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’Too Many Empty Homes, Too Many Homeless’ – A Novel Design and Procurement Framework for Transforming Empty Homes through Sustainable Solutions

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Abstract

The Retro-Tek research project investigates the potential of existing buildings in the UK contributing towards the EU 2050 CO_2 target, through a sustainable retrofit programme aimed specifically at empty homes. It proposes a novel design and procurement methodology to bring empty homes back into use, integrate sustainable technologies and materials and offer them back to the market. Along with the obvious environmental sustainability benefits, it also assists communities and areas in need of regeneration, supporting the developments to both help address housing shortages and tackle socio-economic problems with empty, dilapidated dwellings. The project has formed a consortium of stakeholders and established unique design and procurement processes and methodologies relevant to the sustainable retrofit process. Their viability was tested via undertaking two case studies of representative empty homes, establishing results within a measurable data format. The research further developed a commercial output model based on financing, procurement, the supply chain and the project management process and is currently applying for funding to launch a major scheme of bringing 1000 empty homes back in use by 2020.

Keywords: Empty Homes, Sustainable Refurbishment, Design, Procurement, Regeneration

Nomenclature

Retro-Tek PDMB	Retro-Tek *procure-design-manage-build* system.
Retro-Tek UpS	Retro-Tek up skilling training programme

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1. Introduction

The research explores an opportunity for a reduction in energy usage within existing buildings in the UK through a retrofit programme targeted specifically at empty homes. According to the Guardian [1] there are more than 11 million homes laying empty across Europe, enough to shelter the homeless population twice over. In the UK, the latest statistics by the Department for Communities and Local Government (DCLG) show that for England alone there are over 600,000 empty homes, equating to almost 10 homes per each homeless family in the country, [2]. Regionally the East Midlands have nearly 56,000 empty homes (see Fig.1). Research also shows a strong correlation between concentration of empty properties and areas with higher levels of multiple deprivation [3]. These areas tend to exhibit a myriad of underlying socio-economic issues such as; a decline in the economic attractiveness of an area for the investment, higher than average long-term unemployment, concentration of low income families, high social benefit dependency, above average crime rates, poor health status, below average educational attainment, reduced demand for workers, skills mismatch, fuel poverty, community breakdown, lack of participation in civic life and a poorer quality of mainstream public services, all warning signs indicating areas in urgent need of regeneration; empty homes being a most clear symptom of all.

Region	Number of dwellings	Number of dwellings empty	Percentage of dwellings empty
North East	1,196,943	40,708	3.40%
Yorkshire and Humber	2,357,866	77,117	3.27%
North West	3,193,675	109,485	3.43%
East Midlands	2,014,514	55,737	2.77%
West Midlands	2,413,862	63,991	2.65%
East of England	2,590,719	58,197	2.25%
London	3,470,247	56,715	1.63%
South East	3,768,624	84,666	2.25%
South West	2,457,713	63,507	2.58%
England	**23,464,163**	**610,123**	**2.60%**

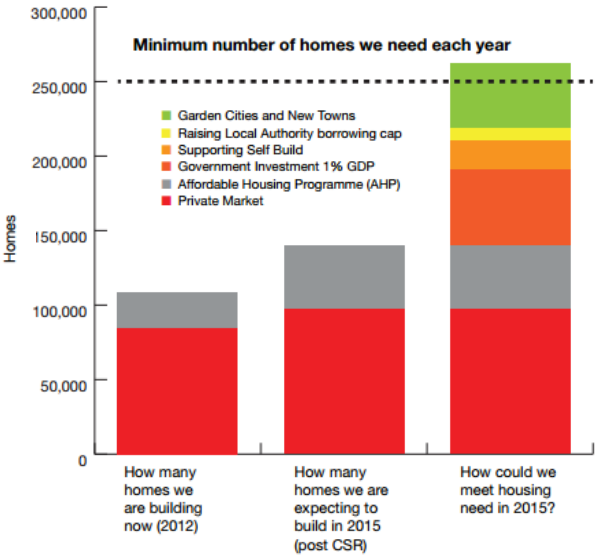

Fig.1. (a) Number and percentage of dwellings empty by region [2]; (b) How do we build 250,000 homes we need each year? [3]

For the housing market to operate it needs to have some empty properties. Often referred to as voids, they could be empty as they are awaiting sale, expecting new owners and tenants to move in or being renovated in preparation for the market. Hence, in reality they are only problematic when they have been empty long term (defined as been vacant for over six months). The figures for long term empty homes in England vary from year to year, but the conservative estimate is around 206,000 in England alone [4]. Some of the key reasons are new owners being unsure whether to sell, rent or move in, landlords and owners being unable to afford renovation of a property due to the pressures of other commitments or financial limitations and owners of a property anticipating a rise in the market value and are therefore unwilling to sell, often referred to as ‘buy-to-leave’ [2].

Stimulated by steady economic growth, a fall in the supply of new homes, cheap credit and a rising population, Britain saw its third property bubble in the 2000s. During this period, house prices more than doubled and was only brought to an end by the global financial crash in 2007. The global recession caused peacetime house building levels to fall to its lowest level for around 80 years. Currently, as of March 2016, house prices in England are rising sharply and averaging circa £300,000, [5]. This rise in property value is set to continue, as “each year we build 100,000 fewer homes than we need” [6].

In England alone, "there are more than 1.8 million households waiting for a social home" [7] and "one in five socially renting households have been on the waiting list for more than two years, with 7% who were on the waiting list for at least five years", highlighting the scale of shortage of homes in England [8].
This is all set in the environmental context that at present 45% of the UK's energy is consumed by existing buildings and 85% of buildings we see today will make up more than 70% of the building stock in 2050. Thus, to get anywhere near meeting the 80% of CO_2 emissions reduction targets by 2050, all existing buildings will require a major sustainable retrofit to ensure improved energy efficiency in use [9]. The empty homes, as long as they are structurally sound, make the easiest case for a sustainable retrofit given the fact that they are empty already. Furthermore, they are part of the existing communities and already established urban and historical fabric, often with a higher architectural merit than the new houses proposed to replace them. Thus the argument of refurbishing the empty homes as one of the ways of tacking the current house shortage certainly has merit.
This argument is further strengthened by the acknowledgement that bringing empty homes back into use can have social, regenerative, financial and strategic benefits for the community and that "the high levels of empty properties are recognised as having a serious impact on the viability of communities". [10].
On the contrary, some argue that the renovation of empty homes will have no effect on the easing of housing crisis [11], stating that the long-term empty homes are not really empty but instead are awaiting a new tenant or owners, having legal or inheritance dispute issues, left empty after the owner went into a care home, cannot find a buyer, or being extensively renovated or refurbished over a longer period. It has to be stated that statistics dispute above [2], and that the other concerns including matters such as "buy-to-leave" remain.

2. Project Aims

Retro-Tek was an externally funded research project with the key aims set as follows:

1. To benefit communities and areas in need of regeneration, supporting the development to eradicate housing shortages, fuel poverty and tackling problems with empty, dilapidated dwellings.
2. To ensure a fair and transparent housing allocation policy to those in 'housing need', irrespective of their race, sex, religion, sexual orientation, disability, age, gender, marital status or ethnic origin.
3. To reinvest any accrued surplus in further empty housing refurbishment projects or into an alternative local community scheme.
4. To promote the transformation of empty homes into sustainable solutions and to contribute towards the Government's commitment of 80% CO_2 reduction target by 2050.
5. To disseminate expertise on a national level, developing both the research and practical implementation of sustainable housing refurbishment.

3. Research Methodology

The main reason for the choice of case studies approach was to examine key principles of design and procurement process within a detailed and complex framework proposed for sustainable refurbishment of empty homes. Two case studies of empty terrace homes with typical typologies and regional geographical locations were chosen and conducted for this initial stage, with a pilot study of a further ten proposed by 2017, followed by a total of 1000 empty homes by the end of the final phase (see Section 6, Fig. 7), subject to the approval of further funding. Simons [12] explains the reasoning behind the choice of case study as a valid research method, stating that: "A case study is an in-depth exploration from multiple perspectives of the complexity and uniqueness of a particular project, policy, institution, programme or system in real life context. It is research based, inclusive of different methods and is evidence-led. The primary purpose is to generate in depth understanding of a specific topic". To ascertain a concise realisation of the research project a case study holistic design method has been chosen. Yin [13] states that the holistic design approach is beneficial when the methodology pertinent to the case studies itself is of a holistic nature or where no logical sub-units can be identified. However, he further asserts the importance of access to the real world case studies and data, stating that otherwise the research may be overly abstract, with a lack of suitably clear measures or data.

4. Design and Procurement Approach

A novel design, procurement and a contractual methodology for a sustainable refurbishment of empty homes was developed, together with the information, templates and examples incorporating best practice [14]. The proposed framework integrates "procure-design-retrofit-manage" process for empty homes, with the integrated multi-client contract procedure, costs/performance and budgets determination at the feasibility stage, including the onsite check list to ensure the best retrofit solution [15]. SAP energy performance analysis, together with the environmental impact versus cost analysis, both at the design and "as build" stage is incorporated, followed by the performance monitoring and occupant training. A Retro-Tek PDMB web based prototype database was developed, with the tested and updated novel procurement and finance route finder, intelligent guidance through the procurement process, list of the local supply chain providers and contractors. A programme for training and up-skilling courses has been suggested together with a Retro-Tek Code for Empty Homes Refurbishment, further discussed in Section 6. A phased design approach is proposed, taking into account limited amounts of funding available at different stages of refurbishment and thus ensuring continuity of the sequence of works. The key principle is to make the process commercially viable whilst maximising energy savings and carbon reductions, i.e. incorporating efficient environmental upgrades so that the costs outlaid for the initial purchase and the refurbishment could be recuperated in a resale of the property (see Fig. 2).

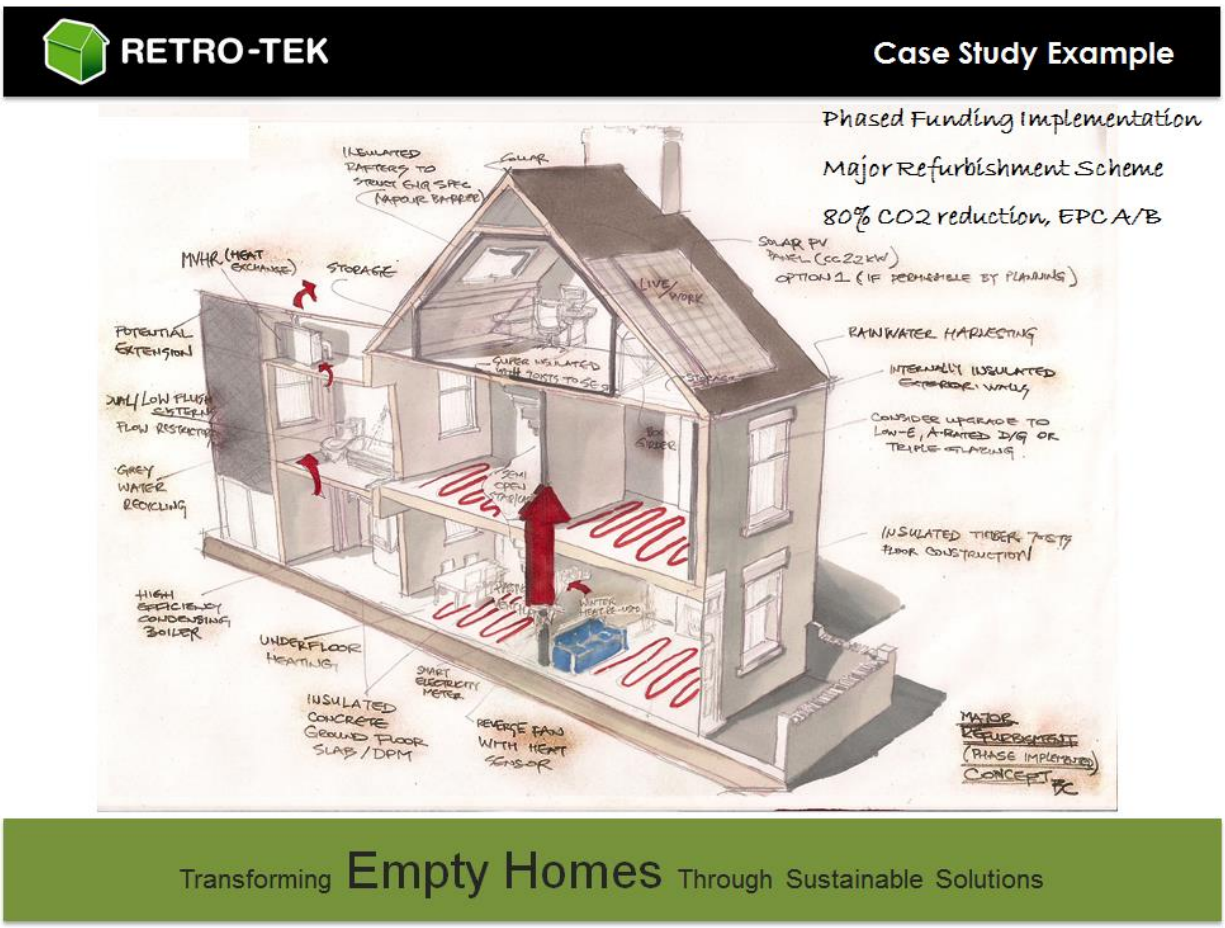

Fig. 2. Refurbishment Strategy - Phased Approach (Source: Author)

In the first phase, dependent on the amount of funding available, dilapidated and inefficient boilers should be replaced with the >90% efficiency rate condensing combination boiler, with the fenestration and roof insulation

improved to the lowest possible U-value affordable by the budget. The draught proofing should be carried out in accordance with BS7880:1997, [16]. Furthermore, the energy efficient appliances, 100% energy efficient lighting and energy display monitor should be installed. The second phase should tackle the major fabric improvements, including insulating the wall and ground floor to the lowest possible U-value affordable by the budget. At this stage installation of renewable energy sources should be considered. The third and final phase considers the holistic sustainable refurbishment strategy from the "first principles", taking into the account the individual circumstances of each property [17, 18], their location, siting and orientation, and utilising passive energy saving measures, such as zoning, additional habitable spaces within a roof void, passive stack, solar gains, natural light, solar shading, thermal mass, natural and heat recovery ventilation, rain and grey water recycling, additional effective renewable energy sources, and such (see Fig. 2). The alterations to the spatial requirements and internal and digital connectivity to create conditions for the Independent Living and Lifetime Homes [19], including rear ground floor extension to improve market value should also be considered, if the sustainability from the first principles is to be respected.

The procurement strategy considers the steps required to bring a vacant property back into use, made complex by the varied circumstances that lead to homes becoming empty. Therefore, the refurbishment and retrofitting of an empty property should always be considered on a case-by-case basis. Once a property has been identified as empty, Fig. 3a,b highlights the necessary steps to be taken in order to bring an empty property back into use.

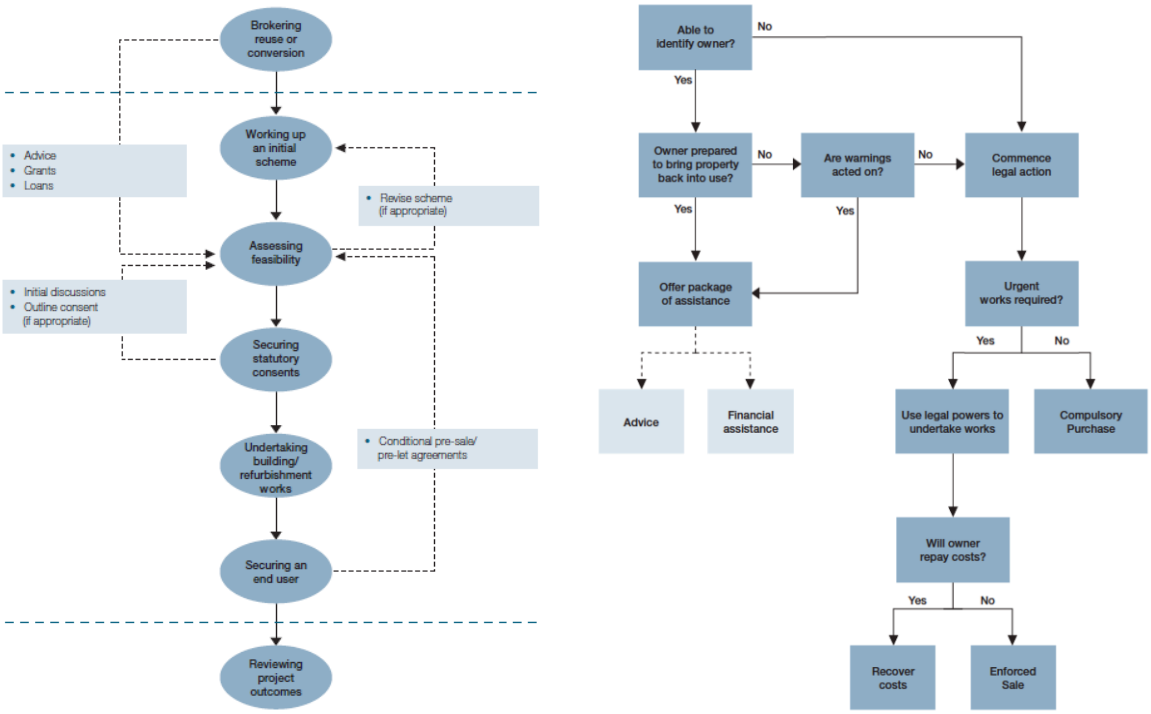

Fig. 3. (a) Key Steps in bringing the empty homes back in use ; (b) Legal action routes [3]

The Retro-Tek procurement process is quite complex (see Fig. 4), with different procurement routes dependent on whether the empty home is on the open market, in the private or Registered Social Landlord (RSL) ownership. Different routes flow from there and consequently different "carrot and stick" approaches are adopted, depending on the level of owner cooperation. The key concept is to form a not for profit Community Interest Company (CIC) who would apply for funding, use the money to lease empty homes from the owners for a nominal agreed sum (£1 or £10), invest into the sustainable refurbishment to a high standard, rent it for as long as it takes to recuperate refurbishment costs and then return the property to the owner for free [20]. The routes from the initial

contact, approaches to finding the owner, incentives, schemes and grants, local authority enforcement powers, legal action and selection of appropriate end use are also given in Fig. 4.

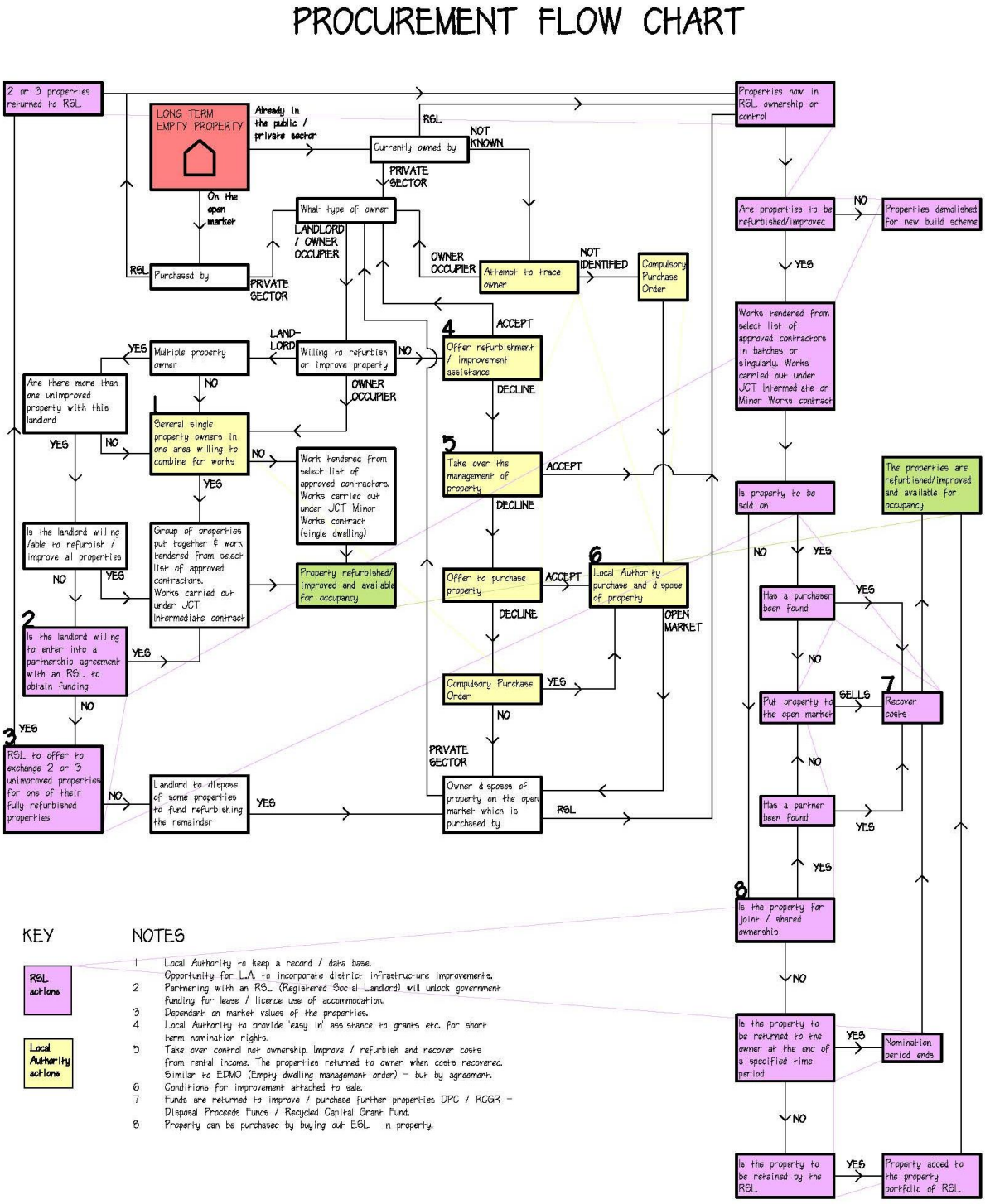

Fig. 4. Retro-Tek Procurement Framework (Source: Authors)

The importance of proposed energy efficient refurbishment approach in preference to a basic cosmetic renovation often seen in today's market is further highlighted by the issue of fuel poverty in England where people, often elderly, are forced to choose between "heating or eating", as they cannot afford both. In other words, if they pay their house fuel costs they would be left with a residual income below the official poverty line. In 2014, the number of households in England classified to be in fuel poverty was estimated at 2.38 million, approximately 10.6 per cent of all English households [21]. This is an increase of about 1.4 per cent on the figures in 2013.

5. Case Studies

The Retro-Tek's case study presented in this paper was an early twentieth century, 2-bedroom typical end terrace, situated in the deprived area of town in the East Midlands. The exact location and client cannot be disclosed due to data confidentiality reasons. It was constructed using traditional 9-inch solid external brick walls with no insulation and recently had standard uPVC fenestration installed. To improve the sustainability of the property on a modest budget, the building fabric was improved, a new condensing boiler was installed, and the property was draught proofed throughout. The ground floor was replaced with a solid concrete floor, achieving a U-value of 0.24W/m^{2}K. The solid walls were internally insulated, achieving a U-value of 0.30W/m^{2}K and the roof was insulated at ceiling level, achieving a U-value of 0.16W/m^{2}K (see Fig. 5).

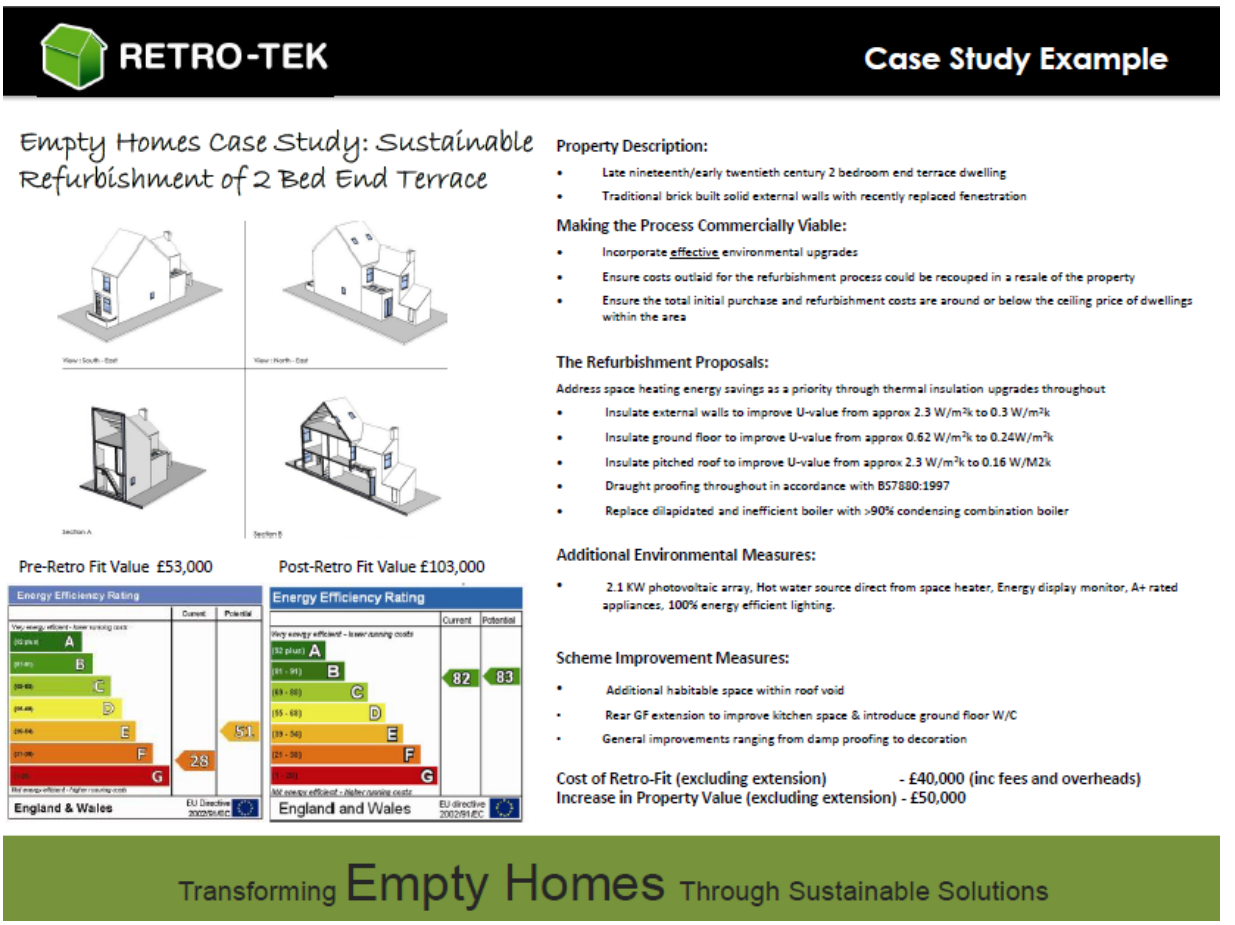

Fig. 5 Case Study 1 - Early twentieth century, 2-bedroom typical end terrace, East Midlands, UK (Source: Authors)

The purpose of the case study was to investigate the benefits of a proposed sustainable refurbishment design and procurement approach, its phasing and potential for profit, once a home has been refurbished and released to the

market. It was important to demonstrate the business case and the potential for profit, as well as the CO_2 emissions reduction case, to encourage developers to undertake sustainable refurbishment rather than opting for "cosmetic" repairs and a quick release back to the market.

6. Discussion

The pre-retrofit value of the property was estimated at £53,000, with post retrofit value being £103,000. The costs of the retrofit itself were £40,000, leaving a modest profit of £10,000 and demonstrating a potential for commercial viability of sustainable refurbishment. In addition, the retrofitting measures produced an annual energy reduction of 74.6% (saving of £849) and an annual CO_2 emissions reduction of 67.1% (4.9 t), see Fig 6. The building lifespan was extended for estimated 60 years, giving the future value of energy reduction saving of £59,304 over the 60 years lifespan. This value assumed costs of the energy at the time of refurbishment and only 0.5% average interest rate. Equally, over the same lifespan, a reduction of 294t of CO_2 emissions is predicted, comparable to 57 medium sized cars taken off the road for a year. The energy efficiency rating calculated via standard assessment procedure (SAP) was significantly improved, from borderline G to borderline B, see Fig 6.

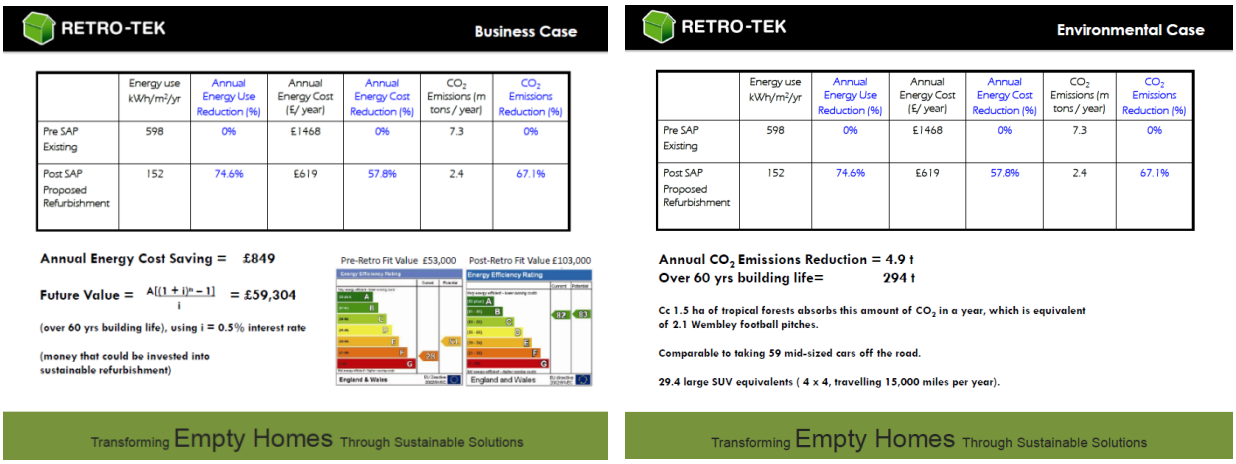

Fig. 6. (a) Annual Energy Cost Savings; (b) Annual CO_2 Emission Reductions (Source: Authors)

To address current housing crisis, it is estimated that 250,000 new homes need to be built each year. Despite a number of schemes and Government incentives there is a significant shortfall in the number of homes being constructed. Thus, as one of the strategies to help alleviate the current housing shortages, it makes sense to consider bringing empty homes back into use through sustainable refurbishment, whilst at the same time addressing environmental issues through CO_2 emissions reduction. Furthermore, there are tangible socio-economic and urban regeneration benefits that refurbishment of empty homes can bring, as well as reducing the pressure on the greenfield development. However, one of the principle reasons as to why sustainable retrofitting is not more common is due to zero-VAT policy for new builds. This seems counterproductive especially when Government's targeted reductions in CO_2 emissions are considered. Some incentives do exist, i.e. if work is carried out on a property which has been vacant for a minimum of two years, VAT is charged at the reduced rate of 5%. Sustainable housing refurbishment in general is also incentivised, through Renewable Heat Incentive (RHI) and Feed in Tariffs (FITs) schemes, offering financial incentives for the use of renewable technology.

7. Conclusions

In summary, addressing the issue of long-term vacant properties could have significant social, economic, environmental and governmental benefits, irrespective of the new build house building rates. Greater efforts should, therefore, be taken to bring empty properties back into habitable use. To do so, a novel design and

procurement strategies require devising, testing and implementing, ensuring their en masse scalability and affordability. They should consider not only enforcement powers and financial consequences but also a financial and refurbishment incentives, as well as innovative schemes, for example sustainable refurbishment through leasing. It currently takes around 20 months for the Compulsory Purchase Order (CPO) to be enforced, and that time needs to be reduced. Equally, where house owners are "sitting" on the properties with a clear intention of doing nothing, financial repercussions should apply. However, there should also be refurbishment incentives by reducing the levels of VAT for the sustainable refurbishment of long-term empty homes and reducing the time for the eligibility of VAT reductions. To encourage refurbishment the same level of tax should be applied to the renovation of long-term empty homes as to that imposed on new build construction. Finally, more funding should be available for innovative and homeowner co-operative schemes, such as Retro-Tek sustainable refurbishment through leasing and rent recuperation, reinvesting any accrued surplus in further empty housing refurbishment projects in area or into an alternative local community schemes. Those schemes have potential to improve social and economic aspects of urban regeneration in areas with a large concentration of empty homes, and develop prospects that inherently encourage social and economic inclusion at the earliest possible opportunity. They can further act as a catalyst for the local supply chain, in upskilling and training provision to relevant third parties such as builders, contractors, Registered Social Landlords (RSLs) and Housing Authorities, amongst others.

8. Future Work

Depending on the success of further funding applications, a total of 1000 empty homes to be brought back into use in the East Midlands by 2020 is proposed (see Fig. 7 below).

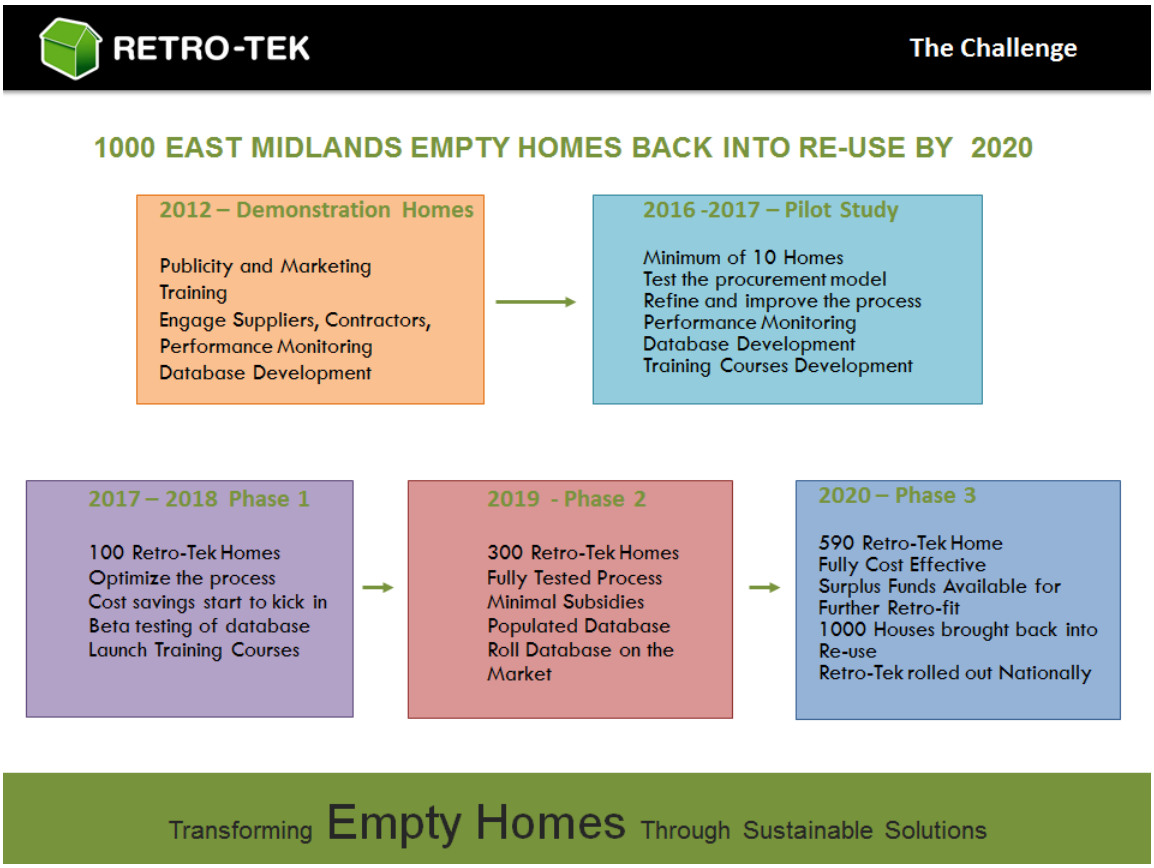

Fig. 7. Retro-Tek 2020 Refurbishment Aim

In addition, development of the Retro-Tek Code for Empty Homes Refurbishment, informed by the BREEAM Refurbishment Domestic Buildings Technical Manual [22] is also planned, taking into account issues of sustainable urban regeneration specific to the areas with concentration of empty homes. Finally, Retro-Tek UpS programme is to be devised for training and up-skilling of local unemployed workers, utilising the build programme for addressing below average educational attainment in the local community, reduced demand for workers and their skills mismatch.

9. Acknowledgments

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