Scenarios for Urban Retrofit: Workshop 2 Visioning Retrofit Futures

Miriam Hunt

Workshop 2 Report

Final Version

February 2012

Contents

1. Introduction

One of the key challenges of retrofitting the built environment for sustainability is the long term nature of the problem at hand. At present, the UK is committed to reducing its greenhouse gas emissions by at least 80% by 2050, relative to 1990 levels[1], and with the built environment accounting for about 45% of CO2 emissions[2], retrofitting activities will necessarily play a large part in meeting this target. Yet there is significant uncertainty as to the shape, nature and scale of this role.

Retrofit 2050 is an EPSRC funded project investigating transitions to sustainability in the built environment of UK city-regions between 2020 and 2050. Bringing together an interdisciplinary team from Cardiff University, Salford University, Oxford Brookes University, Durham University and Cambridge University, it aims to explore and advance theoretical and practical understandings of the drivers and innovations that will underpin a shift towards sustainability by 2050. For more information on the project and its objectives, please visit www.retrofit2050.org.uk.

One of the core aims of the project is to *"articulate and appraise the city-regional specific visions and prospective pathways for urban-scale retrofitting of the built environment",* which it will address through the scenario process outlined in table 1. In the first phase of this process, a panel of leading national experts from the public, private and voluntary sectors is working with the Retrofit 2050 project team to explore visions of retrofitting to 2050. A more detailed description of the scenario process can be found on the project website[3].

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

The overall aim of the second workshop, held on 26 January 2012, was to *explore a range of visions for (retrofit) sustainable city regions for the period 2030-2050.* Visioning, generating a picture of a desirable future (or futures), is a key step in any backcasting process. It allows us to create a shared set of expectations of the future(s) we would wish to inhabit (or wish for our children to inhabit) and therefore to articulate a potential destination (or destinations) to be. In the case of the Retrofit 2050 project, these visions are intended to describe what a sustainable urban environment could look like based on the systemic urban retrofitting of an existing UK city region.

---

[1] http://www.decc.gov.uk/en/content/cms/tackling/2050/2050.aspx
[2] http://www.ukgbc.org/site/info-centre/display-category?id=59
[3] *Developing Urban Retrofit Scenarios: An Outline Framework for Scenario Foresight and Appraisal,* found at http://www.retrofit2050.org.uk/sites/default/files/resources/developingscenarios4.pdf

Further background to this stage of the process is provided in the project working paper *Visioning Retrofit Futures*[4]. This outlines a set of prototype visions (see Table 2), developed on the basis of the project team's literature review and horizon scanning activities, which were used as the basis for the day's workshop activities. The specific objectives of the day were to

- Provide a rich picture of what an existing UK core city-region would look like under each of the visions
- Make transparent the underlying assumptions and explore any contradictions or inconsistencies within each vision
- Assess how successfully the visions encompass the future 'possibility space', identifying any gaps of potential improvements

Table 2 describes the five prototype visions developed by the project team. Given logistical limitations on the day only the first four of these were developed by the workshop participants (the 'Resilient City' will be considered separately by the project team). The vision summaries and brief narratives storylines were intended to convey the essence of each of future, whilst at the same time providing considerable interpretive flexibility. Participants were encouraged to use them as a 'jumping off' point for discussion but to think creatively about what was missing or out of place. Using a series of structured participatory tools, the Workshop provided an opportunity for the technological content and socio-economic and environmental dimensions of these visions to be explored.

Table 2: Summary of prototype visions	
Vision Summary	**Narrative**
Smart-Networked City: The city as a hub within a highly mobile and competitive globally networked society.	Pervasive information rich virtual environments integrate seamlessly with the physical world. ICTs provide real time information to drive efficiencies through both automation and intelligent control, and advanced market oriented solutions for the internalisation of environment costs. This is an open outward looking society in which the mobility of people, goods and services remains high.
The Self-Reliant City: The city as a self-reliant organism, internalising economic and environmental activity within its bio-region.	A self-replenishing largely self-reliant system of circular metabolism, where resources are local, demand is constrained and the inputs and outputs of the city are connected (cradle-to cradle): waste products, for instance, are re-used or recycled rather than exported. Significant efficiencies are obtained through systems integration and re-design.

---

[4] *Visioning Retrofit* Futures, found at
http://www.retrofit2050.org.uk/sites/default/files/resources/VisioningRetrofitCityFutures.pdf

he Compact City: The city as a site of intensive and efficient urban living.	Urban land-use, buildings, services and infrastructure provision are optimised in order to create dense urban settlement forms that encourage reduced demand and more efficient use of energy and resources. Concentration in urban centres reduces pressures on the periphery.
The Green City: The ecological city-region living in harmony with nature	Green and blue space, local biomass and biodiversity, are all harnessed in the provision of (food production, energy, shelter, water & waste treatment) ecosystem services. The extensification of urban living promotes the blurring of urban-rural boundaries, with rise of urban agriculture accompanied by a re-population of rural villages.
The Resilient City: The future proofed city, robust to the emergent risks and hazards of the anthropocene	Ecological security and climate change adaptation are paramount in the design of land-use, infrastructure and buildings. Engineering and social systems are flexible and responsive. Efficiency and demand reduction are servants of security of supply, rather than mitigation per se. Infrastructural systems are designed with a high degree of inbuilt redundancy to ensure resilience against shocks and stresses.

Participants were asked to work in groups to carry out three exercises:

1. **'Picturing' the City – Visions of Place(2050):** To produce a series of annotated pictures, collages or diagrams illustrating how they imagined the city to be at the building, neighbourhood and city-regional levels. The purpose of this task was to imagine what a future retrofit city would look like under this vision in 2050, particularly in terms of the sorts of technologies and systems involved at different scales.

2. **Blog Spot 2050:** To write a day-in-the-life of a resident of the city, with particular focus energy, water, waste, ICT and mobility issues. The purpose of this exercise was to imagine what your future city would be like to live in from a 'user' perspective.

3. **State of the City Report 2050:** To write an executive summary for a hypothetic State of the City sustainability report describing city-regional performance with consideration for issues related to people, environment, economy and energy. The purpose of this exercise was to enrich and elaborate your vision in terms of the broader social, economic and environmental development of the city.

A detailed description of each of these tasks is set out in Annex 1. Together these exercises were intended to tease out some of the issues facing each city vision, including insights into urban form,

quality of life and urban governance. Importantly, participants were encouraged to consider how relevant, likely, desirable and mutually exclusive the visions were.
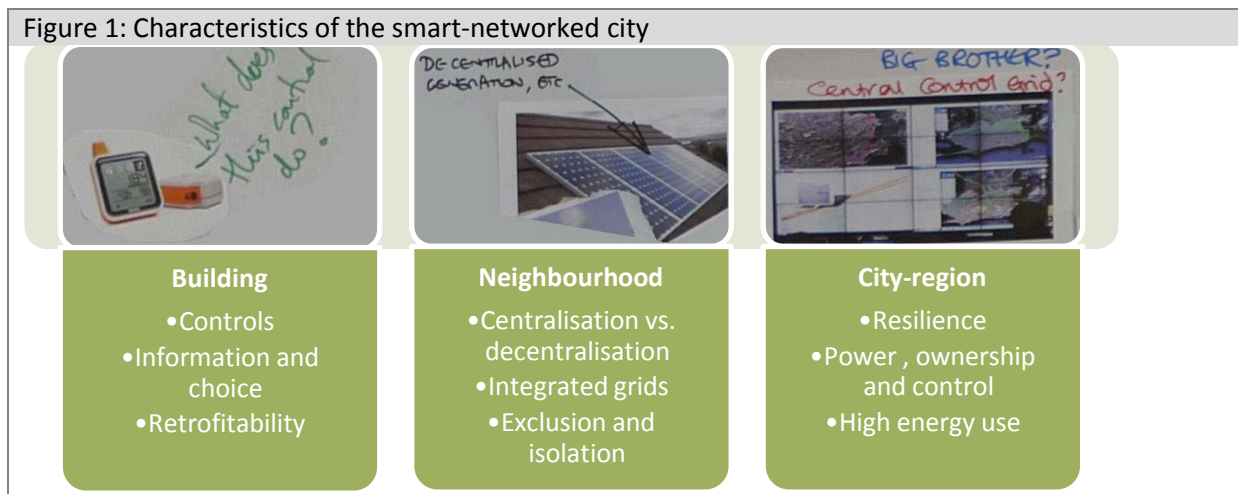
This report will be structured as follows. Sections 2 to 5 will present some of the points and issues raised by each group over the course of the day, first presenting key points of discussion and then trying to draw out some themes for further consideration. Section 6 will then reflect on common issues between the four visions and draw some conclusions.

2. The Smart-Networked City

The city as a hub within a highly mobile and competitive globally networked society

Characteristics of the Smart-Networked City

For the first session of the workshop, participants were asked to think about the defining characteristics of visions of the smart-networked city, including key features, benefits and risks. Figure 1 below highlights some of the key issues that emerged at building, neighbourhood and city-regional level.

Figure 1: Characteristics of the smart-networked city

Building	Neighbourhood	City-region
•Controls •Information and choice •Retrofitability	•Centralisation vs. decentralisation •Integrated grids •Exclusion and isolation	•Resilience •Power , ownership and control •High energy use

At the building level, an increase in controls for electrical appliances was identified as an important feature of this vision. This would allow for greater understanding and control of the quantity of energy used in homes and offices. However, these benefits will not be garnered unless controls are clear and easy to use. Importantly, this vision was identified as relatively easy to retrofit since it could be "*layered on*" to existing infrastructure.

At the neighbourhood level, it was highlighted that the supply of energy would be a significant issue. While it was felt that renewable energy sources would be a vital feature of the city, questions remained as whether generation and supply should be centralised at a regional level or decentralised to the neighbourhood. Either way, benefits would be accrued by integrating energy and infrastructure networks, for example by sharing information across systems.

One important risk highlighted in this vision was the risk of personal isolation. It was felt that visions of the smart city lacked a human dimension, and that bringing innovative community structures back into the city would be necessary to maintain quality of life. On a similar note, households without access to technology – either through affordability, education or choice – would be significantly excluded from wider society.
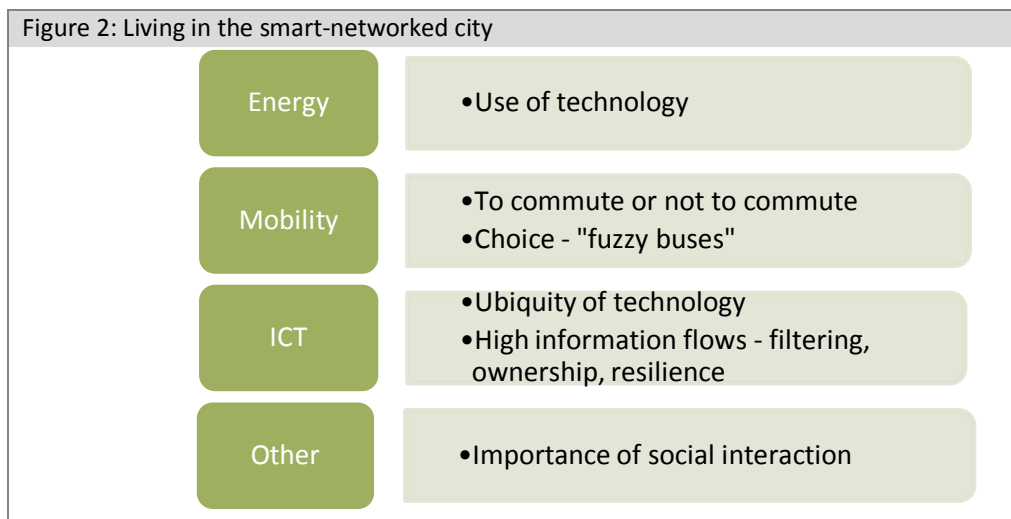
At the city-region level, resilience was felt to be a key issue in order to create a genuinely sustainability city. It was noted the smart-network city is subject to high levels of risk arising from heavy reliance on technological systems: system failure or sabotage would result in the city grinding

to a halt. This reliance also has implications in terms of power, as groups in control of owning and maintaining infrastructure would be in a powerful position, perhaps even to the point of monopoly.

A key characteristic of this vision was high energy use: both operational energy and embodied energy use would be high, since as well as requiring energy to run, technological systems would likely to be subject to short life cycles with implications for waste.

A Day in the Smart-Networked City

The aim of the second exercise was to describe a day-in-the-life of a resident of the smart-networked city in 2050, giving thought to everyday experiences of energy, water, waste, ICT and mobility. Participants choose to describe a day in the life of Sam, a 60 year old woman working in healthcare. Her role, Health Care Advisor, was conceived as one of a new type of role created by increased levels of monitoring and data. As such, it is concerned with analysing data and using them to undertake preventative healthcare, as well as carrying out many of the more familiar tasks of contemporary community health workers. Some key issues are summarised in figure 2.

Figure 2: Living in the smart-networked city

Energy	•Use of technology
Mobility	•To commute or not to commute •Choice - "fuzzy buses"
ICT	•Ubiquity of technology •High information flows - filtering, ownership, resilience
Other	•Importance of social interaction

It is noticeable that much of Sam's day is spent interacting with technology, implying high energy use. Indeed, almost every part of her day is subject to some sort of technological intervention, from getting up to virtual social interaction with friends and family.

There was discussion as to how this ubiquity of technology would impact on working patterns. Since Sam's work involves visiting patients in their homes, it was felt she wouldn't go into an office for her working day but that many people would still commute to offices for work. Notably, Sam travels by "*fuzzy taxi*": transport in this vision is controlled by smart systems intended to respond to individual demands while optimising public transport schedules. An important consequence of this is the level of choice and convenience afforded by public transport.

In this city vision information, like technology, is ubiquitous. This has a number of important repercussions for everyday life. Firstly, filtering processes are important in order to indentify which information is useful or relevant. Secondly, large quantities of personal information will be collected, raising issues of data ownership and protection. Thirdly, resilience is again an issue: for example, if Sam's information feed about her patients were to fail, she would not be able to go about her day.

An important theme in Sam's day is the important of social interaction: her working day is largely independent, relying more on technological systems than colleagues. As such, she structures her free time around family and community activities.

State of the City 2050

The third and final exercise of the workshop was intended to explore some of the key issues that arose at the city-regional level, with particular reference to 'place, people, economy and environment'. In order to do this, participants were asked to present an executive summary for a State of the City report 2050, which is summarised in table 3.

Table 3: State of the City 2050 – the smart-networked city	
Place Localisation of food production Infrastructure costs high	**People** High civic engagement Need for risk governance Augmented communities
Economy Unemployment negative Technological poverty a major issue Shift from replacing to maintaining appliances	**Environment** Energy policy systems based Renewable energy generation with some trade

Place

- There is a focus on meeting food needs locally, with 50% of consumable produced within 40km of consumption. However, there is still a need for trade with other cities and countries.
- Infrastructural investment is necessarily high, with the city relying on large scale mobility and ICT systems. As well as incurring high costs, these represent high embodied costs and, in some cases, high levels of waste due to the short life spans of some technologies. Furthermore, reliance on these systems means that it is necessary to maintain large reserves in case of malfunction, as well as privileging companies capable of providing and maintaining infrastructure – the executive summary notes that government was able to contain price increases to 20%, indicating a monopoly.

People

- The city is led by an elected stakeholder body, with governance based on a referendum process with high levels of civic engagement enabled by strong information flows and networks. High levels of engagement have positive repercussions for inclusion and democratic decision making but result in a short term-ist governance structure.
- The high levels of risk ubiquitous in the smart-networked city – particularly from reliance of ICT infrastructure – mean that long term thinking is essential for resilience. As such, the Resilience Management Committee has been established with the remit of making long term decisions regarding future stability.

- ICT has supported "*augmented communities*": geographically proximate communities connected by ICT networks

Economy

- Unemployment in negative, standing at -7%, with people a limiting factor due to demographic change with a high dependency rate and demand management a key driver.
- One of the most pressing economic issues within the city is technological poverty, with those unable to afford ICT systems being excluded from much of society. The 2045-2050 report identifies a reduction to 12%, but this still represents a significant portion of the population suffering social exclusion.
- The economy has experienced a shift from replacement to maintenance. On the demand side, demand for new products has decreased, with people instead opting to maintain and update their existing possessions. On the supply side, social entrepreneurship has created new business models based on shared ownership and consumption, with change enabled by strong networks.

Environment

- Energy policy takes a systems approach, incorporating ideas of inputs, outputs and resource budgeting.
- Energy generation is orientated towards sustainable, renewable sources: 70% of energy is generated within the city-region from a broad mix of sources while 30% is imported due to limitations on urban renewables.

Overarching Themes

It was felt that the smart-networked city, more than the other visions, focussed on technical rather than social change; it was felt that **social innovation needed to be added** to describe a genuinely sustainable city.

Risk and resilience were identified as key issues in this vision due to reliance on ICT systems across everyday life. Furthermore, energy demands would remain high, with some potential for reduction through innovation in demand management, such as cultural shifts or improved controls.
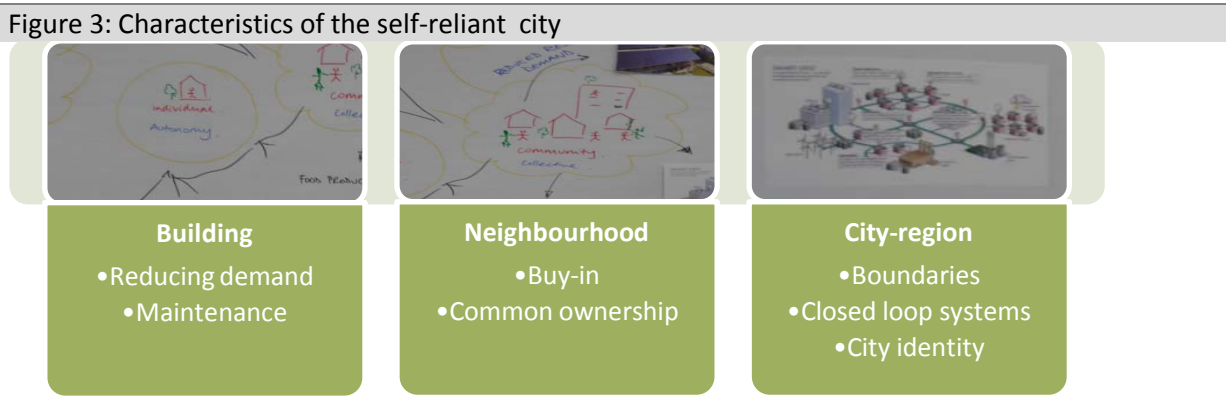
A **systems approach** was felt to be at the heart of the smart-networked city. Improvements in sustainability are incurred through efficiency increases from better flows of information and energy.

3. The Self-Reliant City

The city as a self-reliant organism, internalising economic and environmental activity within its bio-region

Characteristics of the Self-Reliant City

Figure 3 highlights some of the risks and opportunities that were discussed as arising from visions of the self-reliant city.

Figure 3: Characteristics of the self-reliant city

Building	Neighbourhood	City-region
•Reducing demand •Maintenance	•Buy-in •Common ownership	•Boundaries •Closed loop systems •City identity

Demand management was felt to be an important characteristic of the self-reliant city: current levels of demand were identified as unsustainable in a city where demands must be met by resources from within the city-region. Technology was felt to have an important role to play in managing demand and harnessing resources such as renewable energy, making maintenance a key concern for the self-reliant city.
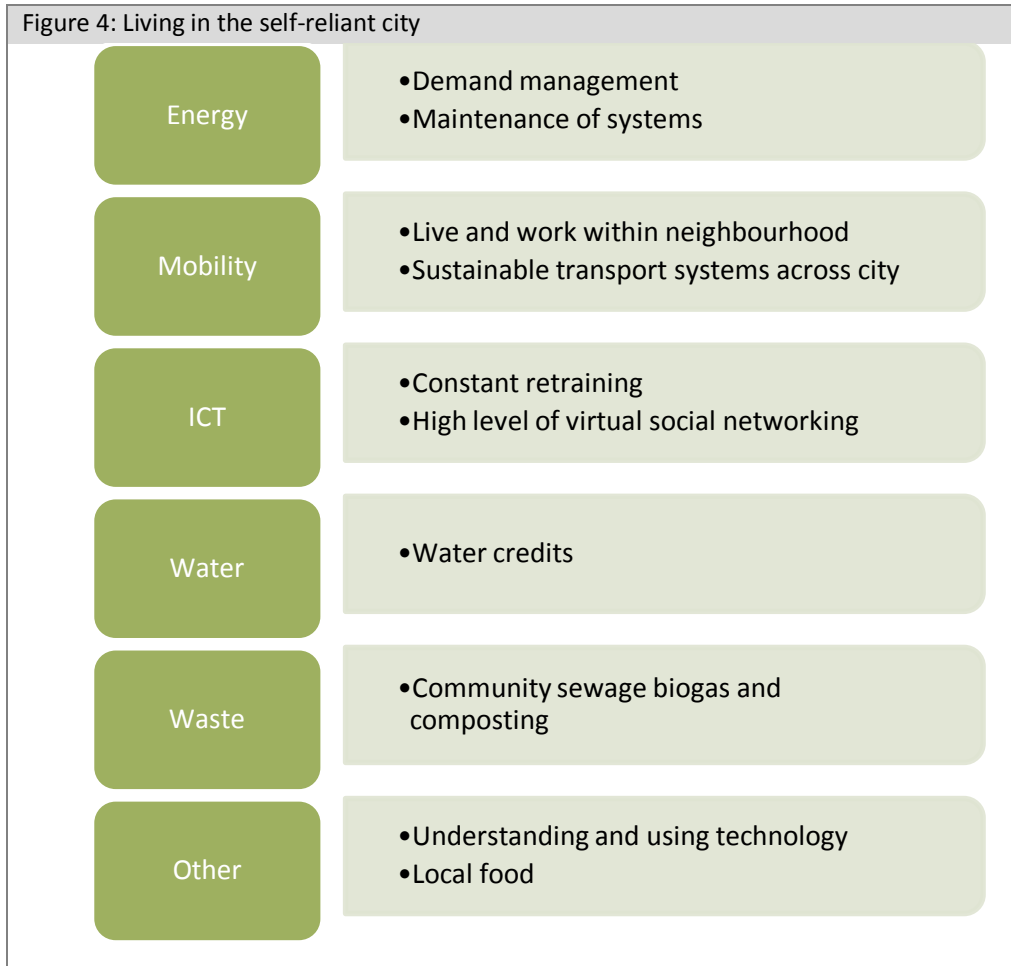
The neighbourhood was identified as an important scale at which to create the high level of buy-in necessary to support the self-reliant city, which would necessitate significant lifestyle changes to live within the city's resources. Common ownership was suggested as one response to this, making people feel more connected to sustainability issues. It was felt that self-reliance was easier to maintain at the community level than with individuals, though the building, community and city-regional levels would all have important roles to play.

Defining boundaries was highlighted as a key challenge in governing the self-reliant city. It was felt that self-reliance would necessarily be subject to limits: external connections were felt to be vital. Rural areas were highlighted as an example, as they are separate from but connected to cities; furthermore, a vast proportion of agricultural land in the UK is found in the Northwest of England, so isolation from these rural areas would isolate the supply of resources from demand.

It was highlighted that sustainability is only one of the potential roles of a city, and that other roles – such as tourism and culture – should not be abandoned in pursuit of self-reliance: maintaining a vibrant city identity was important.

A Day in the Self-Reliant City

In order to explore everyday experiences of energy, water, waste, ICT and mobility in the self-reliant city, participants choose to describe a day in the life of three different residents: a 41 year old engineer, a 71 year-old maintenance engineer and a 28 year old social housing provider. Key aspects of their 'blogs' are highlighted in figure 4 below.

Figure 4: Living in the self-reliant city

Energy	•Demand management •Maintenance of systems
Mobility	•Live and work within neighbourhood •Sustainable transport systems across city
ICT	•Constant retraining •High level of virtual social networking
Water	•Water credits
Waste	•Community sewage biogas and composting
Other	•Understanding and using technology •Local food

The need to change everyday practices to reduce demand for resources was a recurrent theme. It was suggested that such large scale behavioural change may require an underpinning set of values being commonly held: the idea of contributing to the community was one such example.

Indeed, the community played an important part in each of the three blogs, with much of day to day life lived locally. In mobility, this meant walking or cycling to work or community facilities, with sustainable public transport for longer journeys. Food and waste were also managed at the local level, with urban farming for the former and biogas generation and composting for the latter. On the other hand, each blog also contained a large degree of virtual living, with ICT providing access to online social interactions alongside largely independent lives.

Technology is prominent in each blog, with hi-tech systems managing energy generation and waste disposal. It was highlighted that this would have implications in terms of maintenance: they would

require a large, ongoing investment in terms money, embodied energy and time. Skills would also need to developed to maintain them properly.

State of the City 2050

Table 4 presents the key points put forward for the "*State of the City 2050*" for the self-reliant city, highlighting issues of place, people, economy and environment at the city-regional level.

Table 4: State of the City 2050 – the self-reliant city	
Place	**People**
Less mobility	Community engagement prioritised
Reusing transport systems as green corridors	Greater social equality
Urban food production	Small global economic elite
Energy systems on buildings	Concern about social interaction
Economy	**Environment**
More community work	Local capture and recycling of water
Credit based economy	Recycling/material mining
Private investment in infrastructure	Nature as a resource
Migration into city	
Local 'micro' manufacturing	

Place

- Personal mobility has decreased, with people instead living within their neighbourhood. While there is a sustainable transport system across the region, walking and cycling are the most prominent methods of transport. As such, many transport systems are retrofitted as green corridors.
- Green space is integrated into the city. This includes green corridors and urban agriculture, which sustains local food production.
- Energy generation and monitoring systems are built into the fabric of buildings to maintain decentralised micro-generation of energy and inform demand management programs.

People

- Community engagement is a key feature of the city, driven in large part by a shift in values towards 'giving back to the community'; the community also has some governance powers e.g. community charters. This has had the effect of decreasing inequality in the majority of the population, but created a small economic global elite.
- Social interaction was highlighted as an area for potential problems. Both largely interdependent lives, with much socialising occurring virtually, and forced community engagement were highlighted as potential sources of problems, as was a loss of cultural diversity.

Economy

- The economy is now credit based, with unpaid community work a large part of people's lives. Growth has been decoupled from the environment.
- Public investment is at an all-time low, with private investment of £15 billion over 30 years supporting growth in green infrastructure. Despite city-regional autonomy, strategic relationships occur in providing shared infrastructure e.g. between Yorkshire and Lancashire County Councils. Migration into the city has grown 10%.
- Local manufacturing has increased, with examples including grid technologies and 3D baking technologies.

Environment

- Water is captured locally and recycled. Similarly, unwanted goods are recycled with "*material mining*" occurring, treating waste as a resource.
- Indeed, nature is seen as a resource, with green spaces used productively and animals keep for useful purposes rather than as pets.

Overarching Themes

In visions of the self-reliant city, **community engagement was an important feature**. Common ownership and community values were identified as important ways to generate buy-in to lifestyle shifts in order to manage demand for resources and energy. Indeed, the community is an important scale at which residents carry out most of their activities.

However, **defining boundaries was highlighted as a key issue**. Neighbourhoods are unlikely to be clearly delineated within a city, and mutual interdependencies will exist both within the cities and between cities.

The **natural and built environment are both treated as potential resources**. Urban agriculture is a big part of this, with green space used for production as well as recreation. Similarly, energy generation technologies are integrated into buildings.

4. The Green City

The ecological city-region living in harmony with nature

Characteristics of the Green City

Visions of the green city were identified as describing a city-region that was self-sustainable within a boundary, with high levels of integration between the natural and built environments. Key characteristics were discussed and some points arising at the building, neighbourhood and city-regional level are highlighted in figure 3.

Figure 5: Characteristics of the green city

Building	**Neighbourhood**	**City-region**
•Flexible use of land and buildings •Retrofitting of housing •Renewable energy including solar and district heating	•Five-minute-walk neighbourhoods •Energy supply and demand management context based •Urban agriculture	•Integration between city and environment •Transport from public transport, cycling •Closed loop approach to waste, water and energy

Housing was envisaged as consisting largely of retrofitted terraced housing, with key features including high levels of insulation and solar panels incorporated into a variety of surfaces such as roof tiles and render, as well as water collection facilities in each household and large storage collectors in gardens. District heating systems were also important here, making use of waste heat from generators and industry. More generally, this vision was felt to include a more flexible use of buildings incorporating a mixture of uses.
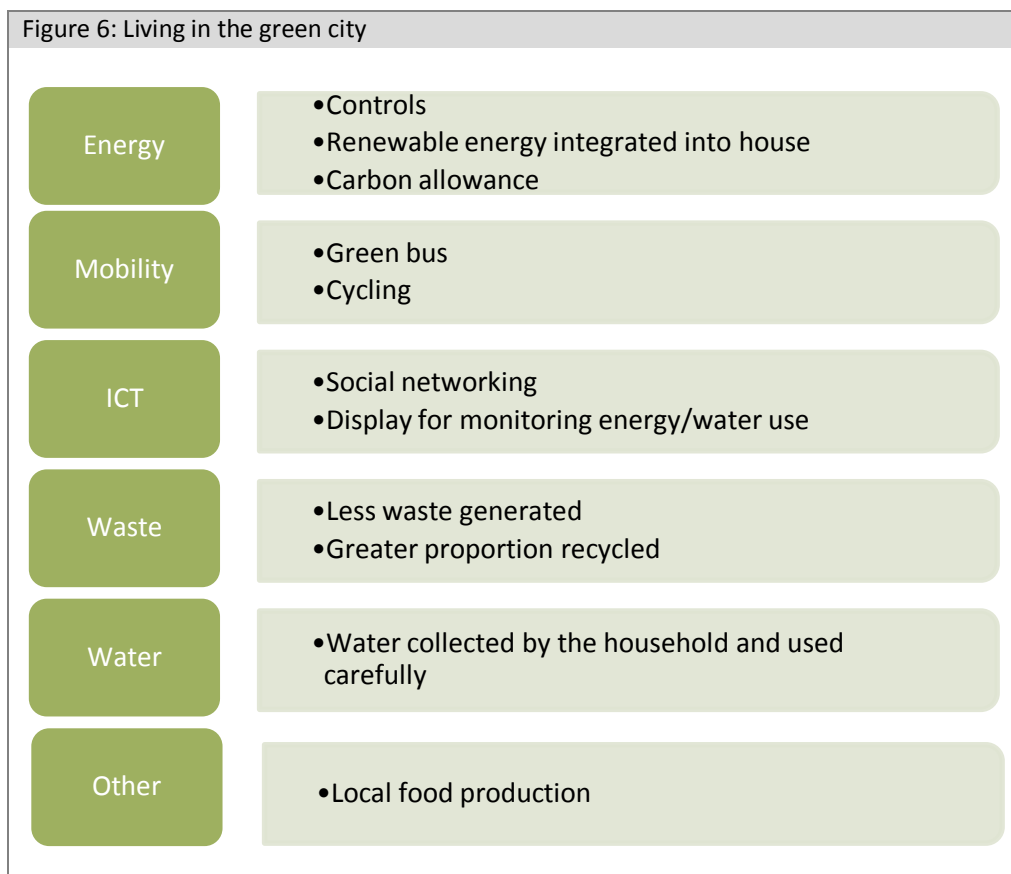
The neighbourhood was conceived as an important scale at which the green city operated. These neighbourhoods would consist of centres were work, school and leisure can be accessed within a five minute walk. As such, urban centres would be high density with varied, intense and vibrant activity surrounded by low(er) density mixed-use neighbourhoods. Energy supply and demand management would be context specific, taking into consideration the circumstances of individual areas as well as interdependencies between neighbourhoods. Urban agriculture, allotments and market gardens would provide locally grown food; community involvement would play a big part in the lives of residents.

Bringing greenery into the city was a central tenet of the Green City. The "*Green Fingers*" model was put forward as the shape of the city-region, where the green penetrates the city and the city

penetrates the rural landscape, allowing more flexibility in using green space than the *"Green Belt"* model. Roads would be downsized to streets to accommodate less traffic, with transport provided by public transport, walking and cycling. Importantly, the city-region would take a closed-loop approach to waste, water and energy, for example generating energy from waste.

A Day in the Green City

For the second exercise of the workshop, participants choose to describe a day in the life of Osama Smith, a 25 year old taking part in a community programme after leaving prison. Some key issues are summarised in figure 6.

Figure 6: Living in the green city	
Energy	•Controls •Renewable energy integrated into house •Carbon allowance
Mobility	•Green bus •Cycling
ICT	•Social networking •Display for monitoring energy/water use
Waste	•Less waste generated •Greater proportion recycled
Water	•Water collected by the household and used carefully
Other	•Local food production

Osama's energy use is finely monitored and controlled, as is his water use. He lives in a terraced house which has been super-insulated in 2013 and again in 2035 and retrofitted with solar PV and a highly efficient wind cowl and a battery storing energy. He is able to monitor the energy he uses through a technological system that displays his energy and water use, and subject to a local currency which includes carbon and eco trading. Collected in a large storage unit in the garden, water is used carefully: for example, he takes a dry shower on waking up. Furthermore, water consumption is monitored by technological display.

ICT plays a significant role in Osama's day: he used technology to monitor his energy use, interact with friends and manage his carbon allowance. As part of his community programme, Osama is undertaking training to maintain local energy systems, which are biased towards electricity.

Most of Osama's travel is done by bike, for the most part contained within his local community. He is also able to use a "*green bus*". Food is sourced locally, with pigs and chickens living in the garden. Muesli is sourced within the community; Osama's food is all either sourced from the community or home-made.

State of the City 2050

The final exercise of the workshop considered the key indicators that would constitute a State of the City Report 2050 for the green city. Key points are summarised in table 5 and discussed below.

Table 5: State of the City 2050 – the green city	
Place Strong, distinctive mixed-use neighbourhoods Local production Improved public transport Flexible use of buildings Extensive green space	**People** Stress reduced by reduced risk/uncertainty More social interaction Improved mobility Lower crime from mixed use Collaborative/cooperative local governance
Economy Transfer to knowledge based economy Local currency involving carbon trading Performance indicator model based on direct benefits and avoided costs Reduced demand for 'stuff' Economy less volatile, more resilient	**Environment** Lack of town/country divide Energy demand reduced Variety of energy sources networked Water demand reduced with high level of recycling Increased biodiversity

Place

- The city-region consists of strong, distinctive neighbourhoods with an increased focus on local production, including food and construction materials.
- Improvements in public transport provision have supported a shift towards mass transit and cycling as the primary forms of transportation.
- Buildings are used flexibly, both horizontally and vertically. Similarly, green space is flexible, with large areas of green space in cities for leisure and agricultural use

People

- People are happier and less stressed due to reduced risk and uncertainty, better environment and more social interaction.
- More flexible housing tenure and types and re-use/diverse use of buildings has helped mobility and choice between the city centre and the "*greenburbs*". Diversity of uses and resulting increased vitality has led to lower crime.
- Local governance is collaborative and cooperative through "*neighbourhood pow-wows*". The community has a high level of influence in individual life.

Economy

- The main economic driver for the city is now the sale and export of knowledge, led by the city's university.
- Local currencies have been introduced, incorporating carbon trading systems. Individuals have increased flexibility to arrange and self-manage a personal bundle of activities, moving away from 9 to 5 jobs; some work will not be financially paid but will contribute to the community.
- Economic performance is measured in terms of direct benefits and avoided costs; growth is considered in terms of quality not quantity. The economy is less volatile and more resilient.

Environment

- Lines between rural and urban have been removed; individuals are more connected to the natural environment. Biodiversity has increased, both in terms of wild and productive flora and fauna. Urban and rural afforestation has taken place.
- Energy demand has been reduced and is met with a variety of renewable sources as part of a network. Similarly, water demand has fallen and is subject to high levels of water recycling.

Overarching Themes

The green city was described as one that was "*green, lean and clean*". **Demand management** is prevalent in terms of energy, water and goods; barriers between rural and urban have been removed, **bringing greenery into the city**.

Community involvement is a big part of day to day life. This includes a broad range of activities, from food production to governance. Importantly, people are able to access important amenities such as work, schools and leisure by foot within their community.
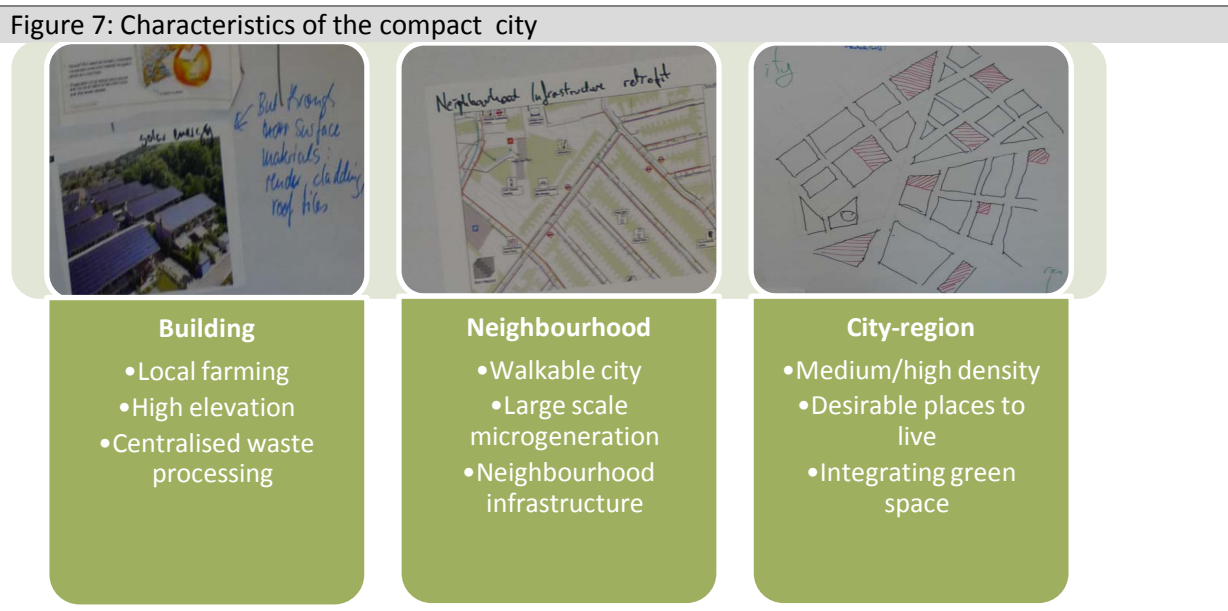
Unresolved questions included to what degree a green city would need to be self sufficient, how electricity demand would be met (and in particular whether nuclear would be an acceptable part of this mix) and whether self sustainability could come as the expense of cultural vibrancy.

5. The Compact City

The city as a site of intensive and efficient urban living

Characteristics of the Compact City

Visions of the compact city were contested, with participants questioning how desirable compactness would be. Key features, opportunities and problems identified in discussion are summarised in figure 7.

Figure 7: Characteristics of the compact city

Building
- Local farming
- High elevation
- Centralised waste processing

Neighbourhood
- Walkable city
- Large scale microgeneration
- Neighbourhood infrastructure

City-region
- Medium/high density
- Desirable places to live
- Integrating green space

At the building level, the compact city was envisaged as high density and high elevation, including retrofitting existing buildings for extra height. Importantly, technologies to enable natural cooling, centralised waste processing and local food production through permaculture were integrated into the fabric of buildings.

It was felt that walkable neighbourhoods with a mixture of commercial and residential uses were an important characteristic of the compact city. In terms of retrofitting existing cities, this would involve infilling urban space to create higher density, mixed use spaces.

Microgeneration was described as an important source of energy as part of a local grid serving the neighbourhood. In this vision, microgeneration installations were described as being ubiquitous, rendering the built environment productive in energy terms. Similarly, parks were envisaged as productive spaces with urban agriculture.

It was noted that this shift to a localised, productive, mixed use built environment would require significant retrofitting of neighbourhood level infrastructure.
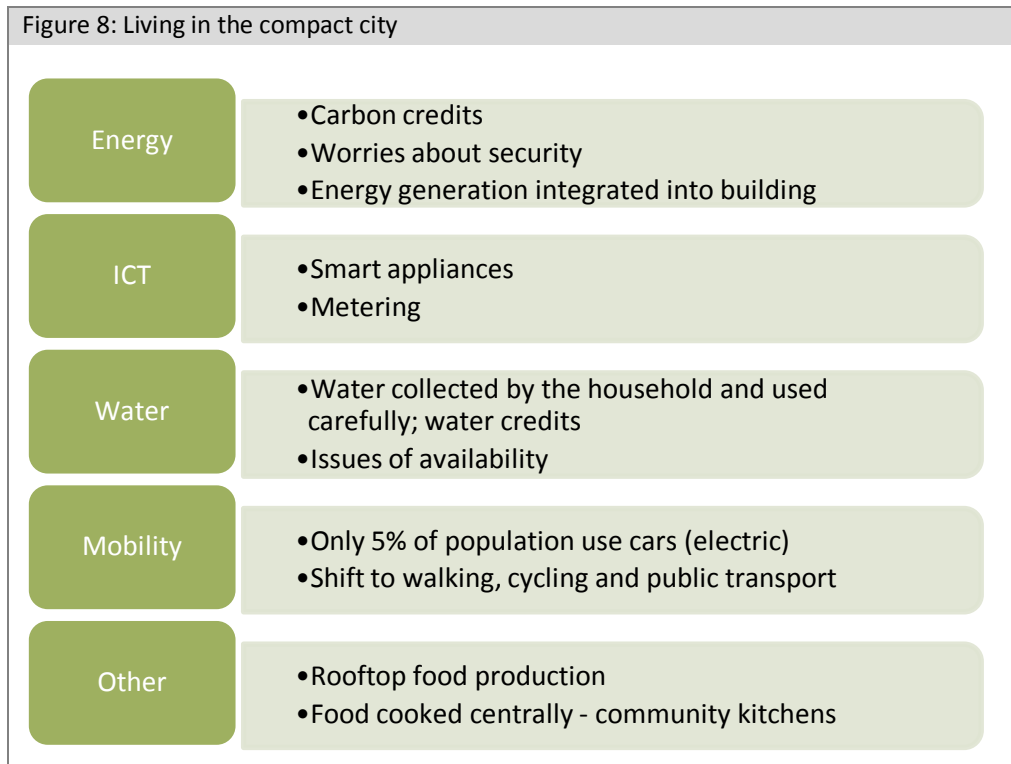
As has been noted above, the compact city was envisaged as medium to high density at the city-region level: there was discussion of whether this was desirable or represented a dystopic vision. As such, it would be important at a planning and governance level to seek to create desirable places to

live. A broad spectrum of amenity and recreation space was suggested as part of this, with green space integrated into this city, for example as green rooftops.

A holistic, systems approach to water, waste and food was highlighted as important in this vision.

A Day in the Compact City

In order to explore issues of mobility, water, waste, energy and ICT in everyday life in the compact city, participants choose to describe a day in the life of Delores, a teacher in her 50s. Some key issues from her 'blog' are presented in figure 8.

Figure 8: Living in the compact city

Energy	• Carbon credits • Worries about security • Energy generation integrated into building
ICT	• Smart appliances • Metering
Water	• Water collected by the household and used carefully; water credits • Issues of availability
Mobility	• Only 5% of population use cars (electric) • Shift to walking, cycling and public transport
Other	• Rooftop food production • Food cooked centrally - community kitchens

Security of energy and water are an important part of Delores' day with both subject to limited availability. Both resources are integrated into the built environment, with microgeneration of energy and collection of rainwater. Nonetheless, both energy and water use is controlled by credits and they are used "*when there is enough*". These credits are earned by working for the community.

ICT still has a role to play in the compact city, with smart appliances enabled to be used when there is enough energy and smart metering to monitor water availability. Mobility has seen a shift away from cars – which are here powered by electricity, but owned by only 5% of the population – towards walking, cycling and public transport.

One notable social innovation in this vision is a shift towards localised communal food production and cooking: Delores tends crops in her cooperative roof garden at the start of her day and also the school's garden during her work; her dinner is cooked communally in a "*local kitchen*" but she takes it home to eat individually.

State of the City 2050

Table 7 presents the key points put forward for the "*State of the City 2050*" for the compact city, highlighting issues of place, people, economy and environment at the city-regional level.

Table 7: State of the City 2050 – the compact city	
Place • Increased density • Highly effective walking, cycling and public transport	**People** • Local/neighbourhood governance • Health and fuel inequalities reduced • Behavioural change • Increased social cohesion
Economy • Local supply chains and entrepreneurs • Zero growth economy • Community focus: recycling/exchange, water and energy credits • Life cycle costing	**Environment** • Decision making principle • Productive green spaces • Car ownership decreased • Community sharing of harvested rainwater • Decentralised energy with heat networks

Place

• An increase in density is a defining feature of the compact city, with a focus on mixed use and "*enhancing the best and improving the rest*". Ensuring that this high density city is still a desirable place to live is a key challenge in this vision.

• Compactness allows for highly effective transport on foot or bike. Wider mobility has been improved in the Compact City 2050 by investing in a public transit system as well as a walking and cycling network.

People

• The community is an important feature of the city, with local/neighbourhood governance an important level at which decision making takes place, improving accountability, transparency and response times.

• Health inequalities have been addressed by healthier lifestyles incorporating more exercise, healthier eating and less pollution. Fuel poverty has also decreased.

• Behavioural change has been driven by greater awareness and prioritisation of sustainability concerns: avoiding environmental degradation is a commonly held value.

Economy

• The compact city of 2050 has a diverse economy based on local entrepreneurship and supply chains. In particular, early support for innovation has grown local businesses. Importantly, economic success is no longer judged according to GDP growth, which stands at 0%.

- Unwanted goods are recycled or exchanged at the community level, decreasing waste. Furthermore, exchange comes to culturally exceed buying new as the primary way of obtaining new goods. Water and energy credits are earned by carrying out work in the community.
- Life cycle costing is required as a part of the decision making process for all capital projects

Environment

- Resource efficiency has been mainstreamed as an integral part of decision making in government and investment. On a similar note, adaptation planning has become a normal part of future thinking.
- Green space, such as parks and forestry, are put to productive use for growing foods and fuel as well as recreation. Streets are exclusively shared spaces for pedestrian and cycle use, decreasing car ownership.
- Energy generation is decentralised and matched to demand through networks. Excess heat and harvested rainwater are also networked.

Overarching Themes

The compact city was envisaged as comprising high rise, high density buildings with a **focus on mixed use** and infill development. Neighbourhood infrastructure has also been retrofitted with a focus on **efficient walking and cycling networks**.

All spaces are put to productive use: the built environment for decentralised energy generation matched to demand and recreation space for urban agriculture.

The **community is an important part of social, economic and political life**, with neighbourhood exchange the primary means of consuming goods and energy and water credits earned by work within the community. Governance also occurs at this level.

While the issue of compactness was contested as a desirable way of living, there was consensus in the fact that living in the compact city in 2050 would have required a **significant behavioural change** by its citizens.

6. Summary and Discussion

The aim of the workshop was to explore a range of visions for (retrofit) sustainable city regions for the period 2030-2050, building on a set of prototype visions of the smart-networked, self-reliant, green and compact cities to examine the key characteristics and issues in each of these futures. The preceding sections summarised the discussions that occurred around each vision, drawing out questions of what the city looks like at different levels and what it would be like to live in or govern. A number of themes can be found recurring in each vision of the city in 2050. Equally, each vision raises its own issues.

→ **Systems approach: energy, water, waste and food**

Participants in each group stressed the importance of taking a systems based approach to planning, governing and managing resource use. A notable example here is the appearance of urban agriculture as a feature of each vision, with food being produced locally. Other examples include a focus on information sharing in infrastructure provision in the smart-networked city and a closed loop approach proposed for the green city.

As these examples show, while systems thinking is a characteristic of each vision, its focus and extent varies across visions. While all propose a holistic approach to governance and infrastructure planning, closed loop approaches to resources emerge in the green city and the self-reliant city.

→ **Trade and external links**

One question that arose in discussions across all four visions was that of boundaries. It was observed that delineating cities is difficult due to external links with rural areas and mutual interdependencies with other cities. Many participants questioned whether self-reliance was necessary for sustainability and, if so, which resources should be self-reliant and which were best traded across cities and countries.

→ **Need for social innovation**

The need for social innovation alongside technological change was a recurring theme across groups. One example was a decrease in demand for new goods: for the smart-networked and self-reliant cities, this was driven by a shift to maintenance while in the compact city this was driven by an increase in exchange rather than consumption. Energy demand management was also an important theme, with credits or allowance systems emerging in visions of the green, compact and self-reliant cities, and energy monitoring occurring in all four visions.

It was noted that this sort of change in everyday practices would likely need to be supported by a change in value systems. For example, participants in the compact city group suggested a rise in concern for environmental degradation while the self-reliant city suggested neighbourhood buy-in as a potential driver.

→ **Resilience and risk**

Risk was noted as pervasive in both the compact city and the smart-networked city but for very different reasons. In the former, issues of water and energy availability raised concerns about blackouts while in the latter, reliance on technological systems left the city vulnerable to system failure or sabotage. In both cases, planning for risk in an important part of making the city resilient to shocks.

→ **Integration of urban and green space**

Participants in all four groups felt that integrating green space into the city was desirable. Different models were proposed e.g. the 'Green Fingers' model highlighted in visions of the green city and the green roof approach implied by visions of the compact city, but each vision describes urban green space for recreation and agriculture.

Each vision also sees micro energy generation integrated into the built environment, with decentralised, renewable energy featuring in each of the four visions.

→ **Issues of equity and poverty**

Issues of equity and social sustainability were an important recurrent theme across discussions. Many visions presented risks and opportunities. For example, visions of the smart-networked city suggested a fall in health inequalities from better information but a rise in social exclusion from technological poverty.

→ **Importance of the neighbourhood scale**

All four visions identified the neighbourhood as an important scale for everyday life, infrastructure provision and governance. For example, mixed use development was a defining feature of the compact city, creating neighbourhoods providing commercial and residential uses; the smart-networked city suggested the neighbourhood or community as an important social hub to counteract the largely independent nature of the working day.

One implication of this is that personal mobility is decreased in many of the visions, with car ownership decreasing and walking and cycling emerging as the main modes of transport with a focus on walkable cities.

Next Steps

This workshop report will be used to inform the further development of the Retrofit 2050 visions by the project team. The third Scenarios workshop, on 3 May 2012, will then focus on the task of backcasting prospective pathways to these futures in the context of existing UK city-regions. We will draw on insights from innovation studies to help structure the development of a set of narrative pathways. Key questions will include: how specific technologies and broader social, institutional and market innovations develop in niches; the role of incumbents, new entrants and intermediaries in different retrofit regimes; and role of wider societal changes in each case.

7. Annex 1: Workshop Sessions

Workshop Session I: 'Picturing' the City - Visions of Place (2050)

The purpose of this task is to imagine what a future retrofit city would look like under this vision in 2050, particularly in terms of the sorts of technologies and systems involved at different scales. You will be working with prototype visions as a starting point but please use your imagination and creativity to flesh out the detail of your particular vision.

This is a free-form expression-led session intended to encourage creative thinking.

Your aim is to produce a series of annotated pictures, collages or diagrams, or combination of all these, illustrating how you imagine this future to be at **the building, neighbourhood and city-regional scales.**

Where relevant to your vision try to highlight elements of this future relating to energy, water, waste & resources use, mobility and ICT.

A selection of pictures have been provided for you to cut and paste and add your own details (with arrows, keywords, flows and other symbols) in order to flesh out the city vision. Use and adapt the generic images supplied to each group to help capture the vision on which your team is working. But don't feel constrained or limited by these – they are simply intended as a stimulus or jumping of point.

Please do not simply produce a series of bullet points. We are not concerned about the artistic merit of your pictures but do want you to produce some sort of visual representation of your future vision.

Workshop Session II: Blog Spot 2050

A story of a 'day in the life' of a city resident in 2050. The purpose of this exercise is to imagine what your future city would be like to live in from a 'user' perspective.

Your group's task is to write a short narrative account of 'a day in the life' of a city resident in 2040. You are free to choose the identity (age/gender/occupation/lifestyle) of your resident but you **must** try to include elements in your story which illustrate aspects of **energy, water, waste, mobility and ICT** in this future world. Use the stick on 'Tags' provided to highlight these themes in your text.

You may choose whatever style you are most comfortable with – diary entry, blog, social media posts, etc. But the story should be told (predominately) in the first person and should try to cover a 24 hour period.

Workshop Session III: State of the City Report 2050

The purpose of this exercise is to enrich and elaborate your vision in terms of the broader social, economic and environmental development of the city.

Your group's task is to write a short 'executive summary' for an imagined 'state of the city' sustainability report prepared by the city-region's local government in the year 2050. The objective of this imagined report is to show case how the city has changed to achieve its vision of urban sustainability.

A template is provided for each group to complete. Your executive summary should be structured around the four sub-headings: **Place; People; Economy; Environment**.

Under each of these sub-headings you may wish to comment on the following themes.

Place	People
▪ Built Environment ▪ Transport/Mobility ▪ Land-use	▪ Values/Behaviour ▪ Governance ▪ Social Equity and Inclusion ▪ Health & Well being
Economy	Environment
▪ GDP/Growth ▪ Employment ▪ Population ▪ Trade & Exchange	▪ Energy/CO2 ▪ Water ▪ Resource Use ▪ Nature

8. Annex 2: Workshop Participants

Charlie Baker	URBED
Abu Bakr Bahaj	Southampton University
Caroline Batchelor	EPSRC
David Butler	Exeter University
Aaron Burton	Environment Agency Wales
Scott Cain	TSB
Pooran Desai	Bioregional
Clare Erikkson	RICS
Nicholas Falk	URBED
Natalie Grohmann	Welsh Government
Mark Hallett	Igloo Regeneration
Barbara Hammond	Low Carbon West Oxford
Gareth Harcombe	Cardiff County Council
Marianne Heaslip	URBED
Chris Jofeh	Arup
Nick Jones	BRE
Phil Jones	Cardiff University
Miles Keeping	GVA Grimley
Liam Lidstone	Energy Technologies Institute
Andrew Mellor	PRP Environmental
Helen Northmore	Energy Saving Trust
Oliver Novakovic	BRE
Michael O'Doherty	Manchester City Council
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

9. Annex 3: Retrofit 2050 Workshop Team

Prof. Malcolm Eames	Floating facilitator
Prof. Tim May	Break out chair
Prof. Simon Marvin	Break out chair
Dr Georgina Butina Watson	Break out chair
Carla de Laurentis	Break out chair
Dr Mike Hodson	Scribe
Judith Britnell	Scribe
Miriam Hunt	Scribe
Dr Simon Lannon	Observer
Dr Yangang Xing	Observer
Dr Heather Cruikshank	Observer
Kate Nash	Administrator