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Energy-efficient retrofit of social housing in the UK: Lessons learned from a Community Energy Saving Programme (CESP) in Nottingham

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ABSTRACT

One of the long-term challenges outlined within the UK Government's Energy White Paper (2011) is to cut both greenhouse gas (GHG) emissions and energy bills by improving household energy efficiency. As such, several energy-related initiatives have, in recent years, been promoted including the Community Energy Saving Programme. In this study, we explore how patterns of user consumption as influenced by occupant awareness and behaviour, can both positively and negatively influence policy initiative delivery. In so doing, we present the results from an extensive pre- and post-retrofit home energy use and performance survey of 150 properties located in Nottingham's Aspley ward, home of one of England's pilot CESP schemes. Our results show that whilst this specific initiative significantly improved home conditions and reduced energy consumption, it failed to achieve the predicted £300 annual savings on household energy bills. This was found to be largely attributed to occupants' ingrained habits towards household energy use, higher comfort level preferences, (lack of) energy consumption awareness, and insufficient information provided to help residents better manage their home energy use following the retrofit. By exploring some of the core lessons learned from the survey, this research seeks to inform and improve the uptake and delivery of future retrofit initiatives.

1. Introduction

Improving UK household energy efficiency is currently seen as a key vehicle through which both energy demand can be reduced and greenhouse gas (GHG) emissions curtailed [1,2]. However, energy policies that seek to decarbonise both new-build and existing domestic stock may not be solely sufficient for achieving carbon emissions reduction targets. This is exacerbated by a slowing in the construction of affordable new-build social housing [3], an uncertain national economy [4] and a volatile construction sector [5]. To this end, retrofitting or renovating existing domestic stock has been identified as a major priority by the UK Government where its vision is to upgrade seven million homes by 2020 [6], a view shared by many countries internationally [1]. As such, to help meet this target, numerous strategies and programmes have been introduced over the last two decades in the UK. Primary among these programmes was the Heat and Energy Saving Strategy (HESS), introduced in 2009, an umbrella programme aiming to save energy and decarbonise heating that incorporated several initiatives such as the Carbon Emissions Reduction Target (CERT), Community Energy Saving Programme (CESP) and Feed in Tariffs (FiTs). In tandem, increasingly stringent energy and carbon-related compliance standards and associated calculation methodologies for domestic energy consumption have been invoked; these are enshrined within the Building Regulations and their associated Approved Documents (England and Wales) [7], Building Standards Technical Handbook (Scotland) [8] and Building Regulations Technical Booklets (Northern Ireland) [9]. Whilst several policy instruments have achieved partial success in reducing domestic energy consumption, they have not fully acknowledged the behavioural, economic and technical elements that are purportedly needed to increase the effectiveness of any policy scheme [10–12]. Given that policy formulation and decision making with respect to environmental issues tends to be complicated [11,13,14], where physical, psychological, economic, ethical and political dimensions need to be considered, substantial research needs to be undertaken in this area in order to maximise the efficacy of any policy initiative implemented.

The study presented here sought to assess the effectiveness of one of the UK's pilot CESP initiatives delivered in the City of Nottingham's Aspley ward between 2009 and 2012, known as the As-

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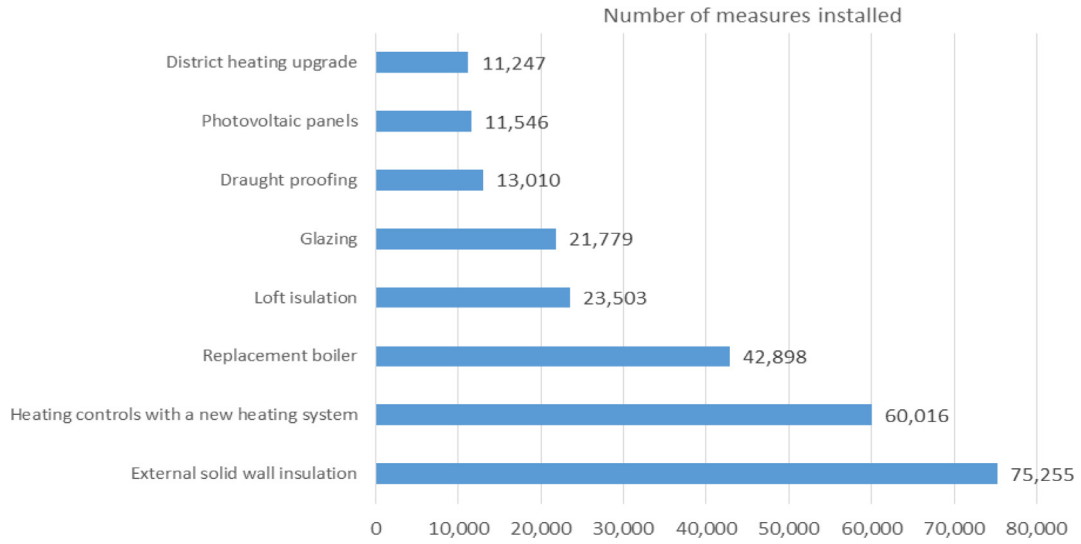

Fig. 1. Number of measures installed in all CESP schemes [25].

pley Super Warm Zone (ASWZ) scheme.[1] In so doing, quantitative and qualitative data were obtained, combined and analysed to explore the associations between domestic energy-related improvements, subsequent building energy performance, and occupants' energy consumption behaviour. Designed and executed in two survey phases, the first phase sought to understand residents' attitudes and behaviour and how these related to home energy use and performance prior to extensive energy-related upgrades to their dwellings. The outcomes of this phase can be found in Elsharkawy and Rutherford [15]. The second survey phase examined the possible impacts of the energy upgrade on home performance, energy use and occupants' energy consumption behaviour and how this was manifested by changes to users' energy consumption behaviour as influenced by their level of environmental awareness or information received, during and after the works were completed. The focus of this paper is to present a comparative analysis between the 'before-and-after' survey phases, ultimately concluding with lessons learned from this scheme that may support effective uptake and delivery of future retrofit schemes.

2. Research background

2.1. Retrofit initiatives in the UK domestic sector

Most countries in Europe are facing the challenge of improving the energy efficiency of existing building stock [17]. Catalysed by the 2003 European Directive on Energy Performance of Buildings (EPBD), many ambitious energy policies have been initiated in the UK by various political parties over subsequent years. Driven by three core objectives –namely to mitigate climate change, ensure energy security and eliminate fuel poverty[2] [18] – energy policy as it is enacted by improving household energy efficiency can help meet these objectives. That is, not only can it reduce greenhouse gas (GHG) emissions and increase energy security by reducing energy demand, promoting the diversification of energy sources and utilising them more appropriately; it also has the potential to reduce overall energy bills and, by proxy, address the increasing number of households who struggle with fuel poverty [20–22].

The CESP scheme, one of the HESS programme schemes, and the focus of this research, entailed the installation of a package of energy-saving measures to 'hard-to-heat' homes in low-income areas using an area-based approach [23]. Improving on its predecessor CERT scheme, it promoted more challenging, difficult-to-install and innovative measures in existing homes [24]. Six core energy-related measures were applied to homes meeting the eligibility criteria. These included solid wall insulation (SWI), loft insulation, the replacement of G-rated (<70% efficient) central heating boilers, installation of heating controls, draught proofing and double glazing. To facilitate scheme uptake and implementation, these were delivered through partnerships between local authorities, energy companies, housing associations, and community groups which had proven engagement with their communities. The programme was set out by the then Department of Energy and Climate Change (DECC) now Department of Business, Energy and Industrial Strategy (DBEIS), with the Office of Gas and Electricity Markets (OFGEM) responsible for its administration and progress reporting [24,25].

A total of 293,922 measures were installed to 154,364 dwellings by the end of the CESP scheme in 2013 (Fig. 1), with an average of two measures installed per property across 11 regions in Great Britain [25]. An in-depth analysis of the scheme showed that the greatest carbon savings arose from insulation measures including external wall insulation, loft insulation, glazing, internal wall insulation, cavity wall insulation, flat roof insulation and draught proofing (59.5%). Heating measures including heating controls with a new heating system, replacement boiler, and fuel switching accounted for a further 36.7% of savings [25]. With a projected target reduction of 19.25 Mt CO_2 by the end of the CESP programme (31 December 2012), the scheme achieved 84.7% of this overall target; a shortfall of 2.94 Mt CO_2 [25]. Nevertheless, there have been wider benefits acknowledged from the CESP scheme particularly where the aesthetic improvements to homes resulted in community pride and direct local economic benefits [24]. This included improved levels of local employment and training, the use of local trades and other businesses, and indirect benefits to local shops

[1] Located in Nottingham's Aspley Estate, the ASWZ was a £2.8 million pilot CESP project funded by Scottish and Southern Electric and Nottingham City Council implemented 2009–2012. Targeting around 1500 social and private tenancy homes in three lower super-output areas (LSOAs), the social housing phase renovated homes with internal wall insulation, modern kitchens and bathrooms and replaced G-rated boilers fitted in accordance with the Decent Homes Standard [15,16].

[2] Households are defined as being in fuel poverty if they spend 10% or more of their income on fuel bills to maintain the recommended minimum temperatures of 21 °C in the living room and 18 °C in all other occupied rooms. Fuel poverty is driven by three key factors: energy efficiency of the home; energy costs; and household income [19].