



Programme Area: Buildings

Project: Building Supply Chain for Mass Refurbishment of Houses

Title: DfX Workshop Report

Abstract:

Please note this report was produced in 2011/2012 and its contents may be out of date. This Report encapsulates the results of the DfX workshop held on 12th July 2010, the workshop was attended by over 45 participants from 32 different organisations representing a wide range of stakeholder groups and interests. The objectives of the workshop and the report are:

- To address the needs and requirements from a broad range of stakeholders in the national retrofit process
- To formulate a preliminary hierarchy of value of 'home thermal efficiency' for stakeholders
- To understand the various barriers and obstacles to the success of a national retrofit implementation plan
- To capture views from the participants and propose a strategy for capturing responses from other under-represented groups.
- To translate the outputs of the workshop into a framework for future deliverables to use as measures of success

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.

Disclaimer:

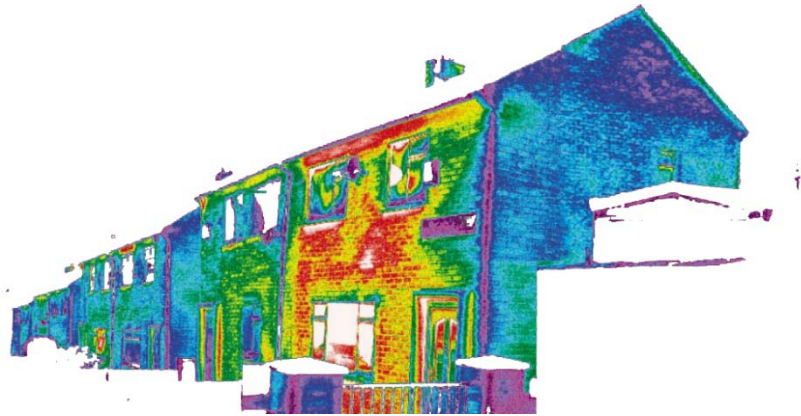
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The **ENERGY ZONE**
CONSORTIUM:



PEABODY



Optimising Thermal Efficiency
of Existing Housing

DfX Workshop Report

Final Submission

Submitted by  on behalf of the
ENERGY ZONE CONSORTIUM

30 September 2010

Optimising Thermal Efficiency of Existing Housing

DfX Workshop Report

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Issue

Final issue

Action

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

Signature



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EXECUTIVE SUMMARY

The Optimising Thermal Efficiency in Existing Housing "DfX" Workshop was held in mid-July 2010 in central London, and was attended by over 45 participants from 32 different organisations representing a wide range of stakeholder groups and interests.

WORKSHOP AND REPORT OBJECTIVES

- To address the needs and requirements from a sufficiently broad range of stakeholders in the national retrofit process
- To formulate a preliminary hierarchy of value of 'home thermal efficiency' for stakeholders
- To understand the various barriers and obstacles to the success of a national retrofit implementation plan
- To capture views from the participants and propose a strategy for capturing responses from other under-represented groups.
- To translate the outputs of the workshop into a framework for future deliverables to use as measures of success

KEY FINDINGS

The following issues emerged as being the top key issues and variables that need to be looked at in relation to the development of a roadmap for the delivery of mass retrofit in the UK:

- COST
- TIME
- STAKEHOLDER VALUE
- PUBLIC ACCEPTANCE
- SCALABILITY
- FUTURE PROOFING
- SKILLS
- DISSEMINATION
- MITIGATING RISK
- ACCESS TO INFORMATION

NEXT STEPS

We hope to capture the ideas and opinions of a wider range of regional stakeholders and other sectors which were under-represented in the workshop. This will be done by sending out this report with an accompanying questionnaire to a targeted set of experts on retrofit delivery in Scotland, Northern Ireland and Wales, as well as key people in the financial and funding sectors.

BACKGROUND

PRP
 responsive, intelligent, enduring design

Optimising Thermal Efficiency in Existing Housing:
The Challenges of Mass Retrofit
 Monday 12th July 2010
 The Hatton
 51-53 Hatton Garden
 London
 EC1N 8HN

Agenda

The ENERGY ZONE CONSORTIUM:
 EDF ENERGY, PEABODY, PRP, wates, bre, EDF, TotalFlow, UCL



The Optimising Thermal Efficiency in Existing Housing "DfX" Workshop was held in mid-July 2010 in central London, and was attended by over 45 participants from 32 different organisations representing a wide range of stakeholder groups and interests.

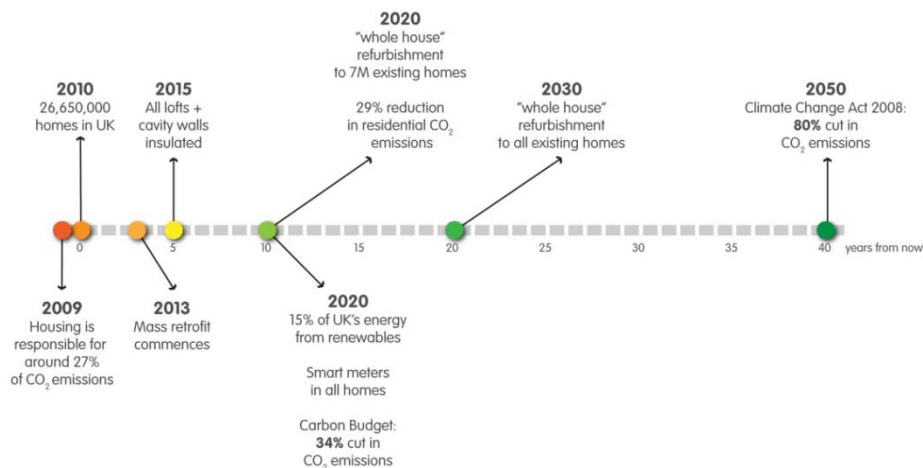


WORKSHOP AND REPORT OBJECTIVES

- To address the needs and requirements from a sufficiently broad range of stakeholders in the national retrofit process
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- To translate the outputs of the workshop into a framework for future deliverables to use as measures of success

The detailed findings from each workshop session are described in the sections that follow.

INTRODUCTION



THE RETROFIT CHALLENGE

The workshop started off with a presentation by Andrew Mellor from PRP on 'The Retrofit Challenge', setting the scene for the day's workshop by giving an overview of current policies and programmes for retrofit and the global challenges we currently face, as well as the unique challenges presented to us by the nature of our housing stock and the current state of our supply chain.

The key points from the presentation include:

- Global drivers - climate change, fuel security, affordable warmth and the need for a stable economy
- 2013-2020 - community partnerships led by Las, local area retrofit programmes with energy providers, Warm Homes Standards, PAYS, customer advice service
- Challenges - owner occupier acceptance, supply chain design, community implementation strategies (efficiency and economies of scale)
- Housing stock - 26.6M homes, 70% owner occupied, 12% private rent, 18% social rent, 7,000 vacant, 8.5M over 60 years old
- The scale of the challenge - to refurb 20-25M homes: 90% pre 1990 by 2030 = 1M homes a year; 6.6M solid wall by 2020 = 660,000 homes a year; 4.5M social housing stock by 2030 = 225,000 a year. Assuming we start NOW.
- Cost - £2,500 - £40,000 per dwelling (government and industry figures). Must not forget additional cost of statutory fees, consultant fees, consequential costs, i.e. decoration, and maintenance and replacement costs. Possible benefit from reduced VAT, energy sales, i.e. FITs, RHI, economies of scale, process efficiency and product innovations.
- Market - 20M homes at £10k per home = £10Bn/year for 20 years = £200Bn total. If £20k then £400Bn over 20 years. 65,000 people employed as installers, 20,000 whole dwelling retrofits per week over 20 years.
- Delivery - residents in occupation, acceptance, planning policy, supply chain and delivery, legal issues, warranties and insurance, value of home, solutions, quality on site, skills, potential consequential environmental problems, embodied carbon vs operational savings, future-proofed solutions, protection of historic streetscapes, opportunity for streetscape improvements, possibility of combining with other work, e.g. climate change adaptation

Visioning Exercise

What will life in the UK be like in 2030? How will our lives change?

What will the major advances and changes be at these key points in time?



The kick-off activity for the workshop was a quick-fire 15 minute exercise in imagining what life would be like in 2030 and beyond. Providing the provocative 'food for thought' for this workshop were three key speakers discussing the theme 'Policy':

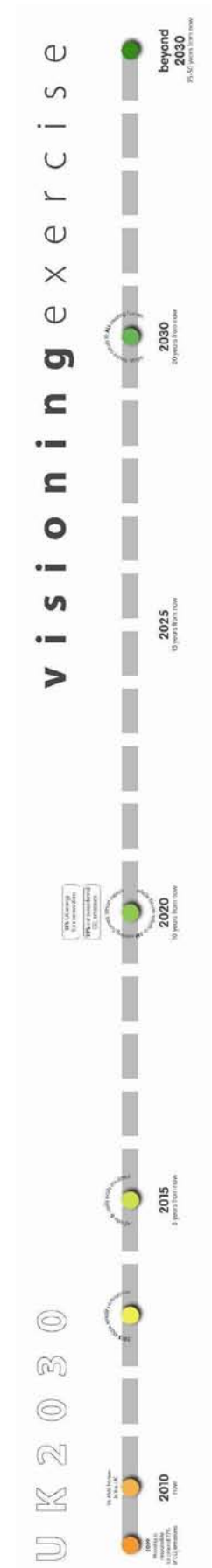
- **Prof Michael Kelly**, University of Cambridge - 'Drivers for Retrofit'
- **Ian Mickle**, Technology Strategy Board - 'Routes to Innovation'
- **Terry Boniface** - 'Government Policy'

We divided the participants into four groups based on a random distribution - Technology, Society, Economy, and Environment.

In the first stage of the exercise we asked them to imagine what life in the UK would be like in 2030 - blue-sky thinking, given that population is increasing and society is changing; the planet is growing hotter; technology is advancing exponentially, and that the current economy is unstable. We asked them to think about what the impact of these societal, environmental, technological, and economic changes would be in 20 years' time.

In the second stage of the exercise we asked them to populate a timeline with key dates, issues, events or advancements in terms of the particular theme they had been assigned and in terms of the retrofit work that we are trying to achieve.

Finally, a representative from each group was asked to report on their key results.



The following table is a summary of the key points that were raised. Highlighted in bold are items that are of particular interest to the retrofit programme which could potentially be included in the model for testing.

Life in 2030:	
Positive Outlook:	Reality Check:
<p>Job security, full employment Leisure-focused 60% living in cities</p> <p>Financial security & wealth Cooperative, Collaborative living</p>	<p>Older Demographic Fuel poverty Energy cost increase/Energy crunch Extreme weather – heat, cold, floods</p> <p>Increasing population Poorer nation (grey pennies, not £) Obesity, Diabetes – less healthy population Less potable water access Social isolation Deaths due to heat – cooling essential for vulnerable Food shortages Tree loss + vegetation loss = +2°C temperature increase Growth of private transport</p>
Gadgets	Housing
<p>Biogas from green waste becomes the norm Low carbon national grid Smart metering 10mm insulation product</p> <p>Comfort delivered 24/7 Self-driving cars Robots and insulating nanobots Cheap, reliable low carbon vehicles, electric vehicles One-device solutions, smartphones that control your home Laser printing additive material Transparent clip-on external cladding</p>	<p>Higher rate of new build</p> <p>Greater rental market Factory built, mass produced housing Flexible living spaces Smart houses, smart meters, responsive buildings Assisted living technology</p>

IMPLICATIONS

Future Working Patterns - if the prediction is for '**Job security, full employment**' and for a '**Leisure-focused**' society then the occupancy patterns for householders in employment may change in the coming years - how would it affect the plan if more people were in employment, and if people spent more time away on holiday? Does this make delivering a retrofitted house easier since the occupants are more likely to be out of the house? Does the leisure focus provide us with a key trigger that we could use to incentivise householders to take up retrofit?

Changing Demographics - an '**Older Demographic**' means that you have an emerging generation of people who will be in their homes during the day, have higher heating and cooling requirements, and who are more likely to suffer from fuel poverty. What proportion of the retrofittable homes are occupied, or will be occupied by this older demographic? The modelling for these homes should reflect the specific occupancy patterns of this demographic group in order to determine overall energy consumption and carbon emissions. Also, in terms of delivering the retrofit, how do we deal with this sector when formulating the plan?

'60% living in cities' - if more people will be living in cities then does this mean that the house types we should focus on are the urban typologies, as retrofitting these would mean the most impact on the national carbon footprint?

Economics - '**Fuel poverty**' and '**Energy cost increase/Energy crunch**' - The cost of energy should be a primary consideration both for modelling and formulating the plan. How is the cost of energy going to change in relation to people's personal incomes? How will this affect the perceived value and cost of a retrofit project?

Climate Change - Extreme weather – heat, cold, floods - UKCIP or similar scenarios should be considered for thermal or energy consumption modelling, not just as a static point in time but as an evolving dataset to incorporate how the UK climate is going to change in the years leading up to 2030, and beyond.

Energy sources - '**Biogas from green waste becomes the norm**' and '**Low carbon national grid**' - A scenario for the decarbonisation of the national grid should be tested to compare with the cost and disruption associated with retrofitting 26M homes - if we are able to decarbonise our grid at a national level earlier would this make things easier? By how much?

Effect of interventions - '**Smart metering**' and '**10mm insulation product**' - installing smart metering is predicted to reduce occupant energy consumption by a certain percentage. Likewise, the emergence of a thinner super insulant which provides U-values of 0.15 could drastically change the way we design and eliminate constraints such as the reduction of space standards - however, what are the unintended consequences of this in terms of installation, waste generation, embodied energy? Are there any that need to be considered? Careful consideration of each product or solution's life cycle implications would be required, not just in terms of carbon emissions but also of its performance in use and beyond.

TIMELINE

The following table is a consolidation of the timeline of events leading up to 2030.

Year	Events
2010	<p>26M homes in the UK</p> <p>Key issues Heating vs Cooling Health Water saving Rising fuel costs</p> <p>Key requirements Understand and develop awareness of what is existing R&D, Exemplars of energy efficiency retrofit Explore benefits of upscaling, effect of improvements to existing stock Define technology needed</p>
2013	<p>Mass retrofit commences</p> <p>Key issues Fuel poverty becomes a major issue as planned fossil fuel rise kicks in Cooling becomes essential for vulnerable population Health issues emerge due to extreme weather and climate change Supply of products and raw materials</p> <p>Key requirements Established markets for renewables and energy efficiency technologies</p>
2015	<p>All lofts and cavity walls insulated</p> <p>Key issues Change in social attitudes and behaviour – profligate energy use is ‘antisocial’ Bees become extinct due to climate change</p> <p>Key requirements Smartphones/devices to control home energy systems and smart metering widely available Embodied energy figures and ratings become more prominent Effective Green Bank (e.g. KfW) established, easily accessible retrofit loans become available</p>

2020

Whole house refurb to 7M homes

Key issues

Indoor health from airtightness

Water quality

Food vs resource+fuel

Population shift to more remote + northern areas

Key requirements

Whole street interventions: terraces, townhouses, semis

Biogas from green waste becomes the norm

High tech materials mature – laser printing, clip on cladding, 10mm WI as standard

Increased accuracy of measurement and data – energy consumption, carbon emissions, embodied energy

UK significant market share of heat pumps

Economies of scale on renewables

Electric vehicles a way of life

Shift to “community” for food and energy

Enabling infrastructure for retrofit in place

Increase in ethical banks and ethical investment products

2030

Mass retrofit complete

Key issues

Rising population, risk of food shortage

Economic ascendance of the East – China, India superpowers

Will we save enough energy that we risk deflation?

Key requirements

Material availability issues resolved

Climate protection achieved – complete global protectionism

Landfill mining underway

2010 mass tree planting – cities and towns are cooler

Low carbon UK national grid in place

Key Elements of the Retrofit Plan

What do we need retrofit to achieve?

What are the key elements of a mass retrofit implementation plan?



The first main workshop session was a 35 minute exercise in developing a set of variables that would correspond to the key elements for the formulation and delivery of a mass retrofit implementation plan. Providing the provocative 'food for thought' for this workshop were three key speakers discussing the theme 'Design':

- **Barry Munday**, Housing Forum - 'UK Housing Stock'
- **Jarrold Hill**, English Heritage - 'Period and Historic Dwellings'
- **Andrew Mellor**, PRP - 'Barriers to Delivery'

We divided the participants into four groups based on their area of expertise - Policy, Design, Delivery and End-User.

The basis of the exercise was based on the idea that we were trying to develop a plan to deliver the mass retrofit of existing homes by 2030. The plan needs to be **deliverable** (within twenty years); **cost effective and profitable** for the supply chain; **affordable** and **acceptable** for customers and effective in achieving our targets in terms of **cost per unit of carbon saved**.

We asked the participants to consider the key elements that would need to be addressed and included in the development of a successful mass retrofit implementation plan. What variables and issues would we need to consider?

In the first stage of the exercise we asked the participants to write down specific issues, variables, ingredients, opportunities, risks and constraints that would inform the retrofit programme for each specific theme on separate post-it notes.

In the second stage of the exercise we asked them to place these notes where they thought they should be on an x-y graph that represented the interaction between two variables, which changed depending on the theme. All four graph sheets had the same **y axis - cost effectiveness**. The x axis changes for each theme:

- **Policy:** Implementability - Can policies easily put in place?
- **Design:** Availability of Solutions - Do the techniques & materials exist?
- **Delivery:** Deliverability - Do we have the skills and processes to make this happen?
- **End User:** Acceptability - Are the customers likely to get on board?

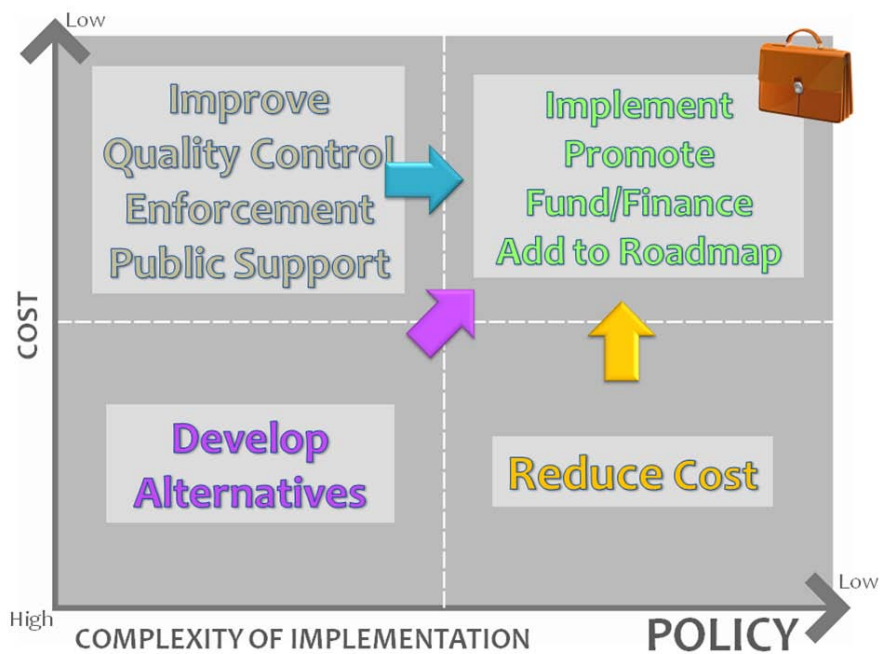
Finally, a representative from each group was asked to report on their key results.



POLICY

Key Plan Elements

- **AFFORDABILITY** - Enable people to pay for solutions
- **LEGISLATION** - Avoid over-regulation, robustness of implementation measures
- **DIRECTION** - end-to-end roadmap, ensure consistency of messaging
- **EMPOWERMENT** - enable local communities and private sector solutions
- **INFORMATION** - quality data and understanding of potential legislation implications essential
- **OPPORTUNITY** - for the creation of a green economy, export of IP and skills to a global market, use of regulations to drive change (Part L)
- **RESULTS** - actual, tangible carbon reductions



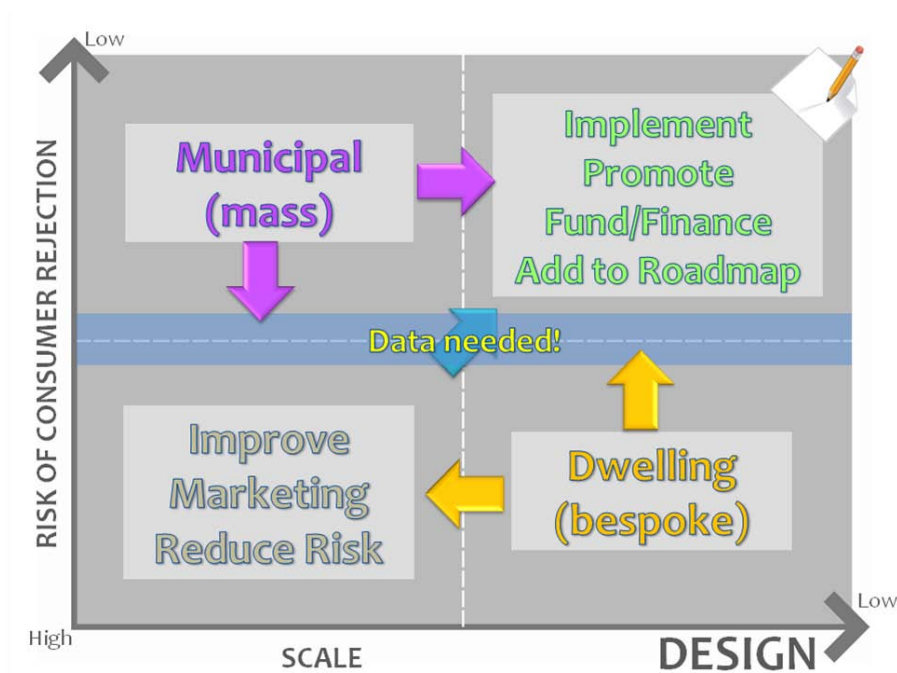
	CHALLENGING	IMPLEMENTABLE
COST EFFECTIVE	<p>Energy Bills based on consumption only</p> <p>Advice, information, referral: A One-stop shop (EST going the other way at present)</p> <p>Create market to encourage delivery</p> <p>Provide support through policy</p> <p>Government to enable consistency/ availability of supply</p> <p>Develop expandable skills and processes using home markets (opportunity!)</p> <p>Shared risks and shared benefits across stakeholders</p> <p>Incentives/Penalties (stamp duty and council tax)</p> <p>Gain trust - consumer confidence</p> <p>Understand householder motivation/incentives to act</p> <p>Opportunity for construction sector growth - products, supply chain</p>	<p>Develop detailed end-to-end road map</p> <p>Top-down and bottom up approach</p> <p>Exemplars</p> <p>Early demo on scale - an existence proof</p> <p>Part L consequential improvements (with teeth)</p> <p>Green Bank Regulation</p> <p>GIB (support green deal)</p>
EXPENSIVE	<p>Zero Carbon Refurbishment Hub (without gov't finance)</p> <p>EPC vs. DECC (evidence)</p> <p>Skills and QA upgrades</p>	<p>Deregulation</p> <p>Complimentarity of funding</p>



DESIGN

Key Plan Elements

- **SCALE** – critical variable in the formulation of the plan
- **INNOVATION** – are there better ways of doing things?
- **ACCESS TO QUALITY DATA** – essential to facilitate innovation and formulating the plan
- **TOOLS** – to make individual bespoke solutions accessible to homeowners, empowerment
- **ACCEPTABILITY** – robust legislation, appropriate messaging i.e. climate change vs. energy security, simple and easier to understand
- **CONSEQUENCES OF IMPROVEMENTS** - consideration of the risks associated with upgrading thermal performance, e.g. overheating and loss of daylight/sunlight, loss of space, loss of architectural character, generation of waste, increased need for transport of materials.



	MASS SCALE	ALL SCALES	DWELLING (BESPOKE) SCALE
ACCEPTABLE	<ul style="list-style-type: none"> Flexibility in the regulation e.g. temperature zones in a home Planning Control Pre-designed, pre approved solutions Quality control Create "House Type" refurb product streams Establish a safe "standard practice" ...a core of measures for 50-75%? Dump the CO₂ Savings message Embrace £££ savings message for wide public engagement! Create new trend/fashion in existing housing redesign Opportunity: Combine energy efficiency with re-styling/enhancing building - add consumer appeal and value Same reasoned judgement of risk vs reward so people can go as far as they feel safe "Value" of retrofitted solution when house sold Sales taxation levy on recommendations of EPC if not implemented Will I see a return on my investment? 	<ul style="list-style-type: none"> Better data for designers!!! (lots of stars) Comfort changes - less heating, more technique? Future will be hotter - design implications of shading or cooling - particularly on lightweight or highly glazed buildings Insufficient quality of base data for designing solutions Window with blinds etc - U-value of 1.4 Triple glazing or good double - U-value of 1.4 	<ul style="list-style-type: none"> Solutions for different occupancy patterns Tool to help build a 'plan' for the house (energy/carbon/cost) Heat loss maps to make private homeowners aware of heat loss from their houses Tool for 'understanding' how the building performs that is usable by the householder Simple solutions to install, use and maintain
UNACCEPTABLE	<ul style="list-style-type: none"> Design-in for sustainable infrastructure Need for whole system design Design for future, not for today...avoid later need for retrofit Combine retrofit with estate energy Fixed pre-cost for consumer vs uncertainty of existing build Risk of losing character or coherence of an area Look at area wide strategy from a design/coherence point of view Area wide solutions- planning policies to encourage decentralised energy hubs/network 	<ul style="list-style-type: none"> Create database of existing materials Better predictive modelling for design Moisture movement implications not fully understood Risk of thermal bridges, dampness 	<ul style="list-style-type: none"> Internal space vs inability to insulate outside space Unviability of solutions for certain property types Practicality of design Acceptability to occupier Resident interaction with systems designed out to reduce need for education and avoid tampering Capability of current products Product availability (technical performance, quantity required) Replacing fabric with less durable solutions e.g. lime plaster for gypsum boards Energy/carbon for deep retrofit is too high c.15+ years

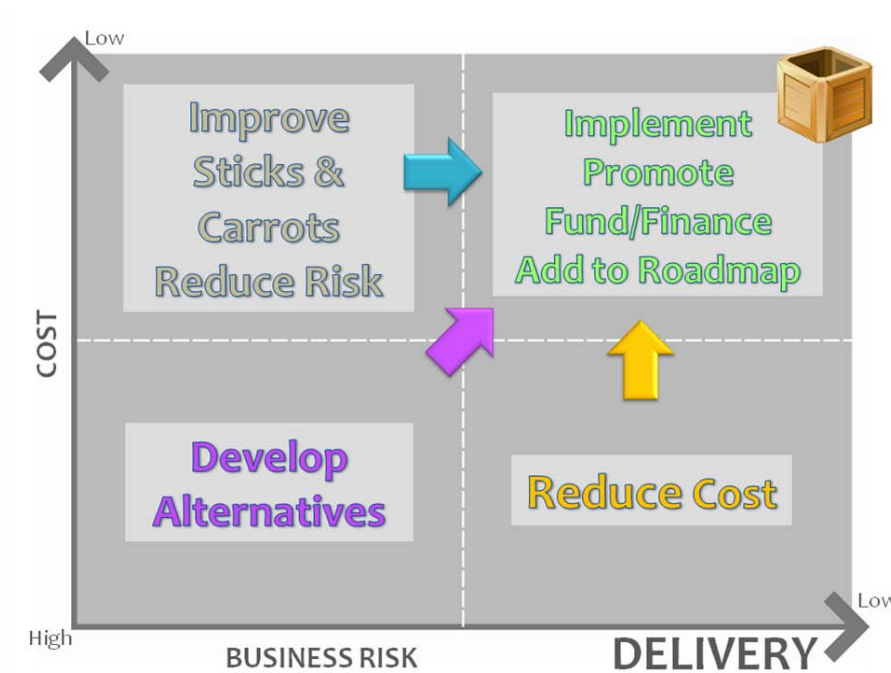


DELIVERY

Key Plan Elements

- **FIRST CONTACT** - The power of the sales call
- **ASSESSMENT and SURVEY STAGE** – opportunity for motivating householders
- **SCALE OF INTERVENTION** – suppliers will require a minimum amount to justify investment
- **SKILLS** - Up-skilling essential
- **ACCEPTABILITY** – managing uncertainty and risk

What are the problems and constraints? What do I need to do? How am I going to do it? Where are the materials coming from and how are they going to get here? When can I do it? (seasonality of external works) How often will it need to be refreshed?



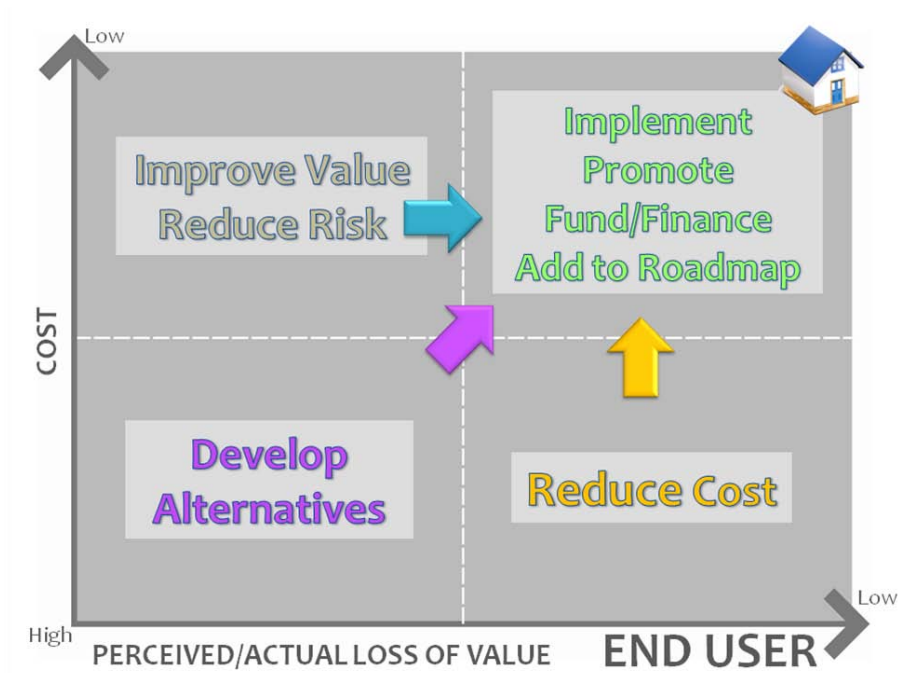
	CHALLENGING	DELIVERABLE
COST EFFECTIVE	<ul style="list-style-type: none"> • Trained & Qualified Installers • Warranty • Size of Market (no of homes) + Scale of Property • Have Maintenance + Life Cycle ~Plan • Minimum constant delivery numbers • Seasonality of Materials/Installation • Demand • Assess Property • Sales Call • Sell more but do it more efficiently • Software to calculate the building assessment 	<ul style="list-style-type: none"> • Cavity Wall • Loft Insulation • Solid Wall Insulation • Move materials to site • Site Storage
EXPENSIVE	<ul style="list-style-type: none"> • System integration • System Specification and kitting • Project Planning • U-value • Airtightness • Systems design • Are the improvements acceptable? • Added value for property and residents • Transparency of cost of each improvement area vs improvement • Sourcing labour • Sourcing sustainable materials • Relocation of occupiers and their stuff 	<ul style="list-style-type: none"> • Step change in u-value for property: 0.30 to ? by ? • Create Plan • Solar Thermal • Renewables • Central Resource Management • Flow Control • Number of stock points & stock quantity • Frequency of supply (what lead time is acceptable?) • Minimum 100,000 units • De-skill operations + de-labour • Material ease of use



END USER

Key Plan Elements

- **MOTIVATION** - Encouragement and Incentivisation
- **AFFORDABILITY** - Finance and Cost
- **MINIMISING RISK** – reputable professionals, warranties, insurers. Economic factors (minimising risk regardless of cost vs minimising risk within a certain budget), quality of work
- **LIFESTYLE** – heritage, aspirational lifestyles, avoidance of disruption



	ISSUES
LIFESTYLE	<ul style="list-style-type: none"> • Aspirational Lifestyles • Heritage + Stick with what you know • Eco Bling - conspicuous greening • Kudos - keeping up with neighbours!
MOTIVATION	<ul style="list-style-type: none"> • Bespoke Advice • More Attractive Purchase Option • Added Amenity • Regulation • Construction Related • Universal support service recognised • Context - why it's important to retrofit • Trigger points - you can do it when I change my kitchen • Engagement - CO₂ reduction • Impartial Energy Advice - complexity of whole life cost • Thermal Comfort • Improved Comfort
FINANCE and COST	<ul style="list-style-type: none"> • Payback • WLC/LCA How do you get the right advice? • Cost Capital • Enhanced Property Value • Availability of Finance • Simple Controls • Lower Running Costs • Running Cost • Incentives Subsidies and Tariffs • Rebates and Taxes
MINIMISING RISK	<ul style="list-style-type: none"> • Disruption avoidance • Quality Work • Warranties Insurance • Sustainability • Flexibility • Flexible with technologies • Limited Disruption during works • Fast Work • Reputable Accredited Supply Chain

Stakeholder Value

Who are the Stakeholders?

Who are the stakeholders and how do we create value for them?



The second main workshop session was a 35 minute exercise in understanding stakeholder value. Providing the provocative 'food for thought' for this workshop were three key speakers discussing the theme 'Delivery':

- **Michelle Burdett**, EEDA - 'Delivery and Funding'
- **Gill Kelleher**, BASF - 'R&D Processes and Issues'
- **Pat Bowen**, CSkills - 'Availability of Skills'

We divided the participants into four semi-random groups: Government and Quality Assurance, Funders and Insurers, Suppliers and Builders, and Owners and Occupiers.

The basis of the exercise was based on the idea that we were trying to develop a plan to deliver the mass retrofit of existing homes by 2030. The plan needs to be **deliverable** (within twenty years); **cost effective and profitable** for the supply chain; **affordable** and **acceptable** for customers and effective in achieving our targets in terms of **cost per unit of carbon saved**.

The aim of the exercise was to consider the role and interrelationships between the various stakeholders. What are the **interests and issues for specific stakeholders** and how do we ensure we **create value for all involved**, and make it worth their while to get on board and stay involved?

In the first stage of the exercise we asked the participants to list down all the stakeholders that fall under the heading of their particular group. Following this, the second stage involved identifying the key **motivators, barriers and incentives** for these stakeholders, bearing in mind the following question: 'What's in it for me?'

The third stage was to establish connections between the various stakeholders in terms of 'wants' and 'offers'. The participants were asked to think of the following question: 'What can other stakeholders

offer me to make me change my mind and make this work for me?' The outputs would be a set of arrows between stakeholders and the particular key interaction between them.

The identified stakeholders fall under the following categories:

- **Funders & Insurers**
- **Quality & Compliance**
- **Government & Local Authority**
- **Products & Suppliers**
- **Designers & Engineers**
- **Builders & Contractors**
- **Householders & Landlords**
- **Marketing & Dissemination**
- **Energy & Utilities**



Finally, a representative from each group was asked to report on their key results.



GOVERNMENT AND LOCAL AUTHORITY

WHO ARE WE?	HMG Policymakers Local Authorities Central Government - Europe DECC DEFRA CLG BIS OFGEM	OUR ROLE	Establish helpline/advice bureaus for homeowners Offer incentives Establish market lead through policy Catalyse market transformation Create a stable market sustained structure Tiered legislation - Building Regulations + additional retrofitter accreditation (e.g. equivalent of "Gas Safe" accreditation) Provide mentoring scheme for builders and contractors Creation of a timeline for the retrofit plan
MOTIVATORS	Clear Drivers Security of Supply Climate Change Modernisation - improvement of Local Economy Cost of Future Energy Balance of Payments Global Legislation Energy Efficiency Obligations Longevity Knowledge Acquisition/Information Commitment of Investment	BARRIERS	Lack of information/understanding Availability and Access - to technology, information, skills Commitment of Investment Reputational Risk Risk vs. Return Public acceptance Inertia Financial Risk
KEY RELATIONSHIPS			



QUALITY AND COMPLIANCE

WHO ARE WE?	<p>Building Control (LABC) Planning Officers - Local Councils Building Material Certification/ Accreditation Bodies Assessors (e.g. EcoHomes, CSH, BREEAM) Trade Associations (e.g. NIA, SWPIG, INCA) Professional Organisations (e.g. RICS, RIBA) Warranty Providers (e.g. LABC, NHBC)</p>	OUR ROLE	<p>Ensure that work is delivered to a certain standard Ensure that projects comply with Building Regulations and Local Authority requirements</p>
MOTIVATORS	<p>Profit Longevity Consistency Education/Knowledge Reputation Development/Progress Market Transformation</p>	BARRIERS	<p>Inadequate or no register of qualified/approved insurers/designers Balance between risk and return Enforcement Public acceptance Training and Knowledge</p>

KEY RELATIONSHIPS



GOVERNMENT & LOCAL AUTHORITY

FUNDERS & INSURERS

OWNERS & OCCUPIERS

BUILDERS & CONTRACTORS

PRODUCTS & SUPPLIERS

ENGINEERS & ARCHITECTS




PRODUCTS AND SUPPLIERS

WHO ARE WE?	Manufacturers Retailers (e.g. M&S, Tesco, B&Q, Homebase) Merchant manufacturers Trade Associations Product R&D	OUR ROLE	Providing solutions to the retrofit programme in terms of products and materials Meeting the demand for materials and products as a result of mass retrofit Providing training/information to installers and designers Point of contact for DIY homeowners
MOTIVATORS	Branding Reputation Business Longevity Profit Volume Cost New Markets Innovation Procurement Demand	BARRIERS	Risk of reputation Speed of Certification Lack of availability of trade incentives Minimum quantities Over-regulation
KEY RELATIONSHIPS			



CONTRACTORS AND BUILDERS

WHO ARE WE?	Local builders/tradesmen Retrofit providers SMEs Large contractors Subcontractors	OUR ROLE	Section 106 Delivery of quality retrofit solutions Providing advice to homeowners Addressing the challenges of 'mass customisation'
MOTIVATORS	Volume Cost Profit - profitability = sustainability Longevity of business Long-term prospects New markets Planned anticipated work Return on Investment (ROI) Access to funding for R&D Accreditation Current downturn - other opportunities, new sectors	BARRIERS	Lack of qualified installers Cowboy builders Skills gap Training/upskilling of staff - costs Gaining homeowner trust Resistance to regulation Inconsistent messaging No sticks to follow carrots Speed of certification Lack of availability of trade incentives
KEY RELATIONSHIPS	 <p>GOVERNMENT & LOCAL AUTHORITY QUALITY & COMPLIANCE FUNDERS & INSURERS OWNERS & OCCUPIERS PRODUCTS & SUPPLIERS ENGINEERS & ARCHITECTS MARKETING & DISSEMINATION ENERGY & UTILITIES PROVIDERS</p>		



FUNDERS AND INSURERS

WHO ARE WE?	<ul style="list-style-type: none"> Pension Funds, Hedge Funds Banks LAS/RSL Energy/Utility/ Service Providers Retailers Central Government/Europe/UK Gov't Energy Contractors Homeowners Local Community Groups NGOs Product suppliers Universities Private companies Builders NHBC/Warranties Trade Associations Professional Organisations 	OUR ROLE	<ul style="list-style-type: none"> Provision of insurance and warranties Financing for projects - grants, mortgages Driving demand for quality assurance and standards Delivery of projects Could potentially require retrofit as part of the mortgage/funding application criteria
MOTIVATORS	<ul style="list-style-type: none"> Profit Return on Investment (ROI) Certainty Benefits Quality Assurance Financial Security Competitive Advantage Corporate Social Responsibility/Energy Provider obligations Energy security Reputation Consumer confidence Business growth and knowledge, quality data Long-term returns Possible future business Economic growth Societal benefits (e.g. health and productivity) Decreased cost of mitigation Information acquisition 	BARRIERS	<ul style="list-style-type: none"> Risk - non-payment, non-completion, possible default Litigation Devaluation Lack of Quality Price of energy Shareholder agreements Over-regulation Administration costs Consumer demand Risk vs reputation Lack of understanding Standard approaches to funding - innovation needed

KEY RELATIONSHIPS


GOVERNMENT & LOCAL AUTHORITY



QUALITY & COMPLIANCE



OWNERS & OCCUPIERS



BUILDERS & CONTRACTORS



PRODUCTS & SUPPLIERS



ENGINEERS & ARCHITECTS



MARKETING & DISSEMINATION










OWNERS AND OCCUPIERS

WHO ARE WE?	<p>Communities Neighbourhoods Homeowners Landlords Tenants Neighbours NIMBYs Local Authorities RSLs Families Universities - student housing Students Care home occupiers Hospital trusts Ministry of Defence</p>	OUR VALUES	<p>TRUST - delivery, skills, not to have properties mucked up, top quality work, no adverse impact on residents/families CONSISTENCY - one key consistent simple message - drivers, central government, security of supply and climate change, what is the reason why I should retrofit, complete whole house energy performance, surveyors COMMUNICATION - how do you turn complex figures into clear straightforward messages? FINANCE - value, surveyors, estate agents - upfront payments, certainty of return on investments, benefits of investments, assurance that the process does what it says on the tin, funding AESTHETICS - something that looks good is value for money, 'Pimp my House' - retrofit is not sexy!</p>
MOTIVATORS	<p>NI 186,187, Decent Homes/Warm Homes (LAS/RSL) Word of Mouth One stop shop vs First stop shop Extra value - more storage, additional rooms, new kitchen Trust Increased property value Increased property attractiveness Lower energy bills/running costs Increased Comfort Increased understanding - technology, operation, service costs, lifestyle changes</p>	BARRIERS	<p>Cowboy builders Disruption Loss of value + space Apathy Cost Lack of information - solutions, interventions required and costs, funding sources Lack of understanding of need to do retrofit</p>
KEY RELATIONSHIPS	<p>GOVERNMENT & LOCAL AUTHORITY QUALITY & COMPLIANCE FUNDERS & INSURERS BUILDERS & CONTRACTORS PRODUCTS & SUPPLIERS ENGINEERS & ARCHITECTS MARKETING & DISSEMINATION ENERGY & UTILITIES PROVIDERS</p>		



ENGINEERS, ARCHITECTS AND OTHER CONSULTANTS

WHO ARE WE?	Architects Engineers Environmental/Sustainability Consultants Surveyors RIBA RICS Universities/ researchers	OUR ROLE	Develop viable solutions for retrofit projects Point of contact with clients/ homeowners Point of contact with suppliers/ manufacturers and builders/ contractors Facilitation of knowledge transfer between clients and builders/ suppliers Research and development Modelling and assessment, evaluation of options Deliver designs and solutions to homeowners - aesthetics and quality
MOTIVATORS	Profit Longevity of business Long-term prospects New markets Planned anticipated work Return on Investment (ROI) in R&D and staff training Access to funding for R&D Experience	BARRIERS	Lack of accurate modeling information/data - technical understanding and business case for convincing clients Speed of certification/ planning approval Lack of understanding of available technologies/ operational issues/ service costs/ product lifetime Lack of information on cost/ funding issues
KEY RELATIONSHIPS	<div style="display: flex; justify-content: space-around; text-align: center; font-size: small;"> <div> GOVERNMENT & LOCAL AUTHORITY</div> <div> QUALITY & COMPLIANCE</div> <div> FUNDERS & INSURERS</div> <div> OWNERS & OCCUPIERS</div> <div> BUILDERS & CONTRACTORS</div> <div> PRODUCTS & SUPPLIERS</div> <div> MARKETING & DISSEMINATION</div> </div>		






MARKETING AND DISSEMINATION

WHO ARE WE?	<p>Journalists/ press officers Sustainability editors/writers Bloggers Interest groups (Existing Homes Alliance, EEPH) Trade magazines Retrofit campaigns (e.g. Great British Refurb) Charities and NGOs (e.g. Energy Saving Trust, Carbon Trust, WWF, UKGBC) Marketing departments (suppliers, contractors, designers)</p>	OUR ROLE	<p>Disseminate information about retrofit solutions to homeowners/ stakeholders - technical information, promotion of retrofit programme, introduction of suppliers/builders/ professional services</p>
MOTIVATORS	<p>Profit New markets Planned anticipated work Experience</p>	BARRIERS	<p>Lack of technical understanding and business case data Lack of understanding of available technologies/ operational issues/ service costs/ product lifetime Lack of information on cost/ funding issues Lack of clarity and direction from policymakers Need for consistency of messaging</p>
KEY RELATIONSHIPS	<p>GOVERNMENT & LOCAL AUTHORITY OWNERS & OCCUPIERS PRODUCTS & SUPPLIERS ENERGY & UTILITIES PROVIDERS</p>		

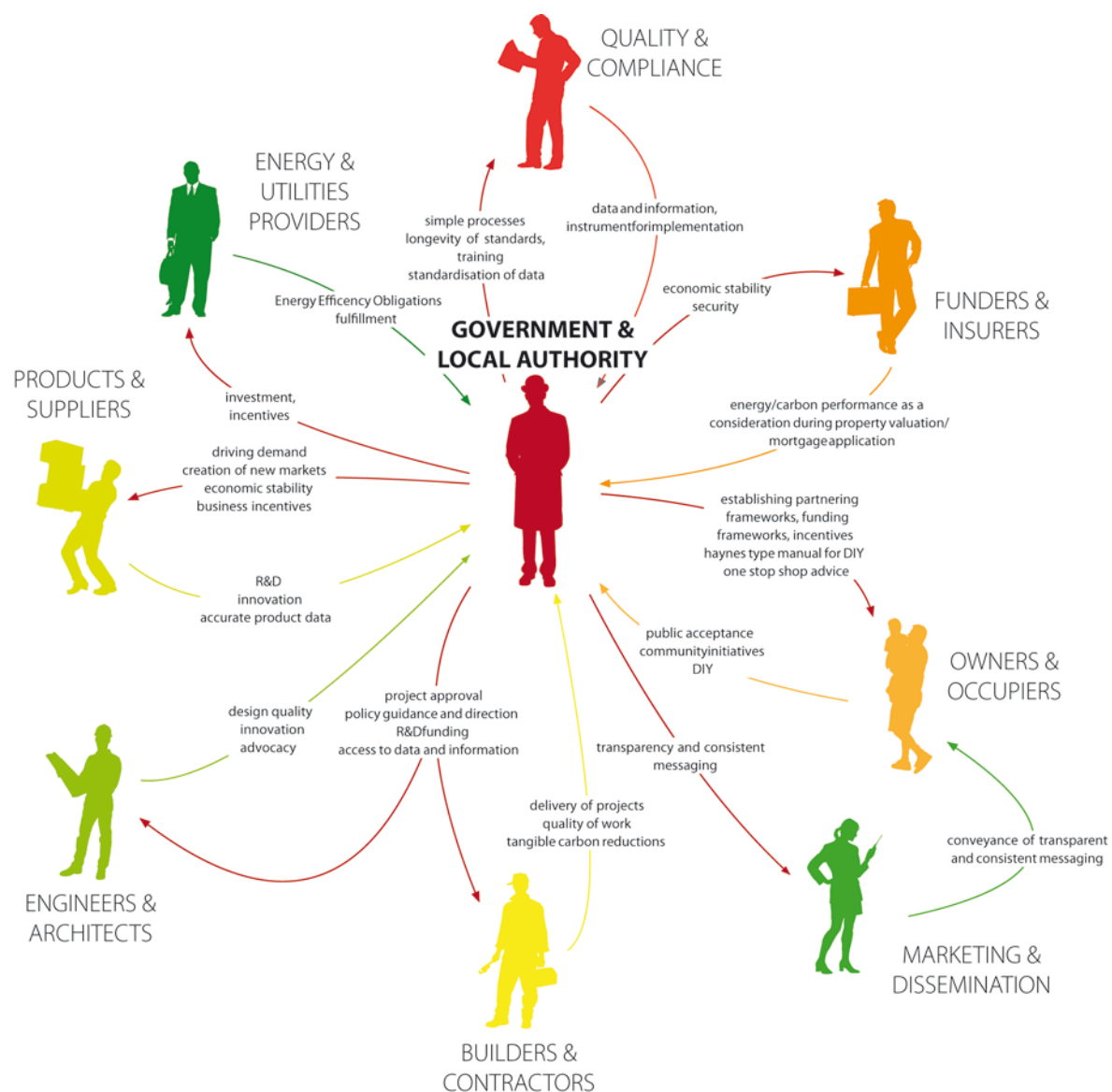


ENERGY AND UTILITIES PROVIDERS

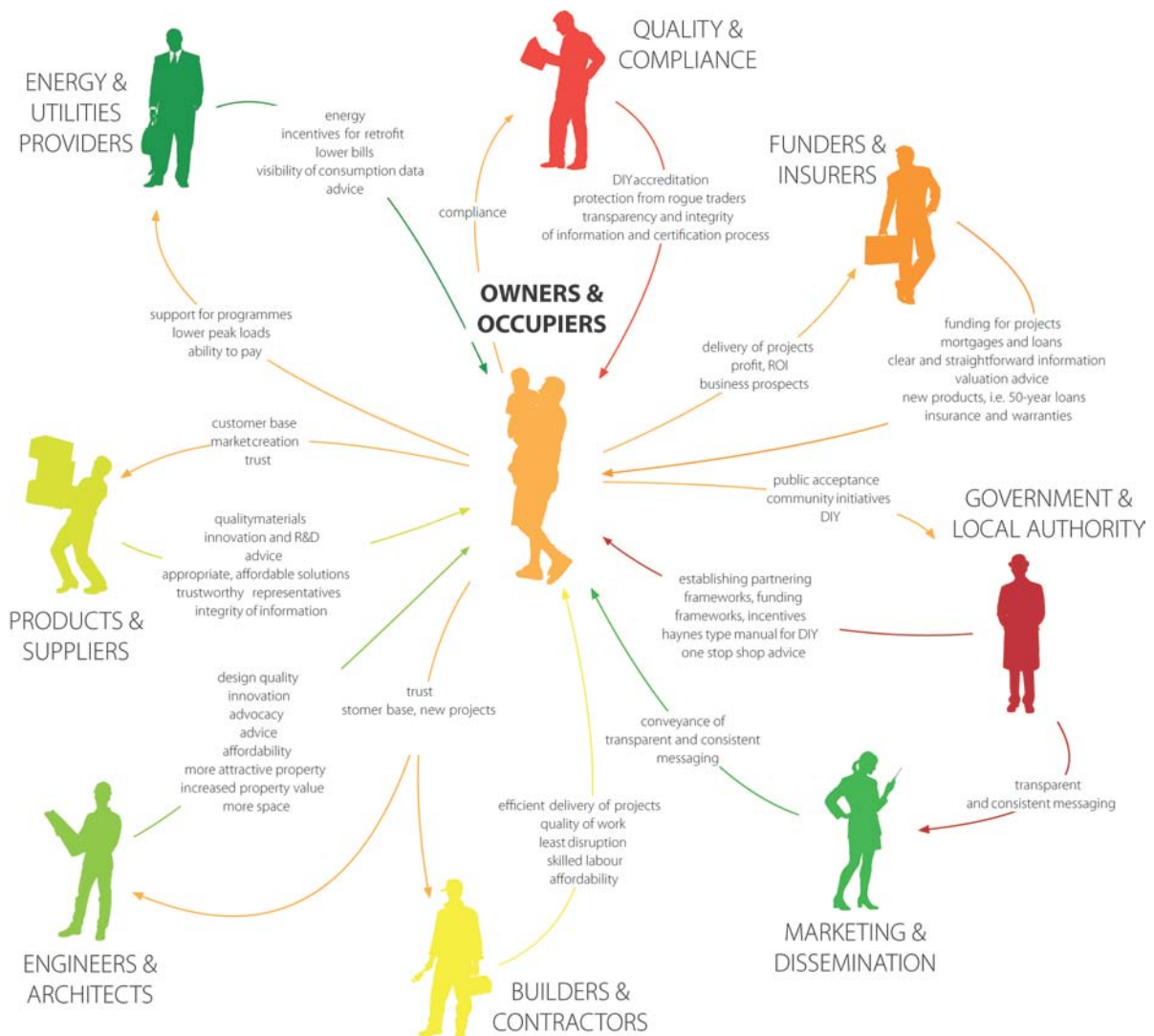
WHO ARE WE?	Energy Providers (e.g. EON, EDF, Scottish Power, British Gas, npower, Scottish and Southern Energy, Wales Energy, South Wales Electricity, Northern Ireland Electricity)	OUR ROLE	Disseminate information about retrofit solutions to homeowners/ stakeholders - technical information, promotion of retrofit programme, introduction of suppliers/builders/ professional services
MOTIVATORS	<ul style="list-style-type: none"> Profit Financial Security Competitive Advantage Corporate Social Responsibility Energy Provider obligations Energy security Reputation Consumer confidence Business growth and knowledge Data acquisition Long-term returns Possible future business Decreased cost of mitigation Reduction of Peak Energy 	BARRIERS	<ul style="list-style-type: none"> Cost - dissemination and subsidy Variability in energy consumption and peak usage Reduced sales due to improved home insulation and reduced consumption Return on Investment (ROI)
KEY RELATIONSHIPS	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>GOVERNMENT & LOCAL AUTHORITY</p> </div> <div style="text-align: center;">  <p>OWNERS & OCCUPIERS</p> </div> <div style="text-align: center;">  <p>PRODUCTS & SUPPLIERS</p> </div> </div>		

Stakeholders: A Virtual Dialogue

The following diagrams illustrate the synergies and linkages between the central stakeholder and the various other stakeholders that could potentially be involved in the UK mass retrofit programme. We have concentrated on the linkages between for two main stakeholders based on the ideas that emerged from the workshop. These two main stakeholders are Government and Local Authority (the main driver of the programme) and the Owners and Occupiers (the main subjects of the programme)



'Virtual Dialogue' between Government and Local Authority and the rest of the stakeholders



'Virtual Dialogue' between Owners and Occupiers and the rest of the stakeholders

The workshop discussions also highlighted similar barriers and gaps of communication between the delivery arm of this retrofit programme - particularly the gap between Funders and Insurers vs Builders/Contractors, Architects/Engineers and Products/Suppliers. Could the improvement of linkages between these stakeholders be the key to the successful implementation of the plan?

Summary of Findings

The following issues emerged as being the top key issues and variables that need to be looked at in relation to the development of a roadmap for the delivery of mass retrofit in the UK. To the right of each issue is the significance of each parameter to each workpackage in the project.

LEGEND

- Very significant - critical success factor for the theme of the workpackage
- Moderate significance - should be considered within the workpackage
- Flag - may be significant and should be kept in mind within the workpackage

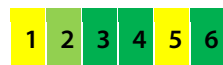
Work Packages



COST - The issue of cost may well be used as a measure of success for the proposed roadmap. This includes the cost of improvements, cost of implementation, cost per unit of carbon saved, cost distribution among the different stakeholders, financing and funding options and profitability will all affect the degree of achievability of the solutions as well as the degree of support from all stakeholders involved.



TIME - The aspect of time is a variable that needs to be considered carefully - the roadmap needs to be able to set out phases of implementation as well as the impacts of any changes over time that may affect implementation. 'time to implement' over the duration of the retrofit exercise needs to be tied in with time to implement at a micro- level - including the time to develop certification schemes and for upskilling the workforce, as well as the time for construction. Consideration of speed of implementation is also essential - gradual changes, step changes and radical changes in the construction sector, supply chain and consumer awareness can form the basis of different scenarios for the plan. Seasonality of changes is also another time-based consideration that could affect the actual time we have at our disposal within which to deliver the retrofit.

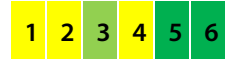


STAKEHOLDER VALUE - An understanding of each stakeholders' motivations and barriers is essential in order to determine the best strategy for incentivisation. An integrated approach between all stakeholders will be essential to the success of mass retrofit - one broken link in the chain may mean falling short of our targets. The main stakeholder in most people's minds is obviously the owner-occupier, but we shouldn't forget all the businesses and companies that have to deliver all of these retrofits - how do we create value for them in terms of business sustainability?





PUBLIC ACCEPTANCE - acceptance from the householders is key to ease of implementation. Understanding their motivations and building trust between the householders and the other stakeholders in terms of quality, standards, information and support should help to inform the plan.



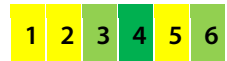
SCALABILITY - early demonstrators of retrofit have helped us gain a better understanding of the technical issues involved in retrofitting individual properties. What role do economies of scale and new technologies play in 'scaling up' this retrofit process? Is it a simple matter of adding materials and skilled workers into the supply chain, or is a radically new approach required?



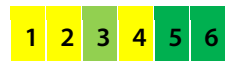
FUTURE PROOFING - the visioning exercise highlighted various societal, environmental, economic and technological changes that may emerge within the next twenty years. How do we manage these changes and create a roadmap that is adaptable to various scenarios that may arise due to changing demographics, climate change, societal attitudes and fuel sources? Assumptions for these changes need to be developed and considered.



SKILLS - 'up-skilling', 'de-skilling', 'knowledge transfer' and the concept of a 'one stop shop' are all variables that need to be tweaked in the development of the retrofit plan, particularly in terms of its effect on the supply chain. What magnitude of upskilling is required and is this deliverable? In the case of retrofits that need to be undertaken whilst the occupants are in residence, the people tasked with the delivery need to relate quite closely with the building's occupants - how do we manage this process and the risks associated with this interaction?



DISSEMINATION - The role of dissemination is closely related to the achievement of stakeholder value - how do we engage the media and marketing promotion to make the prospect of retrofit more appealing - is carbon reduction really the right approach, or is 'pimp my house' a more sexy and effective way to reach out to householders? Consistency of messaging is also critical - what are the targets? Is there a clear strategy for achieving them?



MITIGATING RISK - Most of the barriers to implementation are related to perceived risk - financial, reputational, environmental. How will these risks be identified and managed throughout the process in order to provide stakeholders with a level of confidence in the process? How would we manage design risks, such as unintended consequences of our proposed solutions, such as overheating, loss of space, decreased ventilation and air quality, etc?





ACCESS TO INFORMATION - 'Lack of Information' is a barrier that appears on almost every stakeholder's list. Technical professionals require quality data and information in order to deliver solutions that are viable and well-informed. Homeowners require information about the most cost-effective and appropriate solutions and need to know they can trust the bearer of this information. Government and other NGOs are willing to provide funding in exchange for knowledge and research. How can this flow of information be managed and facilitated through the plan?



Workpackages within the project:

- **WP1** - dwelling model
- **WP2** - stock model
- **WP3** - single dwelling and mass implementation plans
- **WP4** - supply chain design
- **WP5** - customer acceptance
- **WP6** - policy

Next Steps

We hope to capture the ideas and opinions of a wider range of regional stakeholders and other sectors which were under-represented in the workshop. This will be done by sending out this report with an accompanying questionnaire to a targeted set of experts on retrofit delivery in Scotland, Northern Ireland and Wales, as well as key people in the financial and funding sectors.

These forms can be found in Appendix A. These will be sent out via the consortium partners to specific individuals along with the DfX Workshop Report findings in order to gather these opinions - these will subsequently be added on to the original report as the project progresses.

The first form is intended for regional contacts, while the second is intended for financial and funding contacts.

Appendix A

DfX Report Feedback forms

Regional Contact Information

Name:	
Position:	
Company/Organisation:	
Address:	
Phone /Fax:	
E-mail:	
Region of Expertise:	

Dear Sir/Madam

We held a workshop on "Optimising Thermal Efficiency in Existing Housing" in July that aimed to capture the key issues with regards to the roll-out of a mass retrofit implementation plan for the UK. A wide range of stakeholders attended and the key findings are set out in the attached report. However, the attendees were mostly England-based and we recognise the need to capture ideas from Scotland, Northern Ireland and Wales. We would be grateful if you could answer the following questions, which would then feed into the research work on the project going forward.

This work is part of the ETI 'Optimising Thermal Efficiency in Existing Housing' project, which aims to develop strategies to improve the energy efficiency of our existing housing stock, and is a collaboration between the members of the Energy Zone Consortium, which includes the BRE, EDF Energy, EDF R&D, Peabody, PRP, Total Flow, UCL and Wates. We would be happy to provide you with updates regarding the findings on the project as it progresses - please get in touch with Matthew Barton, Programme Manager at the Energy Technologies Institute - matthew.barton@eti.co.uk if you would like to get involved to be kept informed.

Visioning Exercise

1. What are the societal, technological, economic and environmental changes that are likely to occur in your country in the years leading up to 2030/2050?

2. How are these changes likely to affect the national programme for mass refurbishment?

Key Elements of the Retrofit Plan

We are trying to develop a plan to deliver the mass retrofit of existing homes by 2030 (possibly 2050). The plan needs to be deliverable (in terms of time, skills and supply); cost effective and profitable for the members of the supply chain; affordable and acceptable for customers and effective in achieving our national carbon reduction targets in terms of cost per unit of carbon saved. In your country, what would be the key elements of this plan? **What are the most important variables and issues that would need to be considered?**

1. **Policy** - What policies can/need to be put in place to implement the plan? Are there any policies in place, unique to your country, that have the potential to be rolled out on a UK-wide level?

2. **Design** - What are the most common design solutions with regards to retrofitting homes in your country? What are the biggest design challenges?

3. **Delivery** - What are the key elements of the supply chain in your country? What would the greatest challenges be with regards to rolling out a mass retrofit plan?

4. **End User** - What is the current attitude towards retrofit? What are the key motivators that would encourage homeowners (homeowners and landlords) to support a mass retrofit campaign in your country?

Stakeholder Value

One key to the success of this national implementation plan would be to develop a keen understanding of the motivations, barriers and possible incentives for all stakeholders involved. The attached report sets out several stakeholder types, who they are, and what their barriers and motivators are. **Are there any stakeholders not listed that need to be considered for your country? What motivates them, and what are their perceived risks and barriers that need to be overcome in order for them to support a mass retrofit programme?**

1. Funders and Insurers

2. Quality and Compliance

3. Government and Local Authority

4. Products and Suppliers

5. Designers and Engineers

6. Buildings and Contractors

7. Householders and Landlords

8. Marketing and Dissemination

9. Energy and Utilities Providers

Many thanks in advance for your valuable help and insights. Your answers will help us greatly with our research work going forward. If you have any questions please do not hesitate to contact me - marylis.ramos@prpenvironmental.co.uk. We would be very grateful if you could reply back by the within two weeks.

Best regards,



Marylís Ramos

Associate, PRP

Technical Lead, WP3 (Single Dwelling and Mass Retrofit Solutions),
'Optimising Thermal Efficiency in Existing Housing' Project

Financial Contact Information

Name:	
Position:	
Company/Organisation:	
Address:	
Phone /Fax:	
E-mail:	
Area of Expertise:	

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Visioning Exercise

1. What are the economic and financial changes that are likely to occur in the UK in the years leading up to 2030/2050?

2. How are these changes likely to affect a national programme for mass refurbishment?

Key Elements of the Retrofit Plan

We are trying to develop a plan to deliver the mass retrofit of existing homes by 2030 (possibly 2050). The plan needs to be deliverable (in terms of time, skills and supply); cost effective and profitable for the members of the supply chain; affordable and acceptable for customers and effective in achieving our national carbon reduction targets in terms of cost per unit of carbon saved. In your opinion, what would be the key elements of this plan? **What are the most important variables and issues that would need to be considered?**

1. **Policy** - What policies can/need to be put in place to implement the plan? Are there any policies in place, especially related to financing retrofit projects, that have the potential to be rolled out on a national level?

2. **Funding** - What are the key financial instruments that can be used to facilitate retrofitting homes in the uk? What would the greatest challenges be with regards to rolling out a mass retrofit plan in terms of the way the current financing arrangements are structured? Can you propose alternative solutions that would be effective and acceptable to your sector?

Stakeholder Value

One key to the success of this national implementation plan would be to develop a keen understanding of the motivations, barriers and possible incentives for all stakeholders involved.

The attached report sets out several stakeholder types, who they are, and what their barriers and motivators are. **Are there any stakeholders not listed that need to be considered for your sector? What motivates them, and what are their perceived risks and barriers that need to be overcome in order for them to support a mass retrofit programme?**

1. Funders and Insurers

Many thanks in advance for your valuable help and insights. Your answers will help us greatly with our research work going forward. If you have any questions please do not hesitate to contact me - marylis.ramos@prpenvironmental.co.uk. We would be very grateful if you could reply back by the within two weeks.

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Best regards,



Marylís Ramos

Associate, PRP

Technical Lead, WP3 (Single Dwelling and Mass Retrofit Solutions),
'Optimising Thermal Efficiency in Existing Housing' Project



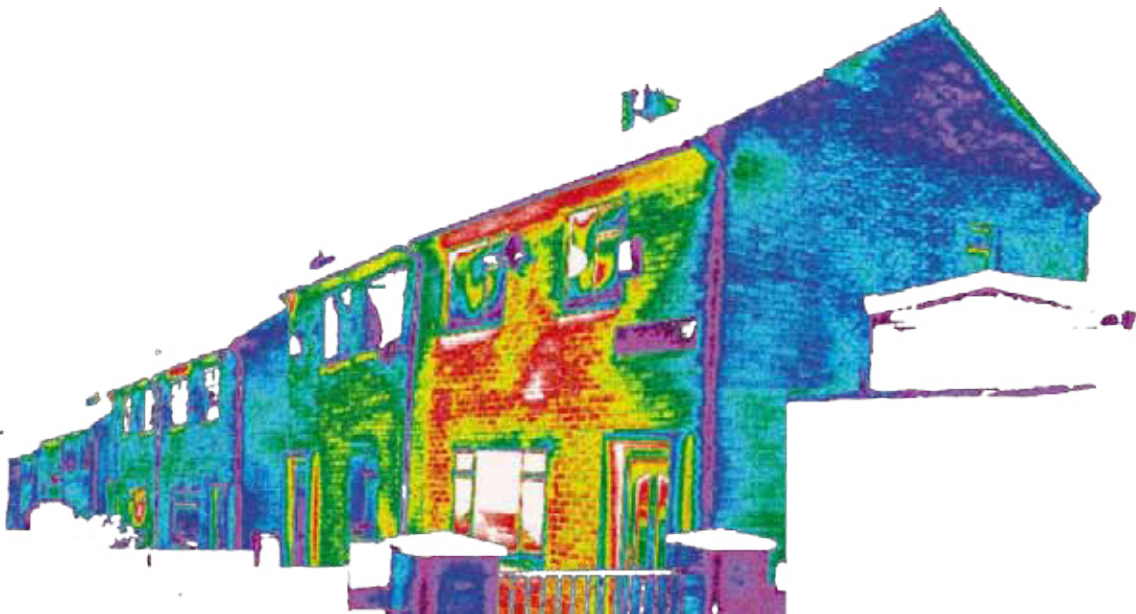
responsive, intelligent, enduring **design**

Optimising Thermal Efficiency in Existing Housing: Housing: **The Challenges of Mass Retrofit**

Monday 12th July 2010

The Hatton
51-53 Hatton Garden
London
EC1N 8HN

Agenda



The **ENERGY ZONE CONSORTIUM:**



AGENDA

- 8.45 - 9.15 **REGISTRATION AND REFRESHMENTS**
- 9.15 - 9.25 **Introduction to the Day**
Sarah Harrison, PRP Project Services
- 9.25 - 9.40 **The Challenges of Delivering Retrofit**
Andrew Mellor , Director (Environmental), PRP
- 9.40 - 10.10 **Visioning Exercise**
What will we need to achieve by 2030 and how do we get there?
Tim Hall, Systems Integrator, Total Flow
- 10.10 - 10.40 **Session 1: Policy and Context**
Chair: Nic Wedlake, Environmental Sustainability Manager, Peabody Housing Trust
- Retrofit Drivers: Concept to Reality**
Michael Kelly, University of Cambridge
- Financing Retrofit, Routes to Innovation**
Ian Mieke, Innovation Platform Leader - Low Impact Buildings, Technologies Strategy Board
- Government Policy and Proposals - Implementation of Mass Residential Retrofit**
Terry Boniface, Department for Business, Information and Skills
- 10.40 - 11.00 **Discussion**
- 11-00 - 11.15 **TEA AND COFFEE**
- 11.15 - 11.45 **Session 2: Design and Development Considerations**
Chair: Andrew Mellor , Director (Environmental), PRP
- UK Housing Stock: Regional Variations and Tenure Implications**
Barry Munday, The Housing Forum
- Retrofit of Period and Historic Dwellings**
Jarrod Hill, English Heritage
- Barriers to the Delivery of Retrofit Solutions**
Andrew Mellor , Director (Environmental), PRP
- 11.45 - 12.00 **Discussion**

- 12.00 - 12.40 **Workshop 1 - What do we need Retrofit to achieve?**
Tim Hall, Systems Integrator, Total Flow
- 12.40 - 13.00 **Feedback and Discussion**
- 13.00 - 14.00 **LUNCH**
- 14.00 - 14.05 **Introduction to afternoon session**
Sarah Harrison, PRP Project Services
- 14.05 - 14.50 **Session 3: Delivery and the Supply Chain**
Chair: Chris Woods, Director of R&D Wates
- Delivery and Funding of Retrofit Projects: Issues and Opportunities**
Michelle Burdett, East of England Development Agency
- Processes and issues in R&D for Retrofit Technical Solutions**
Gill Kelleher, BASF
- The Availability of Skills to Implement Mass Residential Retrofit in the UK**
Pat Bowen, Cskills
- 14.50 - 15.10 **Discussion**
- 15.10 - 16.00 **Workshop 2 - How can we create value for all stakeholders?**
Tim Hall, Systems Integrator, Total Flow
- 15.15 - 15.20 **TEA AND COFFEE**
- 16.00 - 16.30 **Feedback and Discussion**
- 16.30 - 16.40 **Round Up - Top Ideas**
Tim Hall, Andrew Mellor
- 16.40 - 16.55 **What Next: Key Action Points**
Tim Hall, Andrew Mellor
- 16.55 - 17.00 **Final Comments**
Sarah Harrison
- 17.00 - 18.00 **DRINKS IN ROOFTOP BAR**