



Programme Area: Buildings

Project: Building Supply Chain for Mass Refurbishment of Houses

Title: Final summary report

Abstract:

Please note this report was produced in 2011/2012 and its contents may be out of date. This is the final deliverable in Work Package 4. Work Package 4 has developed a system design proposal for a highly effective, domestic retrofit supply chain with minimal waste. The proposal is capable of delivering mass retrofit to reduce energy consumption across the UK housing stock for all tenures. This report summarises the supply chain outputs from the 2 year research project and presents a hypothesis on how a supply chain could be configured to deliver retrofit viably at scale. The outputs have been peer reviewed across industry and run in parallel to the development of the Green Deal model and although the two approaches tackle different aspects of retrofit they are supportive of one another.

Context:

This project looked at designing a supply chain solution to improve the energy efficiency of the vast majority of the 26 million UK homes which will still be in use by 2050. It looked to identify ways in which the refurbishment and retrofitting of existing residential properties can be accelerated by industrialising the processes of design, supply and implementation, while stimulating demand from householders by exploiting additional opportunities that come with extensive building refurbishment. The project developed a top-to-bottom process, using a method of analysing the most cost-effective package of measures suitable for a particular property, through to how these will be installed with the minimum disruption to the householder. This includes identifying the skills required of the people on the ground as well as the optimum material distribution networks to supply them with exactly what is required and when.

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Optimising Thermal Efficiency of Existing Housing

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Final Summary Report

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Issue **Updated Issue for Final Review**

Action

- Accepted
- Accepted subject to minor changes
- Major re-issue required

 Signature

 Signature

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1 Executive Summary

Work Package 4 has developed a system design proposal for a highly effective, domestic retrofit supply chain with minimal waste. The proposal is capable of delivering mass retrofit to reduce energy consumption across the UK housing stock for all tenures. This report summarises the outputs from the 2 year research project and presents a hypothesis on how a supply chain could be configured to deliver retrofit viably at scale. The project has been peer reviewed across industry and run in parallel to the development of the Green Deal model and although the two approaches tackle different aspects of retrofit they are supportive of one another.

The starting point for the supply chain design was to create a new offering from the customer perspective, unencumbered by current methods and approaches. This is referred to as a Right to Left approach.

The project has challenged current sales, survey, installation and supply models and come up with customer focused Retrofit models with minimum waste.

These are characterised by:

- A focus on Whole House retrofit: To get deeper energy savings and reduce the many challenges of a measure by measure approach.
- The use of a small team with all the required skills for a whole house retrofit which avoids duplication and delay of trade based solutions and allows effective single home installations or multiple street level projects.
- Integrated supply where precisely measured and pre-cut components arrive on site just in time, minimising time and waste during installation.
- Alternative business models to suit the requirements of different customer types: Local, National & Retail Brands, Multi-home Contractor.

The technical solutions for Retrofit were developed in WP 3. The emphasis is on standard interventions to deliver the deepest, most cost effective energy savings across 12 housing archetypes which cover the bulk of UK low-rise housing stock.

Two levels were developed by the consortium teams:

- RETROFIX tackling the top energy losses – Loft, Walls, Heating system and Draughts. Where budget is a prime constraint.
- RETROPLUS the enhanced package where floor, ventilation, door and window heat loss is tackled. This is the preferred level of intervention to achieve a true Whole House retrofit without excessive cost.

To ensure a workable and affordable solution the end to end processes for the two packages were then analysed and optimised, with working time schedules developed including the required competences for each task.

The pre-installation survey is crucial to a successful and rapid installation giving opportunities to make a step change in consumer perception of construction.

A two stage survey gives the most robust approach with the first stage engaging with the customers and getting preliminary data about the property; sufficient to make a conditional offer. The second stage is the responsibility of the lead member of the installation team to:

- Collect the detailed material and programme requirements
- Build trust with the householder and ensure continuity during retrofit.
- Take full ownership of the retrofit project to handover.

The survey process has been studied in detail to minimise inconvenience and time for the householder while collecting all the information requirements for a fast, risk and error free installation. Both surveys have been designed to take less than the maximum consumer tolerance of 4 hours, but innovative tools and data capture should reduce this further.

The delivery team consists of 4 retrofitters, a leader (gas and electrically qualified) two medium skilled retrofitters to carry out the fixing of internal and external wall insulation and a fourth person of lesser skill level to carry out more general tasks.

There is scope for improved products for retrofit: For example reducing the time taken to apply external wall insulation with materials which are not weather dependent and access equipment which eliminates time consuming scaffolding.

During the project the importance data collected about properties prior to and during survey work has become apparent. This has significant commercial and research value which could fund the survey work either in part or in full.

A crucial finding emerging from this research project is that the timescale for retrofit can be compressed to deliver the whole house retrofit of a 3 bedroomed semi-detached house in less than a week. This includes all works identified in the standard packages.

The cost of retrofitting each of the house archetypes has been assessed for both the existing supply chain and proposed methods and for the poly-competent team with a more effective supply chain. A summary can be found in section 4 of this report showing savings of between 29 and 31% on current costs.

Our research has delivered a proposed future state supply chain model capable of delivering a whole house retrofit to a 3 bed room semi-detached home with 32% less cost than traditional methods and 37% less than the Green Deal Assessment cost. Despite these savings we have not reached the target cost of £7k as identified using the DECC IAG tool for break even on 'societal energy valuation'.

We anticipate that this could be improved upon with further more detailed analysis undertaken through a pilot project.

The conclusions of this project are that domestic housing refurbishment is possible at scale with significant improvements in the value proposition, efficiency, cost and customer service. Current offerings are characterised by multiple trades delivering single measures such as windows and doors or heating systems meaning a whole house retrofit is longer and more costly than if the most effective working methods and organisation were employed.

The future state designs have been reviewed by industry and government stakeholders and while some are uncertain the step change in cost and service can be delivered at the pace proposed; no systemic blocks to the models or future ambition have been identified.

2 Working Methodology

Throughout this project a right to left thinking approach has been taken, starting with customer needs (right of page) and working back to design, process and materials (left). The alternative, adapting the existing delivery systems to provide new requirements, frequently leads to compromise and sub-optimal performance. The first focus was on understanding and meeting householders' needs and then developing technical solutions and services to satisfy them. The key output is the design of a waste free supply chain capable of delivering the solutions developed for mass retrofit. This is supported by a transition plan to achieve the future state.

2.1 CUSTOMER SEGMENTATION

At the start of the project we took the customer segmentation developed in Work Package 5 as inputs to a workshop where customer value propositions were developed for each of the segments defined by understanding their lifestyles, attitudes and perceptions together with what benefits they want from retrofit and the sacrifices they are prepared to endure. This process exposed differences between the needs of some of the segments and allowed us to define different value propositions to satisfy these needs.

2.2 VALUE PROPOSITIONS

During the work on customer value propositions it emerged that the needs of different customer segments diverged at the Pre-sale, Installation and through life stages as illustrated in the diagram below.

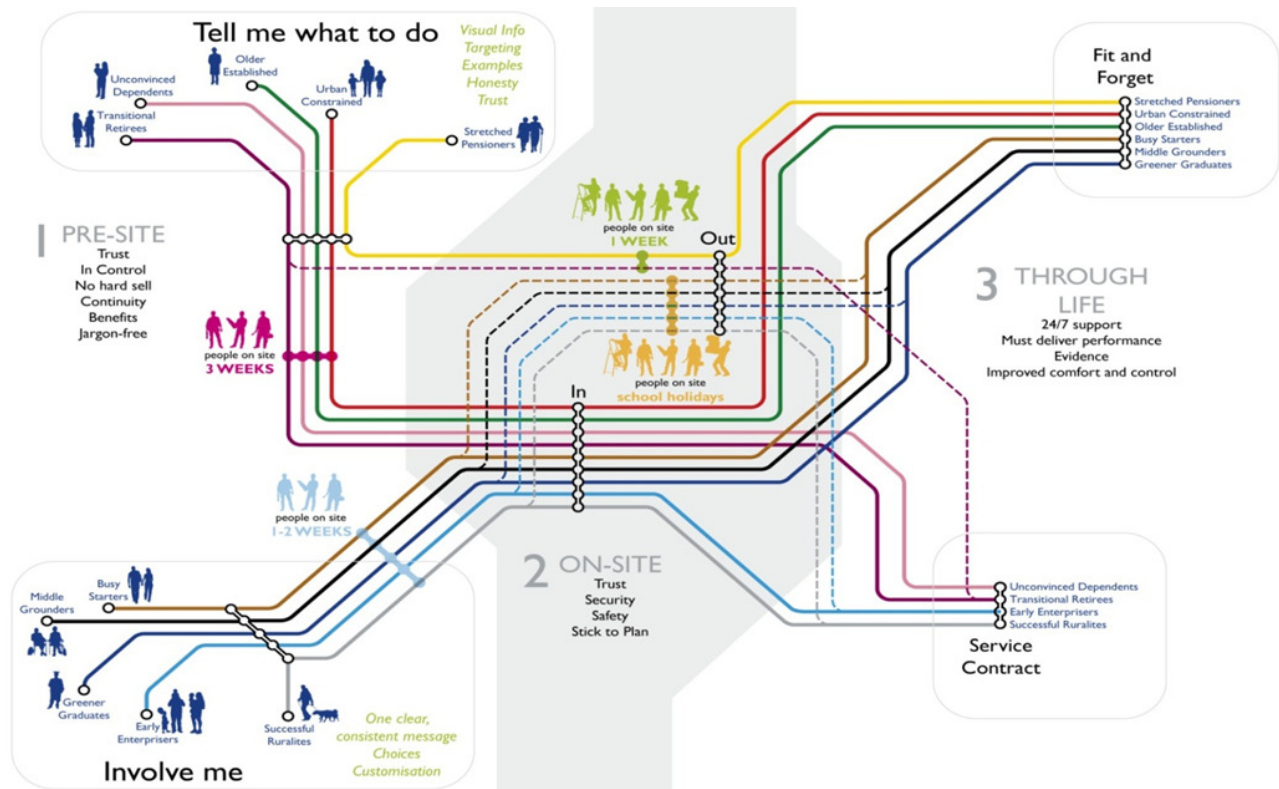


Figure 1 Value Proposition Summary

Dotted lines figure 1 indicate where different segments would consider vacating their property whilst retrofit works is carried out. Only Stretched Pensioners indicated that this was a firm preference.

In summary, at the stage of engaging people, requirements diverge; some want to be told what to do to their property and others to be involved in building the solution. At the installation stage some want to be present when work takes place and others to be away. Post installation there is the third point of diversion with some wanting to fit and forget measures and others wanting a service contract and upgrade path.

Key messages from the Value Proposition development are:

- Trust – There was a high need for trust across the entire retrofit experience, from the information presented; the integrity of the suppliers and their staff from survey through installation to after sales.
- Dependability – This was articulated in a range of ways, but summed up by quality of service i.e. keeping promises for time, cost and performance and having continuity of people and one point of contact throughout the retrofit process
- Respect – Householders are nervous about allowing people in into their home and the impact on their privacy, possessions, routine and safety. Familiar personnel and limited numbers on site required.
- Clarity – Clear information and a simple advice / sales process to help in the decision making process including explanations on legislation, incentives, funding and installers.
- Cost – £10 000 is the ceiling people would not go beyond for home improvement works.

2.3 END TO END SUPPLY CHAIN DESIGN

Throughout the project the scope of work has been the complete supply chain from product manufacture, installation of measures, maintenance and upgrade through life and recycling or disposal at the end of their useful lives. During the project it became clear the most significant potential for improvement is in the survey, supply and install aspects and as a result these get the greatest focus in the report.

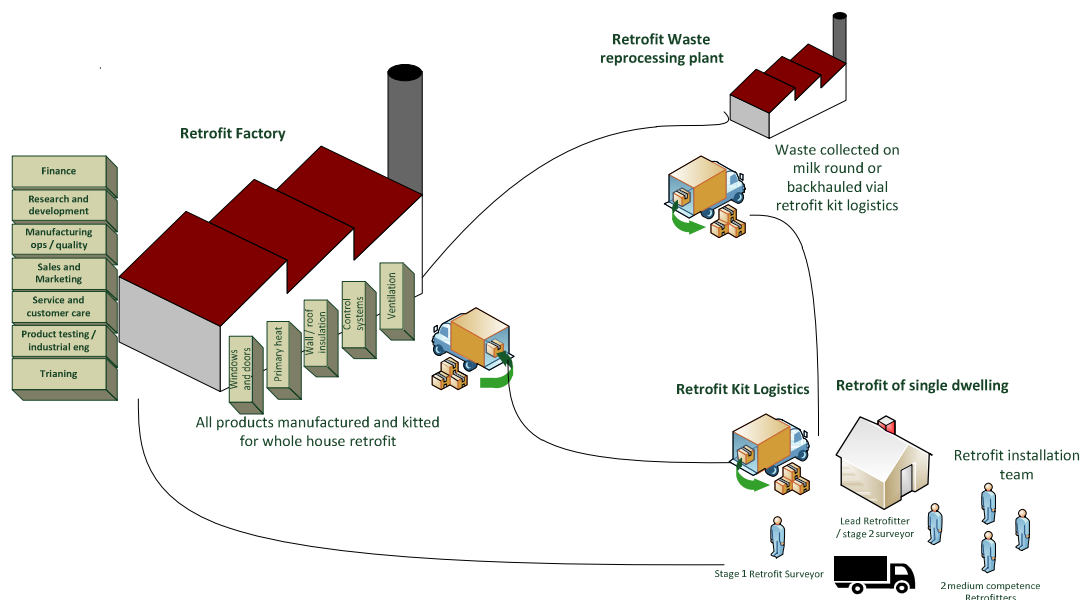
The high level end to end view and right to left thinking are critical in achieving the most effective supply chain design to deliver the value propositions developed. Simply improving what already exists does not overcome the inertia of legacy assets, plant and processes that exist today to serve the market needs of yesterday.

3 The 2020 vision of the supply chain

In order to achieve our objective of creating a sustainable market for whole house retrofit an ambitious and disruptive proposition is required. Using Right to Left thinking not constrained by the paradigms of the status quo a future state, least wasteful supply chain model is presented together with the next possible step. Following also is a summary of the supply chain from a customer experience perspective written as expected in 2020.

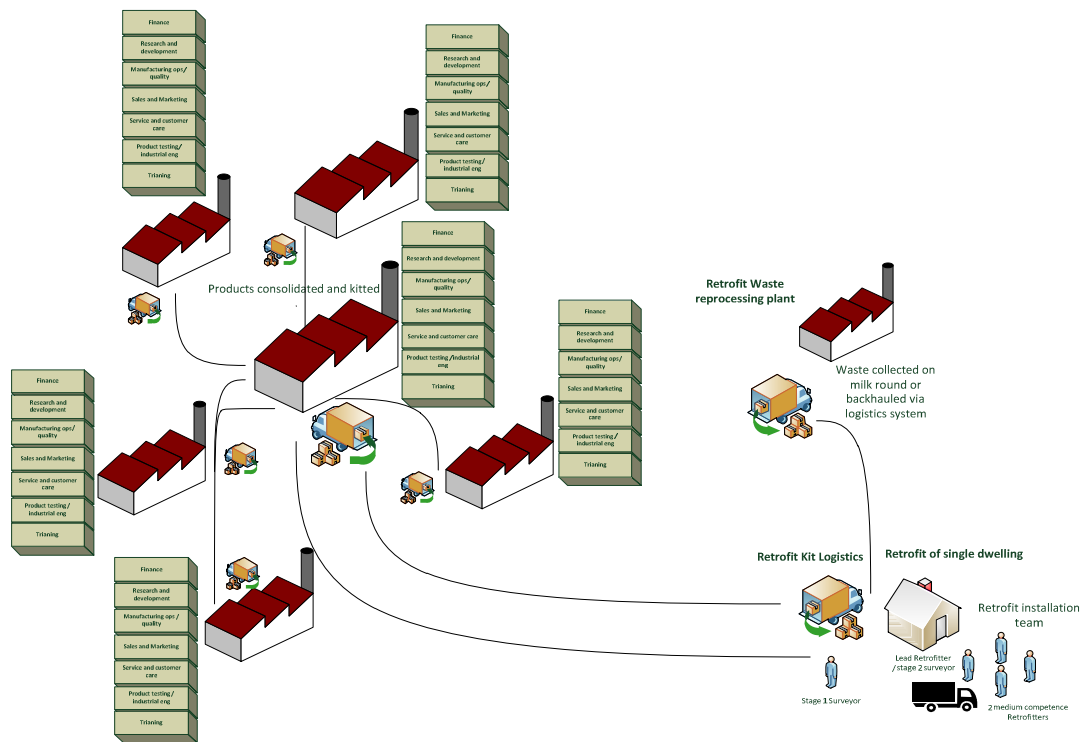
3.1 FUTURE STATE SUPPLY CHAIN MAP

Figure 2 Least Wasteful supply chain configuration



The above diagram shows the delivery team of 4 and the “lead retrofitter” doubling as a 2nd stage surveyor. The stage 1 surveyor is the gateway to the sale and provides the customer with detailed information about retrofit.

Figure 3 Manufacture with kitting plant / consolidation centre (could be a manufacturer)



As can be seen from the above, the *delivery end* of the supply chain is the same as for the least wasteful supply chain. This model contains separate manufacturers for retrofit components and a consolidation centre where whole house retrofit kits are assembled ready for dispatch direct to site. This illustrates how complexity increases with each move from the least wasteful model. Even in the medium term it is considered unlikely that all measures will be manufactured in the same factory space and shipped direct to site; therefore all costs and processes have been developed using the supply chain shown in figure 2.

3.2 CUSTOMER PERSPECTIVE – 2020.

In 2020 the retrofit supply chain should be mature and as a result sufficient capacity delivering high quality retrofit with low cost at scale. The following summary is intended to describe the desired future state and put context behind the transformation actions that need to occur to realise this vision.

Following Government backed marketing campaigns and the advertising media of private enterprises, the public awareness of energy efficiency measures and

benefits are well understood. The retrofit market is established and generating demand to sustain 400,000 retrofits per annum.

- Easily accessible demonstration homes, websites, literature and other media, all provide sources of information for customers to engage with energy efficiency retrofit opportunities.
- Organisations have established parent level retrofit franchise business models which provide; a suite of products with specific safe systems of installation, set training and accreditation standards to comply with product offering, marketing and advertising of their brand and co-ordinate communications between customers, surveyors and franchisee installers.
- Potential customers engage with a single point of contact within the parent company retrofit provider (franchisor) who organise an initial survey of their property. This stage one survey will be free of upfront costs and conducted in less than 4 hours on site.
- The stage one survey:
 - Establishes the necessary legal, planning and financial requirements for works to proceed.
 - Captures the property details and dimensions as well as identify any potential physical factors that may affect delivery.
 - Conducts an energy assessment and visually offers potential solutions with associated programme and likely cost.
- The customer chooses a retrofit option and agrees to pay for a potentially invasive second stage survey, either as a separate survey cost or as part of the installation price.
- The second stage survey takes less than four hours on site and is conducted by the installation team leader and assistant where necessary.
- The stage two survey builds upon the information captured at the initial survey and:
 - Identifies and mitigates any potential risks to the installation process by confirming the physical suitability of the proposed solution for the property.

- Confirms and captures measurements and details for required equipment and materials.
- Establishes project cost, installation and communication programmes and a list of necessary client actions.
- The Client agrees to proceed and signs sales contract with agreed programme start date 4-6 weeks from contract agreement. The signing of the sales contract initiates material orders from consolidation centre.
- The Client receives follow up communications 1 week prior to project start, to confirm programme timetable and compliance with any necessary client actions.
- The consolidation centre automatically orders materials when the sales contract is signed, receives them in time to pre-cut (where possible) and delivers all necessary materials, in a specifically designed secure container, to site on programme day 1.
- The installation team arrive on programme day 1 with all tools and necessary equipment.
- The installation is conducted by a locally based four person poly-competent team capable of delivering and commissioning the entire retrofit. The team consists of:
 - One team leader – Highly qualified and capable of signing off all retrofit works. Project manages the installation team, conducts stage two surveys and is the customer liaison for the entire installation period.
 - Two installers – Qualified to sign off parts of retrofit works and undergoing professional development for promotion to team leader.
 - One apprentice – Trained to basic level and undergoing professional development for promotion to installer.
- The installation is delivered on programme and project completion signed off, initiating payment.

- All waste from the installation is returned to the consolidation centre when the specialist container is retrieved after project completion. Zero waste is sent to landfill.
- The entire installation is covered by product warranty, and the Professional Indemnity and Public Liability insurance held by the installation team leader (franchisee) and the parent company (franchisor).
- Post installation the parent company retrofit provider becomes the single point of customer contact for feedback, complaints, defects, performance monitoring and on-going maintenance issues. The regular inspection and servicing of installed products will be co-ordinated by the parent company retrofit provider in accordance with the client and product maintenance schedule.
- The retrofit industry has established a publically recognised and trusted accreditation body that:
 - Provides a robust system that give confidence to customers that member organisations are competent to carry out the scope of works
 - Ensures insurance backed warranties are provided for all works carried out
 - Provides a means of redress to customer complaints.
- 60 national training centres provide accredited courses and qualifications necessary for entry in to, or professional development within, the whole house retrofit sector. The training centres are capable of delivering the training requirements necessary to support the 10,000 installation teams and 10,000 stage 1 surveyors.
- Product manufactures have reduced the number of product offerings to a few standardised items. Volume output has increased and economies of scale have reduced cost.
- New high performing products shift rapidly from premium to mass market prices.
- Logistic consolidation centres have developed their facilities to allow for product assembly on site and have aspirations to further expand capabilities

to allow for part manufacture on site by 2025. Space has been created by reducing stock levels through improved product flow.

- A governmentally managed database, pooling all house and householder information is established. This data base is used as both a primary source of research and for data capture during the survey stages. This information is commercially viable with revenues raised fed back into the industry via subsidies or directly benefit the client e.g. by reduced insurance premiums due to more accurate house condition.
- Innovation in the market is continuous with thinner and more efficient products helping to lower cost, increase performance and reduce programme.

By 2020 the whole house retrofit market will offer clients are fantastic customer experience which is delivered brilliantly with zero defects or waste.

4 Retrofit delivery programme

Summary

Cost reductions can be achieved through a more efficient delivery process; current methodologies for delivery of retrofit or other home improvements are not lean. By reducing waste across all areas of the process we can reduce programme periods and cost, by minimising waste. By delivering effective standardised designs, using standard processes, to a consistent timeline across the UK, an optimum level of quality can be maintained to ensure in all cases we exceed the customer quality cost and delivery expectations.

4.1 SURVEY DELIVERY.

The stage 1 survey will form a crucial part of the overall client engagement process. The customer will provide information during a four hour consultation in addition to data gathered in advance on the locality, house type and occupants of the home. Work Pack 3 has provided decision trees for the surveyor to work through for all house types with the end result being a standardised approach to the best possible interventions for RetroFix and RetroPlus. The customer will be presented with an affordable solution, subject to a detailed stage 2 survey to reducing their energy consumption and address any added value requests for example a new kitchen.

On agreement from the customer to proceed, a stage 2 survey will be undertaken led by the poly-competent team leader. This survey will take between 3 and 8 man hrs dependant on house type and solution level i.e. RetroFix and RetroPlus. In house types over 4 man hours a second team member will assist the survey to keep within the desired 4 hour customer window. The main outcome of this survey is to assess and establish possible risks, accurately measure and quantify materials for manufacture, understand possible constraints such as access, health and safety or vulnerability, familiarise the Team Leader with the installation and introduce the customer to their main point of contact during the installation.

The cost of the stage 1 and stage 2 survey have been included in the delivery calculations in paragraph 4.3 of this report.

Consideration needs to be given that during the survey and installation processes significant amounts of detailed information will be collected about the house type, occupants, energy consumption and their living style. This information if collected under data protection and 3rd party distribution agreements will have significant commercial value. All data collected with or without distribution permission is fundamental to continuous improvement. Measurement of all processes from marketing and sales performance, quality and customer feedback, through to installation efficiency and waste will identify improvement opportunities and performance trends that can be shared across the supply chain.

4.2 INSTALLATION DELIVERY.

Current practise for delivery of retrofit within large scale programmes such as Decent Homes relies on a multiple trade approach where by works are delivered by mostly single skilled tradespeople following a logical sequence of works. For example in the case of a kitchen being fitted the first operation would be for a labourer to remove the existing kitchen. This would then be followed by a plumber who would relocate pipework, an electrician to move sockets etc. Within this process there is inherently an amount of wasted time from travelling and standing time whilst the project is inactive. If there is a delay in any planned part of the process this can extend the overall programme period as it may introduce out of sequence operations. In order to reduce this waste we have analysed all of the skills and operations required to deliver the RetroFix and RetroPlus options we have looked at the following areas and identified waste that exists within the current process:

1. Transport – Waste exists within distribution and movement of materials
2. Inventory – Material on site is over estimated with each member in the process often adding in a percentage for natural wastage. Waste also occurs due to poor material storage on site and loss / theft.
3. Motion – with the multiple trade approach there is considerable time and resource loss in movements of operatives to / from and around the workplace, in addition with little float in programmes minor delays often lead to major disruption.
4. Waiting – With the multi trade approach there are periods of time where they may be no activity on site, this can lead to frustration with customers. Trades people are often let waiting whilst the previous trade completes their task.

5. Over Production – The traditional multi-tier management approach leads to over allocation of resource with each tier in the process adding material in for margin of error.
6. Over Process - The traditional multi-tier management approach leads to multiple trades conducting surveys to gather the same information; frustrating to the client as well as wasteful of resource.
7. Defects – The multiple Trade approach leads to a lack of ownership of problems, most issues arise at interfaces between trades, this leads to effort being put in to disputes over responsibility for defects, rather than defect resolution.

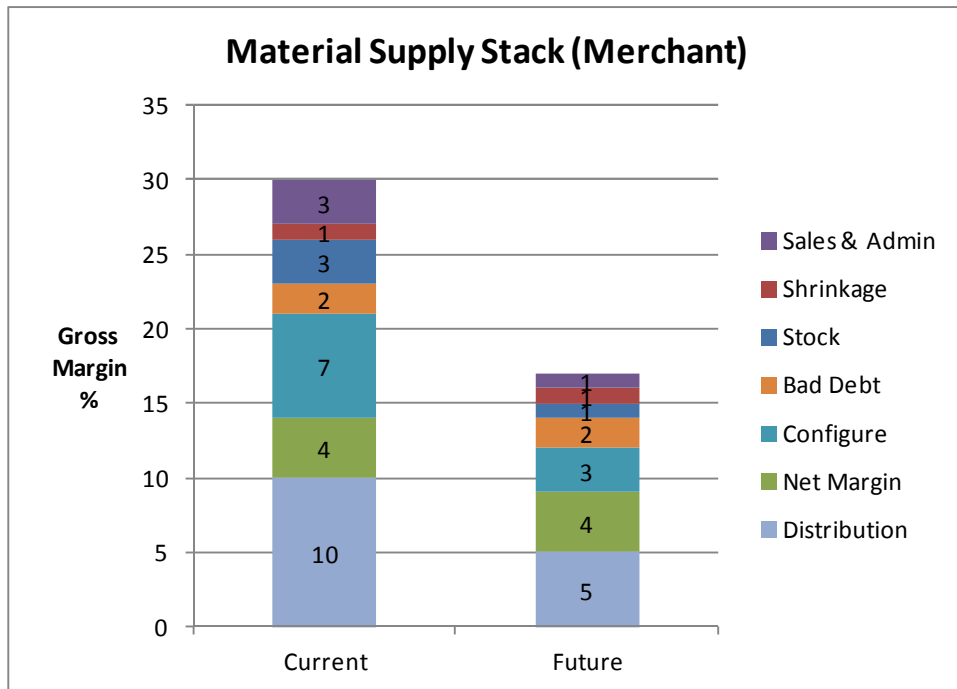
Through our research we have shown that a dedicated poly-competent team is capable of delivering the requirements of the specification in a shorter time period, at a lower cost and with less waste and reduced exposure to defects than current process. The expected labour saving is incorporated for each house type in the table in 4.3 Delivery Outcomes. Also included in 4.3 is an evaluation of the future potential benefit gained by delivering using lean processes to create standard work and innovation.

4.3 DELIVERY OUTCOMES.

A summary of the level of measures to be installed by house type together with cost comparisons between the traditional and proposed approach can be found in Appendix 3

In addition to the efficiencies of a poly competent approach to install and survey further cost can be removed from the material supply process. The following cost reductions have been developed with members of the current supply chain using their knowledge and experience, the figures quoted are considered to be achievable and not aspirational.

Figure 3 Material cost Breakdown at Merchant



In the diagram above a typical supply merchant (between product manufacture and install team) operates to a 30% gross margin across the construction sector as a whole. This model has the following constraints that could be improved for mass whole house retrofit;

- Large overhead of regional depots
- High final mile delivery cost via specialist vehicles (Hiab HGV)
- Bulk delivery quantities to site allowing for wasteful installation.
- Short notice delivery requirements requiring high stock levels with picking errors.
- Multiple production options requiring high stock levels and shrinkage.

Establishment of the whole house retrofit market and associated least wasteful supply chain models will deliver the following remedies to the constraints above;

Table 1

	Constraint	Improvement
Sales & Admin	Short demand lead time from retail & contract installers. Multiple product purchasing approach requiring sales and admin support.	Single house kits & standard product approach reduces stock variation and associated admin. Increased visibility of demand through “pull” approach from poly comp teams who just install retrofit reduces reliance on sales and marketing “push”.
Shrinkage	Large warehouses of regional depot model operating across all construction products. High variation of product, bulk quantities and large stock levels carried due to lack of market planning and push approach.	Move toward JIT supply utilising the transparent forward planning of demand by the poly comp teams. Reduced product variation and demand forecasting reduce stock and loss through shrinkage.
Stock		
Net Margin	Current Level maintained.	ROI increases due to lower overhead.
Configuration	Bulk product delivery to utilise high transport cost of building products (Hiab HGV).	Whole house kit supplied in 1 drop. Retrofit specific transport utilised (NON HGV). That doubles as onsite store.
Distribution.		

Removing the constraints above with improved demand forecasting, reduced variation and efficient delivery techniques can reduce gross margin from 30% to 17% whilst maintain net margin at 4%. This enables the full 13% cost reduction to be enjoyed by the end customer. A single delivery can be made using a 20m³ delivery container / vehicle on all house types for Retrofix. In comparison a Ford Transit Luton Van has a 16m³ capacity. A summary of material volumes can be found in Appendix 8.

In addition to 13% reduction identified by improving the supply chain efficiency a significant cost reduction is anticipated on reducing variation and volume ramp up. As the demand for whole house retrofit increases it is anticipated that the market could grow from 100,000 to 400,000 UK homes per annum by 2020. Three separate suppliers of insulation products gave feedback through the stakeholder review on reduction in variation and volume. The reduction in variation is based around a traditional approach to fitting the exact thickness of insulation required

to exactly meet the target U value for the wall type. This leads to manufacture, storage and distribution of multiple thicknesses of insulation – “just in case” the installer requires it. Using a process of standard measures, installed on to known building fabric we have calculated that it is more cost effective to install in some circumstances a thicker measure of insulation with slightly increased cost than to have numerous thicknesses in the supply chain. There are 3 possible strategies to reduce variety:

- Produce a maximum of say 5 thicknesses (reduced from in excess of 20)
- Produce less thick insulation but use multiple layers to suit each situation
- Produce one size of insulation for all applications

The reduction in variation of thicknesses is anticipated to reduce cost of manufacture by 5%, the dominant factor is less lost manufacturing time changing over manufacturing machinery to produce different product thicknesses, in addition less safety stock and more fluid manufacture will result as confirmed by insulation manufacturers. We also anticipate a further 5% cost reduction at distribution through reduced stock holding between factory gate and retrofit household. The anticipated volume increase to 400k homes per annum by 2020 could yield up to a 20% reduction in cost to manufacture. As some products in the whole house measures package are more mature than others we have applied a 10% reduction in material cost at manufacture due to volume.

The effects of the material cost reductions above can be seen in the following table in the “material” bar for a 1950’s semi-detached home.

Figure 4

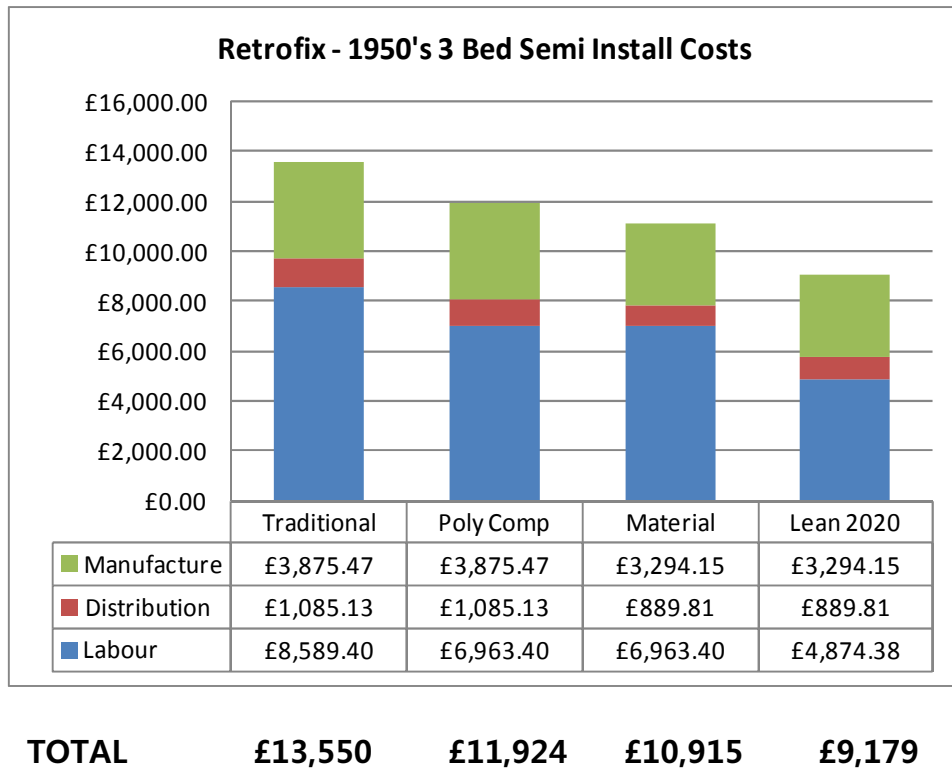


Table showing 1950’s 3 bed semi Retro Fix cost comparison.

The final column in the above table “Lean 2020” shows the benefit of applying Lean Manufacturing techniques to the poly competent team. In addition to eliminating waste as identified in section 4.2 Lean techniques will,

- Create standard work and process.
- Standardise and improve workplace organisation.
- Reduce set up and transition time.
- Implement highly visual controls and measures.
- Implement robust support processes through training.
- Embed a culture of continuous improvement and standardisation.

The implementation of the above tools will ensure predictability and consistency of the quality, cost and delivery performance of the team ultimately leading to improved customer satisfaction. The deployment of Lean tools and techniques to new areas of manufacturing, service industry and healthcare typically delivery up

to a 50% productivity improvement. In the table above a 30% reduction in labour cost has been forecast based on productivity gains.

A summary of the RetroFix and Retroplus cost position is presented in the tables below.

Table 2: Summary of Retrofix Costings.

	Traditional Cost	Lean 2020 Cost	Saving	%
Pre 1919 Mid Terraced	£11,368	£7,764.	£3,603.	32%
Pre 1919 Detached	£21,915	£14,993.	£6,921.	32%
1919 /1944 Semi detached	£13,550	£9,178.	£4,371	32%
1945/1950 Semi detached	£13,550	£9,178.	£4,371	32%
Pre 1919 Converted Flat	£9,084.	£6,498.	£2,594.	29%
1965 / 1980 Flat	£7,673	£5,451.	£2,221	29%
1965 / 1980 Bungalow	£9,254	£6601.	£2,652	29%
1965 / 1980 Detached	£17,105	£11,796	£5,308	31%
Post 1980 detached	£18,473	£12,737	£5,735	31%

Table 3 Summary Of RetroPlus Costs

	Traditional Cost	Lean 2020 Cost	Saving	%
Pre 1919 Mid Terraced	£19,384	£13,470	£5,914	31%
Pre 1919 Detached	£31,256	£21,567	£9,689	31%
1919 /1944 Semi detached	£20,215	£13,815	£6,400	32%
1945/1950 Semi detached	£20,215	£13,815	£6,400	32%
Pre 1919 Converted Flat	£16,370	£11,637	£4,976	29%
1965 / 1980 Flat	£14,959	£10,643	£4,314	29%
1965 / 1980 Bungalow	£16,540	£11,304	£5,236	32%
1965 / 1980 Detached	£26,446	£18,139	£8,307	31%
Post 1980 detached	£28,561	£19,682	£8,879	31%

4.4 HEALTH & SAFETY PROVISION.

Consideration has been given to the provision for health and safety throughout the value stream from initial design of solutions to through life and disposal. Particular reference has been made to the Health and Safety Executive

(Construction, Design and Management) Regulations 2007, as it is perceived that all Whole House Mass Retrofit works will fall under these regulations. The design and installation of standard solutions using as standard as possible list of products installed using standard techniques is critical to reduction variation and managing within known risks. It is anticipated that the surveyor and the poly-competent team leader will need to be trained in elements of health and safety linked to design if they are to fulfil their roles safely and make decisions that are relating to the design and therefore impact on the installation team, customer and general members of the public.

It is important to note however, that work carried out by the poly-competent team on a single domestic dwelling is exempt from Part 3 – (Additional Duties for Notifiable Projects) of the regulations - negating the need for a CDM Coordinator, Principle Contractor and other associated overheads of maintaining health and safety governance for large construction projects. Where Part 3 will apply for Whole House Retrofit is where a project extends beyond 30 working days or 500 man hours which is potentially possible on a multi dwelling street by street social housing project run by a national contractor. In terms of disruption, extra cost or risk, the National Contractors are already experienced in following CDM regulations.

It is anticipated that the top level franchise will create and manage the health and safety policy. As mentioned elsewhere in this report a key component of our future state model is to work from standard processes to deliver constant quality and avoid unnecessary process waste. In order to achieve this significant time is spent during the set up phase creating the optimum standard work. At this point hazard identification, risk assessments and safe systems of work (SSOW) will be created as key outputs of the standard work. Each regional franchise will adopt the overall safety policy along with undergoing general construction safety training, and specific task, hazard awareness, risk assessment and SSOW training in order to ensure they are compliant with CDM parts 1,2 & 4 as well as

maintaining a safe environment for themselves and the customer in their own home.

5 Target Customers / building the market

Client Engagement will be led by creating and delivering a marketing strategy for whole house retrofit products that exceed customers' expectations on quality cost and delivery. Backed by an independent government awareness campaign targeting increasing understanding of rising energy costs and the benefits of retrofit, the marketing will be delivered through multichannel methods to reach across a wide demographic of the UK population

Bringing together the outputs of WP1, WP2, WP3 and WP5 we understand the following,

- Thermal Performance of the existing housing stock by house type
- Impact of specific and a combination of measures for whole house retro fit by house type.
- A series of measures that give best whole house retrofit solutions at two levels RetroFix and RetroPlus across all house types
- The segmentation of the UK population by age, affluence, tenure.
- An assessment of attitudes towards whole house retro fit for each social segment.
- Regional distribution and density by house type and segmentation.

Additional work carried out in WP5 also identified key drivers for the voice of the customer broken down by segmentation. The above data enables a targeted approach to engagement where marketing can be focused on those most likely

to take up Retrofit. Certain segments have been identified as being early adopters through the focus groups and research, whilst certain house types have been identified as having larger potential benefits for either energy saving or aesthetics. Using the criteria set out for the best segments and house types and by procuring commercial data matching this criteria available on the open market, individual house holders can be identified. Different marketing channels can be used to trigger engagement based on the segment being targeted. Direct one to one marketing such as direct mail, telemarketing SMS or email can be combined with mass marketing channels such as social media, online / viral, TV, press and radio.

The different customer groups each have their own specific expectations for the provisions of building work or home improvement and so our initial hypothesis of a single retrofit delivery model was adapted as follows.

The following diagram illustrates the delivery options and the segments they are most suitable to serve,

Figure 5



Contractor	Eg: Wates				
National	Mark Group				
Retail	Everest				
Local	Franchise				

	Capability	Current	Future	Long Term	
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As shown here the larger national providers are the most likely to serve the multiple property Local Authority and Social Housing market, both currently and into the future.

For the much larger (70%) Owner Occupier market a more diverse range is likely to be attractive. Consumer research within the project shows a strong preference for locally based providers who have built trust through quality work and personal recommendation. The franchise model is developed to satisfy this with the back-up from a larger organisation as franchisor. Existing Retail and National providers have a strong presence with more established householders and if their offering continues to improve should maintain sales.

The private rented sector is not shown on the graphic because it is a highly disparate group ranging from commercial landlords and the National Trust to single rental property investors. The latter group will be likely to use the National or Franchise model whereas the multiple property landlords may be more attracted to the larger Contractor model if capital is available for larger projects.

6 Route to achieve the future state.

Working from right to left with the optimum desired future state in mind for 2020 a comparison was made with the current state to establish the individual tasks and these were then scheduled into a Gantt chart to create a complete roadmap including cost and resource to achieve the future state.

To achieve the optimum future state as laid out in section 3 of this report a thorough gap analysis was under taken. The team worked through the future value stream starting with initial customer engagement through survey, sale,

manufacture, install and through life to end of life disposal. For each step in the value stream specific statements of “what good looks like” were noted to enable a benchmark to the current state and formulate requirements to create a roadmap to achieve the future state. The output of the gap analysis work can be seen in Appendix 1 of this report.

To provide confidence in whole house retrofit using poly-competent teams a 100 homes trial is suggested. A proposal is attached to this report as Appendix 6. This proposal is for a 100 home trial taking place in 5 waves to allow processes to be developed and lessons learned to be absorbed and best practice developed. The total cost of the project is set at £4m and duration of 2 years.

For each element of the roadmap an estimate of the appropriate resource required and an applicable rate for that resource was combined to provide an estimate of cost. The resource and cost requirements can be viewed in detail in Appendix 1 of this report and a summary is presented in the table below.

Table 4

Process Step	Resource Type	Estimated Cost
1. Client Engagement	Marketing, Technical, Management, IT.	£47.3m
2. Stage 1 survey	Management, IT, Marketing	£752k
3. Solution Design	Management & Legal	£405k
4. Proposal	Legal	£552k
5. Establish Agreement	Legal	£4k
6. Stage 2 Survey	Management & Technical	£55k
7. Sale	Legal & Management	£154k
8. Material Provision	Management & Technical	£416k
9. Install	Management & Procurement	£176k
10. Through life	Management & Technical	£208k
11. Disposal	Management	£16k
0. Development Project – 200 homes	Consortium	£4m
	TOTAL	£54.04m

Client engagement is dominant and is predominantly the cost of advertising, this has been planned to be pinned to 4 major TV shows, and use 4 daily newspapers and 4 monthly magazines plus radio coverage over a 6 month period.

Calculations and sources of information can be found in Appendix 7

An estimated total budget of circa £54m is anticipated to enable the future state supply chain. A significant proportion at £47.3m / 90% of the budget has been attributed to Client Engagement and establishing the concept and benefits of Whole house Retrofit both independently through government / public service information and through aggressive multichannel marketing from the branded franchise. Also included in this section is the cost of setting up and maintaining

200 regional show homes so customers can easily visit and experience first-hand the products and discuss their benefits. There are lower cost alternatives such as incentivising the first installations in any area to act as advocates and be open to perspective customer visits; however, further research is needed to establish which approach would return the better ROI based on converting to sales. The balance of the cost and resource are focused on activities that enable the processes and policies required to carry out Retrofit.

The roadmap activities have then been scheduled in order to achieve a future state target of enable 400,000 homes to be retrofit annually by 2020. The full Gantt chart can be viewed in Appendix 2 and it can be seen that to achieve the target capacity of 400,000 retrofits the actions identified need to be complete by 2015. There will clearly be continuing action to refine and improve the delivery of retrofit and introduce new methods and materials, we consider that this will be an on-going process after the introduction of the poly competent team.

Key to success will be the identification of an organisation or organisations to lead the design of the supply chain and establishing new ways of working and lead the transformation. Organisations likely to play a part in this include energy companies, large corporate organisations, existing manufacturers and suppliers to the construction industry, merchants or a combination of the above. As the transformation roadmap illustrates, to transform the construction industry and / or create a retrofit industry will require a disruptive proposition.

As mentioned above, organisations that participate and drive this plan could be coordinated by the Construction Products Association, members of the supply chain and Government departments such as DECC and DBIS.

7 Risks and gaps

Outputs from other work packages have been used to develop hypotheses for design of standard retrofit packages, generating customer demand and any regional differences in solutions and demand. This work is based on desk based study and previous survey work and despite a widespread peer review (WP4.5 Report) there is margin for error in the assumptions made during this work package.

During the project the existing supply chain was engaged and attempts were made to understand the detail of the current cost of retrofit, and how this is built up in terms of labour, materials, distribution, inventory and waste processing. Cost information proved to be very difficult to obtain and only late on in the project did we succeed in obtaining visibility of cost distribution. The basis of the cost savings achievable for labour using the poly competent team is sound project planning, work observation this is considered to be robust. The costs of running the delivery organisation are based on business planning activities linked back to recognised cost models. Material and product cost allocations are made based on tested tactics for reducing the variety of products and materials which increases volume; this together with improved methods of distribution and delivering using the most effective model we can conceive. This approach has been tested through the stakeholder engagement process conducted for the WP4.5 report and has not been challenged but remains unproven; some stakeholders remain sceptical about take up of retrofit and understandably remain guarded about cost benefits achievable through improved effectiveness, decreased variety and increased volume. Some see this as a threat to their margin and continued survival despite the cost reduction and waste removal techniques employed not relying on decreasing margin taken. This is an area where further work is needed to test our hypotheses through a pilot project with a material /

product supply consortium or partnership in order to test the effects of the variables listed above in a commercial situation.

Although the value propositions developed during the course of the project have been tested as part of WP 5 through questionnaires and focus groups, take up of retrofit at scale remains uncertain, as do the benefits of retrofit in terms of actual energy savings achievable these can also be tested as part of a pilot scheme.

The data on which our hypotheses on take up are based is taken from WP 1,2 and 5. (The house archetypes and geographical data is taken from the English House Condition Survey and customer segmentation built around academic models, commercial customer engagement organisations, sample surveys and focus group activity)

Our report describes the poly competent team being operated as part of a franchise business. This is seen as a particularly efficient model to develop an easily scalable installation capacity and meet many of the customer value requirements. To date our research has not considered the underlying business implications, relevant to those organisations that could be prepared to take on the franchise parent role; and how exactly they could structure their relationships with individual franchisees. In addition the financial structure between franchisee, franchisor and customer have not been the subject of research for this project and therefore need further evaluation.

The planning approval process remains a considerable risk to establishing Mass Retrofit particularly for EWI. If an EWI installation extends beyond the traditional building line and is on the primary road facing elevations of the property then it requires planning approval. Even if these conditions are not met the Planning Departments we spoke to in our research suggested it was best to check. The same can also be said for replacement windows in conservation or protected area. The ambiguity of interpretation of planning law is no more evident than in the North West of England where there are 63 different planning offices, each with

their own processes for submitting approval and interpretation of the law. To aid in this process for installer and customer we suggest that key components of Whole House Mass Retrofit are made Permitted Development following the precedent already established by Solar PV.

8 Conclusions and Next Steps

We conclude that there is significant scope to develop a more effective supply chain to deliver domestic retrofit and that a small poly competent team will provide the most effective installation vehicle. In addition a disruptive proposition in materials supply and delivery to site is suggested to reduce material cost and interface effectively with the installation team.

The proposed local delivery system backed by a top level franchise company has the advantages of making it easier to enter the market as a provider and offering standard marketing, standard products and service with the backup of a big brand. This is easily scalable and provided customers with confidence associated with a recognised brand. The use of a poly competent team as the delivery entity is a new concept and is unproven but does not require new training systems to be created, merely re-configuration of what already exists. Existing materials supply capacity is not considered to be a limiting factor in developing the market for retrofit however there is considerable work to be done to bring a new supply chain on stream and to maturity.

In addition to the local scalable poly-competent approach it is also recognised that some of the existing routes to market will continue to prosper and mature. For delivery to Social housing in a street by street approach the National Contractor model remains strong. The disruptive development of the supply chain recommended in this report will also benefit National Contractors by reducing

materials costs, increasing product flow and adopting the survey processes and poly-competent delivery.

The current cost to whole house retrofit a 3 bedroom semi-detached home to RetroFix standard using traditional techniques in the existing supply chain is £13,550. The green deal cost assessment for the same home is £14,525 establishing a good benchmark for our costs. We have made significant progress with a 32% reduction in cost generating a saving of £4371 to delivery for £9,178. We have not however achieved the target cost in this project based on a property with 'typical' energy usage of 20MWh/yr. The DECC IAG tool shows that for break even on 'societal energy valuation' the target investment should be £5,900. 65% of this value is consumer energy bill saving, but this excludes VAT. Factoring in the retail energy pricing for the consumer and retaining the benefit to UK plc from the model we take break-even target costs of £7,000.

NB: These are not figures for a single payback, but are mid-point values from the national stock.

To achieve the target cost a further 30% reduction is required representing over a 50% reduction from the starting cost. As an example of where we need to focus future efforts the installation would need to complete in 3.5 days takes and it currently is forecast for 5 days. We also need to realise a further 30% in material costs and this is most likely to be achieved through product innovation for example a dry fit SWI solutions removing time consuming wet trades.

The hypotheses presented here need to be tested at scale to develop the standard work and process to allow easy scaling of the delivery model and development of the top level systems of the franchise. It is suggested that a pilot project of 200 homes of different archetypes is carried out in 5 waves to allow iterative process development and improvement to be embedded

Appendices.

Appendix 1



4 7 Appendix
1_Transition Plan

Appendix 2



4 7
Final_Appendix2_Tra

Appendix 3



4 7 Final_Appendix
3_Matrix of Measures

Appendix 4



4 7 Final_Appendix
4_Road Map Gant.xls

Appendix 5



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Appendix 6



100 Homes Retrofit
(3).doc

Appendix 7



Media Costs.xls

Appendix 8



Appendix 8 Material
Volumes