

# APSE Seminar: Scottish Building and Housing:

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## Whole House Retrofit



- Problems for Councils
- The Performance Gap / BPE
- Hab-Lab
- Additional Concerns
- Current Case Studies / Whole House Retrofit



# Problems for Councils...



- SHQS
- EESSH 2020 (and EESSH 2032)
- Fuel Poverty
- 'Hard to Treat'
- Mixed ownership patterns / consolidation
- Rural, off-grid properties
- Maintenance
- Climate change?
- Financial Context...



### Problems for Councils...



#### • SAP / RdSAP and the associated industry isn't very good

1	EPC RDSA	SAP	1 1-	Comments	Recommendation 1	SAP Sco *	Recommendation	SAP Scc *	Recommendation 3	SAP Sco *	Fused 3 Point Differen			4	Estimated		1.1	
		Score T	ent EESS *								Spu *	Upli *	ce Sp *	Proposed Improvements	EPC Rati	EESSH Pass?	Total Cost	Other Options
391	69	69	YES	0	0	0	0	0	0	0	NO	No	NO			N/A		
392	69	66	NO	0	FLOOR INSULATION	68	LOW ENERGY LIGHTS	70	SOLAR WATER HEATING	71	YES	69	0	Low E Lighting + FS Change	71	YES	£550.00	
393	65	0	NO	NO ANSWER	0	0	0	0	o	0	0	No	NO			NO	100000000	
394	69	67	NO	PLOW ENERGY DGHTS IN ALL OUTLETS WILL MAKE C69 (PASS)	FLOOR INSULATION	70	LOW ENERGY LIGHTS	72	SOLAR WATER HEATING	73	NO	No	NO	Low Energy Lighting	69	YES	£400.00	
395	69	69	YES	0	0	0	0	0	o	0	NO	No	NO			N/A		
396	69	67	NO	PLOW ENERGY LIGHTS IN ALL OUTLETS WILL MAKE C69 (PASS)	FLOOR INSULATION	70	LOW ENERGY LIGHTS	72	SOLAR WATER HEATING	74	NO	No	NO	Low Energy Lighting	69	YES	£400.00	
397	69	67	NO	PLOW ENERGY LIGHTS IN ALL OUTLETS WILL MAKE C69 (PASS)	FLOOR INSULATION	70	LOW ENERGY LIGHTS	72	SOLAR WATER HEATING	74	NO	No	NO	Low Energy Lighting	69	YES	£400.00	
398	69	67	NO	MAKE C69 (PASS)	FLOOR INSULATION	70	LOW ENERGY LIGHTS	72	SOLAR WATER HEATING	73	NO	No	NO	Low Energy Lighting	69	YES	£400.00	
399	69	68	NO	PLOW ENERGY LIGHTS IN ALL OUTLETS WILL MAKE C70 (PASS)	FLOOR INSULATION	71	LOW ENERGY LIGHTS	72	SOLAR WATER HEATING	74	NO	No	NO	Low Energy Lighting	70	YES	£400.00	
400	69	0	NO	NO ANSWER	0	0	0	0	0	0	0	No	NO			NO		
401	69	78	YES	0	o	0	0	0	0	0	NO	No	NO			N/A		
402	69	0	NO	N Tenant not avail until Feb 2020 (Sheltered Housing)	0	0	0	0	0	0	0	Na	NO			NO		
403	69	0	NO	NO ANSWER	0	0	0	0	0	0	0	No	NO			NO		
404	65	51	NO	0	CAVITY WALL INSULATION	56	FLOOR INSULATION	63	0	0	NO	No	NO	Not possible given options available		NO		
405	69	67	NO	0	FLAT ROOF INSULATION	69	FLOOR INSULATION	71	SOLAR WATER HEATING	72	NO	No	NO	Flat Roof Insulation	69	YES	£7,000.00	
406	69	58	NO	0	FLOOR INSULATION	60	SOLAR WATER HEATING	61	SOLAR PANELS	76	NO	No	NO	Floor Insulation + Solar PV	75	YES	£7,800.00	
407	69	68	NO	0	FLAT ROOF INSULATION	69	FLOOR INSULATION	71	SOLAR PANELS	72	NO	No	NO	Flat Roof Insulation	69	YES	£7,000.00	
408	69	67	NO	0	FLAT ROOF INSULATION	68	FLOOR INSULATION	70	SOLAR WATER HEATING	72	NO	No	NO	Flat Roof Insulation + Floor Insulation	70	YES	£12,000.00	Good fabric first
409	65	73	YES	support workers require to be present) -	0	0	0	0	0	0	NO	No	NO			N/A		
410	62	0	NO	Away to end Jan	0	0	0	0	0	0	0	No	NO			NO		
411	62	31	NO	MEASURE - HIGH PERFORMANCE	REASE LOFT INSULATION TO 2708	33	AVITY WALL INSULATION	38	FLOOR INSULATION	48	NO	No	NO	Loft + Floor Insulation + Solar Thermal + Solar PV	64	YES	£13,100.00	Need to check as
412	62	30	NO	MEASURE - REPLACE GLAZING D55, MEASURE 6 - HIGH PERFORMANCE	REASE LOFT INSULATION TO 2708	32	AVITY WALL INSULATION	35	FLOOR INSULATION	39	NO	No	NO	Loft + Floor Insulation + Solar Thermal + Replacement Glazing + Replacement Doors + Solar PV	65	YES	£18,600.00	Need to check as
413	62	50	NO	4TH MEASURE - HIGH PERFORMANCE EXTERNAL DOORS D59, 5TH MEASURE -	FLOOR INSULATION	54	LOW ENERGY LIGHTD	55	SOLAR WATER	58	NO	No	NO	Floor Insulation + LE Lighting + Solar PV	67	YES	£8,200.00	Need to check as
414	62	53	NO	4TH MEASURE - HIGH PERFORMANCE EXTERNAL DOORS D62, STH MEASURE - SOLAR PANELS - C74	FLOOR INSULATION	57	LOW ENERGY LIGHTD	58	SOLAR WATER	61	NO	No	NO	Floor insulation + LE Lighting + Solar PV	70	YES	68,200.00	
415	82	0	NO	0	0	0	0	0	0	0	0	No	NO			NO	Roja vologi	
416	69	0	NO	New tennant needs rebooked	0	0	0	0	0	0	0	No	NO			NO		
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## Problems for Councils...



- It's already difficult enough
- Why make it harder?





# The Performance Gap

- It's already difficult enough
- Why make it harder?

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#### **Because its not working:**

- We're not saving the energy we thought
- We're creating other problems











# The Performance Gap



- Aware since around 2010
- To begin with focussed on energy efficiency
- Raised awareness of shortcomings in most commonly used prediction calculations





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source: see discussion in S Curwell et al, *Green Building Challenge in the UK*, Building Research+Information 27(4/5) 286 as presented by Bill Bordass of the Usable Buildings Trust in August 2010 in a talk entitled "A new Professionalism: An Introduction to Soft Landings



# The Performance Gap

- Anticipated Energy savings not being realised
- Air Quality Issues
- Thermal Comfort Issues
- Building Fabric Issues
- Services Complexity / Clarity
- People Issues
- Compliance Concerns
- Quality Control Issues
- Heritage Concerns
- Placemaking Concerns









# BPE + Hab-Lab

- Building performance Evaluation (BPE)
- Now tends to focus on 4 areas:
  - Energy Consumption Monitoring
  - Physical Testing (of building and systems)
  - Environmental Monitoring
  - People Engagement
- First BPE studies were long-term, detailed and expensive...
- ... so Hab-Lab developed to be more responsive, commercial, targeted to Client needs







### Hab-Lab







### Hab-Lab



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#### Energy monitoring







Indoor air quality



**4**-----



Building fabric measurements







People

**4**-----**>** 











# Investigation



- Evaluate 3 IWI systems with similar lambda values
- Not much difference in practice...
- ... but many issues with *installation*
- Preparation and quality control of installation biggest issue for Client













### Ventilation, IAQ, Moisture, Fabric

- Ventilation and Internal Air Quality (IAQ) is inadequate in almost every home studied, and is not funded as part of retrofit measures
- Increased risks of condensation, mould, House Dust Mites, VOCs and other known air quality hazards increased likelihood of asthma, COPD and other health problems
- Moisture issues lead to building fabric problems
- Lobbying to get ventilation included in EESSH 2

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### Advice

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- Resolve 'cold floors' in solid floor, 'No-fines' concrete tenement
- Expensive to decant tenants
- Opportunity to work on a void...





heat loss. TOTAL GROUND FLOOR HEAT LOSS

# Guidance / Consultancy



- 'U' value or reality?
- 18 problems
- Related to energy, comfort and health, and building fabric
- See 'Sustainable Renovation Guide'





# Better Retrofit...



#### A New Approach / A New Professionalism

#### **Balance:**

Balancing energy efficiency with health issues and building fabric and conservation issues

#### **Reality:**

Greater interest in moisture, quality control / workmanship and working 'beyond' SAP / EPC / EESSH

#### People:

Engaging and upskilling people, education, better design of services and controls, better commissioning and handover

#### Heritage:

Learning from conservation skillset: different materials and construction types, importance of maintenance, 'significance' and good surveys





# Additional Concerns



- EESSH 2032 (B 81)
- Climate Change / resilience
  - Overheating
  - Flooding
  - Storm Damage
  - Maintenance
- Resource Consumption (3 planets)
- Health & Pollution
- Biodiversity Loss

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# Why Whole House Retrofit?



#### **Business-as-usual**

- Piecemeal, does not save energy effectively
- Cannot easily meet EESSH 2
- Cannot deliver EE at scale required
- Can create / exacerbate other problems
- ... comfort issues
- ... health issues
- ... building fabric issues
- Does not address site quality
- ... heritage issues
- ... people skills / understanding
- ... compliance issues

#### Whole House Retrofit

- Effectively saves energy as predicted
- Will meet EESSH 2 (zero fuel poverty)
- Can deliver EE at scale needed
- Addresses other problems
- ... comfort, health & building fabric
- ... site quality and compliance
- ... heritage and placemaking issues
- ... climate change resilience
- ... regeneration, community, biodiversity
- ... people skills and understanding

... is commensurate with realistic sustainability



# Why Whole House Retrofit?



#### **Business-as-usual**

- Costs less in short term
- Costs less in the EE "pot"

#### Whole House Retrofit

- Costs less in the long term
- Costs less across all "pots"





# Why Whole House Retrofit?



#### **Business-as-usual - COSTS**

- £0.4k £25k (EESSH 1, EESSH 2 will be x3)
- Hard to Justify



#### Whole House Retrofit - COSTS

- £5k £50k for EnerPHit WHR
- More than one budget?
  - Energy efficiency / fuel poverty
  - Health / NHS
  - Maintenance / Climate Change
  - Community Health / Resilience
  - Heritage
- Perspective bathroom / kitchen / windows / refurbishment?
- Phasing (External / internal opportunistic)
- Economies of Scale





#### **Owners' Group, Glasgow**

- Straight 'conservation'
- Private money, HS loans, mainly maintenance (roof and stonework), some energy efficiency







#### **Owners' Group + Stirling City Heritage Trust, Stirling**

- Straight 'conservation' (75% funding)
- Minimal energy efficiency







#### Social Housing, Glasgow

- Tight budgets, but broader commitment including both energy efficiency and maintenance
- SG funding and own monies







#### **Canongate Housing, Edinburgh**

- Owners' Group + Edinburgh World Heritage
- EE + Heritage Funding (B Listed) + private contribution







#### **Cavity Walled Housing, Paisley**

- Council-owned
- Innovative detailing to create high perforce energy efficiency with zero moisture risk
- Hygrothermal modelling







#### **Social Housing, Paisley**

- Part of Wider Strategy
- EnerPHit standard











#### **Tenement EnerPHit, Glasgow**

- SFC funded for extensive monitoring and evaluation
- 8 flats, partnership with Contractor
- Supported by GCC, with COP26 in mind





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#### **Social Housing, Paisley**

- 75 homes to EnerPHit standard
- BEIS funder (£1.3m) to demonstrate mainstreaming and cost efficiencies















#### **Social Housing, Paisley**

- Client Requirement: PAS 2035 compliant
- Engaged as "Retrofit Designers" + "Retrofit Co-ordinators"

bsi.

• Careful evaluation and risk assessment



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#### **Cross Walls, Paisley**

- Pilot Project first
- Options for different circumstances
- Offsite Manufacture











Proposed building fabric improvements Option 1/ End-terrace house



#### **New-build Passivhaus Housing**

- 35 completed/on-site, 200 in development
- Same issues











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#### Whole House Retrofit

- The only way we can realistically meet low / zero carbon targets
- Without causing or exacerbating a range of additional problems (ie costs)
- ... comfort, health & building fabric
- ... site quality and compliance
- … heritage and placemaking issues
- ... climate change resilience
- ... regeneration, biodiversity
- ... people skills and understanding
- PAS 2035 will help





# Thank you





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