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RETROFIT FOR THE FUTURE

Energy and CO_2 Modelling and Calculation using the Passivhaus Planning Package (PHPP)

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Background to the Passivhaus energy standard

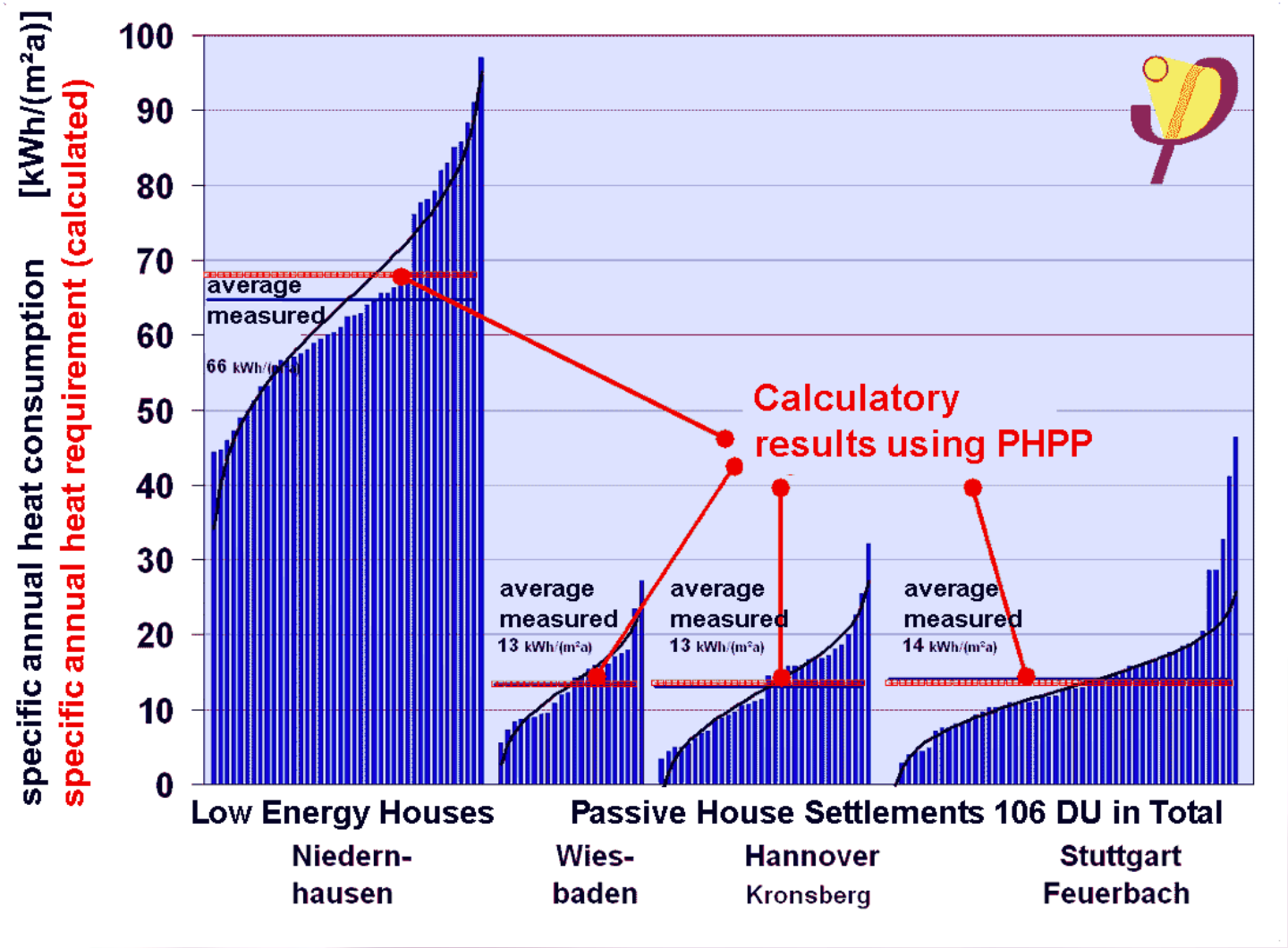
- The first four Passivhaus homes were built as a pilot project in Darmstadt in 1990-91
- The concept was developed in 1988 jointly by Dr Wolfgang Feist, Germany and by Bo Adamsson, Prof. of Building Science at Lund University, Sweden
- The homes were designed using sophisticated dynamic thermal modelling software which was generally only comprehensible to physicists
- Existing German Codes and Standards proved to be not up to the task. The same has since proved to be the case in Denmark, Belgium and the Netherlands.

The key characteristics of PHPP

- A static model based on monthly degree-hours and which treats the building thermally as a single zone
- The utilisation efficiency of solar and internal gains depends on the building construction/thermal capacity and the ratio of gains to gross heat demand
- Calibrated using results of dynamic thermal simulations
- A whole-building model covering energy usage for lights, electrical appliances and cooking, heating and HVAC pumps/fans. Allows for all important phenomena; e.g. water evaporation and heating of liquid water
- Aims at a reasonable compromise between data entry requirements and the accuracy of the predictions

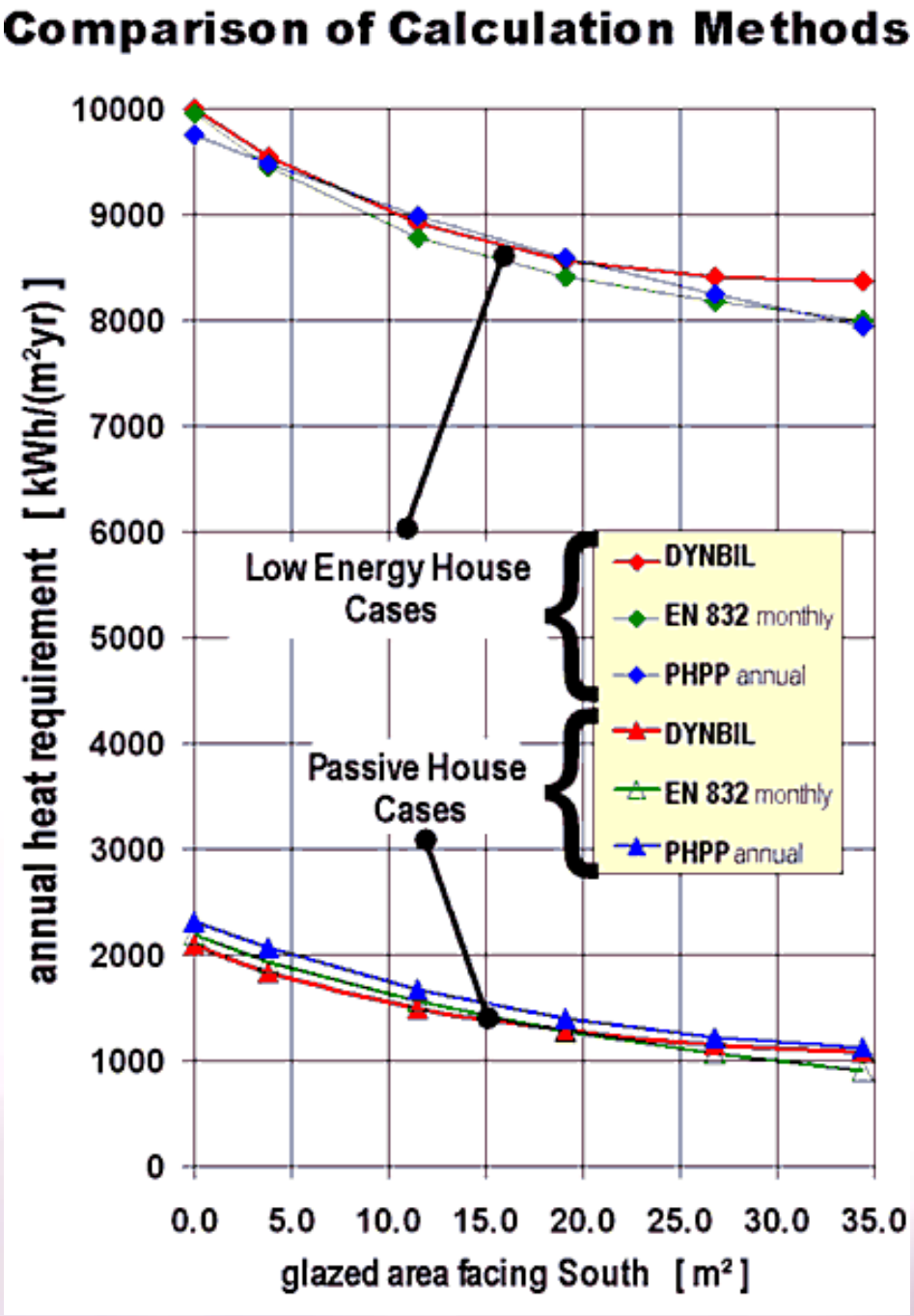
SAP is above all a compliance tool - PHPP is more of a design tool.

PHPP Space heating useful energy - predictions versus measurements



PHPP

How its predictions compare to the results of dynamic thermal simulations



Using PHPP

Model dwelling(s) for standard occupancy conditions and average user habits - the same that would apply if your measures were replicated very widely:

- UK occupancy density, in persons per m^2; equation in SAP-2005.
- Manchester weather data; i.e. close to UK population-weighted average.
- internal heat gains based on a future of more energy-efficient lighting and electrical appliances, most figures based on the *40% House Project* 2005.
- internal temperatures typical of future low-energy dwellings; typical temperatures maintained now in older dwellings reflect a major compromise between comfort and running costs

The energy monitoring of individual dwellings needs to allow for the above factors

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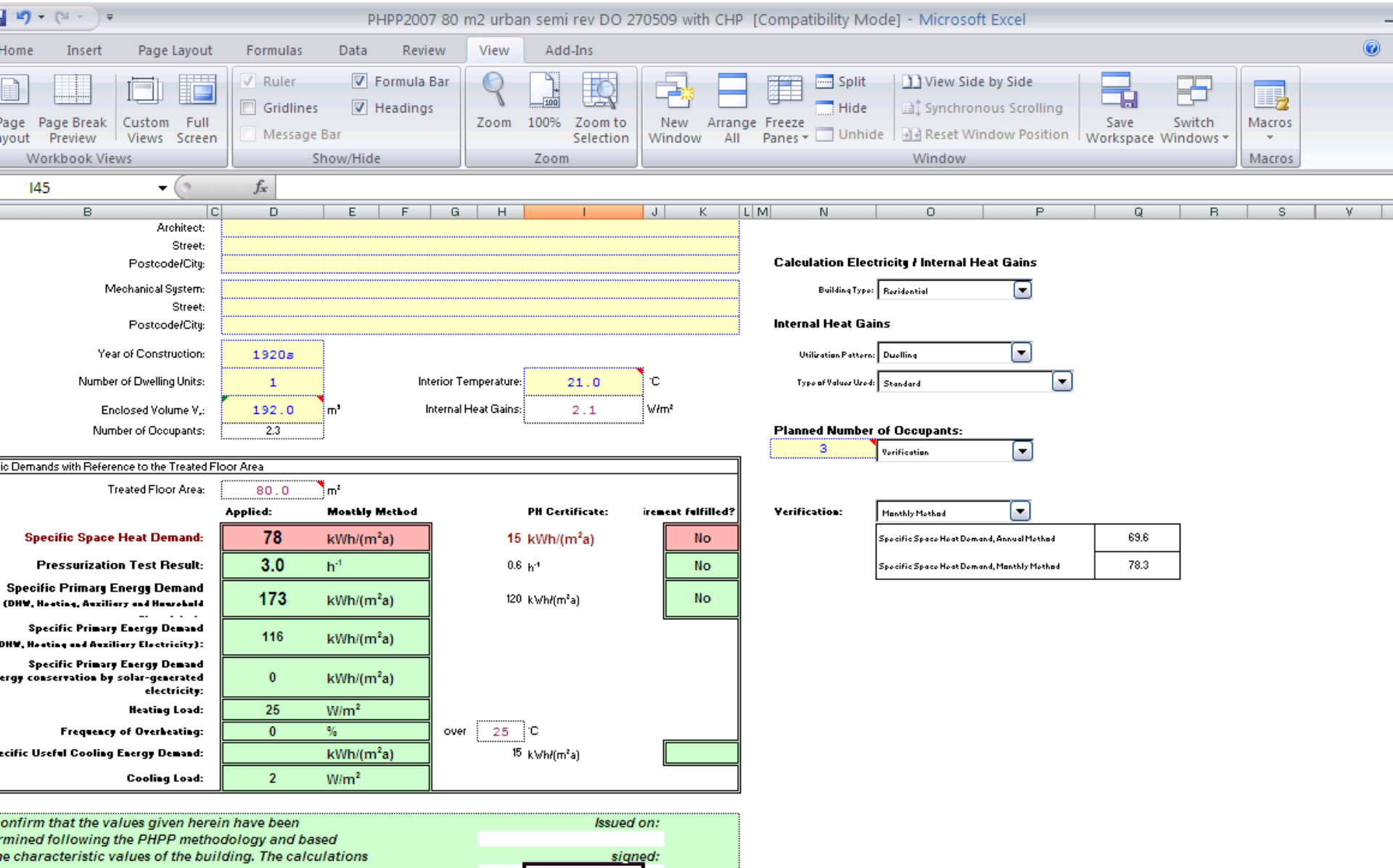
PHPP Example screenshot

"Verification" sheet Space heat 78 kWh/m²yr



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PHPP Example screenshot

"Electricity" sheet Elec. for lights/appl 22.2 kWh/m²yr