Retrofit2050
Re-engineering the city 2020-2050:
urban foresight and transition management

Visioning Retrofit Futures

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1. Introduction

The following working paper is intended to support the 'visioning' step of the first phase of the backcasting process for the Retrofit 2050 project. This first phase of the process aims to develop a set of contextual socio-technical scenarios for the systemic urban retrofitting of core UK city regions (see Table 1 below).[1]

Table 1: Overview of Retrofit 2050 Scenario construction and evaluation process

	Step	Focus	Participants
Phase 1 October 2011 – September 2012	Problem framing and structuring	Practices, drivers and expectations	National experts
	Visioning	Radical & disruptive innovation across scales and domains (Indicator development)	
	Pathway analysis	Transition dynamics (Indicator development)	
Phase 2 October 2012 – June 2013	Regional implementation	Grounding and visualisation (Modelling)	Key regional stakeholders
Phase 3: June 2013 – September 2013	Evaluation and appraisal	Sustainability and resilience under multiple perspectives (Multi Criteria Analysis)	Wider sample of regional stakeholders and societal interests

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 achieved through, for example, (in the case of cities) the pathway(s) of urban development. More broadly, shared expectations or 'guiding visions' are recognised as playing an important role in shaping both the speed and direction of technological and social change. Unlike the 'blind' evolution of biological processes, the quasi-evolutionary processes which underpin complex socio-technical systems include an element of premeditation and choice. We actively shape the future through the choices and decisions we make in the present. Guiding visions then play a generative or 'performative' role: providing legitimacy, mobilising investment, promoting network formation, and reducing risk through aligning R&D priorities and production activities (Eames et al 2006; Van Lente 1993; Dierkes 1996).

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[1] For a full description of this process see Eames, M. 2010, *Developing Urban Retrofit Scenarios: An outline Framework for Scenario Foresight and Appraisal*, available at http://www.retrofit2050.org.uk/sites/default/files/resources/developingscenarios4.pdf

In the case of the Retrofit 2050 project, the backcasting process requires us to envisage what a sustainable urban environment could look like based upon the systemic urban retrofitting of an existing UK city-region (for the period 2030-2050). Whilst envisaging such a future(s) clearly requires some degree of creativity and imagination there is also a rich and diverse literature upon which we can draw critically in undertaking this task. This literature encompasses not only academic work from a range of disciplinary perspectives on 'urban sustainability' and future cities, but also a rich variety of images and narratives from popular culture, politics, the media and the creative arts. In this sense we adopt Grant's (2004) definition of 'urban sustainability' which incorporates survival of the settlement through time, environmental impacts on landscapes, and quality of life for inhabitants. We also treat the term as being synonymous with 'sustainable urbanism'.

We start from the twin perspectives that the future is uncertain and that sustainability is an inherently contested and irreducibly political concept, informed both by incomplete and competing knowledge and the diverse values and interests of different social groups (Stirling, 2007). The challenge is therefore to envisage a range of prospective futures, each encompassing a distinctive understanding of a retrofitted sustainable city-region, which taken together provide a reasonably comprehensive description of the future possibility space.

In doing so, we will particularly seek to illuminate what these visions would look like in terms of expectations of the key innovations (both social & technical) operating at different (building, neighbourhood and city-regional) scales, across different environmental domains (energy, water, waste).

The paper is structured as follows. Section 2 explores the performative role of expectations in shaping the future and the need to move from narrow policy targets to broader guiding visions in achieving urban sustainability. Section 3 briefly reviews and asks what we can learn from the rich literature on city futures, both past and present. Section 4 discusses sustainability city futures as contested spaces. Section 5 maps out a set of prototype retrofit sustainable city-regional futures, whilst finally section 6 summarises the questions to be asked of these in conjunction with our Urban Foresight Panel through our visioning workshop.

2. Mobilizing expectations - from targets to guiding visions

The importance of setting targets to drive innovation and environmental improvement has long been recognised within academic and policy circles. In the UK, the Climate Change Act 2008 for the first time introduced a long-term legally binding framework to ensure that the UK achieves its objective of reducing CO_2 and other green house gas emissions by at least 80% by 2050, compared to 1990 levels, through a series of intermediary national emissions budgets.

This binding commitment to long term CO_2 national emission reduction targets has clearly done much to frame the current retrofit agenda at a UK level (as set out in the UK Low Carbon Transition Plan and subsequent policy documents). However, by themselves such targets can tell us relatively little about what the future of our urban environments and cities might actually look like. Moreover, we know that climate change mitigation is only one of a wide range of social, economic, environmental and technological drivers of urban retrofitting operating in different local and regional contexts.

In light of this, the challenge is not simply one of how best to achieve a particular policy target, but more broadly what sort of sustainable future do we want to create. Exploring alternative expectations and 'guiding visions' can not only assist in 'opening up' societal dialogue around such questions but also play a performative role in mobilising resources and innovative activity around particular desired outcomes.

Moreover, as we shall consider below, 'guiding visions' have an extensive history of shaping processes of urban development and change.

3. City futures: past and present

What is a city?

The term 'city' can refer to spatial form, but it can also refer to the multi-dimensions of urban living, which include ecological, cultural, technological, spiritual and socio-economic elements and interactions.

During the last two centuries a number of 'theories of the city' have been postulated in the context of urban planning, ranging from rational planning models (Edward Banfield), political economy models (for example, David Harvey) through to equity planning (Peter Hall) and the advocacy planning model (Kevin Lynch), which in turn have informed the way in which we understand cities. For David Harvey (1990:46) a city is: *'...a complex dynamic system in which spatial form and social process are in continuous interaction with each other'*.

In contrast, Manuel Castells (Castells, 1989) saw the city more in terms of a fragmented social-spatial reality (*'Dual City'*) brought about by technological change, which created a conflict between a 'space of flows' and a 'space of places'. For Peter Hall, writing in 1998 (p907) cities: *''…were and are quite different places, places for people who can stand the heat of the kitchen: places where the adrenalin pumps through the bodies of the people and through the streets on which they walk; messy places, sordid places sometimes, but places nevertheless superbly worth living in, long to be remembered and long to be celebrated'*.

More than 50 years ago a city was first formally viewed as a 'system', which represented the distinct collections of entities and operated almost entirely as a closed system, with urban planning able to impose command and control prompts (Berry, 1964; Batty, 2011). But it began to be appreciated that cities are complex and do not automatically revert to equilibrium after a perturbation, in the same way that a simple system does. More recently therefore we have seen cities envisaged as a more complex 'meta system' (McNulty, 2011) which represents a system of sub-systems or nested systems, each of which is interdependent with the others and the whole. McNulty suggests there are five such sub-systems in a city:

- Economic – set of arrangements through which goods and services are traded
- Environmental – natural elements of the city
- Infrastructure – built components of the city
- Knowledge – learning and experience of the city
- Social – social practices, culture and people

Similarly thinking in this field has also moved away from seeing the city as a 'machine' towards seeing the city as an 'organism' or, in other words, more like a biological than a mechanical system (Batty, 2011). This thinking has helped inform the view of urban metabolic models, with complex feedback loops, in contrast to simple linear 'input-output' models (Wolman, 1965). It has also led towards the development of an approach which sees cities as 'complex adaptive systems' (Rotmans, 2006) in which cities exhibit the following characteristics:

- Non-linear cause and effect relationships.

- Negative or positive feedback loops.
- Open systems (with energy imported and exported across boundaries).
- Diverse variety of interacting elements.
- System movement towards a single 'attractor'.
- Complexity within the system elements themselves.
- Patterns emerging as a result of relationships between the components.

Rotmans (2006) goes on to suggest that this inherent complexity requires us to think of cities as never being finished and facing continuous change;in this sense spontaneous change can occur through complex interactions, making total control of a city impossible. Moreover, city goals not only need to be flexible and adaptable, with a city's complexity often being at odds with fixed goals (i.e. there is structural uncertainty and intrinsic unpredictability in the dynamics of cities), but cities also need to be viewed from multiple scales, because some properties are hidden at broader scales but tend emerge at lower scales (i.e. a city's 'emergent' properties, based on the complexity arising from many and diverse interactions).

The emergence of utopic and dystopic visions: why do we need visions of the future for cities?

Whilst our understanding of what makes a city and how it works have changed, so our visions of cities have evolved and developed. Cities have frequently been the focus for utopian visions and imaginations, promoting hopes for a better future, but cities have also been imagined in dystopian and apocalyptic terms as hellish places, where poverty and despair prevail. Within this creative tension, it seems fair to say that 'utopic' visions have tended to focus on building new cities (or 'ideal cities'), whilst, in contrast, 'dystopic' visions envisage a world where existing cities reach a point of no return and ultimate social and economic collapse, often realised through literature or film. Re-engineering or large-scale alteration of existing cities has therefore generally not been a feature of utopian visions.

From the days of Plato in ancient Greece, the city has played a significant role in utopian thought, which has, more recently, given rise to terms such as 'Heavenly City', 'New Jerusalem', 'City of the Sun', 'Garden City' and 'Radiant City'. This early thinking stems from the idea, particularly in Egypt and Mesopotamia, that the 'city' itself was 'utopia' (Pinder, 2004), and here the king was a 'god', establishing a spiritual heavenly order on earth. However, as Jared Diamond (2005) noted in his study of societal collapse on Easter Island, once the vitality of a belief and cultural system, and the clarity of its future vision collapses, society and culture also collapse. Societies which create viable images of the future, and help guide a way forward, are therefore more likely to survive, and this explains why city visions have been so important historically, and given the largely urbanised world we live in, why 'city futures' and 'city visions' have become a dominant feature in urban planning in the 20th and 21st centuries (Wuellner, 2011).

The evolution of these city visions has been characterised by Kevin Lynch (1981) in terms of 'city metaphors'. Lynch saw cities in terms of procuring meaning and symbolism for its citizens through the evolution of socio-spatial organisation.

Sourcing his models from antiquity, and from more recent urban forms, he developed three city perspectives:

- 'Cosmic '– highly monumental and anchored in cosmology (e.g. Babylon).
- 'Organic '– freeform and anti-geometric, balanced and in tune with nature (e.g. Athens).
- 'Mechanistic '- simplicity, productive efficiency, autonomous parts linked by well-defined dynamic connections (e.g. Le Corbusier's modern city designs).

Daffera (2004) took these metaphors and developed them further to provide a useful genealogical classification of city visions (Table 2). So for example, Thomas More's geometrically planned Utopia (Box 1) is seen as a direct predecessor of a more modern 'technocity'. Indeed, More's Utopia incorporates thinking not only on architectural form and spatial design, but also incorporates detailed thinking on governance, control, and regulation which were seen as necessary to maintain harmony in the ideal state (Pinder, 2004). In contrast, many utopian visions have focused on *either* 'space' *or* 'society' rather than both elements, leading some to suggest that there is a formal distinction between an 'ideal city' and 'utopia', or what Harvey distinguishes as 'utopias of spatial form' and 'utopias of social process' (Harvey, 2000).
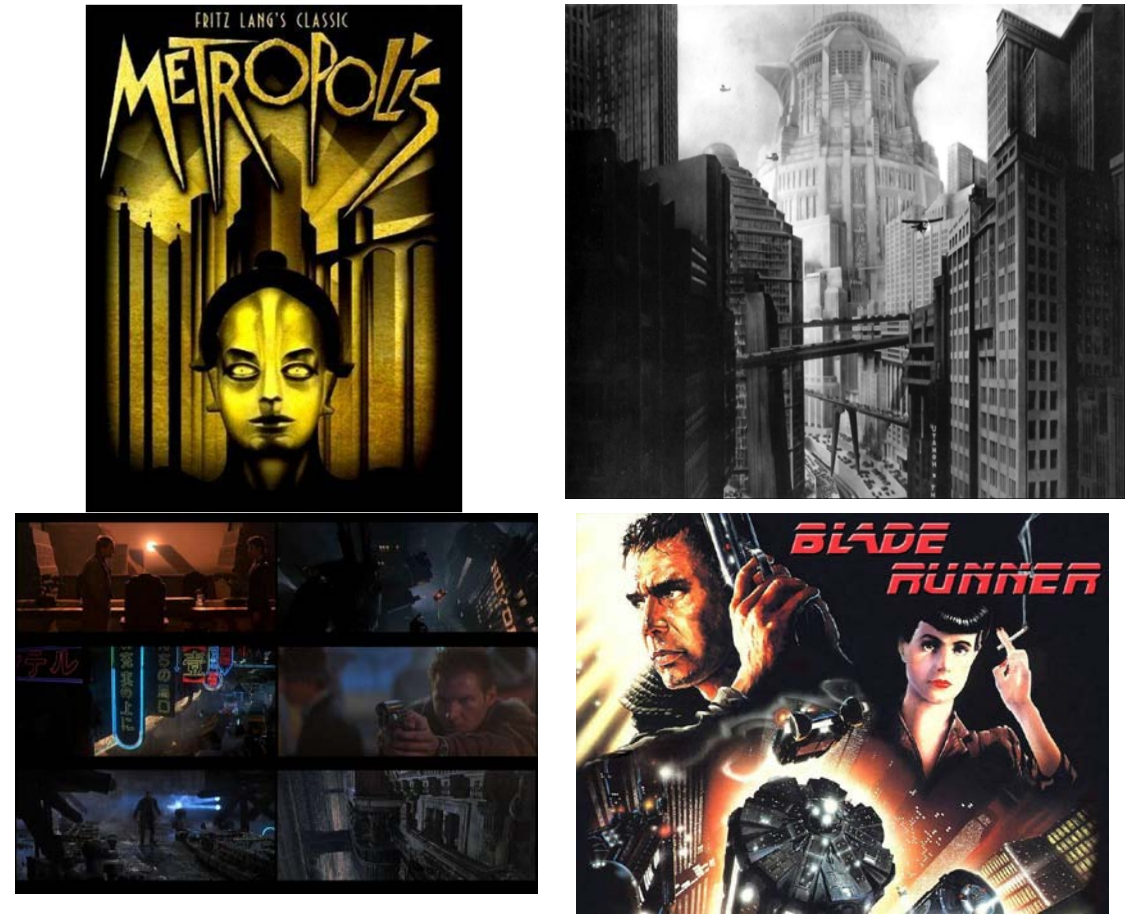
Table 2 Geneological classification of city visions (adapted from Daffara, 2006)

City archetype	Antiquity	Pre-modern	Modern	Post-Modern
Cosmic	Temple City; Atlantis	Renaissance City City of the Sun	City Beautiful	New Urban Monumentality
Organic	Greek Polis	Medieval City	Garden/Social City Biopolis	Eco City Green City
Mechanistic	Imperial City	Amaurote (Capital of More's Utopia)	Cite Industrielle Broadacre City Radiant City	Non-place Technocity Technoburbia
Eclectic Hybrid				Cultural City Heritage City Global City Informational City Creative City Cosmopolis Ecumenopolis

The evolution of these city visions has also been strongly underpinned by literature and film. For example, authors such as Zola, Hugo and Dickens in the 19th century saw the city as chaotic and degenerative, and portrayed dystopic backdrops for their characters. In the later 19th and early 20th centuries a more futuristic tradition in literature developed through the work of H.G. Wells and Aldous Huxley amongst others, and more recently still science fiction has played an important role creating imaginations for the future, often based on city visions. Fritz Lang's *Metropolis* (1926), for example, portrays a future of *'perfected technology in a New Babel with multilevel proletariat subterranean hells'* (Cole, 2001: 375) and Ridley Scott's *Bladerunner (1982)* depicts a dystopian Los Angeles in November 2019 in which

genetically engineered organic robots called 'replicants' must be hunted down (Figure 1).

Figure 1 City visions in film: *Metropolis* **and** *Bladerunner*

Box 1 Thomas More's Utopia (1516)

Thomas More's 'Utopia' was published in 1516, building on other utopic visions such as Plato's 'Republic'. Literally translated as 'no place' (or in other interpretations, 'good place'), Utopia was a book which, written in Latin, depicted a fictional island society and its religious, social and political customs. Utopia was established in More's book after being invaded by King Utopus who created a self-contained society island unit, and then divided the island into a series of spacious and magnificent cities that were rigorously planned and geometric (Pinder, 2004). Each of the 54 cities had a population of 6000 families and was integrated with the countryside, and referred to as a 'civitas' or city state. The capital of Utopia was Amaurot, a 'dark and shadowy' city that was almost square, and like the other cities divided into four districts.

Although 'futures thinking' is a distinct area of activity, and should be distinguished from 'planning' per se (which is concerned with achieving visions), much of the visionary thinking which evolved from the city vision thinking of Thomas More, Leonardo and others, is also very closely linked with urban planning theory. So for example, in the 20th century we have seen the emergence of (Daffara, 2006) (see Table 2):

- *Garden or Social Cities*, which promoted the idea of a metropolitan, polycentric region (for example, Ebenezer Howard).
- *Contemporary or Radiant City*, which emphasised urban monumentality (for example, Le Corbusier).
- *Broadacre City*, which unintentionally led to urban sprawl (for example, Frank Lloyd Wright).
- *Ecological or Spiritual City (biopolis)*, which captured the concept of work-place-people (for example, Patrick Geddes).
- *Cosmopolis (intercultural city)*, which was intended to radicalise city planning to make it more inclusive and diverse.
- *Ecumenopolis (inevitable city),* which foresaw a global city.

4. Sustainable city futures as contested space

In the late 20th century, a number of trends challenged some of the visions discussed earlier. In particular the emergence of an 'ecological crisis' and 'urban crisis' during the late 1960s and early 1970s, caused by the rapid depletion of resources, environmental degradation and the expansion of cities, with its severe consequences for urban populations, refocused the debate towards 'sustainable urbanism' (Whitehead, 2012).

Sustainable urbanism recognised that cities could be key to regulating environmental and ecological impact and social welfare but that unchecked, cities could themselves lead to catastrophic socio-environmental impacts. There was a growing recognition amongst disciplines which included planning, economics, ecology and architecture that understanding and recalibrating the urban form and functioning of cities was essential to developing a more sustainable future. The emergence of cyclical, 'urban metabolic' models, which moved away from thinking of cities as consuming resources in a linear fashion, was key to this transformation in thinking. Ideas and concepts which saw cities as compact, mixed use entities with low carbon technologies, driven on by related concepts of 'smart growth' and 'new urbanism' began to take root (Krueger and Gibbs, 2008; Whitehead, 2012).
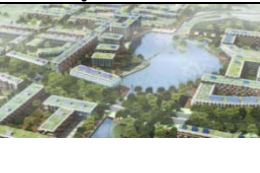
Some of these concepts can be traced back to the thinking of Patrick Geddes and Le Corbusier, but differ in key respects (Whitehead, 2012). Firstly, sustainable urbanism tends to work with existing urban systems to achieve more sustainable outcomes rather than envisioning entirely new cities (although eco cities are one possible exception), and local community empowerment is seen as being critical to successful transformation. Secondly, the more recent city visions have tended to focus on wider city-level and city-region changes more than their historical counterparts, and thirdly the intergenerational aspects of visions, in terms of resource implications for the future, are placed more fully and explicitly centre stage.
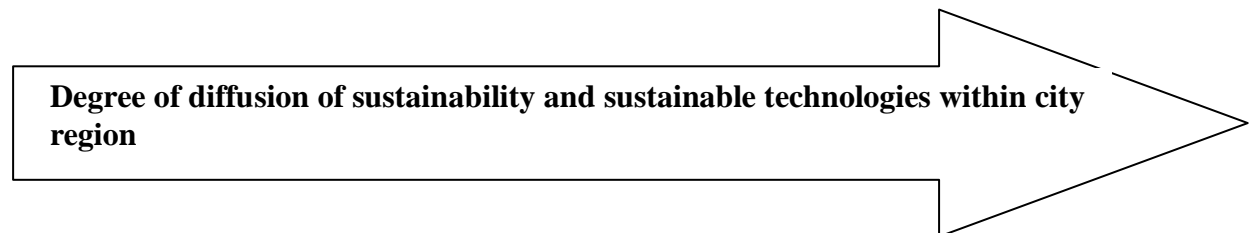
Daffara (2004) offers a helpful typology of 'post-modern' city futures linked with the concept of sustainability (Figure 2). For example, a 'techno city' is a dystopic vision, where urban contradictions remain unresolved, and which is a precursor to ecological and social collapse, and a 'smart city' is a place where growth management is being used to try and resolve urban contradictions, but where planetary well-being and biodiversity are still not as important as the well-being of the city and its region. In contrast an 'eco city' is a place where a sustainable future is being achieved and where urban contradictions are being resolved and a 'Gaian' city is where sustainability is a way of life and civilisation is transformed in a utopian future.

Indeed the term 'eco city', as Joss (2009) points out, has its roots in the 1980s, when it was first coined in the context of the burgeoning environmental movement, notably by Richard Register through his Urban Ecology initiative and the publication of Eco-City Berkeley (Register, 1987). Since then, the term has been 'mainstreamed' with a plethora of eco city developments and plans being mooted in the mid 2000s (Joss, 2009). Although the term is normative, and there is no single agreed definition of eco city, according to the World Ecocity Summit 2008 (cited in Alusi et al, 2011) it is:

' …an ecologically healthy city. Into the deep future, the cities in which we live must enable people to thrive in harmony with nature and achieve sustainable development. People oriented, eco-city development requires the comprehensive understanding of complex interactions between environmental, economic, political and socio-cultural factors based on ecological principles. Cities, towns and villages should be designed to enhance the health and quality of life of their inhabitants and maintain the ecosystems on which they depend.'*

Figure 2 'Post modern' city futures and sustainability (adapted from Daffara, 2004)

Technocity	Smart City	Eco City	Gaian City
A place where all urban contradictions remain unresolved. An antecedent to ecological and cultural collapse.	*A place where people are trying to resolve the contradictions of sprawl, and its sytemic impacts through growth management. But it creates a blinkered view of ethnocentricity.*	*A place where inhabitants are reconstructing their ways of life to resolve contradictions through a systemic policy of sustainable development. Social justice is pursued through a world-centric view of reality*	*A place of dreams where all urban contradictions are resolved within a sustainable and holistic culture.*

Degree of diffusion of sustainability and sustainable technologies within city region

	Up to 25% (Cultural creatives and early adopters)	Up to 50% (mainstreamers start adopting)	75% adoption (laggards and reactionaries persist)	Saturation (sustainability is the way of life)
Causal Layered Analysis				
Litany	Sprawl	Growth management	Sustainable development	Utopian/Visionary
Systems Perspective	Continued growth	Smart growth and Back to the Past	Zero Growth and development	Civilizational Transformation
World View	Egocentric	Ethnocentric	World-centric	Holistic
Myth/metaphor Sustainability	Land of Cockaygne	Arcadia	Spaceship Earth	Gaia
The City	Perpetual colonisation	Garden City ideal	Arcology (architecture + ecology)	Holonic (or holistic) ecologies

More recently the concept of sustainable urbanism has been under scrutiny as some (for example, While et al, 2010) have pointed to the way in which power and politics are shifted through the exercise of 'carbon control' and its ramifications not only for

governance structures in cities, but also the way in which some groups may be marginalised through the creation of 'eco-enclaves' (Hodson and Marvin, 2010).

What is clear, however, is that many existing cities around the world are increasingly focused on developing city visions for 2030 and beyond, promoted and underpinned by such initiatives as the C40 Cities Group. In the UK the Core Cities have developed 'carbon city' (Eadson, 2012, Dixon, 2012) agendas based around a low carbon future (see, for example, Greater Manchester's *From Red Brick to Green Brick* (AGMA, 2010)) and many other cities globally have tapped into this agenda. Often the vision is challenging in its own right: Stockholm, for example, has placed the low carbon economy at the heart of the long term vision for the city, including the target of becoming fossil fuel free by 2050, and this has been backed up by shorter term actions, such as integrating the low carbon agenda in new regeneration and development projects.

5. Towards a typology of retrofit sustainable city-regional futures

Drawing upon the discussion above together with the project team's wider knowledge of the literature, Table 3 below sets out a number of prototype city-regional visions. The intention is that together these visions should provide a reasonably comprehensive description of the possible and plausible sustainable retrofit futures.

The vision summaries and brief narratives storylines are intended to convey the essence of each of these futures, whilst at the same time providing considerable interpretive flexibility. The purpose here is to work with our Urban Foresight panel to enrich and interrogate each of these futures. Using a series of structured participatory tools, the Visioning Workshop will provide an opportunity for the technological content and socio-economic and environmental dimensions of each vision to be explored.

The narratives are therefore deliberately written in an open and neutral style, avoiding normative language and subjective judgements as far as possible.

Table 3: Retrofit 2050 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.
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.
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.
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 ecosystem services (food production, energy, shelter, water & waste treatment). 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.
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.

6. Workshop Questions

- To what extent do these visions make sense in terms of the future for an existing city?
- What would they mean in terms of the type and scale of retrofitting undertaken?
- How relevant/likely are they?
- How comprehensive are they?
- How mutually exclusive are they?
- To what extent can they be improved upon (hybrid/alternate visions)?

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