



UCL POLICY BRIEFING – JUNE 2014

## AUTHORS

### Dr Sarah Bell

UCL Civil, Environmental and Geomatic Engineering  
s.bell@ucl.ac.uk

### Sarah Chaytor

Head of UCL Public Policy,  
Office of the UCL Vice-Provost (Research)  
s.chaytor@ucl.ac.uk

### Dr Kate Crawford

UCL Civil, Environmental and Geomatic Engineering  
catherine.crawford@ucl.ac.uk

### Miss Felicity Davies

UCL Civil, Environmental and Geomatic Engineering  
felicity.davies.12@ucl.ac.uk

### Dr Charlotte Johnson

UCL Energy Institute  
c.johnson@ucl.ac.uk

### Ms Sunyoung JooJoo

UCL Energy Institute  
sunyoung.joo.13@ucl.ac.uk

## CONTRIBUTORS

### Mr Kell Jones

UCL Civil, Environmental and Geomatic Engineering  
kell.jones.13@ucl.ac.uk

### Mr Colin Rose

UCL Civil, Environmental and Geomatic Engineering  
colin.rose.13@ucl.ac.uk

## KEY CONCLUSIONS

- **Refurbishment of social housing can deliver significant improvements in energy, environmental and health performance**, which can lead to costs savings and improved living standards for residents.
- Refurbishments can have **lower overall lifetime costs than demolition and construction** and can cause less disruption to communities and residents.
- **Engaging residents in regeneration decisions is crucial** and has resulted in successful refurbishment of a number of social housing properties.

## Making Decisions on the Demolition or Refurbishment of Social Housing

### Key points for making decisions

- **Social factors and well-being indicators** should be incorporated into decision-making alongside cost, energy and carbon indicators.
- Decisions about refurbishment and demolition can be complex: **cost and performance models are highly sensitive to a few key assumptions** about the expected lifetime of buildings and future energy prices.
- **Key environmental factors:**
  - **Embodied carbon in buildings** may start to make a more significant contribution to emissions than operational carbon as the UK generates more electricity from renewable sources.
  - **Water efficiency** should be considered both in designs for new buildings and in refurbishment programmes.
  - The construction sector produces 35% of waste in the UK.
- **Refurbishment avoids considerable waste** from demolition and construction of new buildings.
- Sharing evidence and synthesising case studies would help social landlords, tenants, developers and lenders make and explain decisions about refurbishment and demolition. This, alongside development of the supply chain, may help to **unlock investment in refurbishment**.

### Introduction

This policy briefing summarises the main factors involved when deciding whether to refurbish or demolish social housing, including environmental and economic costs and benefits. Such decisions will involve trade-offs between different objectives and values. The briefing discusses:

- evaluating the economic case for refurbishment, including impacts on communities and residents;
- the energy and carbon implications of demolition compared to refurbishment;
- issues around water and waste; and
- social factors in housing and regeneration, including health and community participation.

# 1. Evaluating the economic case for refurbishment

## Estimating costs and impacts of refurbishment

Estimating the costs and impacts of refurbishment or demolition is complex, uncertain and subjective. The typical cost indicators used in assessment refurbishment and demolition projects are: *capital expenditures* or CAPEX (the cost of fixed assets); *operational expenditures* or OPEX (the costs of goods and services); and *capital investment appraisal* (understanding the value of an investment over time).

## Assessing maintenance and repair

As more experience has been gained in managing repairs and maintenance, management risks are easier to estimate, although estimating maintenance remains difficult. Key issues for management of repairs and maintenance include:

- allocating resources to the most appropriate stock;
- delivery of maintenance programme on time and on budget;
- controlling responsive repair work;
- involving tenants and leaseholders in decisions;
- managing and monitoring performance.

## Assessing impacts on residents

There is a growing body of research suggesting that **extending the lifecycle of buildings by refurbishment is preferable to demolition** in terms of improved environmental, social and economic impacts. However, **the assessment of benefits to residents is limited** to reductions in bills or improved comfort, which risks over-estimating energy or carbon savings and under-emphasising rebound effects. This limited assessment is partly due to a lack of quantitative monitoring of before and after refurbishment projects, and of qualitative work on occupant behaviour.

There are also **difficulties in estimating the costs and impacts on residents**, particularly around: quantifying tangible returns; valuing future savings; and the complex interaction of individual and institutional behaviours. Key issues affecting residents include:

- **delays** in refurbishment and demolition work (which generally takes longer than expected);
- **moving** residents during works taking place (there is little comprehensive data on the cost or time involved);
- complications of **mixed tenure** and sharing costs fairly between residents and over a wide variety of occupancy periods.

The costs of rehousing tenants, the time taken to do so, and the resulting pressure on other local housing resources should be included in economic analysis of demolition compared to refurbishment.

## Costs and benefits to wider society

Assessing the impacts on wider society remains difficult. Key issues are:

- the environmental costs of **waste disposal**
- the social or market **costs of carbon**
- **longer-term impacts** of refurbishment or demolition

Further work is needed to gather more data and analysis in all these areas.

# Institutional factors in evaluating the economic costs for refurbishment

There are a number of institutional factors that affect the costs, benefits, quality and risks of refurbishment projects which are briefly discussed below.

**The UK supply chain and retrofit market is under-developed** and suffers from increased risk due to lack of knowledge. There are a variety of technical, economic, and social risks and hidden costs associated with refurbishment. Prices and perceived risks amongst architects and designers, owners, investors and developers are all factors in the undeveloped supply chain and market. There is a need for a change in perceptions, awareness and behaviour throughout the supply chain, supported by appropriate policy frameworks.

**Tenure types and management capacity**, in particular the different skills and priorities of landlords, affects how costs and risks are shared between investors and occupants; how refurbishment can be financed; how savings can be realised by tenants; and how energy-saving behaviour can be encouraged. Particular issues include recovering investments through rent, and the tension between short-term tenures and long payback periods for energy efficiency.

**Access to finance and willingness to invest in refurbishment:** the risk of current costs and uncertain future savings mean there is a reluctance to both lend and borrow. Grants, subsidies and guaranteed loans could address this.

There is a need to address the capacity, willingness and confidence to make and explain decisions about refurbishment and demolition and to invest in refurbishment on the part of tenants, local authorities, housing associations, developers and lenders. In part, this can be tackled through: collecting more data on costs; undertaking further analysis of the impacts of different scenarios on different peoples and places over time ('do nothing' / refurbishment / development); and research into behavioural and technical realities and wellbeing outcomes of living through refurbishments to inform other projects.

# 2. Improving energy performance and reducing GHG emissions

Residential buildings generate greenhouse gas (GHG) emissions through two processes: occupants' use of a building (*operational energy*); and the extraction, manufacture and transportation of materials for a building's construction and demolition (*embodied energy*). The greatest impacts on global warming are likely to be through the energy consumption and emissions of a building during its lifetime rather than its construction and demolition. However **the embodied energy of a building will become more significant** as the UK achieves more stringent building standards and takes steps to decarbonise electricity generation.

## A £13 MILLION 'DEEP RETROFIT' OF 107 HOMES IN 3 TOWER BLOCKS INCLUDED

- External wall insulation render
- Roof insulation and waterproofing
- Surface over-cladding, enclosing balconies & access decks
- Triple glazed windows
- Replacement of heating and hot water systems
- Replacement of ventilation system with whole house heat recovery ventilation

## UNINTENDED CONSEQUENCES OF RETROFITTING

Delivering carbon savings through the UK's building stock risks a number of negative unintended consequences, including:

- **Indoor Air Quality** problems associated with reduced ventilation;
- Energy efficiency improvements increasing the risk of **summer-time overheating** which can adversely affect health;
- Energy efficiency improvements resulting in **increased greenhouse gas emissions** due to the 'rebound effect';
- Improvements in buildings' thermal properties causing **cold bridges, condensation, mould growth and decay**;
- Health and safety issues associated with refurbishment increasing the potential for **elevated fire risk**.

Current buildings standards mean that newly constructed homes have a lower operational energy than older buildings (*ie* typically produce fewer emissions when occupied). However **refurbishment of buildings can achieve similar levels of energy performance to new buildings** whilst avoiding the GHG emissions of demolition and construction of new buildings. Major refurbishments of existing residential buildings will need to comply with nearly zero energy emission standards from 2016.

The operational energy of residential buildings contributes 23% of the UK's greenhouse gas emissions. Retrofitting to reduce energy consumption can also deliver other benefits, including reduced fuel bills and increased thermal comfort, and can be done by:

- **Improving energy performance** through improvements to the building fabric, installing more efficient appliances and controls, and improving occupant understanding of how energy is used in the home;
- **Switching fuel sources**, such as using renewable resources on-site to generate heat or power, or connecting to neighbourhood energy supplies such as low carbon heat networks.

## The scale of the retrofit challenge

There are nearly 27 million homes in the UK – most of these will still be standing in 2050, creating a **refurbishment rate of roughly 60 000 homes a year** for the next 35 years. Developing the skills and supply chains capable of delivering this level and scale of housing stock refurbishment is challenging, but presents an opportunity for the 'green economy'. Retrofitting of buildings for energy efficiency measures can range from low cost measures such as loft and cavity wall insulation to complete refurbishment of buildings and their systems. **Only 'deep retrofit' (total fabric and system refurbishment) measures are likely to achieve the target of a 60% reduction in operational energy.**

## 3. Other environmental factors: waste and water

The environmental impacts of refurbishment compared to demolition are not only about energy and carbon, but also about the environmental impacts of the production of water, concrete, steel, timber, glass and many other materials used in the construction of new buildings, and the impact of the waste that is generated through demolition and construction.

## Water

Water is often overlooked in regeneration schemes but is a vital issue in terms of: how it is used in construction; how it is used by residents; and how sewage and storm water are dealt with.

**Water efficiency should be considered both in designs for new buildings and in refurbishment programmes.**

In London – a water-scarce region – average water consumption is 162 litres per person per day. Reducing the amount of water used by individuals and by the construction industry will help to alleviate pressure on scarce resources. Improvement of water management in housing estates will also benefit communities: increased water efficiency can reduce bills for residents with water meters; and better management of storm water using green infrastructure to tackle runoff can create local green spaces with advantages for residents' health and for biodiversity.

## Retrofitting for water efficiency

Considerable reductions in water use can be achieved by refurbishing bathrooms and kitchens. A case study in London showed that retrofitting a shower into social housing property can save 39 litres per property per day; and installing dual flush toilets can save 61 litres per property per day.

Local authorities have an increasing role to play in managing drainage through the planning process. New developments and regeneration schemes will be required to include Sustainable Drainage Systems (SUDS) wherever possible in order to reduce the amount of water flowing into the sewers. This in turn can reduce the need for demolition to solve drainage problems. **Retrofitting SUDS and other green infrastructure to existing buildings and estates should be considered in any regeneration scheme.**

## SUSTAINABLE DRAINAGE SYSTEMS (SUDS) MEASURES

- green roofs
- permeable paving
- rain gardens
- rainwater harvesting
- using green spaces to store water temporarily during storms

## Reducing waste

The construction sector generates 35% of all waste in the UK; waste reduction is thus a key priority. Waste management has improved considerably, with 73% of waste from construction and demolition recycled as aggregate. Using recycled aggregate in new construction reduces landfill waste and the environmental impacts of new construction. Additionally, recycling materials at the end of houses' lives may reduce the potential to contribute to global warming by 2-3%. Decision making and policy in this area could be improved by improving the availability and consistency of data relating to demolition and construction waste.

**Refurbishing existing buildings is the best way to reduce waste:** this avoids demolition waste and reduces costs, carbon emissions and social and environmental impacts associated with transport, landfill, recycling and the mining and manufacturing of new materials.

## 4. Social factors in decision-making

### Impacts on residents' wellbeing

Understanding the impact of demolition or refurbishment on residents is complex, as health and wellbeing are broad and interdependent on many different factors. Because wellbeing is a highly subjective concept, it can be used to support cases for demolition even where strong evidence is lacking. Further research into the impacts of demolition and refurbishment on wellbeing is therefore needed.

There is evidence to show **improved physical and mental health as a result of refurbishment**, particularly around energy based improvements. At the community level, refurbishment can lead to a reduced sense of isolation and maintenance of social capital. However, these positive impacts are undermined if the neighbourhood and surroundings remain in decline. **Housing improvements need to take place alongside other area-based interventions** in order to be truly effective and to reach maximum potential. Such an approach requires multidisciplinary collaboration with different departments in local authorities and other stakeholders working together.

Whilst refurbishment has been shown to improve individual mental and physical health, it is also important to bear in mind unintended consequences, such as retrofitting ventilation units leading to poorer indoor air quality which can have a detrimental impact on respiratory health.

There is some evidence from Glasgow that **relocation after demolition can improve wellbeing**. There may be improvements in social relations, contrary to perceptions of demolition breaking up community networks. However, demolition and relocation can also **compromise the mental health of residents**, with increased reporting in stress, anxiety and depression post demolition. This stress is linked to feelings of powerlessness and the lack of control or opportunity to engage with the housing authority about the move.

### Wellbeing, health, housing and urban design

Poor housing quality has a negative impact on individual and public health. This is a significant problem; research into the health costs of poor housing has shown that addressing the worst health and safety hazards in the UK's poorest homes could save the NHS £56 million a year. Particular housing factors that affect health include:

- agents such as asbestos, carbon monoxide, radon, lead, and mould that affect **indoor air and environmental quality**;
- **internal environment**, such as cold, damp, housing design or layout, infestation, hazardous internal structures or fixtures and noise;
- **lack of space** which can contribute to poor mental health;
- **fuel poverty**, which affects physical and mental health (4.5 million people are recorded as living in fuel poverty; retrofitting to improve energy efficiency is key to addressing this);
- the **broader social and behavioural environment**, such as overcrowding, sleep deprivation, neighbourhood quality, infrastructure deprivation, neighbourhood safety and social cohesion;
- the **broader macro-policy environment**, such as housing allocation, lack of housing tenure, housing investment, and urban planning.

### Rethinking high-rise

Demolition and construction of high-rise buildings has been a strong feature of many urban regeneration schemes. Traditionally, high-rise social housing is associated with social decline and poor health. In contrast, many urban regeneration schemes incorporate high-value high-rise housing for private ownership or rent, with high service standards. Increasingly it is recognised that it is **wider area interventions, rather than high-rise buildings, that affect wellbeing**, with studies also showing that families enjoy living in high-rise (contrary to the belief that high-rise is bad for families). This challenges the view that demolition of high-rise is preferable. There are also opportunities to create other benefits through refurbishment: retaining high-rise buildings can leave room for more green spaces in densely populated cities (providing planning policies are put in place to maintain green spaces). **Refurbishment of a building should be part of the refurbishment of the wider area** to ensure the opportunity to improve wellbeing is maximised.

### Job creation

The retrofit industry and the decentralisation of energy offer considerable opportunities for local development and community engagement, which in turn can lead to **local regeneration, lower energy costs, generation of local income, and improved trust**:

- refurbishment of buildings significantly contributes to job creation (for example 100,000 jobs created from insulating existing housing stock);
- small and medium businesses involved in refurbishment and retrofitting in the UK can particularly benefit;
- employment benefits have been shown to be higher when the refurbishment of the building has higher energy saving specifications.

### Community participation

**Community participation is crucial to the success of any regeneration scheme.** A lack of resident participation from an early stage is often a determinant in decreased wellbeing, yet residents are not always involved effectively in regeneration. Decisions on demolition and refurbishment have different impacts on leaseholders and tenants. Delays to housing improvements can also lead to stress for residents.

**Involvement of the community in the decision making process, regardless of the outcome, is essential in order to reduce impacts on wellbeing**, particularly mental health. This should include actively engaging residents so that they feel a sense of ownership and participation and keeping them fully informed of the process.

### BACKGROUND

This policy briefing summarises the main findings from research commissioned by Just Space and the London Tenants Federation and undertaken by UCL Urban Lab and Engineering Exchange. The research report provided a review of technical methods, evidence and case studies for decision-making relating to the refurbishment or demolition of social housing. For a copy of the full report, email Dr Sarah Bell, UCL Civil, Environmental & Geomatic Engineering (s.bell@ucl.ac.uk).