***Funding UK Residential Energy Efficiency: The Economy-wide Impacts of ECO and its Alternatives***

 [Antonios Katris, Faculty of Humanities and Social Sciences, University of Strathclyde, +44 141 548 4227, antonios.katris@strath.ac.uk]

## Overview

In 2019, the UK Government has adopted more ambitious targets regarding its transition to net zero. One of the key instruments currently used, and will have a significant role in the transition, is energy efficiency. Energy efficiency policies have been used for a multitude of objectives including mitigation of greenhouse gas emissions and improvement of energy security but also seeking to address social problems such as fuel poverty. But retrofitting a property to enable improved energy efficiency can be costly, especially for those households that are in fuel poverty and already struggle to meet their physical and energy needs. Hence, energy efficiency projects are often supported either directly by the government, at different levels, or through indirect mechanisms.

In Great Britain, the main funding mechanism used is the Energy Company Obligation (ECO). ECO is delivered through the major electricity providers, which are obliged to support retrofitting projects that improve the energy efficiency of residential properties and through that to achieve goals related to reduction of carbon emissions and provision of affordable warmth among others. To achieve the goals assigned to them the energy companies have to find appropriate projects to support which introduces search costs to the ECO bill as well as significant administrative costs. In essence, ECO runs as a central energy efficiency provider, meaning that specific types of retrofitting activities have a fixed price, leaving room for large economic rent that further increases the cost of ECO. The cost of ECO is passed on the residential consumers, ultimately being socialised based on the size of the electricity bill. Alternatively, beneficiary households could be responsible to source the appropriate retrofitter. This way the need for specialist services to identify appropriate projects, and the associated search costs, would be eliminated as would be the economic rent as beneficiaries would, in principle, look for the best value for their money. Moreover, it is likely that administrative costs would be smaller than ECO, bringing the total cost down while directing more funds on actual efficiency improvements. The options to cover the cost in this alternative approach could range from zero or low-interest loans to full socialisation via taxation to raise funds for government issued grants.

In this paper we focus on the potential economy-wide impacts of ECO to the UK economy, as well as the potential impacts of alternative funding mechanisms. We build on previous analyses for energy efficiency programmes in Scotland (see Turner et al., 2018). We explore different scenarios for ECO, depending on the presence or not of economic rent. We also simulate two alternative funding mechanisms where the cost of energy efficiency improvements is covered via interest-free loans or it is fully socialised via the income tax. We also study the impact to the potential outcomes driven by how access to funding is distributed to different household income groups. Our central case assumes equal distribution across all household groups, while the alternative approach involves a tapered distribution where the lowest income households (HG1) receive access to 54% of the total funds and the available funding gets progressively smaller with the highest income households accessing only 2% of the total funds. We find that equal funding distribution enables the best GDP and employment results, while a tapered distribution delivers greater real income boost to HG1. This result comes at the expense of smaller GDP and employment gains. We also find that fully socialising the cost through the income tax, or providing interest-free loans has the potential for greater GDP, employment and real income gains compared to any version of ECO we examined. Fully socialising the cost of energy efficiency through an endogenous income tax can deliver the best results compared to any other funding approach. However, we identify the potential that lies with interest-free loans and full socialisation of the cost to deliver temporary negative GDP, employment and income results if for any reason the retrofitting activity that was paid for does not deliver any efficiency gains. This danger is not present with ECO, which delivers only benefits regardless of the presence of rent and in all timeframes.

## Methods

For this paper we use a recursive dynamic model of the UK economy, UKENVI, based on the model used by (Figus et al., 2017). The model is calibrated using a 2010 UK Social Accounting Matrix (SAM), which includes all the sectors of the UK economy aggregated into 30 sectors. For the purposes of this work we keep at the same level of aggregation as the UK input-output tables the energy sectors, as well as the sector that manufactures gas boilers. We also identify final domestic consumers, public (government) and private (households) with the latter being disaggregated into 5 quintiles based on their gross annual income. We assume a fixed labour supply and a fixed nominal wage. There are also some scenario specific assumptions. When we assume ECO as the funding mechanism, a temporary markup is introduced to the price paid by households for electricity to recover the cost of ECO. With interest-free loans as the funding mechanism we assume a 10-year repayment period starting on the year that each household retrofits its property, while the repayments preceed any other need. Finally, when the cost of energy efficiency is fully socialised we assume an endogenous income tax and the government pursuing a balanced budget. This way the income tax rate increases to cover the cost of retrofitting but also decreases as budget savings are realised due to energy savings-driven demand expansion. We also assume a 17.2% efficiency improvement per more efficiency household (figure is data driven) but since not all households in a quintile receive efficiency improvement we scale that figure to represent the average efficiency improvement per quintile.

## Results

When we consider ECO as the funding mechanism, with an equal distribution of access to funds, we find that a key factor that determines the magnitude of the potential impacts is the presence or not of economic rent. If we have a large economic rent we can see that the retrofitting alone, i.e. the enabling stage, can deliver a temporary maximum GDP expansion of 0.02% compared to what it would otherwise be, while supporting just under 6,500 full-time equivalent (FTE) jobs. The sustained gains are delivered by realising the energy efficiency gains, i.e. the realising stage, so when we consider both the enabling and the realising stages we see that ECO may ultimately support a sustained GDP boost of 0.07% and just over 19,500 FTE jobs. This means that when there is a large rent ECO can deliver a societal return of 1.8 jobs and £2.3m cumulative GDP gains (by 2040) per £1m spent. The absence of rent means that more funds are directly used to retrofit properties and enable greater efficiency gains, as more households can get their property retrofitted. In the absence of rent, ECO may deliver a sustained GDP boost of 0.14% and 37,400 FTE jobs, meaning a sectoral return of 3.4 FTE jobs and £4.4m 2040 cumulative GDP gains per £1m spent.

If interest-free loans are used to fund efficiency improvements the combined outcomes of the enabling and realising stages may be of sustained GDP boost of 0.17% and 45,200 FTE jobs. However, it is important to highlight that if the efficiency gains do not materialise then there can be temporary negative GDP changes along with job losses, while there can be up to a £22 net income drop per household of HG1 quintile. Socialising the cost via income tax has the potential to deliver the best GDP, employment and income outcomes compared to all other funding mechanisms we examine. Because the tax is endogenous and we assume a balanced budget, the government returns back to the households any budget savings in the form of tax reductions. Thus, the potential sustained GDP boost is 0.25%, supporting 64,700 FTE jobs. This means a societal return of 6.6 FTE jobs and £6.7m cumulative GDP gains in 2040 per £1m spent.

These outcomes change when a tapered approach is followed in distributing access to the funds. The fact that lower income households receive more funding means that more affluent households, which are the ones with higher purchasing power, are receiving less efficiency gains and therefore smaller income boosts. This leads to a smaller demand expansion of the UK economy, which in turn is reflected in 0.02% smaller GDP gains and 5,300 fewer sustained FTE jobs. However, a tapered distribution strengthens the social side of energy efficiency policies as it can lead to net income gains for the households of HG1 that can be up to £30 larger per household compared to an equal distribution. On the other hand, a tapered distribution, when loans are used as the funding mechanism, creates a higher repayment burden for the lowest income households. This time if the efficiency gains do not materialise then the potential income drop for HG1 households may be £58 per household instead of £22 with an equal distribution.

## Conclusions

Our analysis highlighted that there are significant trade-offs that need to be taken into account when designing an energy efficiency policy. We find that energy efficiency improvement programmes have the potential to deliver significant GDP, employment and household income gains. ECO as a funding mechanism can enable those gains without the risk of negative effects at any timeframe, even if the efficiency gains do not materialise. However, the magnitude of the gains greatly depends on the presence or not of economic rent, while the search and administrative costs limit what could be achieved with the same amount. On the other hand, making the beneficiaries responsible to source the appropriate retrofitters can deliver better outcomes than ECO, but at the risk of temporary negative impacts if the efficiency gains are not achieved. Furthermore, an equal distribution can enable the best GDP and employment outcomes but a tapered distribution enables better income gains for the lowest income households. It is a ‘take-home’ message of our work then that it is key for policy makers to carefully consider and identify the main objectives of an energy efficiency improvement policy as no combination of the funding mechanisms and distributions we examined can deliver the best outcomes across the board.

## References

Turner, K, Katris, A, Figus, G and Low, R. (2018) ‘Potential Wider Economic Impacts of the Energy Efficient Scotland Programme’, CEP policy briefing, University of Strathclyde, <https://strathprints.strath.ac.uk/63819/>

Figus, G, Turner, K, McGregor, P and Katris, A. (2017) ‘Making the case for supporting broad energy efficiency programmes: impacts on household incomes and other economic benefits’, Energy Policy 111, 157-165