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Private household investment in home energy retrofit: reviewing the evidence and designing effective public policy

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Executive summary

What this report is about:

Improving the energy efficiency of Scotland's buildings is an urgent policy concern, and a central element of the Scottish Government's Climate Change Plan and Energy Strategy. Given the long-lived nature of the building stock, the vast majority of the buildings that will exist in 2050 have already been built – placing emphasis on efficiently retrofitting existing buildings, through measures such as improved insulation, more energy efficient glazing, more efficient boilers and more efficient lighting and appliances.

Around half of energy use and carbon emissions from UK buildings are associated with our domestic buildings, mostly to provide space heating. Domestic energy efficiency policies have tended to focus on lower income and more vulnerable households (including those in fuel poverty) and on the most cost-effective, 'low hanging' measures. As the ambition to decarbonise Scotland extends across the building stock, there is an expectation of significant improvements in the energy efficiency of domestic properties belonging to homeowners that are (at least partly) 'able to pay'.

There has been a substantial level of retrofit in Scotland in recent years, and this has helped to contribute to falling energy demand and carbon emissions. These recent changes relate to a building stock that was one of the oldest in Europe and that offered many relatively low cost and non-disruptive measures. Remaining retrofit options are becoming gradually less cost-effective and future retrofit is likely to involve higher costs for lower returns than has been experienced thus far.

The recently launched Energy Efficient Scotland route map sets out an ambition for a potential £10 billion investment in energy efficiency in buildings over its 20-year lifetime. Although precise levels of investment are uncertain, available public funding is likely to remain well below this figure. There is, therefore, a looming investment gap between the available public funds and the investment needed – a gap which could, in theory, be met by private households. Our review therefore considers the question: *"How can public policy more effectively encourage private, 'able to pay' households to invest in energy efficient retrofit?"*

The evidence base reviewed here is international, drawn primarily from published peer-reviewed academic literature but also some non-peer-reviewed, so-called 'grey' literature developed by consultancy groups, independent think tanks, government agencies and others. The review spans evidence from almost 100 documents, primarily from Europe and North America. Our approach has been informed by the systematic evidence review methods used by the UK Energy Research Centre (UKERC) for over a decade.

Our review considers both *policy effectiveness,* in terms of the overall amount of energy and carbon savings achieved; and *policy efficiency*, in terms of maximising the ratio of private-to-public spending (or 'leverage') and the number of measures that otherwise would not have otherwise happened (or 'additionality'). In terms of specific policies, the review covers measures that directly cover upfront costs, such as grants or loans, as well as indirect measures such as information dissemination, regulations, etc. Although direct incentives and information-based measures are routine parts of retrofit policy packages, limiting policy support to them will have only limited effects. The review therefore also covers supply-side aspects, such as how installers and advisors can support retrofit activity, and the overall retrofit policy package.

What the report is not about:

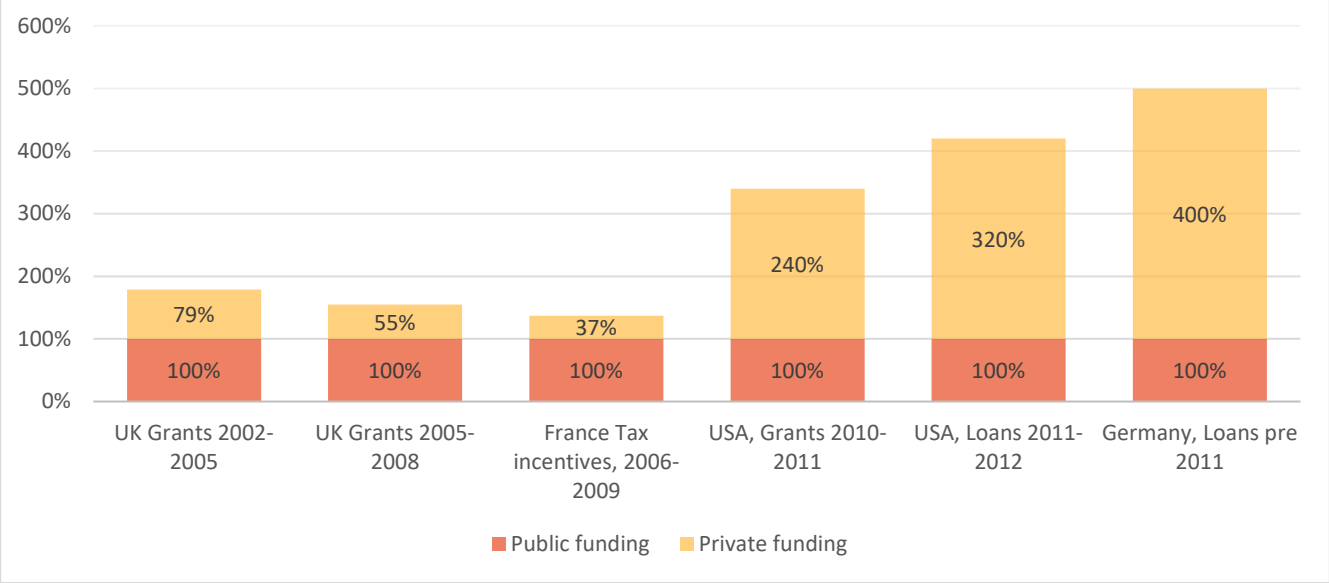
The review focusses on how public policy can be used to encourage homeowners to invest in improving the energy efficiency of their homes. Rather than the detailed impacts of specific retrofit measures, in terms of energy demand or carbon emission reductions, our concern is more on levels of investment in such measures by private homeowners, and how public policy can effectively encourage such spending. Our review is focused on owner-occupier section of the residential sector (with or without mortgages), around 60% of all Scottish households. Much of the findings will, however, have relevance to the other tenures of residential buildings, for example, the private rental sector.

Review Findings

Leverage Ratios

A wide range of retrofit leverage ratios are reported internationally. A number of programmes reviewed here saw leverage ratios of less than 1 (i.e. total private investment was smaller than total public funds). The highest example of leverage in this review was from the 'KfW' loan scheme in Germany, with an estimated leverage ratio of 4. Figure 1 presents leverage figures reported in our evidence review.

Figure 1: Leverage: public-to-private funding ratios

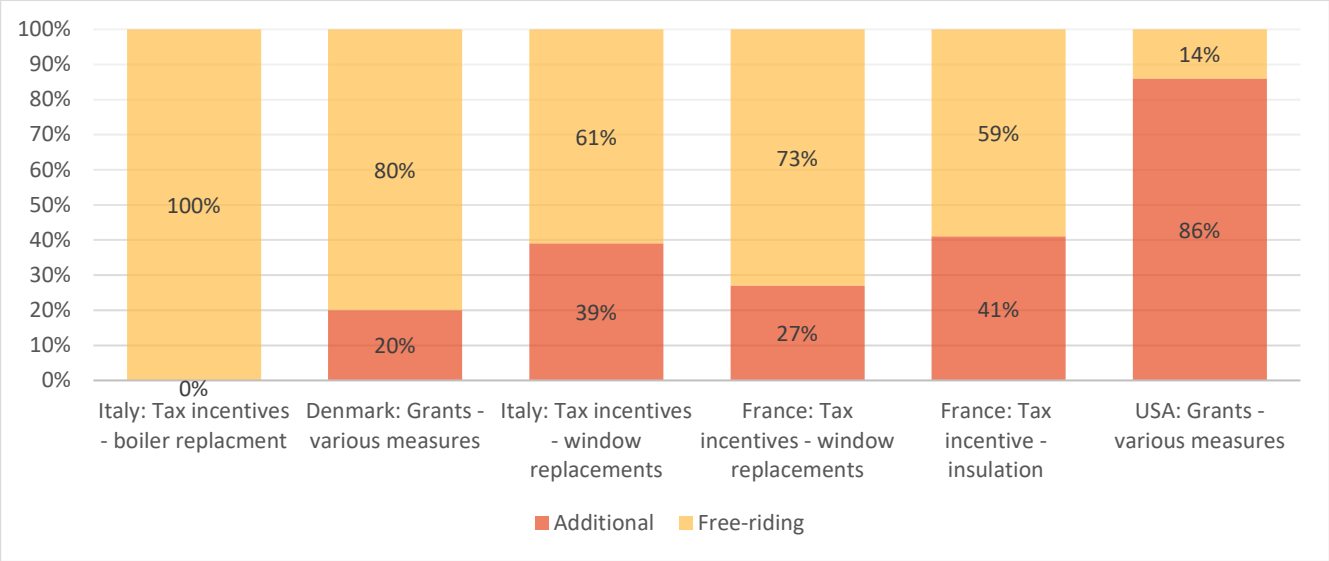


Additionality and free-riding

Additionality is the proportion of retrofit measures that received a subsidy that otherwise would not have been implemented. 'Free-riding' refers to measures that received a subsidy but which would have been carried out even without policy support. The total number of subsidised measures minus the number of free-riders gives the level of additionality: an important measure of retrofit policy efficiency.

Several studies have estimated the level of additionality in retrofit subsidy schemes (Figure 2 shows six estimates reported in the review). Additionality is difficult to estimate reliably, and is most commonly measured using self-reported, ex-post methods such as household surveys. These tend to downplay the importance of policy interventions, so underestimating additionality. Other evidence highlights the potential for positive 'spillover effects', in terms of indirectly encouraged retrofit investments.

Figure 2: Additionality and Free-riding



Reported levels of additionality and free-riding vary with the type of measure involved. Free-riding is typically higher when retrofit involves 'replacement' measures such as windows, doors, and heating systems, and lower for 'supplementary' measures that have no prior equivalent, such as new insulation. For measures that are typically replaced only when they malfunction, such as a boiler, free-riding can be as high as 100%. Policies should therefore reflect the specific measures involved. In some countries, 'replacement' measures – for example, for replacement boilers and windows – involve *minimum regulatory standards*. Focussing public funds on supplementary measures is likely to lead to lower free-riding and higher additionality, although this may limit overall policy impact. Households that are most ready to invest are associated with higher leverage ratios (as they require least added incentive), but are also likely to show lower additionality, as they are likely to invest anyway.

Financial incentives

Financial incentives to encourage retrofit can be broadly divided into those that don't require repayment (such as grants and tax incentives), and those that do (such as loans). Loans may involve a subsidy to reduce interest rates, but ultimately still involve repayment. Incentives that do not require repayment are the most common method of subsidising the direct cost of retrofit, and they tend to achieve higher uptake rates than loans; though loan programmes tend to achieve higher leverage ratios. Due to their relative attractiveness to households, grants and tax incentives are often considered an appropriate means of 'kick-starting' interest in retrofit, but as policies extend more widely, there may be a need for a transition to less popular loan mechanisms.

Readiness to retrofit and supply side aspects

Identifying 'ready to retrofit' households can be difficult; the only common factor that universally indicates a readiness to invest is a belief among homeowners that retrofit offers increased comfort and reduced bills. Demographic and other variables such as house type, age of occupants and income have inconsistent

influence across different studies. There are, however, some aspects which can be usefully identified. Trigger points – points in time when investment in retrofit is more likely – include moving house and other more general home renovations. At these points, the costs and disruption associated with retrofit can be minimised. The vast majority of retrofit takes place alongside general renovations, and households do not normally think of retrofit as distinct from non-energy home renovation. Policy support should therefore seek to incentivise retrofit through businesses of general repair, maintenance and home improvement.

A recurrent theme in the evidence is the need to develop proactive, integrated retrofit supply chains, alongside demand side aspects. Some of the least successful policy initiatives reviewed here focussed solely on demand-side incentives. A more balanced 'supply-push and demand-pull' approach, involving training for salespeople and installers, is important for overall policy effectiveness. Supply-side firms and intermediary advisors can be effective proponents of energy efficient retrofit, and offer the opportunity to integrate it alongside much more prevalent general home renovations.

Information aspects

It is frequently suggested that if households were more aware of the benefits of energy retrofit they would be more interested in investing in it. However, the international evidence reviewed here suggests that policy measures that seek to increase householders' awareness of energy use and retrofit options (such as energy performance certificates and personal energy assessments) have a very limited effect in encouraging retrofit in practice, and should be seen as a 'supportive' or supplementary form of policy. This is partly due to how retrofit is framed: a focus on household retrofit as solely or primarily an exercise in direct cost saving is repeatedly criticised for offering an overly narrow view of homeowners' decisionmaking. Wider framings, such as how information-based interventions can affect a property's sale or rental value, offer opportunities for more effective policy.

Policy packages

Policy stability and predictability are important for retrofit policy effectiveness, both for the development of householder demand for and the capacity of supply side actors to respond. Stability is particularly valued in terms of a policy programme's identity and branding – with little benefit from rebranding if the approach is largely unchanged. However, policy programmes need some flexibility, to respond to evidence of poor results or changing contexts. Finally, simplicity in application processes are also important, particularly to encourage households with low levels of pre-existing interest.

There are tensions between policy efforts to maximise overall effectiveness (the reach and impact on the total building stock) and efficiency (the additionality of public spending). No one policy measure can be considered in isolation: private household investment on energy retrofitting is embedded in particular behavioural, technical and cultural contexts, and these need to be taken into account in any effective and efficient policy approach. The effectiveness of retrofit policy is also sensitive to the specifics of building stock and the wider energy system, and also capacities within government to develop, deliver and review policy programmes: the 'institutional fit' of policies. Therefore, this review does not attempt to 'pick a policy winner'. Effective policy involves a stable yet flexible package which informs, incentivises and regulates household demand for retrofit, the businesses that supply it, and the intermediary bodies that support it.