BUILD TEST SOLUTIONS

Buildings Behaving Badly: why are half of all buildings not performing as predicted?

Dr Richard Jack

BTS Webinar Series #1

Build Test Solutions: Who We Are

- **Trusted authority in building performance measurement**
  Influencing industry standards and policy.

- **Pioneering technologies**
  Creators of market-first solutions incl. Pulse, Heat3D and SmartHTC.

- **Accurate, actionable data**
  Transforming how buildings are assessed, verified, and improved.

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Our Users

- **Making measurement mainstream**
- Measurement as a service: surveyors, consultants, building owners and operators, installers
- Integrators: smart tech, IoT, energy providers

Today We'll Cover

- What a Heat Transfer Coefficient is
- How they're calculated and measured
- How & why calculation and predictions differ
- Why that matters

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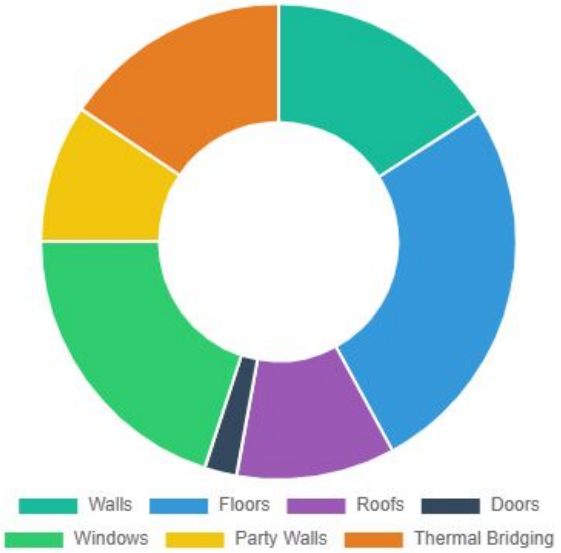
What is a Heat Transfer Coefficient?

- Sum of heat transfer paths
- Estimated for every EPC
- Estimated: U-value * area
- Or measured in-situ
- ***How good are the estimates?***



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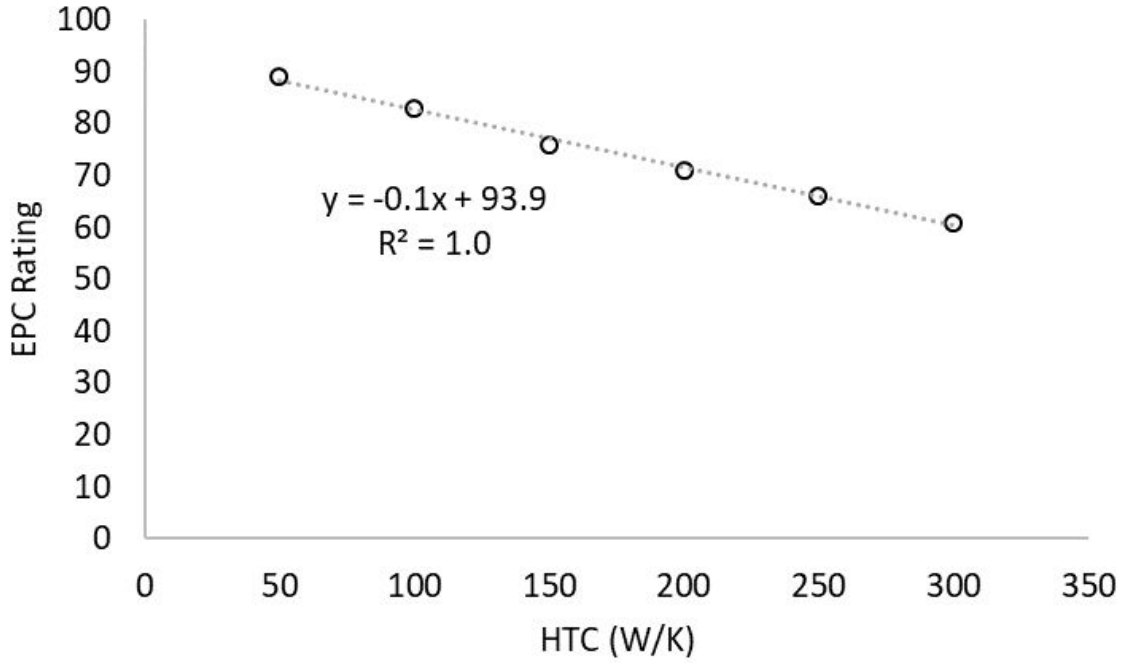
HTC in RdSAP

- EPC outputs are linearly related to heat loss (HTC)
- Including ratings, bands, heat demand, energy use, costs, & CO_2
- Inaccuracy in HTC directly impacts outputs



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SmartHTC

- Tool to measure HTCs
- Building used as normal
- In-use energy balance
- 21 days winter data
- Cloud hosted calculator
- Browser interface
- API integration

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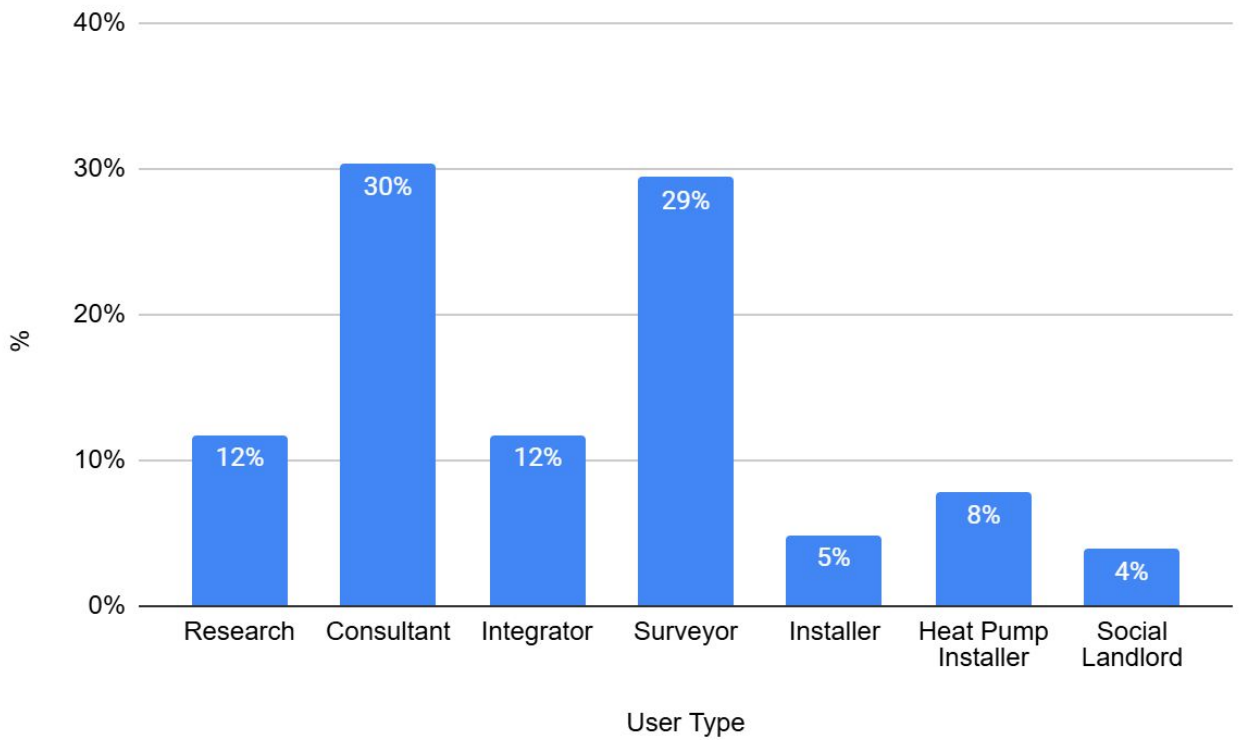
SmartHTC

- Available since 2021
- >11,000 measurements
- >100 users
- Two business models:
  - Measurement as a service
  - Integrated



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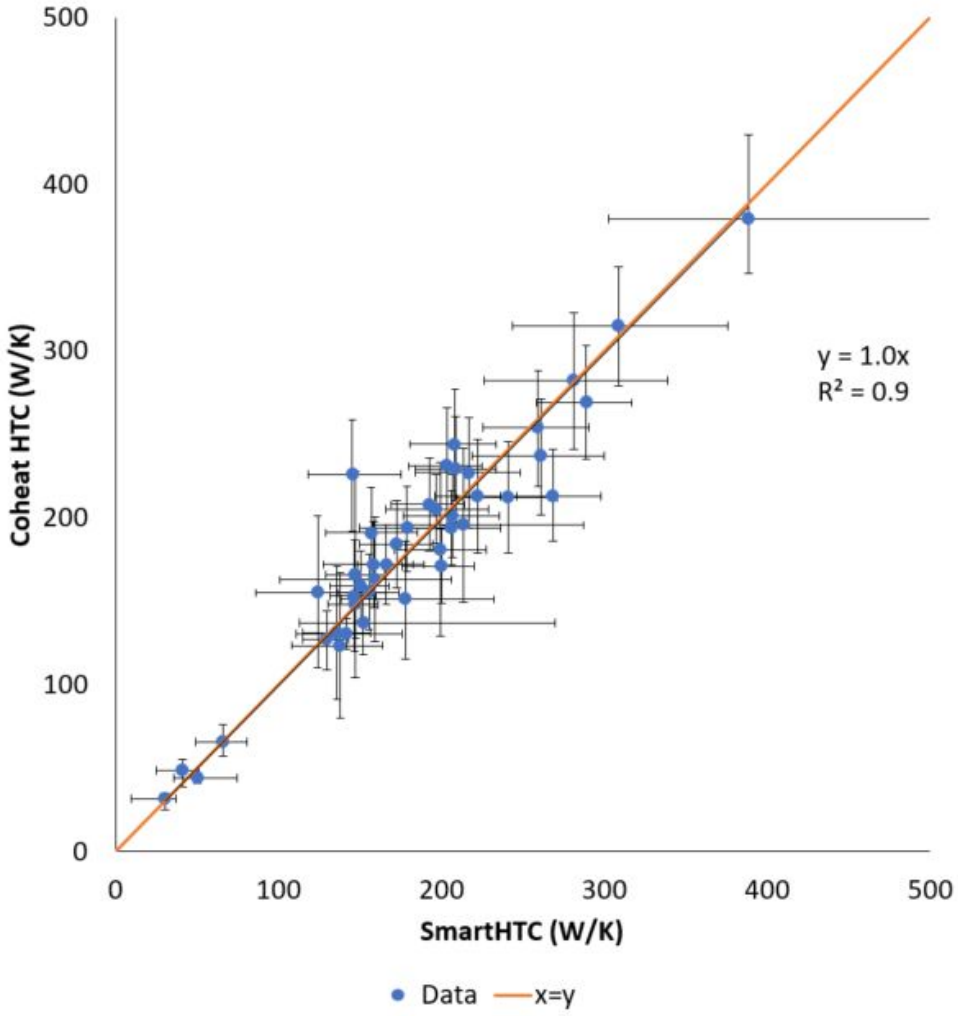
SmartHTC Validation

- 43 comparisons with baseline measurement
- Buildings with varied thermal performance
- Very high accuracy, high precision:
  - Accuracy (NMBE): -1%
  - Precision (CVRMSE): 12%



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Performance Gap Study

energy saving trust

- Measured vs RdSAP HTC
- Sample size - 503
  - Biggest ever!
  - Biased to **older buildings**
- EST generated RdSAP HTCs
- Why not more?
  - **HTC not stored in EPC Open Data**
  - Not even all reqd inputs stored!

Property Type	Qty	Main Wall	Qty	SAP Band	Qty	Age	Qty
Flat	184	Cavity	313	A	12	Pre-1900	25
End-terrace	44	Solid brick/stone	152	B	6	1900-29	77
Mid-terrace	72	System Build	24	C	98	1930-49	92
Detached	22	Timber frame	13	D	280	1950-66	120
Semi-detached	180			E	97	1967-75	152
				F	9	1976-82	15
				G	1	1983-90	7
						1991-95	2
						1996-02	4
						2007-	8

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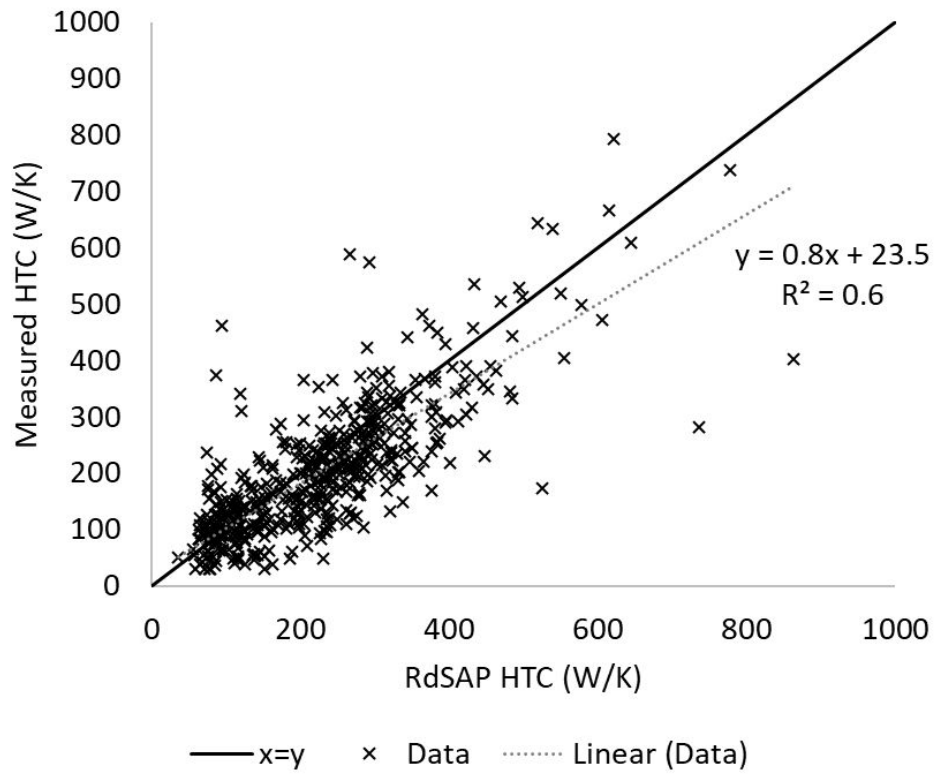
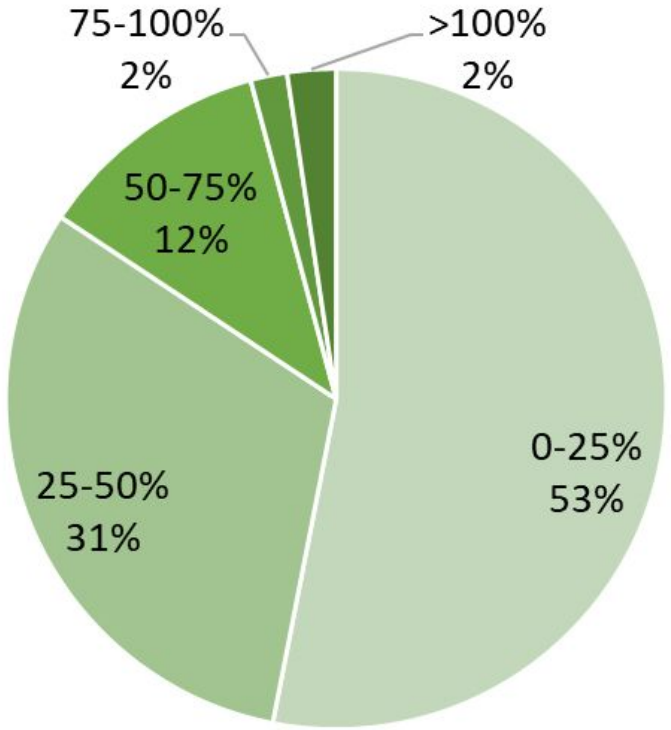
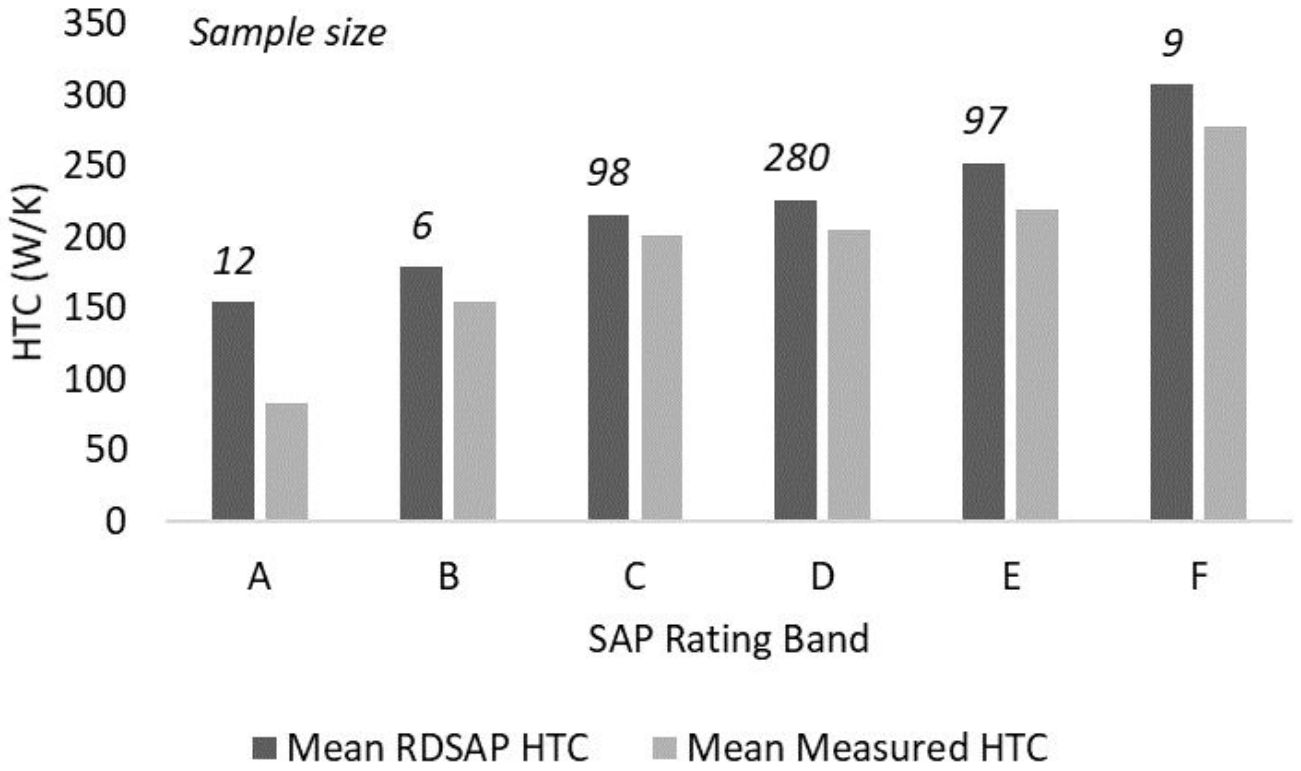
Performance Gap

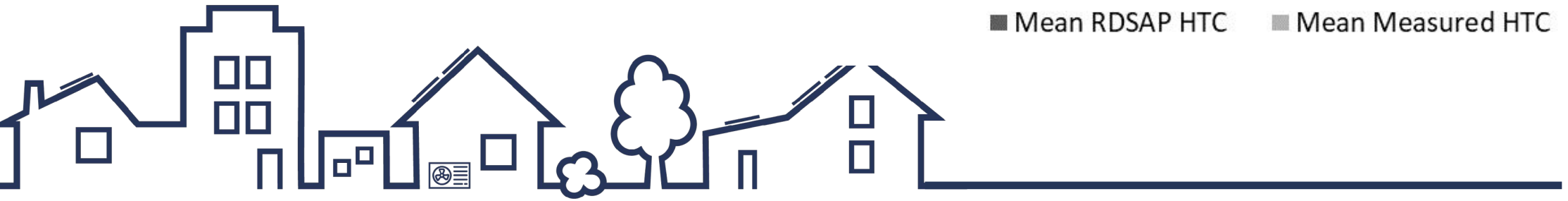
- 57%(!) of RdSAP HTCs wrong (out of measurement CI)
- More common (72%) to overestimate heat loss
- Average performance gap 30%
- Large errors common, 1 in 6 >50%



Performance Gap







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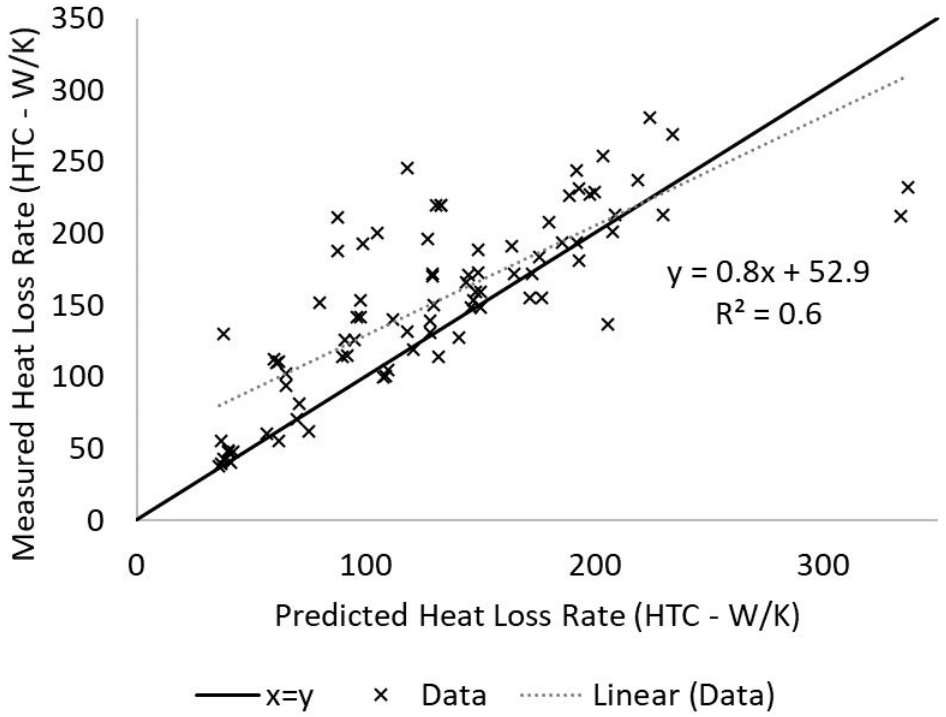
Previous Performance Gap Studies

- Total sample 84
- Bias towards **new build**
- 70% of RdSAP HTCs wrong
- More common (85%) to *under*estimate heat loss
- Average performance gap 31%
- Similar average gap and trend to the BTS/EST study



Studies:

- Leeds Beckett University, *Quantifying the domestic building fabric 'performance gap'*
- Building Performance Network, *State of the Nation*
- DESNZ, *SMETER project*

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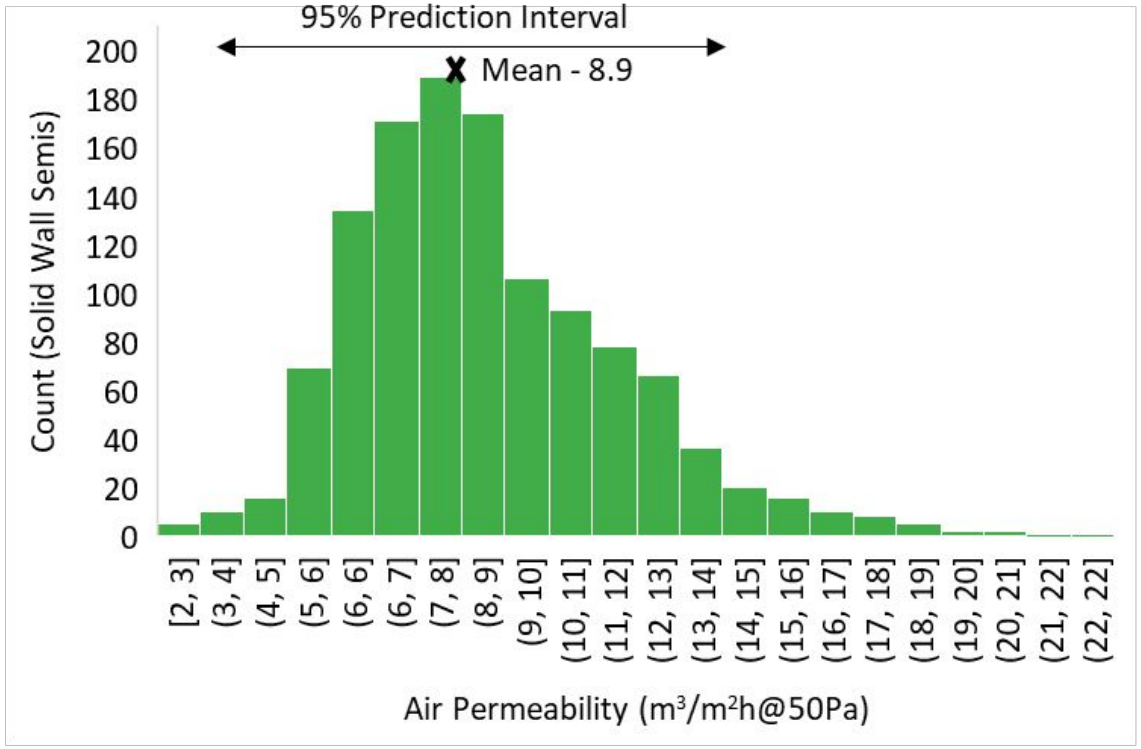
Why Are These Calculations Wrong?

- Building performance is incredibly variable
- Visually similar buildings have vastly different performance
- The ‘prediction interval’ describes how accurately a value can be estimated given previous data
- Here it’s ±62% of the mean!



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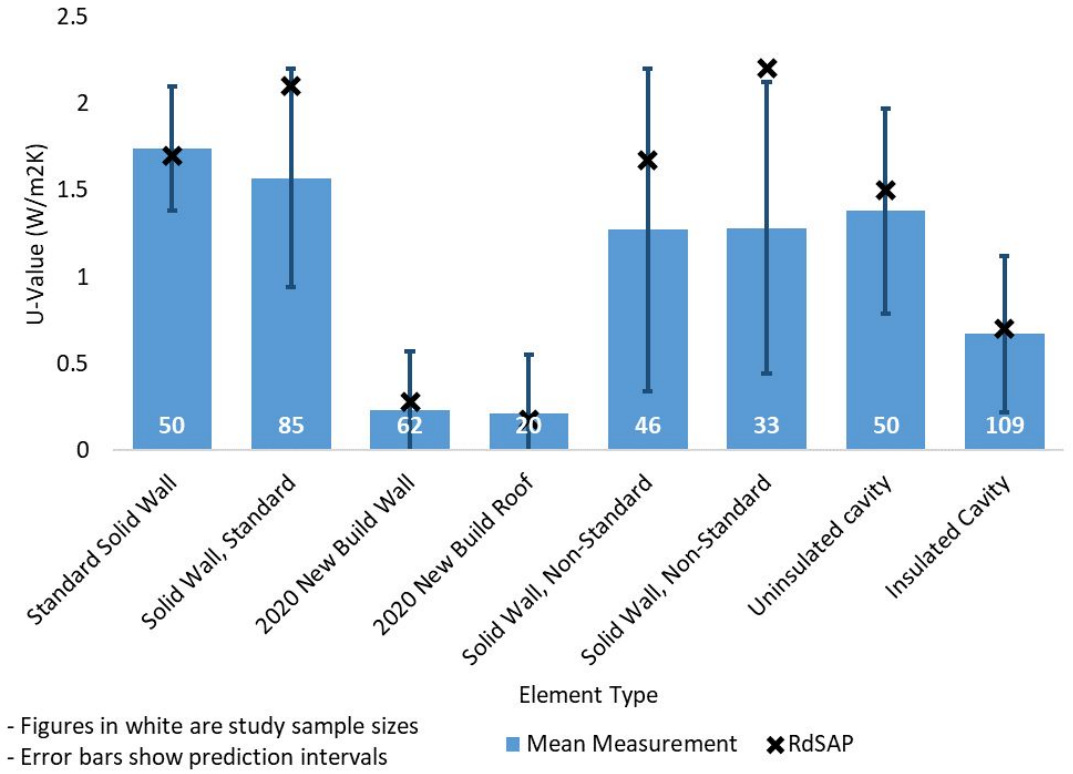
Uncertain Inputs

- Here we look at previous U-value field trials
- RdSAP can be right on average
- But not for all buildings
- Prediction intervals range from ±20% to ±163%
- Repeated for all input assumptions



Studies by BRE x2, Historic Scotland, & BPN

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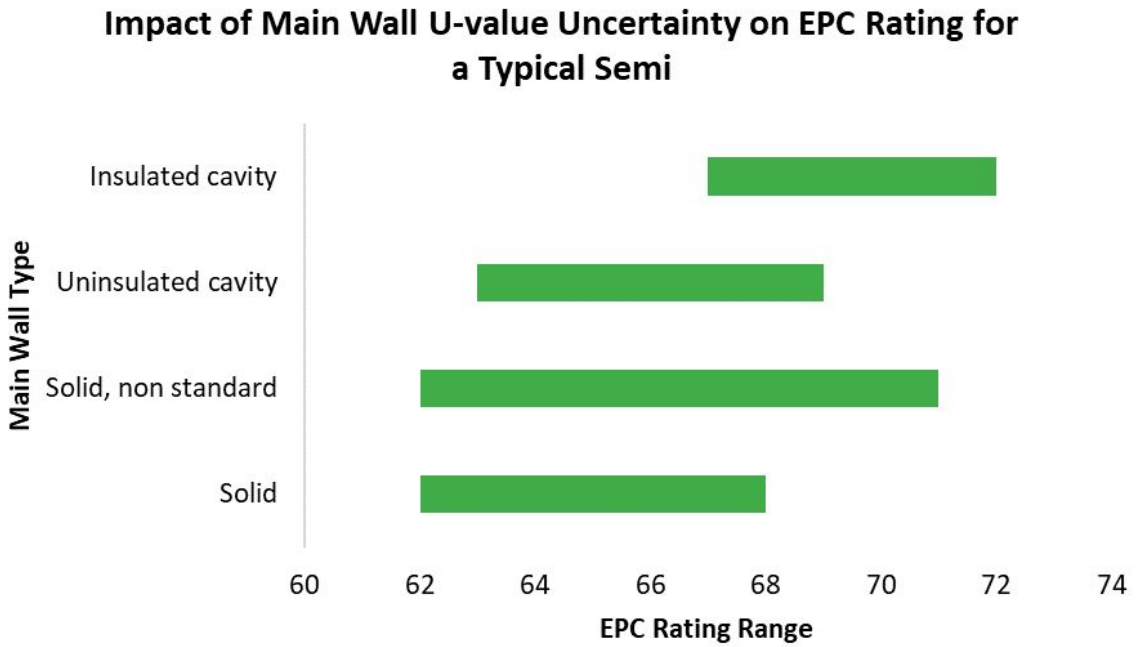
Mean Uncertain Outputs

- Like EPC ratings, bands, heat demand, energy demand, cost, & CO_2
- E.g. Wall U-value uncertainty results in 5 to 9 point swing
- Policy design and regulation undermined by this uncertainty



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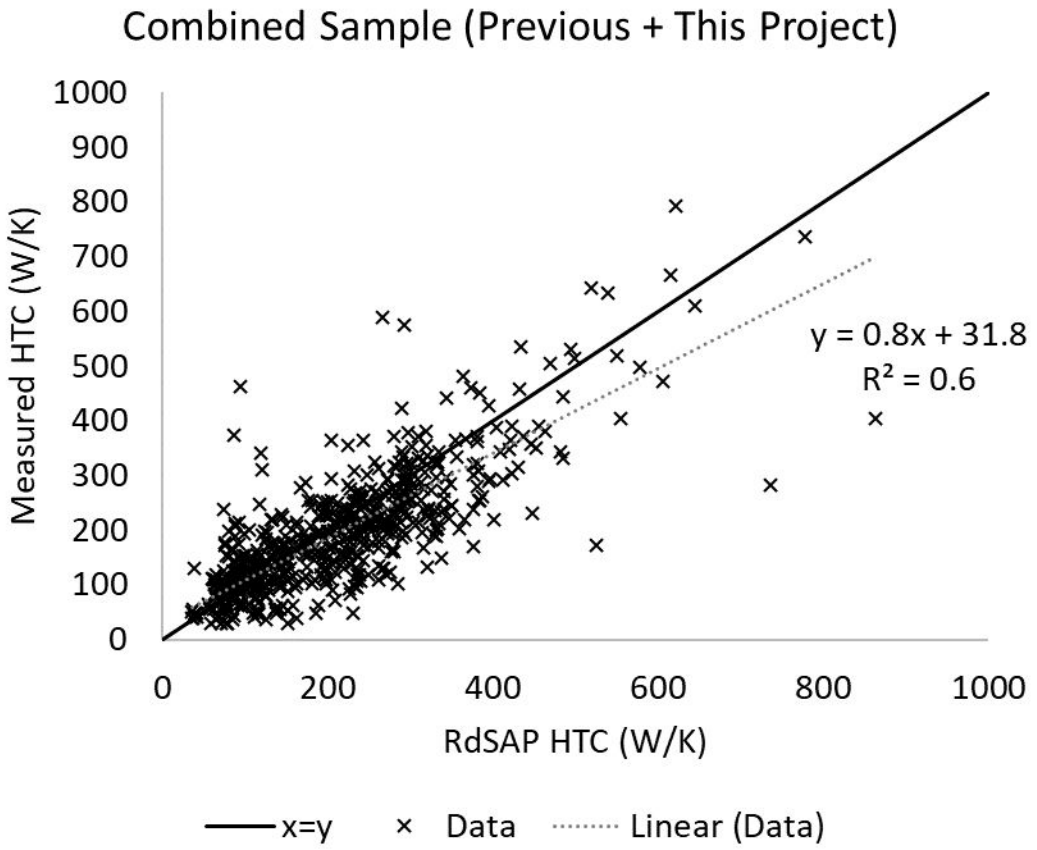
Conclusions

(Energy models like) RdSAP:

- Accuracy OK (NMBE): 8%
- Precision poor (CVRMSE): 38%
- Useful for groups of dwellings
- Poor for individual dwellings
- Risks misdirecting retrofit spending (£60bn in EST study)
- Poor for QA
- Poor for heating/cooling sizing



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Next Seminar

From Complaints to Confidence:
Proactively Managing Moisture with Measured Data

Wednesday, 27th August, Midday

Sign Up Here

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