

Housing, Fuel Poverty and Climate Change

Zero Tolerance for Fuel Poverty, Carbon Emissions and Sick Homes

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Powerpoint notes (to complement title page & visual images) Colin Porteous, 20/07/09

1: TITLE PAGE

Key word links:

No need to explain link between Housing and Fuel Poverty - we don't tend to talk about Fuel Poverty in relation to the non-domestic sector.

Housing and Climate Change - link quantified by UK Government - housing responsible for 30% CO₂ in 1992 and 27% in 2007. Planned reduction in Scotland of 42% by 2020 would bring housing down to 15.7% CO₂ emissions - i.e. we will need to accelerate the rate of reduction over the last 15 years by a factor of over five if we are to meet this new 2020 target.

Fuel Poverty and Climate Change - more complex, depending on what fuels are used in 'before' and 'after' situations, but more energy efficiency, albeit raising the number of kWh units that are affordable in the pursuit of comfort, coupled with more use of renewable fuel tackles both issues.

Presentation title: The Big Picture: Issues & Challenges Especially for Housing Associations.

Background as an architect relating to problems, solutions and complexity: recalling first experience of condensation and black mould only days after landlord replaced old window in kitchen in mid 1960s; and irony of first condensation-dampness investigation (late 1970s) as it was not connected to fuel poverty ... rural hydro cottages with free electric under-floor heating, cavity insulation (U-value = 0.33 W/m²K) ... mould caused by migration of moist air to stagnant pockets next to cool surfaces. 1974 conference presentation on climate-sensitive by Prof. Tom Markus ('father of fuel poverty') was influential. Several investigations from late 1970s onwards found that evaporation from flooded solums below floors a significant factor for condensation and mould, although often related to poor heating systems, high tariffs, demographics, intensity of occupancy and low income. Adequate ventilation and warmth is critical in terms of solutions.

Unintended consequences of altruistic reform: Clean Air acts of 1956 and 1968 lead to shift from solid fuel to electricity (mainly portable appliances); coupled with electricity price hike in late 1960s to early 1970s (Middle East wars), gas and electricity from 1979 into early 1980s (Iranian revolution) and unemployment hike in 1980s (Thatcher) led to poor air inside homes - more airtight, draught phobia and black mould smells bad (see Cathy McCormack's autobiography, *The Wee Yellow Butterfly*).

Passive solar techniques as part of the solution to the fuel poverty problem: research from early 1980s followed by role with community technical aid ... Project Leader Technical Services Agency (TSA) at much same time as Energy Action Scotland (EAS) and Heatwise set up in mid 1980s; followed by Right to Warmth (RTW) forums initiated by Prof. Tom Markus, using EAS and TSA as enablers -. RTW's Technical Forum published *Condensation Culture* (Colin Porteous & Tom Markus) 1991 and 1995, where 'culture' alluded to Cathy McCormack's reference to mould at time of Glasgow's 1990 Year of Culture; and ConDamp Database (relevant references for legal cases) in 1993 and 1995. Legal Services Agency (LSA) set up 1988-90 along same lines as TSA under direction of Paul Brown - initiator of this conference. Full-time research from 1981-84 and analytical involvement with first passive solar new-build council housing in Stornoway indicated knowledge transfer route to issue of tackling fuel poverty by means of retrofit - see later slides of Easthall Solar Demonstration Project. Early 1990s.

Last decade - Housing Associations which have championed solar technology - 2-9:

2: Housing in Coldstream, Berwickshire HA, circa 1999 - sunspace buffers (ventilation preheat) and mechanical ventilation with heat recovery (MVHR)

3: 1st demonstration house at Ayton, Berwickshire HA, 2002 - direct solar gain, sun-porch buffer (ventilation preheat), MVHR, SolarTwin thermal collector inside sun-porch, PV on roof.

4: 2nd demonstration house at Ayton, Berwickshire HA, 2008-09 - direct solar gain, MVHR, evacuated tube solar thermal collector on garage, PV on house roof, Proven wind turbine, electrolyser, hydrogen store, PEM fuel cell (members of SSEG see SunTimes 28)

5: Gigha new-build housing by Fyne Homes HA (CP Architects), visit 2008 - direct solar gain (living rooms with large patio doors face sun rather than access road); solar thermal collectors and renewable electricity (owned by community trust, with profit ploughed into island's development although electric bills paid in normal way to supplier by individual tenants).

6: Panmure St. new-build housing by Queens Cross HA (Development Officer Andy Woodburn and architects Campbell & Morris), 2004-05 - direct solar gain and PV arrays (members of SSEG see SunTimes 28).

7: Lumphinans retrofit housing by Fife Special HA (architect John Gilbert), 2001 - sunspace buffers from former open balconies (ventilation preheat) and water-source communal heat pumps (water in old coal mine below site).

8: Methil new-build housing by Kingdom HA (architects Fife Council), 1999 - sunspace buffers, flat-plate solar thermal collectors (by AES, Forres, and installed by Solar Energy Systems).

9: Shettlestone new-build housing by Shettlestone HA (architect John Gilbert), 1999 - direct gain and sunspace buffers, including entrance close and water-source communal heat pumps (water in old coal mine below site).

Despite CARES (Communities and Renewable Energy Scheme), formerly SCHRI (Scottish Community and Householder Renewables Initiative), HAs find renewable energy (RE) implementation daunting; and current HA context is greater efficiency expected by Scottish Government for less money!

HAs find meeting statutory standards hard enough, without aiming for zero CO₂, where barriers are more financial/political than technical, and definitions vary - refers to regulated energy for space heating water heating and lighting in Scotland (cf. HMRC which includes all power use).

Scottish Housing Quality Standard (SHQS) first hurdle for HAs re upgrading existing stock.

Technical Standards 2007 (TS07) benchmark for Sullivan Report's stepped reductions of carbon emissions (regulated energy only) - 'low carbon' = 30% reduction by 2010; 'very low carbon' = 60% reduction by 2013; 'net zero carbon' = 100% reduction by 2016-17 if practical; and 'total life zero carbon' by 2030 includes embodied energy and disposal, but refers to the building as responsible, which still implies excluding power use for appliances by users.

Planning's SPP6 in Scotland and Glasgow's ENV15 further confuse HAs. - do Sullivan's higher carbon reductions overtake or satisfy this 15% renewable target?

EcoHomes (BREEAM) assessment method - HAs aim for 'very good' (corresponding with English Code 3) or 'excellent' (corresponding with English Code 5); but weightings make this a controversial tick-box technique.

BRE is backing EU 'PassivHaus' via PEP (Promotion of European PassivHaus), but this is voluntary and HAs are not yet opting in - has benefit of hard-edged energy targets, unlike TS07 and Sullivan, where carbon targets not readily translated to energy consumption.

Wider sustainability concepts - eco-footprint and carbon footprint - 10-13:

10: BedZED (Beddington Zero Energy Development by architect Bill Dunster), 2002, one of the very few such urban projects in the UK - transport and food included as part of concept; wood-chip CHP (not currently operational); some building-integrated PV or BIPV; no central heating needed; passive stack ventilation with heat recovery; large amount of thermal capacity; sunspace buffers (overheating an issue). (see SunTimes 26 on SSEG website under resources)

11: Hockerton Housing Project, near Newark, Nottinghamshire, 1998 (designed 1994 by architects Brenda and Robert Vale) also one of the very few such projects in the UK this time intended as a rural paradigm - again transport and food included as part of concept; all electric with wind turbines and PV meeting all need over year (grid connected); no central heating needed; MVHR; large amount of thermal capacity; sunspace buffers (overheating a very occasional issue) are air-source for heat pumps to heat hot water, with electric immersion back-up now main source due to breakdowns. (see SunTimes 26 on SSEG website under resources; and Solar Architecture in Cool Climates by Colin Porteous with Kerr MacGregor, Earthscan, 2005)

12-13: 'Wohnen & Arbeiten' (Living & Working) PassivHaus project, Vauban area of Freiburg, 1999, (by Michael Gies of Id Architektur) - BIPV and solar thermal array as canopy, augmented now by district bio-fuel CHP system; MVHR; virtually no CH; efficient public transport (tram). (Solar Architecture in Cool Climates by Colin Porteous with Kerr MacGregor, Earthscan, 2005)

Scottish equivalent possible, with enough finance, but what about retrofit? 14-19:

14-17: Easthall Solar Demonstration Project, monitored 1993-95 - space heating loads averaged more than five times PassivHaus standard of 15 kWh/m², but U-values higher (e.g. walls 0.25 cf. 0.1 W/m²K; windows 3.0 cf. 0.7-0.8 W/m²K) and no heat recovery (other than passive via sunspaces); solar air collector used to preheat water ... conclusion: Easthall model capable of upgrading to PassivHaus level, and further work indicates potential for window-integrated solar air collectors to reduce ventilation loads - alternative to, or in addition to, MVHR.

18-19: Caledonia Road tower block retrofit by Assist Architects (1994 and 2003) - includes glazing in former open balconies and economic district heating (charged with rent).

Footnote on air quality and well-being, including mood - 20-21:

20: Out of 12 case studies by Dr Janice Fung, only one, Caledonia Rd, had air quality as indicated from internal CO₂ levels within recommended limits! This appears to relate to the presence of sunspaces and their 'ventilation preheat' contribution.

21: Five case studies by Dr Janice Fung show a correlation between living room windows expressed as a percentage of floor area (up to circa 25-30%) and positive mood. The Mackintosh Environmental Architecture Research Unit (MEARU) propose to extend this field of research.

CONCLUSIONS:

Comfort in the fullest sense means letting some sunshine into our lives.

That same sunshine can help to mitigate global warming, as well as fuel poverty - with some help from indirect solar energy like wind..

Complexities with regard to efficient and effective control of heating and ventilation are still poorly understood - MVHR is not a panacea; air tightness is not a panacea; insulation is not a panacea; and neither is central heating.

Housing should be designed with idiosyncratic occupants in mind - fears and fads will vary.

If this is acknowledged by architects and engineers, unexpected consequences will be fewer.

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