REF2021

Institution: Ulster University

Unit of Assessment: Geography and Environmental Studies (14)

Title of case study: Warmer, healthier homes: tackling fuel poverty with a geographic approach to energy efficiency measures

Period when the underpinning research was undertaken: 2011-2020

Details of staff conducting the underpinning research from the submitting unit:

Name(s):	**Role(s) (e.g. job title):**	**Period(s) employed by submitting HEI:**
Dr Paul McKenzie	Senior Lecturer in Geography	2006–present

Period when the claimed impact occurred: 2014–20

Is this case study continued from a case study submitted in 2014? N

1. Summary of the impact

At Ulster University (UU) Dr McKenzie developed an area-based model to identify fuel-poor households that has changed policy on reducing fuel poverty in Northern Ireland (NI) and improved the provision of assistance to people in need. McKenzie improved the approach of finding fuel poor homes by devising an algorithm that uses Geographic Information System (GIS) technology to increase the precision with which homes suffering from fuel poverty can be targeted for support. This model is now the main tool used by government to direct energy efficiency interventions at fuel-poor homes, and its use has led to better local council service delivery on energy.

Between 2014 and 2017, government used the model to allocate spending of over GBP66,000,000 on making approximately 16,000 fuel-poor households (42,000 individuals) across NI more energy efficient. Significant impacts, equivalent to gains worth over approximately GBP93,370,000, have been made on health and wellbeing. Related reductions in NHS costs were GBP4,090,000. Each participating household stands to save approximately 118,000kWh of energy, 25,100kg of CO_2 and GBP4,000 in fuel costs over the lifetime of the energy efficiency measures installed. McKenzie's research also formed the evidence base for the allocation of a further GBP84,000,000 in government funding for fuel poverty interventions throughout NI between 2017 and 2022.

2. Underpinning research

McKenzie's research has focussed on investigating the factors that make the problem of fuel poverty disproportionately severe in NI, and designing novel methods of identifying those most at risk. First, approximately 70% of homes in the region are not connected to the gas network, leading to over-reliance on home heating oil **[R1]** and making households vulnerable to energy price fluctuations, for example between 2006 and 2018 when oil prices in NI increased by 80% **[R1**; **R4**; **C2]**. Second, as reported by the Consumer Council, the particularly acute effect of the 2010 recession in NI led to decreases in household income which increased rates of fuel poverty. Thirdly, NI has low temperatures throughout the year, which leads to near continuous demand for indoor heating.

In 2011 UU identified significant differences between the places across the UK that were affected by fuel poverty, finding the highest rates in NI **[R2]**. This research concluded that the definition of fuel poverty should be reviewed, because previous definitions had not identified significant numbers of people who were fuel poor, while many others who did not need assistance received it anyway. The research estimated that approximately 156,000 households in high need areas received very low levels of government support **[R3; C7]**. Based on this

research, in 2012 the Department for Social Development (DSDNI) commissioned UU to evaluate the efficacy of government fuel poverty policies [**C6**; **C7**]. This study found that government interventions had been poorly targeted and tended to focus on small energy efficiency measures (costing less than GBP600), with minimal benefits for those living in extreme fuel poverty [**R3**].

Creating an area-based model of fuel poverty
Driven by the need to identify fuel-poor homes accurately and efficiently, in 2012 DSDNI further commissioned UU to produce a model that calculated the risk of fuel poverty in defined areas. McKenzie developed an innovative spatial algorithm within a GIS to combine data and information from different sources [**R1**; **R3**–**R6**; **C4**; **C6**; **C7**]. McKenzie based the high-resolution model on small census zones and used it to give those zones a fuel poverty risk score based on variables including tenure, household income, property age and type, temperature, and type of fuel source [**R4**]. Funded by the Office of the First Minister and Deputy First Minister (OFMDFM) and DSDNI in 2013, UU partnered with 18 NI councils to test the effectiveness of this area-based approach. This project identified that the model was more than 90% accurate and could effectively target the most vulnerable fuel-poor households across the entire region [**R5**; **I2**; **C2**; **C4**; **C7**]. The direct result of this work was change in government policy and the way in which all councils target and assist fuel-poor households [**I1**; **I2**; **C3**–**C4**; **C6**–**C7**].

3. References to the research Outputs can be provided by Ulster University on request.

The following outputs, except for R6 which is a government report, have been subject to blind peer review by internationally based editorial boards:

R1	Walker, R, McKenzie, P, Liddell, C & Morris, C (2015) Spatial analysis of residential fuel prices: Local variations in the price of heating oil in Northern Ireland. *Applied Geography*, 63, pp. 369-379. https://doi.org/10.1016/j.apgeog.2015.07.016.
R2	Liddell, C, Morris, C, McKenzie, P & Rae, G (2012) Measuring and monitoring fuel poverty in the UK: National and regional perspectives. *Energy Policy*, 49, pp. 27-32. https://doi.org/10.1016/j.enpol.2012.02.029.
R3	Walker, R, Liddell, C, McKenzie, P & Morris, C (2013) Evaluating fuel poverty policy in Northern Ireland using a geographic approach. *Energy Policy*, 63, pp. 765-774. https://doi.org/10.1016/j.enpol.2013.08.047.
R4	Walker, R, McKenzie, P, Liddell, C & Morris, C (2012) Area-based targeting of fuel poverty in Northern Ireland: An evidenced-based approach. *Applied Geography*, 34, pp. 639-649. https://doi.org/10.1016/j.apgeog.2012.04.002.
R5	Walker, R, McKenzie, P, Liddell, C & Morris, C (2014) Estimating fuel poverty at household level: An integrated approach. *Energy & Buildings*, 80, pp. 469-479. https://doi.org/10.1016/j.enbuild.2014.06.004.
R6	McKenzie, P, Liddell, C & Morris, C (2018) The Affordable Warmth Scheme: Development of the 2018 targeting algorithm and associated technical reports. Department for Communities Northern Ireland. 78 pp. [Research report].

4. Details of the impact

Research from UU [**R1**–**6**] has been instrumental in improving the lives of people in fuel-poor households in NI. The research directly influenced the NI government's fuel poverty policy, practice and approach to targeting for energy efficiency measures those at greatest risk of fuel poverty.

I1 – Influence on Northern Ireland government policy
In 2011, the NI government introduced a fuel poverty strategy that recognised the potential impact of area-based targeting to reduce fuel poverty rates across NI. The strategy confirmed that fuel poverty rates were particularly high and that many people at greatest risk of fuel poverty were not receiving necessary assistance. The fuel poverty strategy adopted UU research findings, endorsing in particular the potential of area-based targeting to identify fuel-poor homes [**R2**–**R4**; **C6**; **C7**].

In 2014, the Department for Communities in NI (DFCNI) overhauled its fuel poverty strategy on the basis of McKenzie's innovative GIS model, and initiated a new strategic intervention plan to reduce fuel poverty – the Affordable Warmth Scheme (AWS) [**R1**–**R6**; **C6**–**C7**]. In line with the AWS, between 2014 and 2017 the Northern Ireland Housing Executive and all councils in NI used McKenzie's model to focus investment in energy efficiency measures on those in greatest need [**C3**; **C4**; **C7**]. The UU model enabled targeted spending of approximately GBP66,000,000 on measures for 15,815 fuel-poor households across NI [**C8**], helping approximately 42,000 people [**I3**; **I4**; **C1**; **C2**].

Owing to the effectiveness of this approach, in 2017 DFCNI commissioned McKenzie to update the area model. Between 2017 and 2018 McKenzie further refined and enhanced the model's capacity to target households accurately, creating new address lists for the next wave of energy efficiency measures. In response the government allocated a further GBP84,000,000 of funding for fuel poverty work throughout NI [**R6**; **C6**; **C8**]. The money is being spent on installing measures such as insulation and new boilers and windows in fuel-poor homes [**C4**; **C5**].

I2 – Enhanced practice and service delivery in all Northern Ireland Councils
UU's research has directly led to improvements in the way local authorities identify and help those households in fuel poverty across all councils in NI [**C3**; **C4**; **C7**].

Before UU's area-based targeting approach was developed and rolled out in 2014, each council relied on a self-referral system for provision of fuel poverty support. Verification of claims was labour intensive [**R3**; **C7**] and UU research discovered a lack of substantial investment in areas of greatest need, potentially affecting approximately 156,000 households [**R3**]. Hidden need was a particular problem in rural areas. As the ex-Minister for Social Development (2014-2016) said:

"Providing empirical evidence of the prevalence of fuel poverty in rural areas empowered vulnerable rural homeowners to admit to financial difficulties in heating their homes and avail of targeted government funding through the Affordable Warmth Scheme" [**C7**]

Using UU's area-based targeting approach has allowed councils to increase the accuracy of their assessments and the efficiency of their system for access to fuel poverty relief [**R5**; **C3**; **C4**; **C6**; **C7**]. Crucially, since 2014 the UU model has provided each council with specific addresses to contact in areas at risk of fuel poverty, streamlining the process of determining eligibility for assistance [**C4**; **C5**]. By facilitating this advancement in local authority practice, UU's research [**R1–6**] has enabled resources for fuel poverty interventions to be allotted with greater precision and rapidity, ultimately enhancing councils' ability to identify those in need and – measurably – to improve the lives and life chances of some of NI's most vulnerable people [**C3**–**C5**].

I3 – Changes in household energy efficiency
In 2019 the Energy Saving Trust carried out an independent review of the AWS [**C1**]. The review found that the scheme was associated with substantive improvements in household energy efficiency and heating costs across NI.

Having been identified for support by UU's model [**R4**; **R6**], each household in the AWS stands to make cost and energy savings over the lifetime of the measures installed, on average amounting to:

"118,000 kWh of energy, £4,000 of fuel costs and 25,100 kg of CO_2 throughout the lifetime of the energy efficiency measures installed, and also around a 24-point increase in the SAP rating" [i.e. by the Standard Assessment Procedure used by the UK government to assess and compare the energy and environmental performance of dwellings, there was a marked increase in energy efficiency, enabling residents to maintain comfortable living conditions at lower cost] [**C1**, p.4].

I4 – Improvement in health and wellbeing across Northern Ireland

In 2018, in response to a commission from the DFCNI, McKenzie and colleagues from Sheffield Hallam University conducted a health impact assessment of the AWS [**C2**]. The assessment modelled the health benefits of energy efficiency measures installed in homes, such as reduced cardiorespiratory problems, fewer falls in the home, improved mental health and increase in number of working days.

The research estimated that damp and mould were reduced in at least 876 homes, with residents feeling warmer and more comfortable as a result. Gains in wellbeing from the AWS were estimated to equate to at least GBP93,370,000, while NHS costs were reduced by at least GBP4,090,000. The value of improved mental health conditions reflected in increased numbers of working days was estimated to be GBP4,950,000. The cost-benefit ratio was conservatively estimated to be 1.59, which was a significant improvement on previous estimates of 0.42.

Independent research carried out for DFCNI in 2019 on the impact of AWS on household health also found reductions in damp, condensation and mould, greater control over more efficient heating, and less financial anxiety over household energy costs:

"The heating is on far less … it is absolutely brilliant. There are no gaps in windows, the house is perfect now. There is no need to be touching the heating as much, no altering settings. There is a vast difference, I don't have to worry about windows or heating anymore." [**C8**]

5. Sources to corroborate the impact

C1	Energy Saving Trust (2019) Northern Ireland Energy Efficiency Schemes Evaluation: Boiler Replacement Scheme and Affordable Warmth Scheme. Final Report. 80 pp.
C2	McKenzie, P, Green, G, Gilbertson, J, Stafford, B & Cook, S. (2018) A Health Impact Analysis of the Affordable Warmth Programme: 2014–18. Department for Communities Northern Ireland [Research report]
C3	Head of Health & Built Environment – Causeway Coast and Glens Borough Council – Testimonial
C4	Community Health & Wellbeing Advisor – Mid and East Antrim Borough Council – Testimonial
C5	Mid and East Antrim Borough Council – Community Health & Wellbeing – Video Testimonial from Affordable Warmth Scheme (AWS)
C6	Senior Civil Servant with Department for Communities (DfC) – Author of the Northern Ireland Fuel Poverty Strategy (2011 and 2014) - Testimonial
C7	Member of Legislative Assembly (MLA) – Minister for Department for Social Development (2014–16) responsible for approving Affordable Warmth Scheme (AWS) – Testimonial
C8	Senior Civil Servant Department for Communities – Health Impacts from Affordable Warmth Scheme – Testimonial