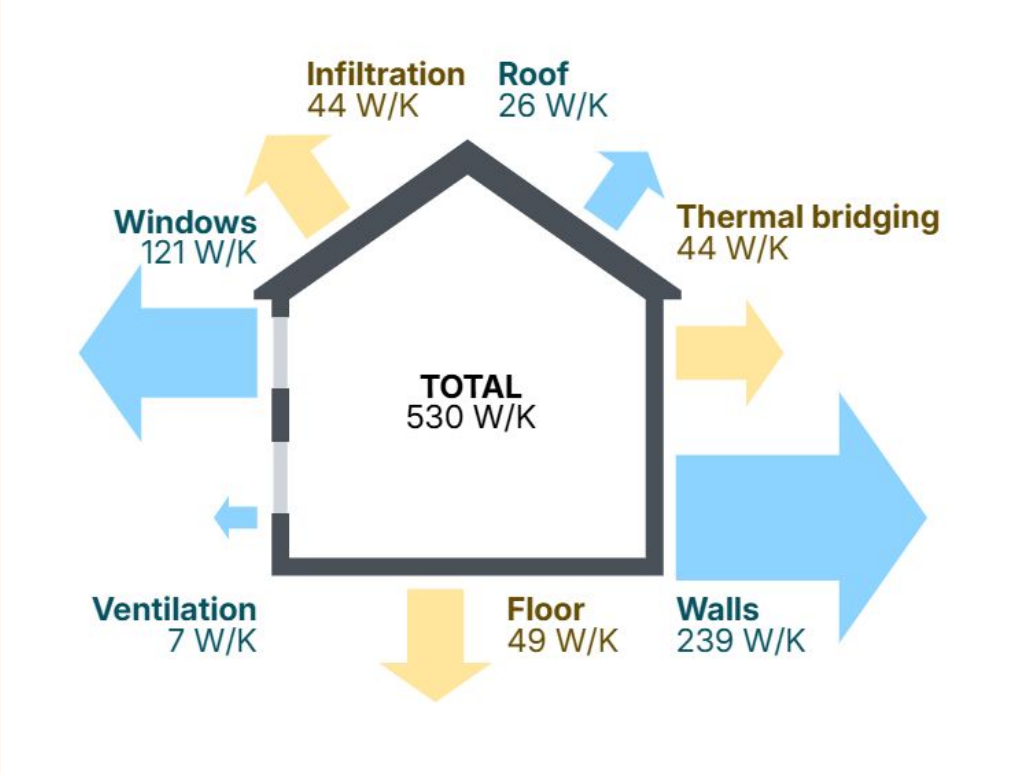
BRE Garston, Watford, WD25 9XX
Enquiries to https://bregroup.com/sap/sap10

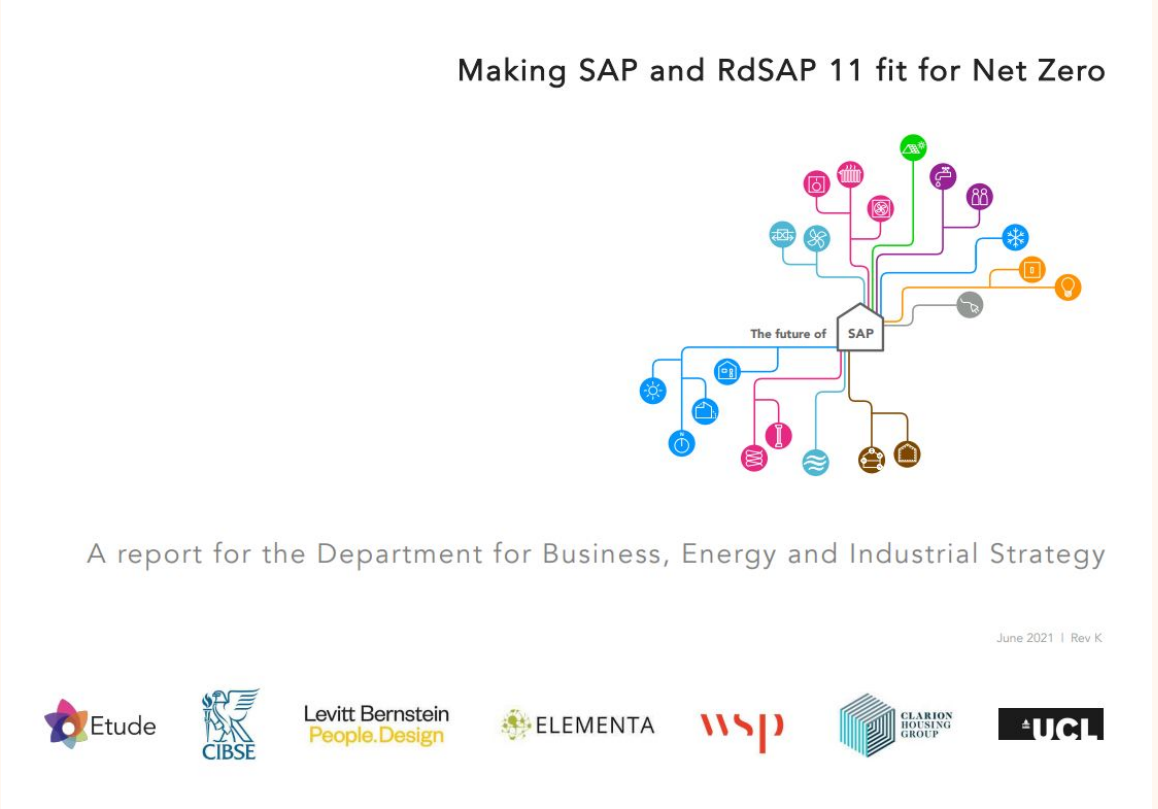
Why and how do we model homes now?



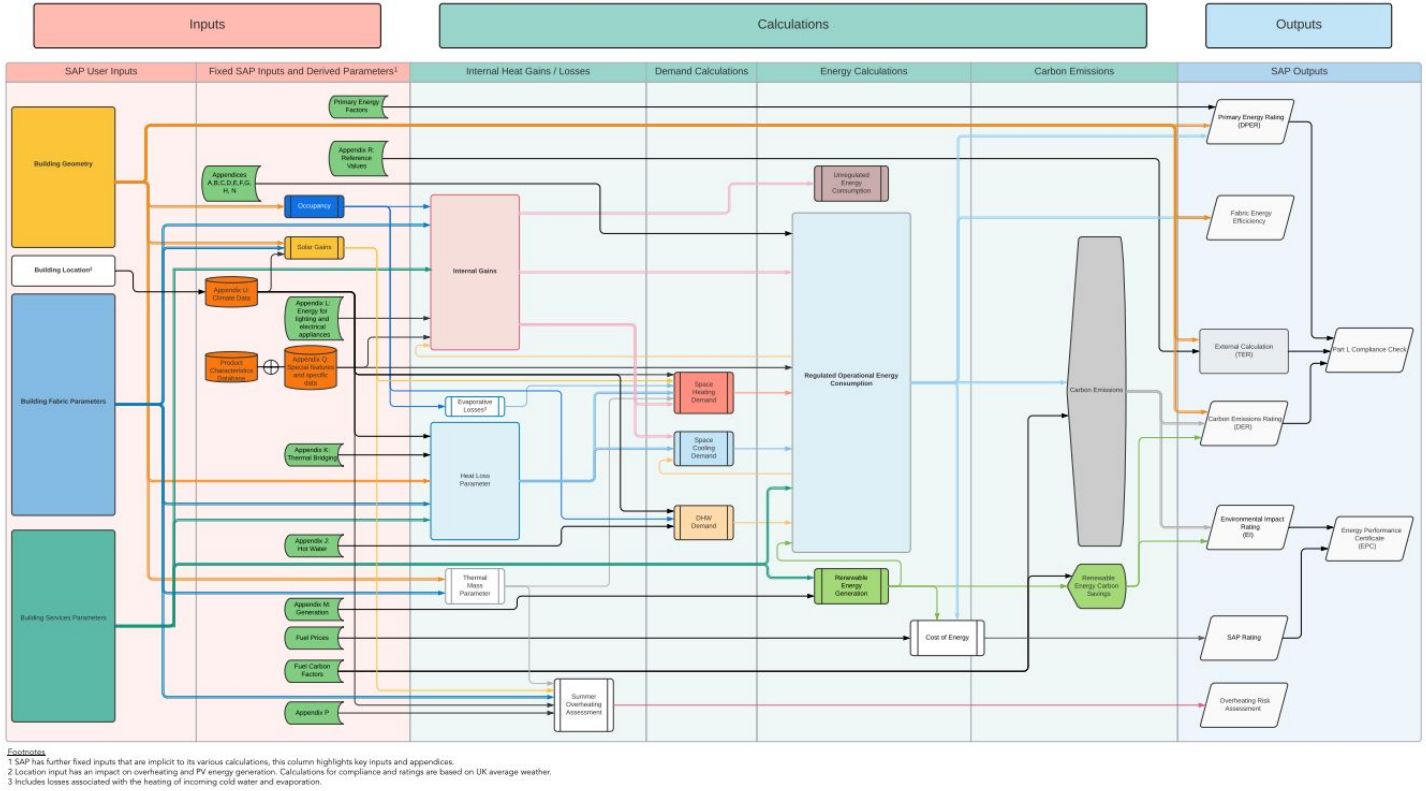
https://retrofit.coop/home-retrofit-planner

The Future of SAP Past

https://etude.co.uk/wp-content/uploads/2022/06/Making-SAP-and-RdSAP-11-fit-for-Net-Zero-Full-report.pdf



The anatomy of SAP and RdSAP | Simplified SAP 10 diagram

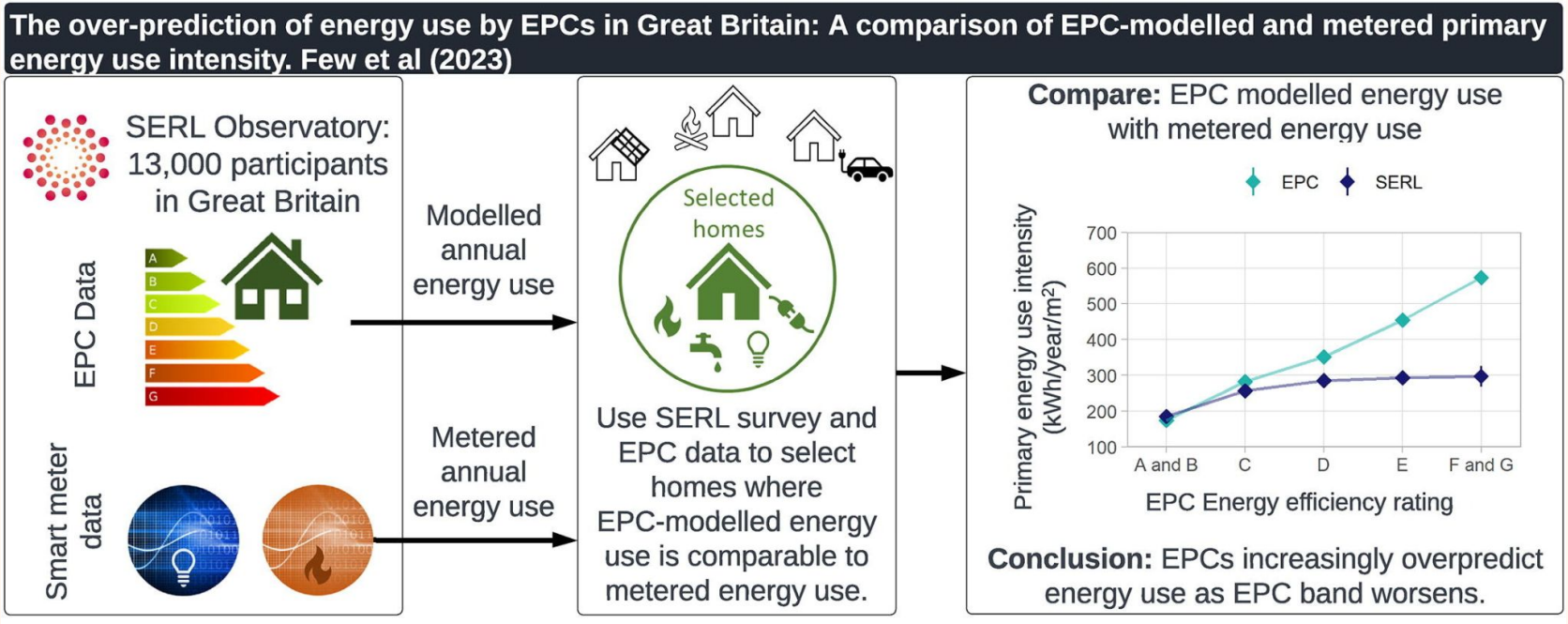


Footnotes
1 SAP has further fixed inputs that are implicit to its various calculations, this column highlights key inputs and appendices.
2 Location input has an impact on overheating and PV energy generation. Calculations for compliance and ratings are based on UK average weather.
3 Includes losses associated with the heating of incoming cold water and evaporation.

A simplified representation of the SAP10 process depicting the main data flows and calculations.

https://etude.co.uk/wp-content/uploads/2022/06/Making-SAP-and-RdSAP-11-fit-for-Net-Zero-Full-report.pdf

SAP and EPCs in Existing Homes



Jessica Few, Despina Manouseli, Eoghan McKenna, Martin Pullinger, Ellen Zapata-Webborn, Simon Elam, David Shipworth, Tadj Oreszczyn, The over-prediction of energy use by EPCs in Great Britain: A comparison of EPC-modelled and metered primary energy use intensity, Energy and Buildings, Volume 288, 2023

https://www.sciencedirect.com/science/article/pii/S0378778823002542

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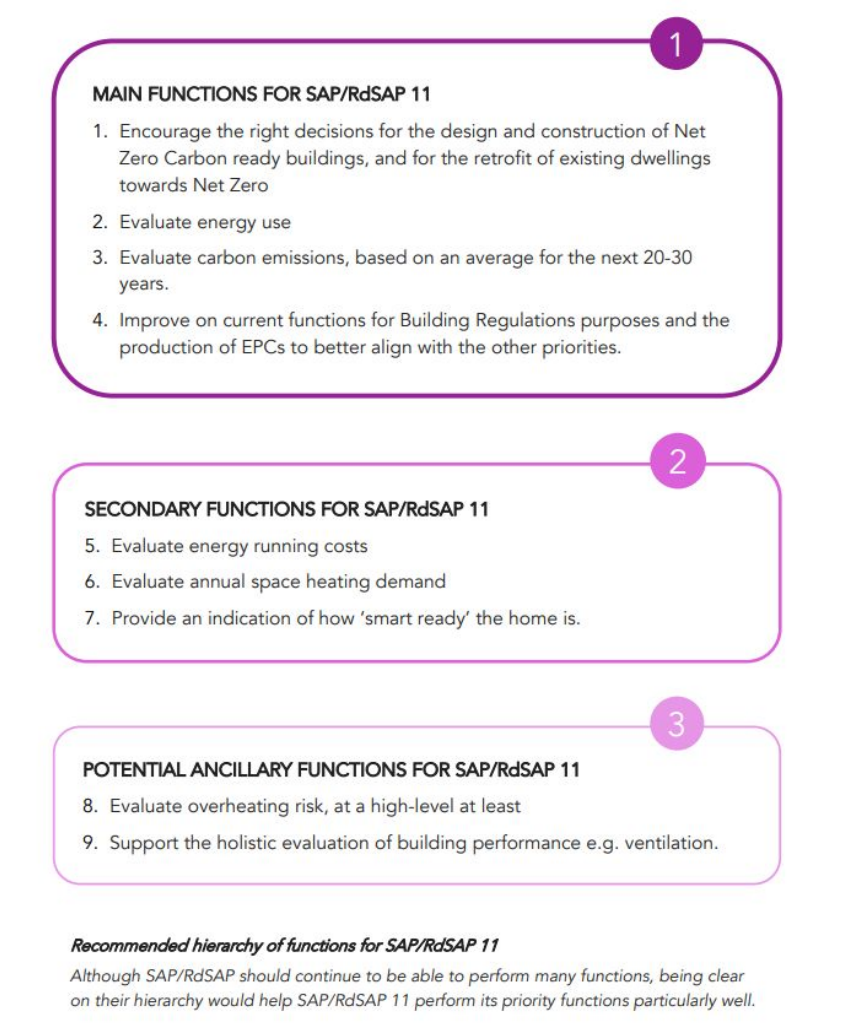
https://etude.co.uk/wp-content/uploads/2022/06/Making-SAP-and-RdSAP-11-fit-for-Net-Zero-Full-report.pdf



Energy Performance of Buildings Standards

BS EN ISO 52000-1:2017

BSI Standards Publication

Energy performance of buildings — Overarching EPB assessment

Part 1: General framework and procedures

bsi.

Energy Performance of Buildings Standards

OPEN BEP4EU

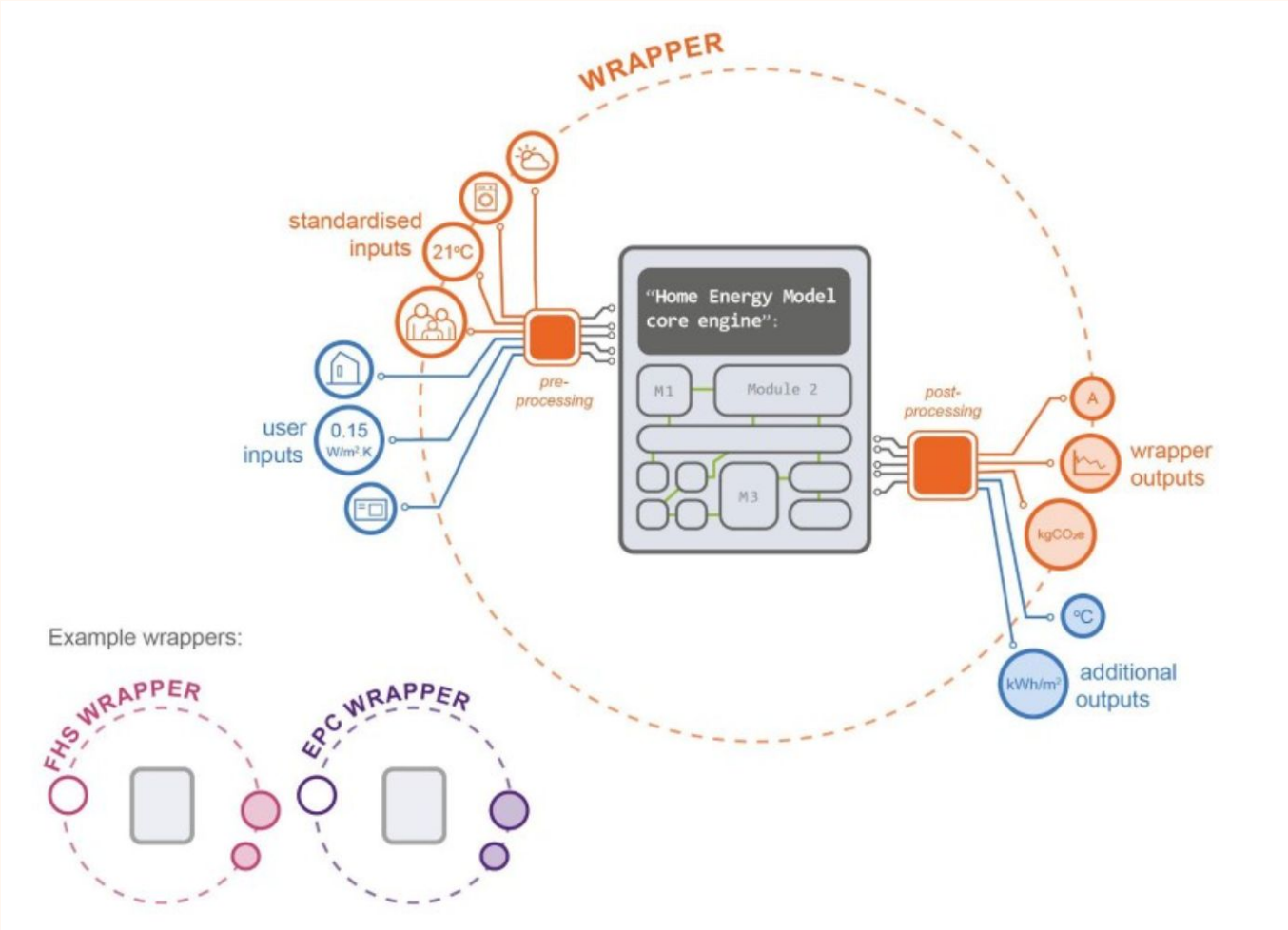
https://www.openbep4.eu

HEM! Home Energy Model

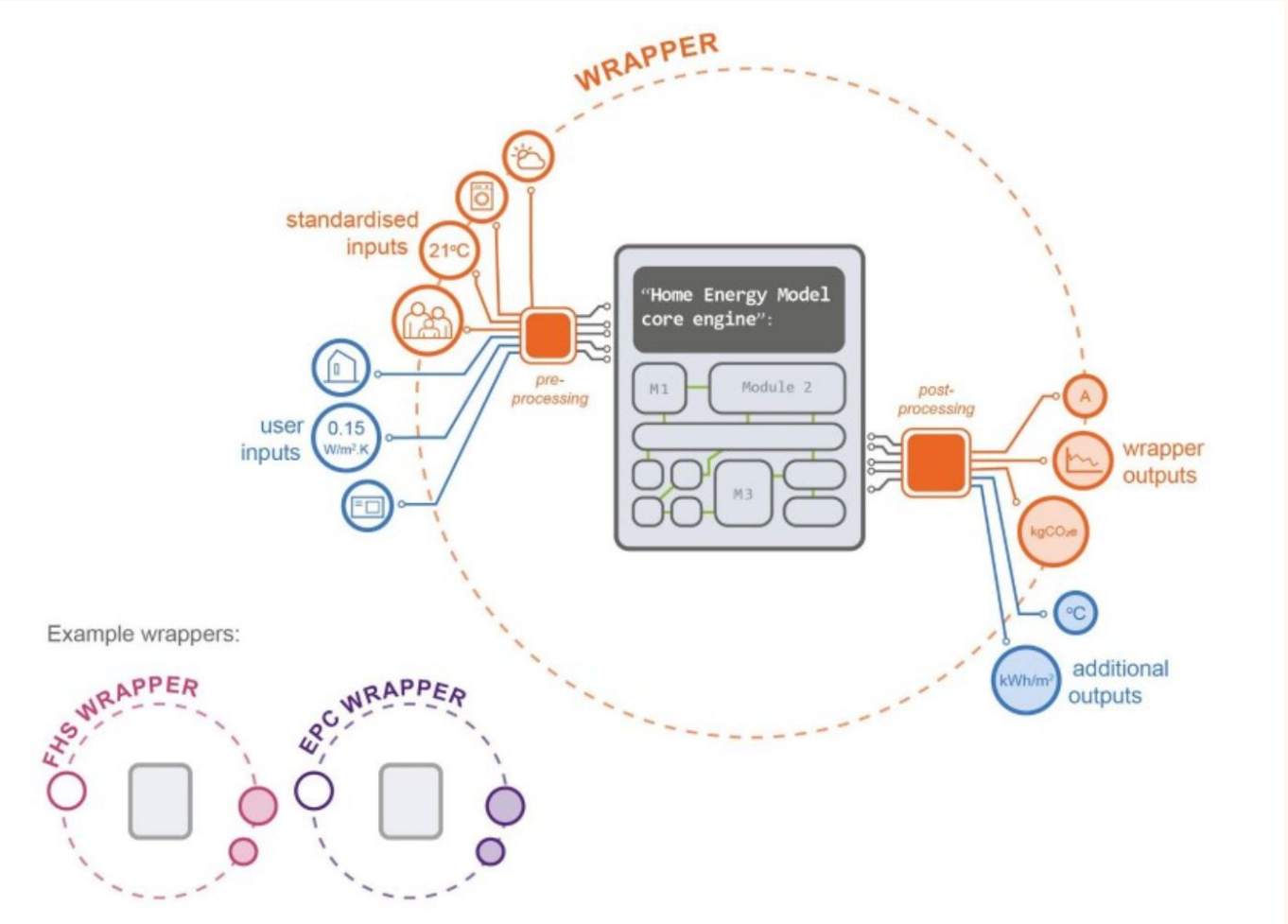
https://www.gov.uk/government/consultations/home-energy-model-replacement-for-the-standard-assessment-procedure-sap/the-home-energy-model-making-the-standard-assessment-procedure-fit-for-a-net-zero-accessible-webpage

https://www.gov.uk/government/publications/home-energy-model-technical-documentation

Thanks to Clare Murray from Levitt Bernstein for this excellent diagram!

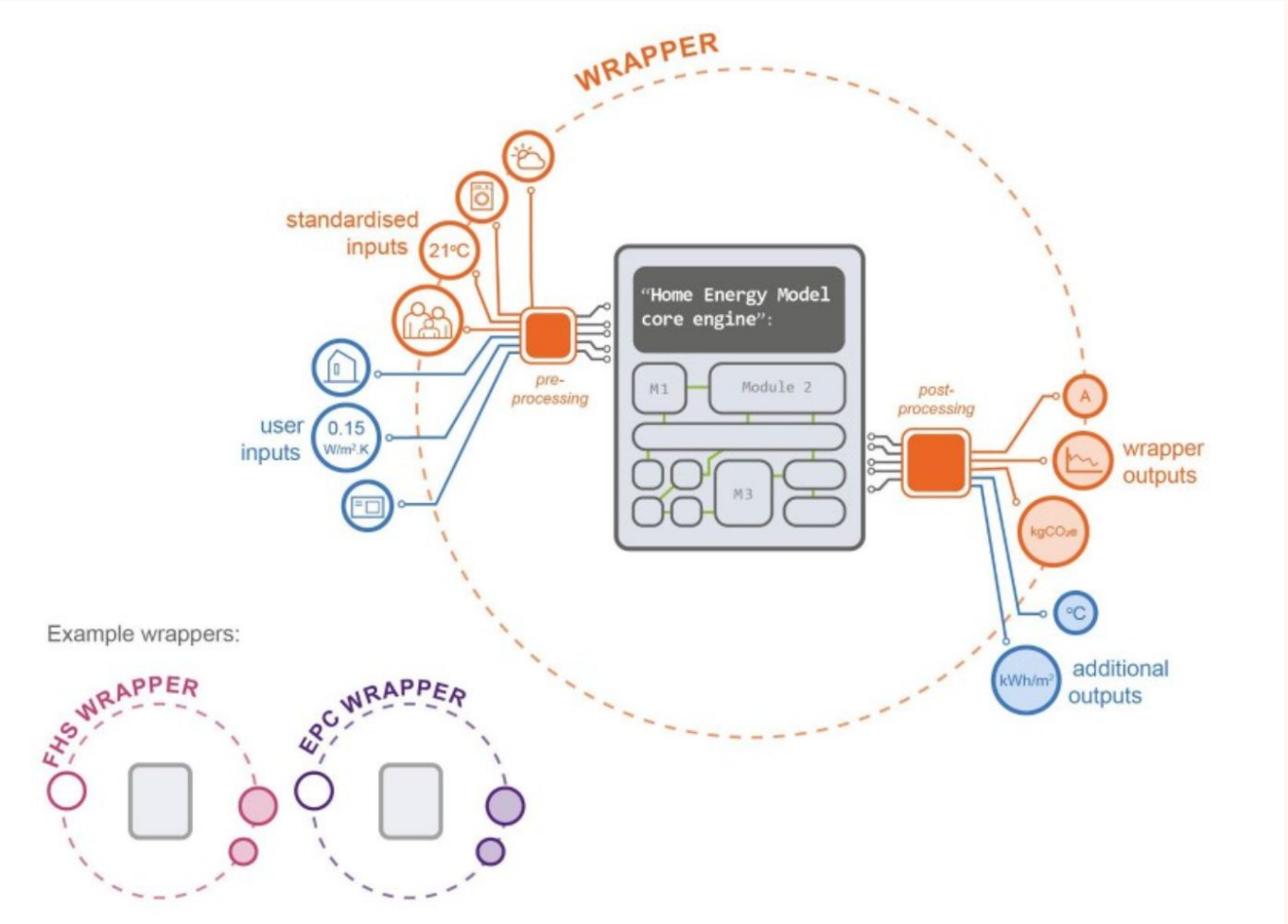


Modular: Wrappers



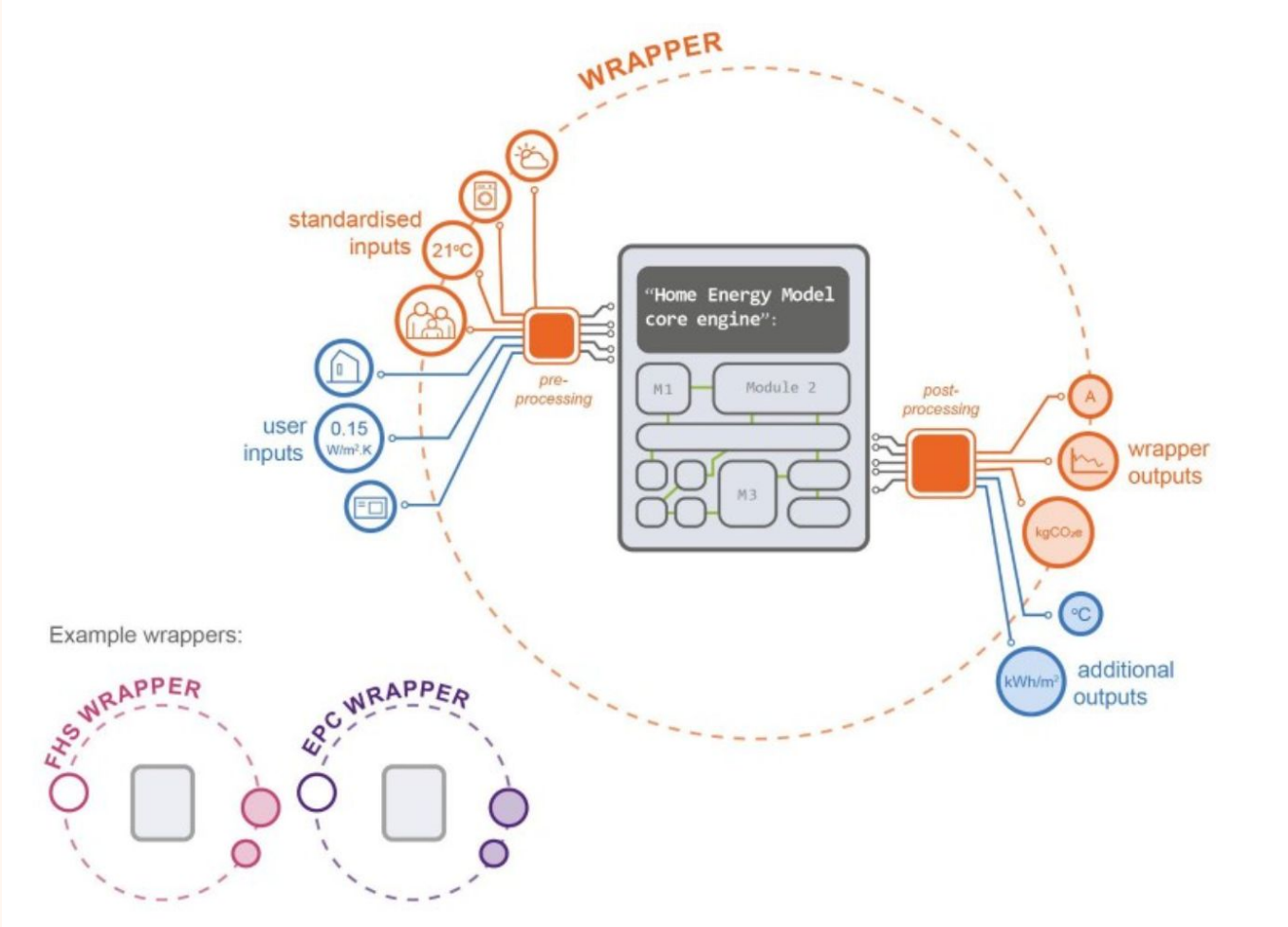
Open Source

https://dev.azure.com/Sustenic/Home%20Energy%20Model%20Reference



Energy Calculation as a Service (ECaaS)

- a single approved version



HEM: Better than SAP?

"It can model the behaviour of heat pumps and the dynamic electrical demand of housing very effectively, which is crucial for the future of energy networks"

https://etude.co.uk/how-we-work/the-home-energy-model-hem-a-major-improvement-over-sap/

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HEM-TP-12 Heat pump methodology

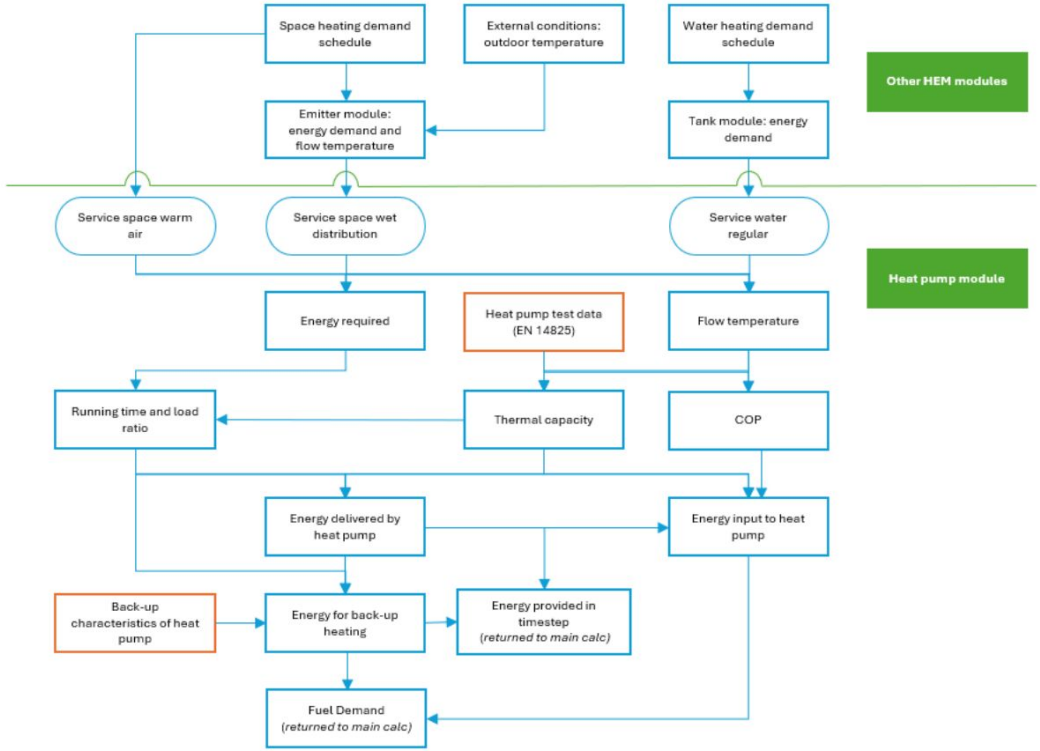

Figure 1 – Simplified flowchart of calculation steps for heat pumps in HEM

https://assets.publishing.service.gov.uk/media/69a6cbe7723a61518b9f1395/hem-tp-12-heat-pump-methodology.pdf

HEM: Better than SAP?

"It is much more accurate at modelling air infiltration and ventilation systems, rewarding efforts to make dwellings more airtight and improving ventilation systems"

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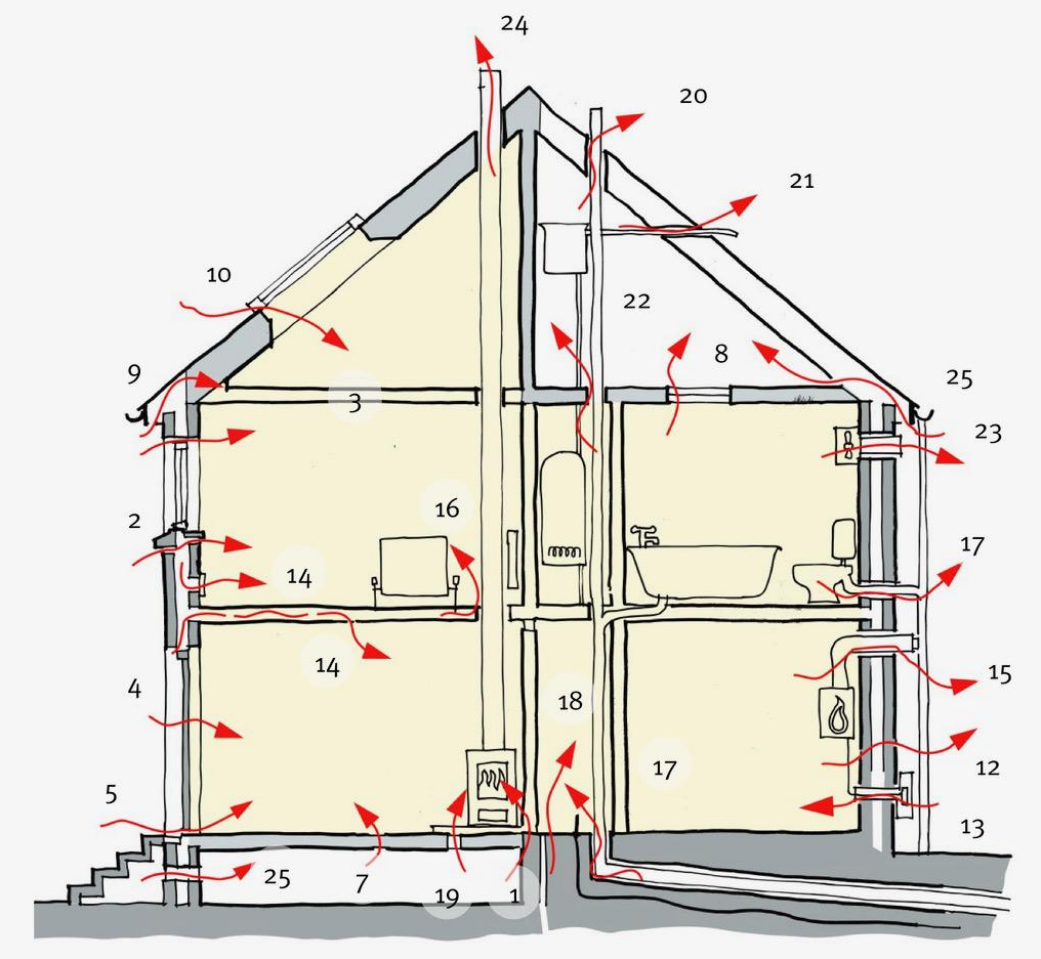

Diagram showing typical air leakage points in a house with cavity walls.
Image copyright John Gilbert Architects, used with their permission from the Pebble Trust publication Sustainable Renovation.

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https://etude.co.uk/how-we-work/the-home-energy-model-hem-a-major-improvement-over-sap/

HEM-TP-06 Infiltration and Ventilation

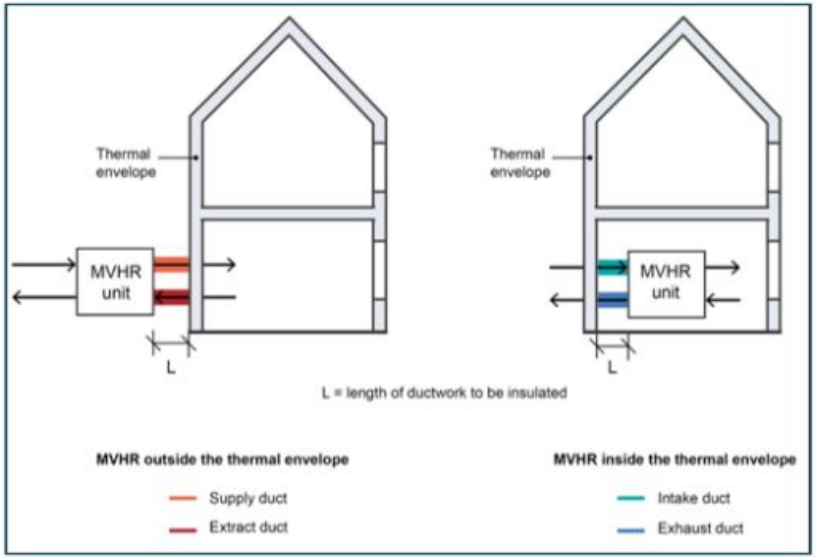

Figure 1 – The section of duct that needs to be insulated depends on the location of the MVHR unit. The length of insulated ducts subject to internal to external temperature difference should be entered in the HEM.

https://assets.publishing.service.gov.uk/media/6902358d3650bacb01af7086/hem-tp-06-infiltration-and-ventilation.pdf

HEM: Better than SAP?

"It operates at a half-hourly timestep rather than SAP's monthly approach. This higher resolution enables better modelling of renewable energy self-consumption and export, energy storage, smart technologies, and time-of-use tariffs"

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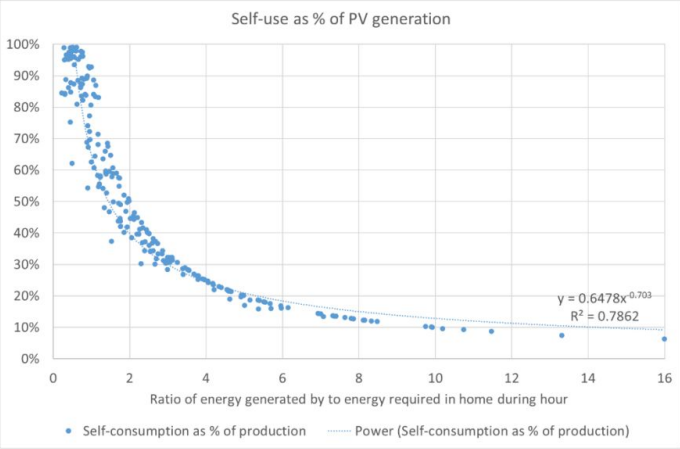
HEM-TP-18 PV generation and self-consumption

monthly data, which was used to check the results from applying the formula to typical generation and demand profiles. The fraction of self-consumption is calculated as a function of the ratio of PV energy available to the electricity demand (the 'demand ratio') during the time step, based on the field data (see graph below):

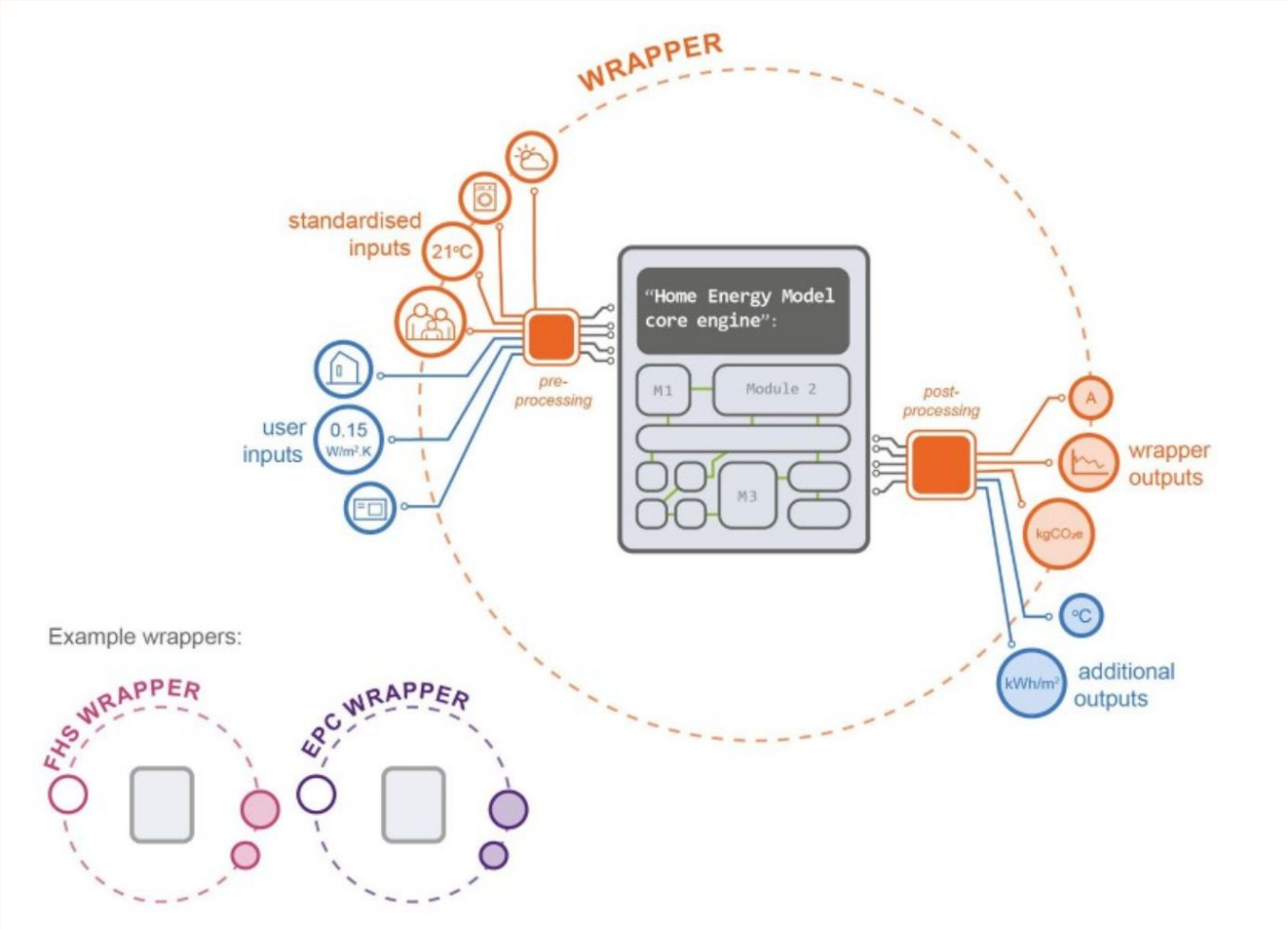
$$demand\ ratio = \frac{PV\ energy\ supply}{electricity\ demand} \qquad (3)$$

$$self\text{-}consumption\ factor = \min(0.6748 \times demand\ ratio^{-0.703}, 1) \qquad (4)$$



https://assets.publishing.service.gov.uk/media/69a6cc7d2e1f4fbda42521fa/hem-tp-18-pv-generation-and-self-consumption.pdf

HEM:
Making it better, together.....

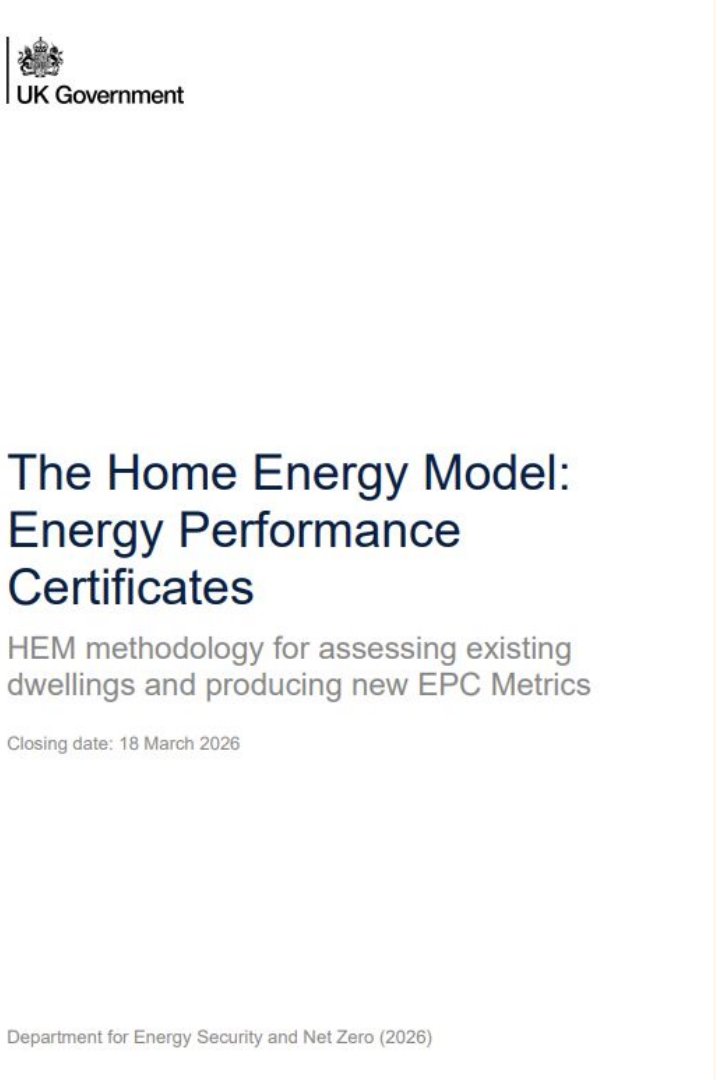


HEM: EPC
Current Consultation

- Modular approach to data for existing buildings - greater flexibility
- New metrics for EPCs:
  - Fabric
  - Heating System
  - Smart Readiness
  - Energy Cost
- SMETERS and measured HTCs

https://www.gov.uk/government/consultations/home-energy-model-energy-performance-certificates

https://nationalretrofithub.org.uk/resource/home-energy-model-energy-performance-certificates-consultation-response/



Questions and Discussion

www.retrofit.coop