Scenarios for Urban Retrofit: Workshop 1

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Workshop report

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Executive Summary

Meeting current carbon reduction targets will require the retrofitting of 28 million of the 30 million buildings current standing in the UK. To date, efforts have been piecemeal and fragmented, with limited opportunity for large scale change and learning. There is a need for a better understanding of how retrofitting can be scaled up as part of a large scale transition to a more sustainable society.

In this context, the aim of the Retrofit 2050 project is to investigate opportunities, barriers and drivers for sustainability transitions in UK city-regions, focussing on processes of retrofit in the built environment and urban infrastructure. This report presents the key findings of the first of a series of three scenario foresight workshops, intended to frame problems of urban retrofit considering socio-technical histories and futures in housing, non-domestic buildings and urban infrastructure.

Key issues included:

High initials costs: Retrofitting the built environment will incur large costs and significant disruption raising issues of finance in terms of access to credit, risk aversion and distribution of resources. This also introduces incentive problems, noted as particularly important in housing and non-domestic buildings with key examples discussed included the 'hassle factor' and long payback periods. In urban infrastructure, high sunk costs in existing transport and energy systems are likely constrain transitions.

Need for inter-disciplinary collaboration: Processes of retrofit will involved a large number of actors and dense networks of professional institutions. Decision making within these structures was considered to fall into 'silos', standing in the way of interdisciplinary action.

Uncertainty: Highlighted as an important barrier to change, uncertainty was considered to arise from a number of sources such as rapidly changing technology. It was felt by some participants that dwindling government ambition presented another source of uncertainty.

Timing: Understanding when people are most likely to undertake retrofit projects was felt to be crucial in scaling up activity. At the household or firm level, these junctions were termed 'trigger points' and included moving home and maintenance in the housing sector and rolling refurbishment in non-domestic buildings. At the macro level, 'tipping points' were identified as important: wider socio-economic trends that made retrofitting more appealing, with an important example being the rising cost of energy.

Roles for policy: Policy is critical drivers for retrofitting activities, as both a motivator and a benchmark. Other potential roles for policy makers included a co-ordinating role, facilitating collaboration across spatial and sectoral boundaries and building capacity, as well as a sending clear market signals to industry. The Green Deal emerged as an important potential 'game changer' in the long run, stimulating a step change in the level of retrofit undertaken by households, but was identified as subject to significant uncertainty with regards to design, operation and demand.

Changing behaviour: Behaviour change will play a vital role in transition: demands and expectations of the general public are critical in supporting large scale change. Key opportunities discussed included the importance of engagement, better understanding and use of technology and reframing sustainability to take in quality of life dimensions.

Contents

1. Scenario Building in Retrofit 2050

Meeting current carbon reduction targets will require the retrofitting of 28 million of the 30 million buildings current standing in the UK[1]. To date, efforts have been piecemeal and fragmented, with limited opportunity for large scale change and learning. There is a need for a better understanding of how retrofitting can be scaled up as part of a large scale transition to a more sustainable society.

Retrofit 2050 is an EPSRC funded project investigating sustainability transitions in UK city-regions, focussing on processes of retrofit in the built environment and urban infrastructure. It brings together an interdisciplinary team from Cardiff University, Salford University, Oxford Brookes University and Cambridge University to explore the challenges, opportunities and drivers that will shape change to 2050.

Figure 1: Project structure
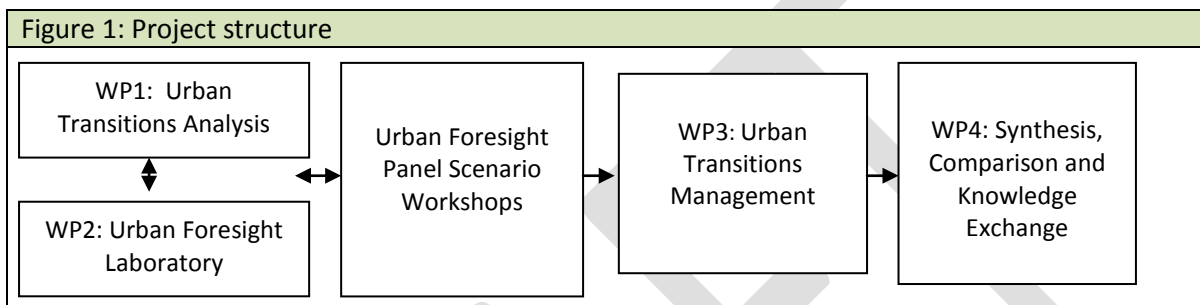
Through case studies, modelling and international comparison, the project aims to advance and explore both theoretical and practical understandings of the systems innovation and transition that will underpin a shift towards sustainability between 2020 and 2050. To do this, it will undertake four interlocking Work Packages: i) Urban Transitions Analysis ii) Urban Foresight Laboratory 2020 – 2050 iii) Urban Transitions Management iv) Synthesis, Comparison and Knowledge Exchange.

The Scenario Workshop process is intended to provide the 'glue' that brings coherence to the project's work programme. Addressing one of the core project aims – *to articulate and appraise city-regional specific vision and prospective pathways for urban-scale retrofitting of the built environment* – the workshops will bring together a panel of experts from the public, private and voluntary sectors to explore visions of retrofitting to 2050. More information about the project can be found online at www.retrofit2050.org.uk, including a more detailed explanation of the aims and structure of the scenarios process[2].

Table 1: Overview of scenario construction and evaluation process			
	Stages	Focus	Participants
Phase 1: scenario workshops Oct 2011- Sept 2012	Problem framing	Practices, drivers and expectations	National experts
	Visioning	Radical and disruptive innovation	
	Pathways analysis	Transition dynamics	
Phase 2 Oct 2012- Jun 2013	Regional implementation	Grounding and visualisation	Key regional stakeholders
Phase 3 Jun 2013 – Sept 2013	Evaluation and appraisal	Sustainability and resilience in multiple perspectives	Wider regional stakeholders

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[1] Chartered Institute of Building (2011) Carbon budgets: written evidence submitted by the Chartered Institute of Building

[2] *Developing Urban Retrofit Scenarios: An Outline Framework for Scenario Foresight and Appraisal*, found at http://www.retrofit2050.org.uk/working_papers

The purpose of the first workshop was to frame the problem at hand. Introducing participants to the project, it considered the meanings of urban retrofitting, drivers of change and future transitions. This report presents findings that emerged. It is structured as follows:

- First, it presents some perceptions of retrofitting from the domestic and work lives of participants as gathered in an informal icebreaker session
- Second, it answers questions of what, why, who and how regarding past, current and future practices of urban retrofit around four core 'regimes' of social housing, private housing, non-domestic buildings and urban infrastructure
- Third, it draws together some conclusions. These will inform the second workshop, to be held on January 26th 2012.

2. Perception of retrofit, at home and at work

By way of an introductory icebreaker session participants were asked to consider how they thought about retrofitting in their day to day lives, first within their organisation and then in their own homes. These responses are presented below as Wordle[3] diagrams along with a discussion of key themes that arose.

2.1 At work

Figure 2: What does retrofit mean to your organisation - post it responses

Participants felt that retrofit constituted a significant part of their work, in both present and futures work streams. One participant felt that refurbishment of existing buildings already accounted for 80% of their organisation's work while another described it as the "*basis of much current and future work*". Another respondent observed that retrofitting could generate publicity, complementing other work carried out by the organisation.

There was a feeling that retrofitting activities needed to take place "*across building sectors*", with "*cross disciplinary actions*", "*combining different expertise*". Retrofitting requires the bringing together of different skills and knowledge sets as well as interdisciplinary action. This reflects that fact that, as one participant observed, retrofit presents a "*significant technical challenge*".

Several participants felt that, for their organisations, retrofit meant a "*part of [their] rolling refurbishment programme*" or "*repair/maintenance*": it was "*not necessarily just regarding sustainability*". Similarly, for others it meant gradual changes such the introduction of movement sensors on lights or the replacement of life-expired equipment.

Not all perceptions of retrofit were positive. For a number of participants, retrofit implied cost and disruption. One felt that their organisation "*wants to save energy but [is] not keen on investments at significant scale*"; another noted that retrofit was necessarily "*governed by resources*". Uncertainty was also highlighted as a prominent problem.

2.2 At home

A large number of participants identified LED lights or energy efficient light bulbs as the most recent retrofit project in their home. This presents one way in which retrofitting can form part of ongoing maintenance i.e. choosing energy efficiency lights when bulbs need replacing. Insulation was

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[3] http://www.wordle.net/ Size of text denotes the frequency with which a response was given: larger text represents recurring themes

another prominent choice, often entailing a much larger project, especially in cases of external insulation.

Figure 3: What was the last retrofit project to undertook in your home - post it responses
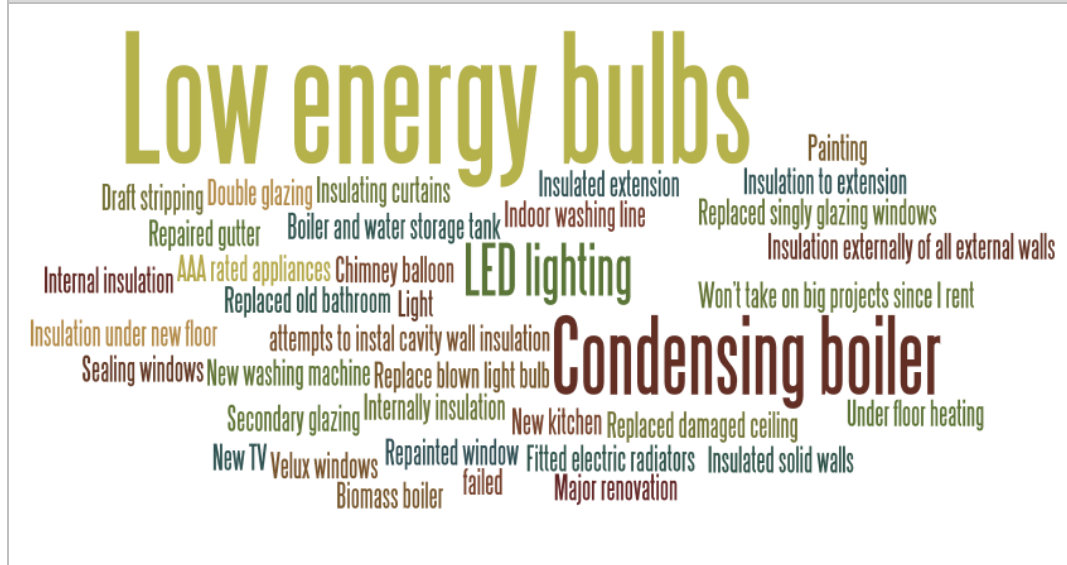
Not all projects were large-scale interventions. Changing the type of light bulbs used was a prominent change undertaken; other relatively small projects included hanging insulating curtains or draft stripping windows. At the other end of the spectrum, some participants had undertaken large-scale changes such as externally insulating their property or switching to a biomass boiler.

Energy efficiency was not the only motivation for undertaking retrofit: some participants reported that the last retrofit project they had undertaken at home was making changes to the layout or installing a new kitchen– changes intended to improve attributes such as convenience or comfort. Furthermore, some participants had made changes such as buying a new TV, potentially increasing the energy usage of their home but improving other aspects of the house.

One participant noted that they wouldn't take on big projects because they were living in rented accommodation and would resent adding value to their landlord's property at their own expense. The problem of rented houses – with both landlord and tenant disincentivised against making energy efficiency investments with long payback periods – is well documented as was discussed throughout the workshop.

3. Housing

3.1 Private housing

Table 2: Private history - post it responses					
Passive/active demand management	Extensions, infilling	Bathroom and kitchen replacements	Local/national government	Householder	(Keeping up with) the Joneses
Double glazing	**What**	Changing lifestyles	EU regulators	**Who**	Private sector drivers
Central heating	Greater comfort	Growth of suburbs	Government initiatives	Utilities	Individuals
Population growth	Money saving	Smaller households	Peer pressure	Timing	Building regulations
Hassle factor	**Why**	Conservation rules	Waste and water	**How**	Interest rates and credit
Gentrification of inner suburbs	Increasing standard of living	Aesthetics, aspiration, comfort	Recognising value of energy efficiency	Savings, grants, Green Deal	Ownership life cycle

A key feature of this regime was the importance of changing lifestyle patterns. For example, heating was identified as a key characteristic of this regime, with most households now expecting greater comfort. The issue of home improvements – e.g. extensions, kitchen replacement - was raised, and could hold either positive or negative energy usage connotations in different cases. Long term demographic changes were noted as influential drivers, population growth and trends towards smaller households amongst them. It was noted that energy efficiency is not considered a high priority by many households, rather one of a number of concerns.

One important issue highlighted by several participants was that of timing. It was noted that households would be more likely to invest in major retrofit project at certain points of the 'ownership lifecycle' than others, for example when moving in. Money saving and the 'hassle factor' were noted as drivers that could encourage or discourage uptake of retrofit, respectively. Conservation and planning controls were also highlighted as important here: they affect the cost and practicability of many retrofit projects in many private residences.

It was felt that encouraging energy efficiency in the private sector was technically more difficult and politically more challenging than its social counterpart, due in part to the large number of actors. As decision making powers are dispersed across a large number of householders and individuals. One participant felt that individual householders have little to no motivation to undertake retrofit. Furthermore, decisions made by government at EU, national and local level will affect outcomes considerably, as will private sector actors such as equipment manufacturers.

The problem of funding retrofits was raised, with the high initial capital cost problematic in many cases. Private savings and grants were suggested as sources of such capital; the importance of low interest rates and availability of credit was highlighted. The Green Deal, government's proposed framework for financing retrofit and paying back the loan over a longer period through energy bills, was noted as important in this regime. Indeed, the programme is intended to drive a step change in the level of investment undertaken for energy efficiency in private homes.

3.2 Social housing

Table 3: Social history- post it responses							
Legacy of poor housing stock	Communal heating	More experimental		Landlords: LAs, HAs, RSLs	Local regeneration	Tenants	
Like private housing	**What**	Smart meters by 2020		Housing associations	**Who**	ALMOs	
More group technologies	Modern high standards	Housing standards		Victorian philanthropists	NHS/MOD	Charitable trusts	
Regeneration	Fuel poverty	Planned maintenance		Sustainable Homes	Government policy	Feed in tariffs	
Regulatory drivers	**Why**	Policy e.g. Decent Homes		Longer timescale	**How**	Local authority policy/action	
Balance of needs	(Non)- engagement	Cost		Easier to contract	Owner and tenant	Policy levers	

Policy drivers were considered to be particularly important in this regime. One participant observed that national policy objectives and targets are often the "first target" for local government, with the Welsh Housing Quality Standard highlighted as an important example. Other important driver included the planned maintenance programmes undertaken in social housing. Similarly, regeneration projects were identified as a potential driver, with energy and resource efficiency aims potentially sitting alongside economic and social notions of sustainability.

Local authorities were noted as an important actor playing a number of roles in the regime as a landlord, regulator, funder etc, while local regeneration bodies were also identified as relevant as their remit will often incorporate social housing areas. Social housing, like other rented property, is characterised by a 'split incentive' between tenant and owner with the potential to discourage either party from making significant improvements to the property though it was noted that social housing is far more regulated than its private counterpart and less likely to fall victim to this. It was felt that social landlords were in a position to act more rationally than private home owners, considering longer timescales from a less personal, more economic. Furthermore, they were able to coordinate retrofit at scale, enabling economies of scale and easier contracting. Two points were raised regarding social tenants. Firstly, areas of social housing are in fact home to a mix of right-to-buy home owners and social tenants, making ownership patterns less homogeneous than they may at first seem. Secondly, there are issues of engagement to be considered when undertaking significant change to the fabric of social homes.

One issue highlighted was the legacy of relatively poor stock in some social housing, for example post WW2 prefabs and Victorian workers' housing. At the other end of the scale, some participants highlighted the high standards of modern social housing, aiming for Code 4 on the Code for Sustainable Homes.

3.3 Reflecting on the past: what, who, why, how

It was suggested that there were three reasons why people altered their homes: comfort, appearance and saving money. Innovations in these three realms could encourage take up of retrofit measures. It was strongly felt that normalising retrofit as a form of general maintenance - choosing the energy efficient option when repairing or maintaining a property - would represent a step change in the way retrofit is perceived. However, the length of payback periods was highlighted as a barrier to retrofit due to perceptions of risk and debt. It was observed that uptake of measures such as loft and cavity wall insulation was low despite short payback periods.

A key issue that arose was the importance of drawing lessons from past transitions. For example, it was felt that 'rushing' change created the risk of skills problems that could act as a barrier to change or result in inefficiencies further down the line. Two particular past transitions were highlighted as informative and drivers discussed are summarised table 6.

Table 4: Understanding drivers from past transitions	
Double glazing	**Condensing boilers**
• Necessary maintenance - skills needed for older single glazed windows less common	• Regulation led
• Became a desirable feature in a house – a selling point	

Considering retrofitting as part of a wider energy system was felt to be important, with issues of demand management and fuel poverty arising as important issues; with fuel prices rising and more households fall into fuel poverty, retrofit offers social as well as environmental sustainability gains. On the other hand, the 'sustainability' of retrofitting was called into question. The costs of installing multiple technologies and the prospect of increased landfill as technologies needed to be replaced in the near future were both raised as critical issues.

3.4 Future transitions: trends, technologies and scaling up

Driving uptake amongst the general public was felt to be integral to scaling up demand for retrofit. Participants felt that it is important to consider the way that people interact with their homes in order to encourage demand. A key aspect of this is aesthetic value: retrofit is unlikely to reach widespread acceptance if it is unattractive. It was observed that current trends are towards consuming more energy in our homes rather than less, for instance increasing appliance use or increasing heating demands: although participants felt that concerns over energy efficiency were increasing, they were still thought to be low down on the list of people's priorities.

It was suggested that local government had significant potential for acting as a leader, in terms both of encouraging retrofit and providing innovative finance with the Green Deal highlighted as a mechanism. Utilities, too, are likely to play an important role in future transitions. As well as holding an obligation to encourage energy efficiency by government policy such as the Carbon Emissions Reduction Target (CERT) and Community Energy Saving Programme (CESP) - and, potentially, the Green Deal – it was noted that they affect the energy usage choices made by householders.

The need for a clear market signal was considered to be important in developing a mass market for energy efficiency technologies and so driving down costs, though it was unclear who should be responsible for sending this signal. Some participants felt that government should not be picking winners; other felt that government incentives would play a vital role in enabling retrofit. Indeed, it was noted that government was currently pursuing a shift away from regulation and that this was worrying when considering sustainability goals.

It was noted that the costs of retrofit are not limited to buying and installing measures. Surveys were identified as a significant cost, both in terms of money and time. Reducing these costs as felt to be vital in scaling up retrofit. Similarly, insurance was felt to be "worth a discussion" since risk is likely to play a vital role in the decision making processes of many actors. The insurance market was felt to provide a potential form of third party regulation as well a potential trigger point: it was suggested that bringing insurance into line with energy efficiency aspirations could help to stimulate demand.

4. Non-domestic buildings

Table 5: Non-domestic buildings - post it responses

	What			Who	
Growth of out-of-town parks	Consolidation	Air conditioning	Developers	Estate managers	Contractors, planners etc
Public sector improvements	**What**	Repurposing buildings	Heritage	**Who**	Institutional investors
Low quality interwar stock	Open plan office	Building management	Tenants	Professional institutions	Building physicists

	Why			How	
Comfort vs. energy	Car ownership	Rise of consumerism	RDA regeneration	Leasehold	Building regulations
Government targets	**Why**	Social trends to green	Energy certificates	**How**	Reputational drivers
Financial drivers	Landlord/tenant relationship	Need for flexibility	Low interests rates	Listed properties	Pension trust

Several changes in the shape and design of non-domestic buildings were felt to be important, for example, mass solutions, consolidation (with more people per m^2 of office space) and open plan offices. Similarly, the growth of out-of-town parks was noted as a wider trend in this regime. Participants also noted important changes in the way that this regime uses energy. Air conditioning, for example, was noted as a now vital part of office design as part of a move to "highly serviced glass boxes". On the other hand, government targets and social trends to green were highlighted as positive drivers encouraging retrofit.

It was noted that actors in this regime are characterised by a dense network of professional institutions. In particular, the landlord-tenant relationship was noted as influencing retrofit in a number of ways. For example, the prevalence of predict and provide models of utility provision distances tenants from their energy usage in a way similar to standing order payments in the private domestic sector. Furthermore, it was observed that decision making is taken at a number of operational levels in the commercial sector, introducing a large number of actors. Commercial decision making was also commented upon, with different mechanisms behind rental yield and investment decisions potentially acting as a barrier to investment in retrofit. Landlords' need for flexibility to provide for a wide range of potential tenants was noted as likely to impede the installation and use of retrofit measures designed to optimise use of energy.

Energy certification was noted as a potential driver for initiating retrofit in this regime, with Energy Performance Certificates (EPCs) in the private sector and Display Energy Certificates (DECs) in public buildings. These, alongside reputational drivers, were felt to have the potential to increase the value given to energy efficiency by building owners. Low interest rates were noted as another important driver in implementing retrofit, emphasising the issue of cost.

It was felt that the non-domestic regime incorporated a broad range of property types and that recognizing the differences between, for example, commercial office stock, retail centres and public buildings would be important here.

4.1 Reflecting on the past: what, who, why, how

It was observed that the general shift from manufacturing to service industries across the UK has changed the function and shape of buildings. Air conditioning has risen in importance, becoming a ubiquitous part of commercial buildings; the rise of ICT has increased the number of appliances using energy. Low energy prices encouraged increased transport mobility and a general trend to high energy usage though the 1970s brought with them a growing concern for levels of energy use.

A large number of actors were identified in this regime (table 6) – in fact, the question was raised as to whether there were too many parties involved. It was suggested that there was a potential role for a new discipline specialising in the complexity of energy efficiency. The development of skills was cited as critical for delivering retrofit.

Table 6: Actors in the non-domestic building regime		
Client	**Intermediaries**	**Delivery**
Owners, developers, tenants and government	Agents, lawyers, regulators, professional bodies and utilities	Architects, contractors, engineers and building managers

Short termism was highlighted as a consequence of decision making structures, which in this regime are made on an investment appraisal basis, often not taking into account the longer term or intangible benefits of improved energy efficiency. On the other hand, it was noted that buildings undergo extensive refurbishment processes in order to increase rental yield providing a potential lever point at which to encourage retrofit.

Corporate Social Responsibility (CSR) was discussed as a further framework for change. It was observed that competition by reputation could act as one driver for increasing uptake of retrofit as 'green' values grow in public concern. It was also suggested that moving energy efficiency from the CSR 'box' to the profit making 'box' would be an important part
of scaling up retrofit.

4.2 Future transitions: trends, technologies and scaling up

Government ambition was felt to be diminishing in the face of difficult economic circumstances. Local authorities were considered to be a "mixed bag"; many public authorities are simply unable to afford to retrofit. Trends towards grouping and reducing local authority building stock were also highlighted. Participants felt that short termism in government horizons was a key barrier: it was suggested that 2020 was simply beyond the gaze of current government, whereas industry perspective tended towards the longer term. Indeed, some participants felt that there was a growing frustration at government inaction within the private sector. Nonetheless, it was felt that policy, legislation and targets were vital mechanisms for scaling up retrofit.

It was suggested that innovation would likely decrease the cost of energy efficiency measures - one example given was that triple glazing is now cheaper than double glazing. Importantly, it was felt that controls would improve, allowing for greater efficiency in appliance use. Energy storage was also highlighted as an important target for technological innovation. Incentives were felt to be an important mechanism in kick starting technological change. Some participants felt that the future would see a new generation of more informed staff and tenants, understanding the need to use energy more efficiently and ways of doing so. As such, behavioural change would facilitate better use of new technologies and controls. On the other hand, one participant cautioned that a lot of low carbon technologies would cause problems in the future as they will be applied in a misguided way, often as technology for technology's sake. The risk of 'eco-bling' was suggested, with technologies used inappropriately as a status symbol.

It was felt that genuine business interest in green issues was increasing, with demand emerging from leaders in the private sector. Economic growth was cited as another potential driver. Indeed, the 'green growth' agenda has been championed by authorities including UK government and the OECD, suggesting opportunities to connect growth and emission reduction aims. Growing energy, water and waste costs were also cited as important drivers that would prompt business to take more interest in the energy efficiency of their buildings. Some participants suggested that it would soon be more expensive not to act, in terms of reputation and fuel. However, some participants felt that industry has become "*efficient at producing inefficient buildings*", and change to the design and construction of buildings would be slow to materialise.

5. Urban Infrastructure

Transport	Utilities: waste, water, energy	District heating	From state to private owners	'Silo'ed	Local authorities
Public sector improvements	**What**	Repurposing buildings	Utilities, transport	**Who**	City authorities
ICT	National grid	New technologies	Government agencies	Private sector	Residents

Age of infrastructure	Government policy	Disease and public health	Nationalised industry	District heating	Building regulations
Cost	**Why**	Population changes	Planning policy	**How**	Government incentives
Public perception	Regeneration	Utility provider profit	PPI/PFI etc	Deregulation of utilities	Need for cycle facilities

Table 7: Urban infrastructure - post it responses

It was felt that the term 'infrastructure' was extremely broad, with potential to be further unpacked and considered at a later stage in the project. Utilities – referring here to water, waste and energy services – and transport were identified as important aspects of this regime, as was provision of ICT services. The national grid was highlighted as an important factor, representing an extremely large sunk cost and something of an organising principle in current provision of energy. Interactions between processes of maintenance and change in the grid and innovation in low carbon energy generation and provision will have important repercussions. It was also noted that suburban infrastructure deserved special consideration within this regime as home to a large proportion of the urban population.

One of the key questions that arose in this regime was whether the private or public sector was best placed to initiate change since top-down change, led by government actors, would likely have a very different nature to bottom-up change led by the private sector. It was felt that both state and private actors were important within this regime, with the move from state to private ownership of the major utility companies introducing a myriad of interests and decision makers. One issue that was raised was the 'silo' nature of decision making in this regime. With decision making distributed not only across the private and public sectors but also across departments within firms and government, it is often marked by a lack of holistic, strategic thinking. Residents were identified as a further important group of actors. The way that infrastructure is used by residents will have huge implications for the shape of future transitions, particularly in the context of privatised industry.

The public sector was noted as driving change in this regime through policy. This would incorporate not only infrastructure specific policy such as planning policy, but also related agendas such as public health and regeneration. Deregulation of infrastructure providers, in particular energy companies, was noted as important, with potential concerns for the sustainability agenda. The private sector, on the other hand, was described as driving change through profit objectives, with important repercussions for sustainability interventions. It was highlighted that change in infrastructure is extremely expensive. Issues here include not only access to credit, but also risk aversion and distribution of resources. Public-private partnerships (PPPs) and private finance initiatives (PFIs) were highlighted as key mechanisms in this regime, using private capital to fund public infrastructure.

5.1 Reflecting on the past: what, who, why, how

This regime was characterised as incorporating high sunk costs: with very large initial capital costs both to build and upgrade, infrastructure tends to be slow and difficult to change. Trends towards

decentralisation were also noted as an important characteristic of this regime. Important consequences of this are the growing number of actors and decision makers involved, as well as a dominant focus on growth that is likely to be problematic for the sustainability agenda. Actors were categorised as falling into three groups: (i) supply management, (ii) demand management and (iii) intermediaries. It was suggested that new forms of intermediary would be beneficial for future change, with new partnership structures and potential Multi Utility Services Companies (MUSCos) suggested as potential innovations in this area. It was also noted that there was potential for new, different business models in future transitions. Regulation and legislation were highlighted as strong drivers for change in this regime. However, it was felt that 'lock in' still prevented further change.

Participants noted a change in patterns of demand: increasing demands for appliances and electric goods alongside growing awareness of ecological constraints. People have become more aware of climate change issues but at the household level, energy efficiency remains a niche concern. There was also a feeling that people are being sent mixed messages, perhaps limiting the impact of increased awareness. In legislation, sustainability issues have been growing in status, accompanied by an increase in green growth rhetoric. It was felt that considering qualitative ways of looking at quality of life should be part of transitions to sustainability.

5.2 Future transitions: trends, technologies and scaling up

It was observed that while improvements in communications and a shift to digital living seemed intuitively as though they would decrease emissions by reducing the need to travel, this had not proved to be the case empirically. This was attributed to the "double blades" of digital cities by which trends that lower energy consumption, such as improved communications, are offset by those that demand more power, such as increased appliance use.

One participant felt that the real cost benefits that would drive scaling up of sustainability retrofit were to be found as city level, for example sustainable energy supply. Indeed, a number of participants suggested an important role for local or city-level governance of transitions.

Table 8: Functions of visions[4]
1. Mapping the possibilities for change
2. Defining problems to be resolved
3. Setting a framework for targets and monitoring
4. Building and binding networks of actors
5. Focussing capital and other resources

It was suggested that clear models and visions would play an important role in the scaling up of retrofit. Visions can play a number of important functions in transitions (table 8). It follows, then, that generating visions will be important in leading a step change in the level of sustainable retrofit. More integrated local plans were offered as a potential example of a shared vision for regional infrastructure. Indeed, the planning system was cited as a potential driver for change, though participants commented that it would need to undergo change in order to successfully lead transition.

It was felt that there is currently insufficient capacity available to support retrofit on a wide scale in terms of skills, finance and networks. Metropolitan engineering skills were noted as an important area for improvement, as were financial structures able to support long pay back periods. With regard to networks, it was new types of intermediary were suggested with the potential to support better communication and facilitate change, particularly between the state and households. Furthermore, it was felt that data and information sharing needed to be more comprehensive and cohesive in order to deliver efficient large scale infrastructure.

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[4] Smith, A, Stirling, A and Berkhout, F (2005) The governance of sustainable socio-technical transitions *Research Policy* 34 p1491-1510

6 Cross cutting themes

A number of crossing cutting themes arose from plenary discussion as important across the regimes:

- Since retrofit projects often require large upfront investment, availability of capital or credit will be vital in enabling change. Furthermore, actors capable of providing capital may find themselves in a stronger position to influence the nature and objectives of change.

- Behavioural change will play an important role in any transition to sustainability and there are ethical, political and practical questions over how this should be done. Demand management will be important in driving change; raising public understanding is as important as technical innovation.

- Transition to low carbon will require change in the level and kinds of skills available: capacity building will be important

- It is important to consider time scales going forward. Firstly, it is important to acknowledge the different time scales observed by private, public and civil actors. Secondly, framing issues in a way that is accessible and understandable will be important in driving demand.

- Policy levers are an important driver, with policy determined at different layers of government. A number of national initiatives were considered important, for example Decent Homes, the Warm Front (or Nest in Wales) initiative and the Code for Sustainable Homes, as well as funding mechanisms such as the feed in tariffs. However, policy is not always widely known or fully understood, even within some local authorities. Better communication is needed to augment policy.

- Population change is important driver along with lifestyle changes, with large increases in the number of people living in cities and increases in demand for energy and transport asserting considerable pressures upon the built environment.

- Uncertainty was highlighted as a potential barrier to scaling up as many households would be tempted to wait by a broad range of unknowns including changing technology, future legislation and the potential for falling costs.

- Different actors will need different messages to inspire change, depending on factors such as their commitment to the environment, their inclination towards considering future generation and their risk aversion. Increasing public awareness is not just a matter of a one-size-fits-all statement of the benefits of retrofit but rather a tailored response to different concerns.

- Rising energy prices could present opportunities for retrofit, as households are pushed to consider the value of energy efficiency in the face of rising bills. Furthermore, rising energy prices and growing resource constraints are likely to increase the importance of energy resilience.

- There is a need for co-ordination across boundaries, both spatial e.g. local authorities and sectoral e.g. housing and transport. Mechanisms for collaboration will be needed to support this, with the local level important for interdisciplinary working.

- Some thought was given as to how well the 'regimes' concept worked as a way of framing discussion. It was felt that they were helpful in exploring issues but that they had their limitations. For example, it was noted that they were extremely broad, with need for further unpacking in the future. It was also noted that the regime concept would need to be complemented with analysis at different 'scales', such as neighbourhood and city level, in order to fully appreciate processes across the built environment and urban infrastructure.

7 Conclusion

Discussions throughout the workshop highlighted a wide range of barriers standing in the way of a successful transition to a more sustainable built environment. Importantly, retrofitting the built environment will incur large costs and significant disruption. The high capital cost raises issues of finance in terms of access to credit, risk aversion and distribution of resources. These costs also introduce disincentives– key examples discussed included the 'hassle factor' and long payback periods. Incentive problems were noted as particularly influential in the rental sector in both housing and non-domestic buildings. Thirdly, they raise problems of high sunk costs, especially in the infrastructure regime. Conservation and planning controls are likely to be problematic here as well, where retrofit measures are rendered either prohibitively expensive or infeasible.

Each regime involved a large number of actors: dense networks of professional institutions were noted in the non-domestic buildings regime in particular but can be found across retrofit activity. Decision making within these structures was characterised as falling into 'silos', standing in the way of interdisciplinary action. Furthermore, different actors are subject to different time frames, creating problems of short termism. Uncertainty was highlighted as an important barrier to change, arising from a number of sources such as rapidly changing technology. It was felt by some participants that dwindling government ambition presented another source of uncertainty.

Changing lifestyle patterns were observed as creating problems for the sustainability agenda. For example, people now expect higher thermal comfort of their homes and offices. Increasing levels of car ownership were also highlighted as problematic. It was observed that sustainability, while increasingly recognised as important, was still not a priority for many people.

Despite an array of barriers, a number of opportunities were identified. One of the most important opportunities highlighted was that of timing. Understanding when people are most likely to undertake retrofit projects was felt to be crucial in scaling up activity. At the household or firm level, these junctions were termed 'trigger points' and included moving home and maintenance in the housing sector and rolling refurbishment in non-domestic buildings. At the macro level, 'tipping points' were identified as important: wider socio-economic trends that made retrofitting more appealing, with an important example being the rising cost of energy.

Several potential opportunities for policy to lead transition were discussed. In the housing regime, it was noted that social housing had the potential to take a more rational, longer term view than private housing and to implement more experimental measures. The importance of policy as a motivator and a benchmark was highlighted as a critical driver across all regimes. Other potential roles for policy makers included a co-ordinating role, facilitating collaboration across spatial and sectoral boundaries and building capacity, as well as a sending clear market signals to industry.

An important recurring theme throughout the workshop was the importance of behaviour. The demands and expectations of the general public were recognised as critical in supporting large scale change. Key opportunities discussed included the importance of engagement, better understanding and use of technology and reframing sustainability to take in quality of life dimensions. Encouraging a wider take-up of sustainability concerns – through better communicating potential costs of inaction and benefits of change – emerged as a critical step in leading transition.

8 Annex: Urban foresight panel

Bakr Bahaj	Southampton University
Caroline Batchelor	EPSRC
David Butler	University of Exeter
Aaron Burton	Environment Agency Wales
Scott Cain	TSB
Fionnuala Costello	TSB
Pooran Desai	Bioregional
Clare Erikkson	RICS
Nicholas Falk	URBED
Rufus Ford	SSE
Natalie Grohmann	Welsh Government
Richard Guy	Carbon Trust
Mark Hallett	Igloo Regeneration Trust
Barbara Hammond	Low Carbon West Oxford
Gareth Harcombe	Cardiff County Council
Marianne Heaslip	URBED Ltd
Chris Jofeh	Arup
Phil Jones	Cardiff University
Miles Keeping	GVA Grimley
Andrew Mellor	PRP Environmental
Roger Milburn	Arup
Helen Northmore	Energy Saving Trust
Oliver Novakovic	BRE
Michael O'Doherty	Manchester City Council
Mark Scaife	Energy Technology Institute
Katherine Randall	DECC
Ben Ross	Forum for the Future
Martin Russell-Croucher	RICS
James Walker	Kingfisher
Jeremy Watson	CLG
Joanne Wheeler	UKGBC
Jonny Williams	BRE
Chris Woods	Wates Group