Using futures inquiry to create low-carbon, resilient urban futures:

a review of practice, theory and process
options for the Visions and Pathways project

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Executive Summary

This paper presents a scan of futures inquiry trends, an outline of recent advances in relevant theory, and critically reviews similar 'transition'-focused and related projects in Europe and the United States. Five leading projects are described and examined: 'Retrofit 2050', 'Urban Transition Labs', 'SPREAD Sustainable Lifestyles 2050', 'Future Car(d) Urbanism', and 'Futurescape City Tours'. Collectively, the projects epitomise four key trends in visioning and scenario practices:

1. *Development of visioning and backcasting approaches better suited to addressing value-laden, complex and uncertain sustainability issues.* To assist with handling sustainability issues, new approaches have been pioneered which combine visioning and backcasting techniques with more interactive processes. These processes go well beyond consultation, opening up the process to a larger group of stakeholders and potential users (of the outputs) to facilitate more inclusive exploration of complex choices and alternative futures.

2. *Use of advanced information and communications technologies (ICTs) to enable 'network-based foresight' and wider deliberation on future scenarios.* The use of ICTs can improve these exercises by enabling expanded participation and stakeholder scrutiny.

3. *Use of 'experiential' futures activities to deepen stakeholder and public engagement.* Visioning and scenarios practices are increasingly being fused with design research methods to provide a more evocative, fuller experience of future possibilities. These activities provide a 'pre-experience' of potential futures, often instead of traditional written reports.

4. *Increased engagement with multiple perspectives and the politics of the future.* Theorists and practitioners are increasingly: recognising the inherently value-laden nature of visioning activities and most futures inquiry; shining a spotlight on the ideological assumptions (i.e. deep, often implicit beliefs) that inform images of the future and influence responses to them; and drawing on theorisation of evolving social values and 'value systems'.

Overall, the major findings of this review support many of the methodological choices made in the Visions and Pathways 2040 project. In particular, the findings support an approach which:

- draws on and shapes the presence of expectations (i.e. beliefs about the future) and visions in relevant networks (e.g. in the built environment sector and other networks);

- combines visioning and backcasting techniques with interactive processes to facilitate mutual learning between stakeholders, improve coordination and generate buy-in;

- combines the use of multiple techniques in a broader 'strategic foresight' process;

- enables innovating actors to better cope with uncertainty and 'time shift' (i.e. to routinely move their thinking beyond the short-term future and present-day reality);

- recognises the issues associated with technocratic-style efforts to define a fixed 'blueprint' of the future and, instead, recognises complexity and limited actor control.

This paper also points to opportunities for using scenario and other techniques in additional ways in urban and organisational planning to help enable *resilient* urban futures. These include:

- developing or adapting existing future context scenarios (e.g. national scenarios regarding the future of Australia) which are used to help build 'vision resilience'. The scenarios could be used to clarify the *core* of a vision and explore *adaptations* for different contexts;

- considering potential system shocks – e.g. via 'wildcard' identification and assessments, or drawing on relevant scenario work – when developing transition pathways. This assessment can test and broaden the pathways and contribute to system resilience;

- the use of structured scenario exercises to build 'adaptive capacity': these exercises can help to identify resilience-building policies and develop institutional flexibility.

Finally, the critical review of leading projects finds that key process considerations are addressed in varied and often partial ways. That is, urban transition projects need to adequately consider: the social dynamics of expectations; the degree of emphasis on 'guiding visions' vs. more pluralistic and open approaches; the roles of power dynamics and politics; the change model that is adopted and participation in exercises; and, lastly, normative and cultural change in transitions. Reviewed theory suggests that these five dimensions strongly influence the impacts of transition exercises.

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Glossary of key terms

Backcasting: a process which involves 'generating a desirable future, and then looking backwards from that future to the present in order to strategize and to plan how it could be achieved' (Vergragt & Quist 2011, p. 747).

Scenario: 'A story with plausible cause and effect links that connects a future condition with the present, while illustrating key decisions, events, and consequences throughout the narrative' (Glenn 2009). Future scenarios are usually normative or exploratory (see 'transition scenario' below for a normative approach), but some scenario practices can also aim to be predictive.

Transition scenario: an output produced from 'participatory explorations of possible long-term development trajectories that incorporate a structural systems change towards a desired, sustainable future state of the system' (Sondeijker 2009, p. 18).

Transition: 'changes from one sociotechnical regime to another' (Geels & Schot 2007, p. 399), where a 'socio-technical regime' is a semi-coherent set of rules including regulatory, normative and cognitive rules that work to underpin stable inter-group coordination (Geels 2004). Actors within interdependent groups share these rules (Geels 2004). Similarly, the term 'system innovation' refers to a societal transition from one 'socio-technical system' to another.

Vision: a compelling image of a preferred future.

Wildcards: 'low-likelihood, high-impact surprises' (Petersen, Steinmüller & Adeyema, 2009).

1. Introduction

Cities are increasingly seen as the locus for action on sustainability challenges and a key context in which greenhouse gas emissions reductions must be achieved (Höjer, Gullberg & Pettersson 2011; Ryan 2013). Major urban systems and related infrastructures – for example, energy systems and transportation systems, buildings and communications, among others – will likely have to be rapidly transformed in order to address these sustainability challenges (Newton 2012). Such changes will require both whole-of-city scale thinking and changes, and purposeful interventions in existing urban precincts (Ryan 2013; Weller & Bolleter 2013). Such transformations will involve changes to both the 'hard' elements of the built environment (e.g. actual buildings, infrastructure, and so on) and the 'soft' elements, such as governance processes, institutions and human behaviour (e.g. see Dixon et al. 2013; McCormick et al. 2013; Newton & Newman 2013; Newton 2012).

This paper and the Visions and Pathways project adopt particular ways of framing such changes focused on the notion of 'transitions'. A transition perspective aims to take a broader view than other approaches to sustainability, such as those focused on behavioural change or market reform (STRN 2010). This perspective foregrounds structural change and multi-actor change processes. Transition theory informs numerous attempts to generate low-carbon transitions, including in urban contexts (e.g. see 'Retrofit 2050' project described in this paper). Visioning and scenario exercises are also widely seen as part of the toolkit for enabling transitions (Sondeijker et al. 2006).

The paper has four objectives: 1) to review trends in the use of scenario and visioning exercises relevant to urban change and low-carbon focused visioning processes, i.e. evolving practice; 2) to review the theorisation of these practices; 3) to inform the 'Visions and Pathways 2040' project by contributing to the methodological and theoretical grounding, design and implementation of the project; and 4) to critically review similar projects that also seek to catalyse urban sustainability transitions.

The paper has been structured to address each of these objectives in turn.

However, first, some clarification of concepts and related terms is in order. A vision is an image of a preferred future, whereas a 'scenario' is, in general, a story about the future, which may be told for a range of reasons and may be exploratory, normative or predictive (also see the glossary). As Dixon et al. (2013) note, exercises in which visions and scenarios are developed tend to have one of two contrasting objectives: they can be conducted to *influence* the emerging future (e.g. developing new perspectives on the future in order to influence present behaviour and thinking); or they can be used as an *adaptive* planning aid, which helps actors to be prepared for a wider range of plausible futures and develop a more flexible approach to future reality. Future-influencing exercises typically involve the co-creation of desirable images of the future through participatory exercises that often aim to generate greater alignment around a set of common goals (Dixon et al. 2013).

2. Trends in visioning, scenario analysis and foresight practice

This section outlines four major themes in recent trends in practice and provides illustrative examples wherever possible to bring them to life. These trends both inform the Vision and Pathways 2040 project and highlight opportunities for improving urban and strategic planning.

Development of visioning and backcasting approaches better suited to addressing value-laden, complex and uncertain sustainability issues

Visioning is generally recommended to be a highly participatory process (Shipley 2002). Similarly, backcasting studies have shifted from focusing on scenarios created by researchers, exploring a range of ways to achieve externally predefined targets, to more participatory exercises where the scenarios and targets are the product of these processes (Robinson et al. 2011).[1] Such approaches aim to support stakeholders in expressing their views about what futures are desirable, such as through multi-stakeholder and cross-sectoral deliberative workshops, advanced modelling, and 3-D visualisation tools (Davies et al. 2012; Miller et al. 2013; Robinson et al. 2011).

Beyond this, visioning guides typically provide little practical instruction and are not based upon detailed underpinning theory (Frantzeskaki et al. 2011; Shipley 2002). Nonetheless, an area of increasing agreement is the need to prepare participants' minds for visioning, such as via knowledge-sharing and capacity-building (Robinson et al. 2011) or creativity exercises (Ghişa et al. 2011; Gunnarsson-Ostling et al. 2012). Published 'foresight' guides recommend processes that contain multiple phases, e.g. exploring possible futures (i.e. scenarios) before the visioning

workshops, or combining multiple methodologies in other ways (for examples see: Hines & Bishop 2006; Voros 2003).

Given the values-based nature of visioning, an important issue is whose values and preferences shape a vision. For example, some experienced practitioners assert that 'by minimizing the influence of the researchers' own values and visions of sustainability on both the process and the future scenario, participants are able to explore emergent visions that more accurately reflect their own values' (Robinson et al. 2011, p. 758). Some current projects – such as Retrofit 2050, described in Section 4 – aim to make room for competing problem framings and associated different preferences (Dixon et al. 2013). O'Brien & Meadows (2007, p. 560) further note that 'when involving multiple stakeholder groups … each group may be concerned about a different set of issues and hold a different and possibly conflicting set of values that could influence their choice of a preferred future', i.e. they may pursue different futures influenced by contrasting values.

A recent finding from practice is that sophisticated tools like city or precinct modelling tools, such as MetroQuest (Robinson et al. 2011) and ENVISION (Newton & Glackin 2013) are, alone, 'insufficient to fully support collective visioning of sustainable futures' (Robinson et al. 2011, p. 758). This has led to shifts in process design that focus more on participant interactions, conflict resolution, better supporting mutual learning, and encouraging dialogue (Jenssen 2010; Lang et al. 2012; Robinson et al. 2011). Additionally, the processes need to be responsive to the social context within which the tools are deployed, such as the level of pre-existing conflict or consensus (Lang et al. 2012).

Recent innovations in practice also aim to enhance participants' capacity to explore complex, value-laden and uncertain issues

(Robinson et al. 2011; Swart, Raskin & Robinson 2004). Some published cases indicate that dialogue and other interactive processes in scenario generation and backcasting enhance understanding of complexity and elicit deeply held values, and that participants need to be appropriately supported to effectively participate (Robinson et al. 2011). Additionally, scenario analysis techniques are also used to explore the trade-offs and potential consequences associated with different preferences (Miller et al. 2013; Robinson et al. 2011; Rodríguez et al. 2006).

Regarding the challenges of uncertainty and complexity, some practitioners recommend combining visioning with scenario planning. These practitioners argue that visions must be cast and considered within the plausible future conditions under which they will be achieved (Bok, Hayward & Voros 2012); and call for 'dynamic visioning' suitable for 'dynamic environments', combining visioning processes with analysis of the dynamic external context that actors must cope with (Winch 1998). A local example for water management transitions in Melbourne is described in Box 1:

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1. In contrast some researchers articulate pre-determined visions of the future and gauge participant responses.

Box 1: Combining visioning and scenario analysis – an example of strategic planning process for facilitating transformative change in urban contexts

A guidance manual has recently been published outlining the strategic planning methodology used as part of the Melbourne's Transition to a Water Sensitive City project (Frantzeskaki et al. 2012). The methodology is for long-term, visionary change. It principally draws on two bodies of research: transition research (e.g. transition management, etc) and resilience research.

As part of phase 3, focused on vision development, a range of 'future context scenarios' are produced for building 'vision resilience'. These contextual scenarios 'represent a range of possible combinations of trends that could affect the system'. The scenarios are used to examine how the definition of the vision would need to be adapted under different future conditions. This informs identification of the 'core' of a vision (i.e. uncompromisable aspects) and adaptations.

As part of phase 4, which is focused on developing strategic transition pathways, it is recommended that descriptions of 'different extremes and surprises' be developed that focus on the range of disturbances the focal system could face in the future. The workshops can draw on existing relevant scenario work, and/or a range of 'wildcards' that are developed for the project. The objective of the workshops is to consider these possibilities and develop mitigation strategies (i.e. building resilience through preparation), adaptation strategies (i.e. building resilience through responses), and recovery strategies (i.e. building resilience through coping measures).

One innovative project called 'Nano Futures' – which was initiated by the Center for Nanotechnology in Society at Arizona State University – experimented with using Web 2.0 tools to enhance public engagement (Selin & Hudson 2010). The project used possible nanotechnology scenarios that were vetted by scientists for plausibility to 'set the stage' for dialogue and then invited people to join an online forum to explore and critique their appropriateness. A Nano Futures website was used as one tool of data collection and outreach, hosting a wiki platform and discussion forum.

The approach is described as 'open-source scenario thinking'. This meant that 'naïve product scenes' were presented 'stripped of elaborate social description and function' (Selin & Hudson 2010), with participants asked to flesh out the implications and contribute to developing the scenarios. In this way, the researchers did not presume to know what different publics think about potential nanotechnologies (Selin & Hudson 2010). This can be considered a form of crowd-sourced scenario analysis in which power is delegated to wider publics, who are enabled and encouraged to co-construct the scenarios and define their implications (rather than the researchers).

The Nano Futures project represents an innovative attempt to subject future scenarios and visions 'to democratic assessment by a range of stakeholders' (Selin 2011, p. 723). Such approaches may contribute to 'anticipatory governance' (Barben et al. 2007) and point to important emerging uses of ICTS for involving affected stakeholders and wider publics in the scenario analysis.

Use of advanced information and communications technologies (ICTs) to enable 'network-based foresight' and wider deliberation on future scenarios

Network technologies have ushered in new possibilities and practices and for enabling more participation and collaboration (Ramos, Mansfield & Priday 2012). Network-based, participatory forms of foresight include: online scenario development and planning approaches (Raford 2011); crowd-sourced scenario analysis (e.g. Wikistrat); scenario gaming platforms;[2] online scanning systems (e.g. 'iKnow futures'); and the use of social software in environmental scanning processes (Pang 2010). Two common aspects are conducting analysis in more collaborative ways, and a 'participatory turn' that seeks to ensure anticipatory thinking is produced in ways that 'reflect the needs of the vast majority of people' (Ramos, Mansfield & Priday 2012, p. 86).

To-date, crowd-sourcing approaches tend to focus on the early stages of processes. For example, they can be used to accelerate data-gathering or broaden inputs, or to develop trend or weak signal databases (Raford 2012a).[3] Some practitioners are experimenting with 'open foresight' methods which aim to analyse complex issues in open and collaborative ways, using social media and other tools for 'harvesting collective insight' and public participation (Miemis et al. 2012, p. 92).

2. For example, see the Institute for the Future's 'Foresight Engine' which 'gamifies' scenario building, see: http://www.iftf.org/what-we-do/foresight-tools/collaborative-forecasting-games/

3. For an overview of current approaches to crowd-sourced scenario planning see: http://news.noahraford.com/?p=780. These are currently more useful in the earlier stages of a scenario process; less useful for actual scenario-building.

Use of 'experiential' futures activities to deepen stakeholder and public engagement

'Experiential' futures activities aim to give people a much more evocative, fuller experience of future possibilities, aiming to bring future scenarios to life. Experiential scenario methodologies include: immersive scenario performances, 'artifacts from the future', mock news stories and media, and guerrilla-style activism techniques (Candy 2010). Raford (2012b, p. 34) describes these approaches as 'highly visual, often emotional, and ethnographically infused, their approach brings the future alive through videos, objects, and print media'. The objective is to create 'a profoundly engaging experience' that goes well beyond typical technical reports and PowerPoint presentations. This trend is a new fusion of futures research and common design research techniques.

Stuart Candy, a leading practitioner of experiential futures, argues that such techniques are used to stage interventions to influence the future, and do not purport to predict the future (Candy 2010). A range of experiential, cross-media approaches were included in the state-sponsored 'Hawaii 2050' project, including the theatrical performance of alternative scenarios at the project launch. Other activities included: staging experiential interventions that expose the publics to future possibilities, such as scenario 'installations' in real-world contexts dramatically presenting a possible future (see Figure 1); and provocative 'postcards' sent from the future.[4] These activities sought to address participants in more affective modes, exploring ways of going beyond text and traditional charts.
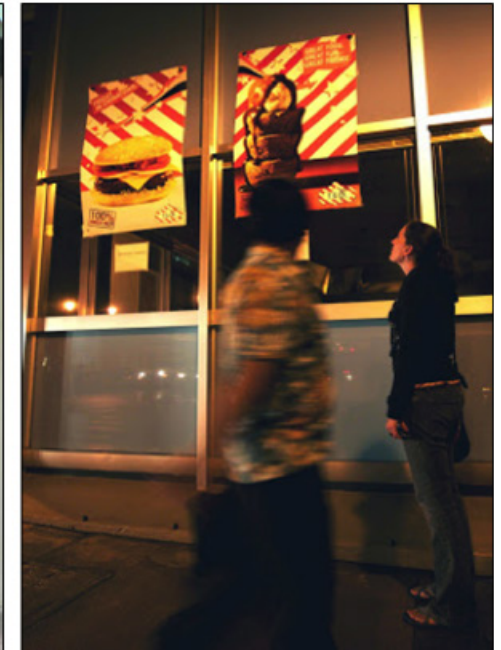

Figure 1 - elements of the 'McChinatown' installation in Hawaii (Candy 2010)

The above experiential intervention included arranging for a fake grassroots activist group to gather outside the supposed future Starbucks, calling on the fellow publics to 'Save Chinatown'.

The 'Dark Winter' biosecurity simulation is another example. This 'table-top' scenario-based exercise simulated a large-scale smallpox attack on the United States (Mallard & Lakoff 2011). Prominent public figures role-played the scenario over two days, which depicted a time span of two weeks following the attack. The exercise involved official briefings from mock National Security Council meetings, simulation of unfolding events based on the decisions and actions of scenario exercise participants, and, importantly, the role-play exercises were held before an audience of over 100 observers (for a detailed description of the exercise see: Mallard & Lakoff 2011).

Such practices aim to reduce what Candy terms the 'experiential gulf'. That is, 'the difference between how we imagine or expected something to seem in advance, and what it's actually like being there' (Candy 2010). The organisers of 'Dark Winter' argue that without experiential exercises people don't adequately feel what the future would actually be like (Mallard & Lakoff 2011).

Greater engagement with multiple perspectives and the politics of the future

Although cultural analysis has a long history in futures research (e.g. in critical futures inquiry), over the past decade more scenario and visioning projects have incorporated this analysis. These include approaches that draw on theorisation of evolving social values and 'value systems' (Hines 2011; Stewart 2008) or apply various forms of integral theory (Hayward & Morrow 2009; Slaughter 2004). Additionally, from a communication perspective the cultural types of scenario users can influence how the scenarios are interpreted and how/if they are used (Eames & Skea 2002).

Similarly, leading Australian practitioner Inayatullah (2013, p. 7) argues that 'all images of the future are not neutral – behind each are worldviews and deep myths. He further contends that 'politics is complicit in any future [e.g. a vision or scenario], even those that claim the value neutrality of trend analysis and prediction' (p. 7).[5] Consequently, some approaches include consideration of the influence of world views and related narratives on what possible futures are anticipated and/or preferred, and 'unpacking' these dynamics to help to innovative analysis and action.

Table 1 to the right summarises the issues and opportunities highlighted by these frontier areas:

Table 1: Core issues and related process options for the Visions and Pathways 2040 project

Practice/theory frontier	Core issue being addressed	Process options/opportunities
Development of visioning and backcasting approaches better suited to addressing value-laden, complex and uncertain sustainability issues	• Traditional approaches are often poorly suited to the value-laden, complex and uncertain nature of most sustainability issues	• Combining visualisation and/or modelling tools with interactive processes to support mutual learning and encourage dialogue • Combining visioning with scenarios, e.g. to explore trade-offs, increase vision resilience
Network-enabled foresight and wider deliberation on future scenarios enabled by ICTs	• Implications of the 'network era' for visioning, scenario and broader foresight practices; and common constraints on process inputs and involvement (e.g. time, resources, and knowledge of contributors)	• 'Crowd-source' process inputs (e.g. weak signal identification) and/or trend analysis activities, e.g. via the project website • Adopt 'open-source' approach • Consult with citizens to examine the level of support for visions and public perceptions
Experiential futures activities	• Cognitive limitations and biases constraining how humans mentally simulate 'the future'	• Explore creative ways of bringing possible futures 'to life', such as through video, futuristic objects and creative use of media • Use of 'scenario installations' to increase public engagement
Deepening engagement with multiple perspectives and the politics of the future	• The cultural and political aspects of futures thinking (e.g. influence of cultural factors on scenario development and visioning)	• Draw on cultural and political theory during vision/scenario development, analysis and/or communication processes • Use methodologies that can 'unpack' perspectives on the future and key circulating images or visions, e.g. causal layered analysis, or analysis of different major 'schools of thought' (Burns & McGrail 2012)

5. Similarly, some transition scholars have argued that 'visions contain implicit (or explicit) ideological assumptions (e.g. over the way problems are framed), and these will colour their attractiveness to different audiences' (Smith, Stirling & Berkhout 2005, p. 1507)

3. Theorising practice: advances in understanding the roles of future visions and expectations in transitions and related process considerations

Social scientific research on expectations in innovation processes and technological change

An emerging domain of sociological research, termed the Sociology of Expectations (SoE), theorises the roles of future expectations in technological innovation and scientific research. Researchers associated with the UK-based Retrofit 2050 project have drawn on SoE research to argue that a transition experiment is, in essence, a strategic attempt 'to mobilise and exploit the performative power of expectations' (Eames & McDowall 2010, p. 672). They also view methodologies, such as backcasting and roadmapping processes, as 'performative' in their core focus on influencing actor expectations and, thereby, shaping the way that technologies develop (Dixon et al. 2013). The key relevant findings from recent SoE research are briefly summarised below.

These studies have identified and theorised the crucial roles that actors' beliefs about the future play in the early stages of innovation, and when actors act under conditions of uncertainty (Borup et al. 2006; Eames et al. 2006; van Lente 2012). In the context of visioning and scenario exercises, expectations and related social dynamics can be enabling and constraining. A framing observation is that 'actors continuously and explicitly refer to what is possible in the future', and 'draw from and add to a repertoire of images, statements and prophecies' (van Lente 2012, p. 772).

SoE research has identified three sets of social processes that point to the enabling effects: the force of expectations, the social dynamics of expectations, and steering effects that are related to expectations (van Lente 2012). The force of expectations is central to all these processes.

The 'force' of expectations refers to forceful presence of future expectations within professional and industrial networks. Research has identified three common forces of expectations: heuristic guidance, coordination effects and legitimisation effects. These are described below:

1. *Heuristic guidance (expectations as a decision-making and problem-defining aid):* in the early stages of innovation or technology development the optimal path typically cannot be rationally calculated due to uncertainty and the range of possible paths. As a consequence, decision-making is informed and assisted by expectations. For example, 'visions and expectations are used by technology developers to reduce uncertainty in decision-making, as they provide a sense of the 'way things are going'' (Eames et al. 2006, p. 362).

2. *Coordination effects:* often innovation and technology development is not a solitary process but is full of positioning strategies. For example, successful innovation often requires selection of mutually-aligned strategies by multiple actors (Truffer, Voß & Konrad 2008). However, in such situations, a lack of centralised contract can create coordination problems. Van Lente (2012, p. 774) found that 'expectations indicate pieces of work and stipulate roles'.

3. *Legitimation effects:* the legitimacy of a project or research program can be increased by referring to a promising future, and positive expectations can, in this way, be protective.

The social dynamics of expectations depicted in SoE research refer to processes such as self-fulfilling prophecies (see 'performative effects' above) and inherent issues regarding how claims made about the future are assessed. Van Lente (2012, p. 773) argues that 'a [claimed] promising future of a technology option lacks … independent tests. In fact, the only reliable way to validate the claim is to try to achieve it'. Overall, according to the SoE, expectations are performative.

Related steering effects generated by expectations have also been examined. High-level visions, such as the idea of an 'electronic superhighway' (regarding the internet) or a 'hydrogen economy', can help to enable the successful coordination of efforts (van Lente 2012), as was noted above.

However, expectation dynamics can also be constraining. Circulating assumptions and prophecies tend to constrain the articulation of novel perspectives and make any surprising analysis that challenges prevailing assumptions socially vulnerable (van Lente 2012).[6] In foresight and visioning exercises, participants draw from circulating statements and assumptions (van Lente 2012).

6. SoE theory predicts that surprising outputs are vulnerable because they are disconnected from circulating expectations and assumptions. SoE research suggests that these dynamics can limit the efficacy of forward-looking exercises, particularly with respect to prevailing lock-in conditions (e.g. carbon lock-in).

The role of normative visions in innovation and transition processes

Visions are generally understood to have a couple of main features: first, they are mental images of futures that are shaped by actors; second, they can, strongly or weakly, guide the actions of and the interactions between these actors (Grin & Grunwald 2000). For example, a vision can provide direction to innovating actors, or help secure access to resources (Eames et al. 2006).

In the 1990s, early efforts, such as the Dutch Sustainable Technology Development (STD) initiative (Weaver et al. 2000), began to experiment with related approaches for influencing innovation processes in new sustainability-focused directions. The STD program demonstrated that longer-term sustainability goals could be incorporated from the outset (of an innovation process) by bringing actors together to: clarify sustainability requirements; develop a vision; and collaboratively 'backcast' pathways to the vision. The STD project adopted a 50-year time-frame consistent with the time period needed for development and diffusion of radical innovations and aiming at Factor 20 reductions. The STD program also had weaknesses, such as adopting a techno-centric perspective and not being able to incorporate recent advances in understanding co-evolutionary change (Gaziulusoy 2010). Methodologies for developing normative 'transition scenarios' and backcasting have since been refined and more widely applied (Robinson et al. 2011; Sondeijker 2009).

Many transition theorists and system innovation practitioners advocate the use of visioning and backcasting activities to stimulate innovation (Loorbach 2007; Quist, Thissen & Vergragt 2011; Vergragt & Quist 2011). In particular, visioning is widely used by the Dutch Research Institute for Transitions (DRIFT) in the Netherlands and elsewhere in Europe (Loorbach 2007;

Nevens et al. 2013). While some transition theorists are not convinced that there is much to be gained from visioning within 'transition arenas' (Schot & Geels 2008, p. 542), the experience of practitioners indicates this approach can help to enable sustainability-oriented system innovation (Vergragt & Quist 2011).
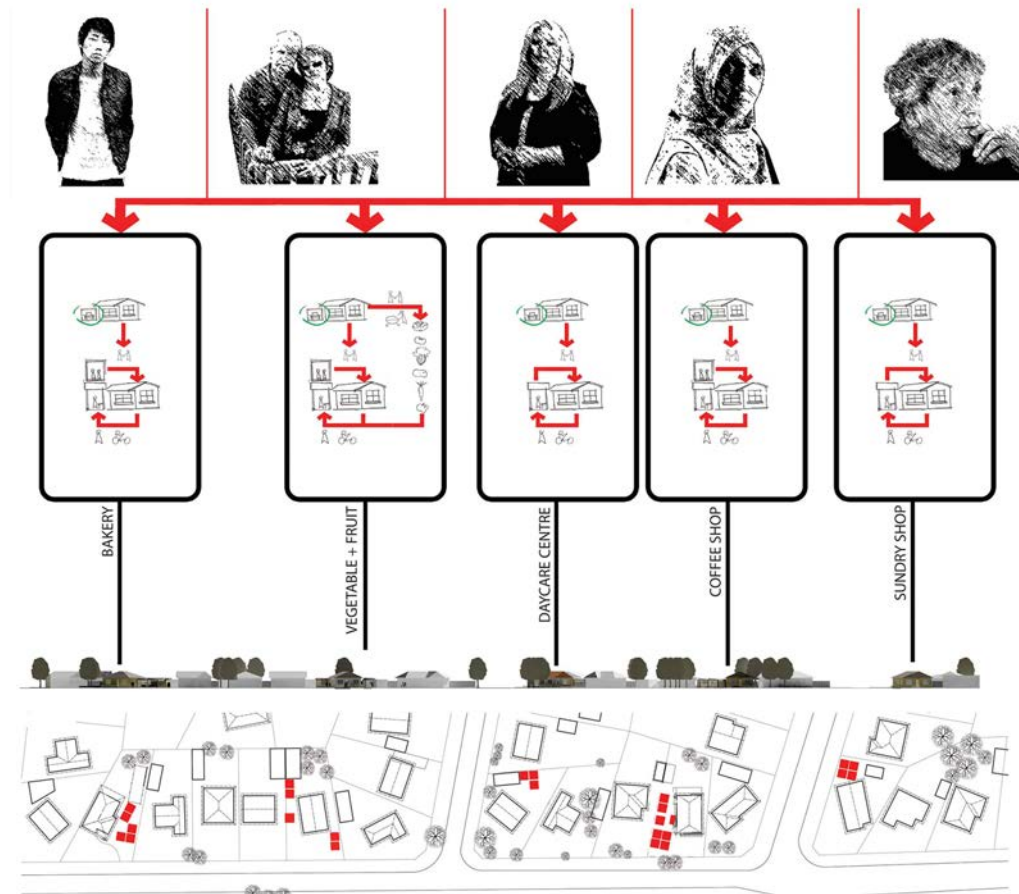
BUSHFIELD CRES, COOLAROO
Vision: Broadmeadows 2032. Image © Yee Hui Xiuan, VEIL, 2010.

Recent advances in understanding the functions of visions in 'system innovation'

A highly cited paper on 'the governance of sustainable socio-technical transitions' (Smith, Stirling & Berkhout 2005) has advanced understanding of the potential functions of visions in processes of 'system innovation' (which are also termed transitions). The analysis discusses these functions as part of agency and power relations across networks of actors in innovation processes.

These transition scholars draw on research which demonstrates that 'codified representations of technological expectations play a vital role in framing socio-technical problems, as well as motivating actors to seek to solve them' (Smith, Stirling & Berkhout 2005, p. 1506). Five potential functions of visions are outlined (see Table 2 adjacent), ranging from acting as problem definition tools, to enabling access to resources, through to network-building and developing 'coalitions for change':

Table 2: Functions of visions for future system innovation (Smith, Stirling & Berkhout 2005)

Function	Description
Mapping a 'possibility space'	Visions identify a realm of plausible alternatives for conceiving socio-technical functions and for the means of providing for them.
A heuristic	Visions act as problem-defining tools by pointing to the technical, institutional and behavioural problems that need to be resolved.
Providing a stable frame for target-setting and monitoring progress	Visions stabilise technical and other innovative activity by serving as a common reference point for actors collaborating on its realisation.
Providing a metaphor for building actor-networks	Visions specify relevant actors (including and excluding), acting as symbols that bind together communities of interest and of practice.
Providing a narrative for focusing capital and other resources	Visions become an emblem that is employed in the marshalling of resources from outside an incipient regime's core membership.

This analysis also considers vision construction processes and key factors that shape the influence of a particular vision. They emphasise power relations between actors and agency. For example, they note that actors 'exert varying degrees of influence on the construction of these guiding visions and deploy their resources strategically to those ends' (Smith, Stirling & Berkhout 2005, p. 1506). Additionally, the credibility and influence of those backing a vision can influence the chances of receiving adequate material support for successfully realising the vision.

Other transition scholars have also considered the role of visions and expectation dynamics (Geels 2011; Geels, Hekkert & Jacobsson 2008; Truffer, Voß & Konrad 2008). Although they argue no transition is planned from the outset, some transition scholars contend that 'every transition becomes coordinated at some point through the alignment of visions and activities of different groups' (Geels & Schot 2007, p. 402). Others question this assessment. Berkhout et al. (2004) raise three substantive concerns about the emphasis on guiding visions in transitions and practices of 'transition management': they contend that for many past transitions a particular guiding vision was largely absent or played a modest role, and conversely many guiding visions failed to deliver upon the hype that they generated; second, they argue the idea of a social consensus around any particular guiding vision is inherently problematic (e.g. due to divergent social values and interests, etc);[7] and third, whether it possible, ex ante, to identify what guiding vision ought to be pursued.

7. Similarly, some researchers argue visions require some 'interpretative flexibility' to be effective. That is, they suggest that 'adaptability to different circumstances, can influence the coherence and robustness of the coalition organised through it [i.e. the vision]' (Smith, Stirling & Berkhout 2005, p. 1507).

Ongoing research contributes to these debates. Recent findings are summarised below for transition management, along with different key processes within major transitions, drawing on the so-called 'multi-level perspective' (Geels 2002) and published case studies of transition processes.

Transition scenarios in transition management: Sondeijker (2009) found that transition scenarios help to enable the coalescing of seemingly unrelated bottom-up initiatives in different domains. Transition management theorists term this synchronisation process 'goal-oriented modulation' and argue it is a prerequisite for achieving transitions. Specifically, transition scenarios can downscale a broad long-term vision to a more practical level, specifying tangible desired directions of future development, and function as a benchmark against which outcomes can be measured (Sondeijker 2009). The overall 'added value' is guidance on how the processes of change can be initiated in the short term and thereby be accelerated – a task that long-term visions alone do not fulfill. This helps to link and mobilise a range of change-inclined and visionary players (Sondeijker 2009).

Influencing the development of 'niches' in which new innovations develop (micro-level): transition scholars argue that the functions and dynamics of expectations influence the development of new 'niches' (Geels 2011; Geels & Raven 2006; Raven & Geels 2010). For example: the articulation of future expectations and visions can legitimise (continuing) protection and nurturing of the niche, provide direction to learning processes, and attract attention (Schot & Geels 2008); and visioning prior to experimentation may help to broaden networks and learning processes (Hegger, Vliet & Van 2007). However, 'hype–disappointment cycles' in niche trajectories – in which

inflated expectations lead to actor disappointment – can cause backlashes that impair change and innovation (Verbong, Geels & Raven 2008). Expectations and visions also need to change in response to the ongoing learning processes that are occurring within these niches (Schot & Geels 2008).

Destabilisation of socio-technical 'regimes' (meso-level): Some transition scholarship points to important related change processes influencing existing regimes (e.g. existing energy systems), which are comprised of rules and routines, together with technological artefacts used in practice (Elzen et al. 2011; Geels 2011). An important aspect of regimes is that they include 'cognitive routines' and prescribe roles for actors that are viewed as normative (Schot & Geels 2008). These aspects can be influenced by changes to actors' expectations, visions and values. Transition scholars have also begun to study the normative contestation of regimes occurring as part of transitions 'in the making' (Elzen et al. 2011). For example, regime outsiders use framing processes to increase the level of normative pressure. Additionally, change-inclined regime player participation in the visualisation of visions or pathways can help to resource and enable transitions (Sondeijker 2009).

Changes in 'socio-technical landscapes' (macro-level) creating pressure on regimes: This landscape is generally described as an exogenous external environment (i.e. beyond the direct influence of actors in niches and regimes) which changes slowly. It includes macro-economic and macro-political developments and 'deep cultural patterns' (Schot & Geels 2008). Relevant processes here include new innovations linking up with broader shifts in cultural values and cultural visions (Geels, Pieters & Snelders 2007), which can lead to increasing cultural enthusiasm regarding the potential benefits of adopting new

technologies (e.g. as seen regarding enthusiasm for distributed systems).

The above theorised dynamics also informed by new understanding of transition processes. The multi-level perspective (MLP) was developed to better conceptualise regime-shifts that linked 'internal' niche-level processes and broader external changes. The MLP as a theory of transitions contends that transitions result from interactions between processes at different levels (see the detailed arguments in: Geels 2011; Schot & Geels 2008), although the MLP has been criticised for a perceived bias towards 'bottom-up' change processes (Geels 2011).

The functions of 'futuring' activities in strategic management and sustainability science

Finally, over the past decade an increasing number of scholars have explored the role of 'futuring' activities in strategic management (Heger & Rohrbeck 2012; Konnertz, Rohrbeck & Knab 2011; Ramírez & Selin 2014; Ramírez, Selsky & van der Heijden 2008; Rohrbeck & Gemünden 2011), along with sustainability science (Frame 2008; Frame & Brown 2008; Miller et al. 2013; Swart, Raskin & Robinson 2004). These literatures are vast. We limit the review to noting four themes:

- Building 'adaptive capacity' via scenario exercises that help to develop institutional flexibility and identify resilience-building policies (Folke et al. 2002; Johnson et al. 2012);

- Social learning and strategy alignment via participatory exercises that contextualise actor expectations, 'enable the development of shared interpretive frames and may therefore constitute a basis for alignment of strategies' (Truffer, Voß & Konrad 2008, p. 1361);

- Supporting more systematic exploration of the future that is both sensitive to normative issues and sufficiently rigorous (e.g. see: Swart, Raskin & Robinson 2004); and

- Prospective sense-making: Sense-making traditionally refers to meaning constructed from our past experience, i.e. efforts to retrospectively make sense of what occurs and to create order. In contrast, prospective forms of sense-making activities involve 'making sense of uncertain futures' to support decision-making, e.g. via scenario analysis (Ramírez & Selin 2014). This

form of sense-making is increasingly demanded when past trends are not a good guide to the future, for example, as systems become more complex, interrelated, uncertain and turbulent (Ramírez & Selin 2014; Ramírez, Selsky & van der Heijden 2008).

We now draw on the above literature reviews to isolate five key considerations when using visioning, scenario and related exercises to support sustainability transitions.

1. *The social dynamics of expectations*

;Participatory exercises such as scenario exercises are shaped by ongoing expectation dynamics in relevant networks and wider society. In addition to the issues already noted above (e.g. perspectives and process outcomes being shaped by already circulating statements and assumptions about the future), the subjective perceptions of actors are shaped by the discourses that they participate in and their institutional context. These and other social dynamics can limit the influence of these exercises and also inform part of the rationale for conducting them (van Lente 2012).

2. *Degree of emphasis on 'guiding visions' vs. more pluralistic and 'open' approaches*

Some transition scholars argue that the ambition to define 'guiding visions' is misplaced. Key questions include: whether it is possible to identify ex ante (i.e. in advance) which vision(s) should be followed and have good prospects of success; and whether guiding visions are always a necessary part of social processes leading to regime change (Berkhout, Smith & Stirling 2004).

Others point to the existence of divergent values and interests and pluralistic nature of contemporary societies, and levels of uncertainty that often must be grappled with when assessing the sustainability of envisaged developments (Geels 2011; Miller et al. 2013; Rittel & Webber 1973; Truffer, Voß & Konrad 2008; Voß, Bauknecht & Kemp 2006). Consequently, it may also be impossible to obtain a consensus view on what future is the most 'sustainable'. The concept of 'wicked' problems is informed by related issues that can thwart commonly used planning approaches (Rittel & Webber 1973).

A related consideration is, thus, whether views are 'closed down' around visions or a consensus, or instead the emphasis is on 'opening up' to consider multiple viewpoints. This important tension is emphasised in reflexive governance theory, which explores new ways of handling complex societal problems(Voß, Kemp & Bauknecht 2006). It argues that such problems must be 'opened up' (e.g. conisidering more perspectives), but 'closing down' is also needed to take action.

3. *Politics and power relations*

Third, the processes by which visions are constructed and have (or don't have) influence are shaped by power, interests and the credibility of actors. Visioning practitioners have noted similar issues, with multiple contested visions often battling for supremacy, both in society and during these exercises. Some transition theorists have also begun to focus more on role of power relations (e.g. see Berkhout, Smith & Stirling 2004; Shove & Walker 2007), for example, by highlighting the impact of power relations in transition processes and viewing innovation as an act of power (Avelino & Rotmans 2009). Similarly, Geels argues

two challenging characteristics of sustainability transitions are: politics and power struggles caused by the need for 'changes in economic frame conditions' (e.g. subsidies, regulatory frameworks), which are resisted by vested interests; and the 'strategic reorientation of incumbents' that currently defend existing regimes (Geels 2011).

4. *Change model and participation in exercises*

A fourth consideration is related to who needs to be involved in exercises and when. As noted, transition experiments have been criticised for being biased towards bottom-up change processes. For example, minimal involvement of regime actors can result in insufficient resources being accessed and poor institutional embedding (Schot & Geels 2008). Additionally, transition exercises and analyses tend to focus on a single regime (Geels 2011) – whereas sustainability transitions require attention to multi-regime interactions, e.g. between energy, transport and housing, or between the electricity and waste regimes (Konrad, Truffer & Voß 2008; Raven 2007; Truffer, Voß & Konrad 2008). Both issues have important implications for actor participation.

5. *Normative and cultural change in transitions*

Transition scholars have noted that in most studied cases, 'normative and cultural changes were often implicated in these transitions, [but] these were not the main drivers' (Elzen et al. 2011, p. 263). In contrast, these changes are widely seen as central to sustainability transitions and to sustainable futures (McGrail 2011). This raises the need to consider and incorporate mechanisms through which such normative pressure can be

increased (e.g. framing processes, the role of social movements and 'outsiders'). It also raises the associated need to incorporate methodologies and research activities that balance traditional descriptive-analytical academic research and other forms of anticipatory, normative and participatory research (Miller et al. 2013).

These process considerations also provide useful lenses through which to view and critically review urban transition projects. Examples of projects are outlined and considered in Section 4 below.
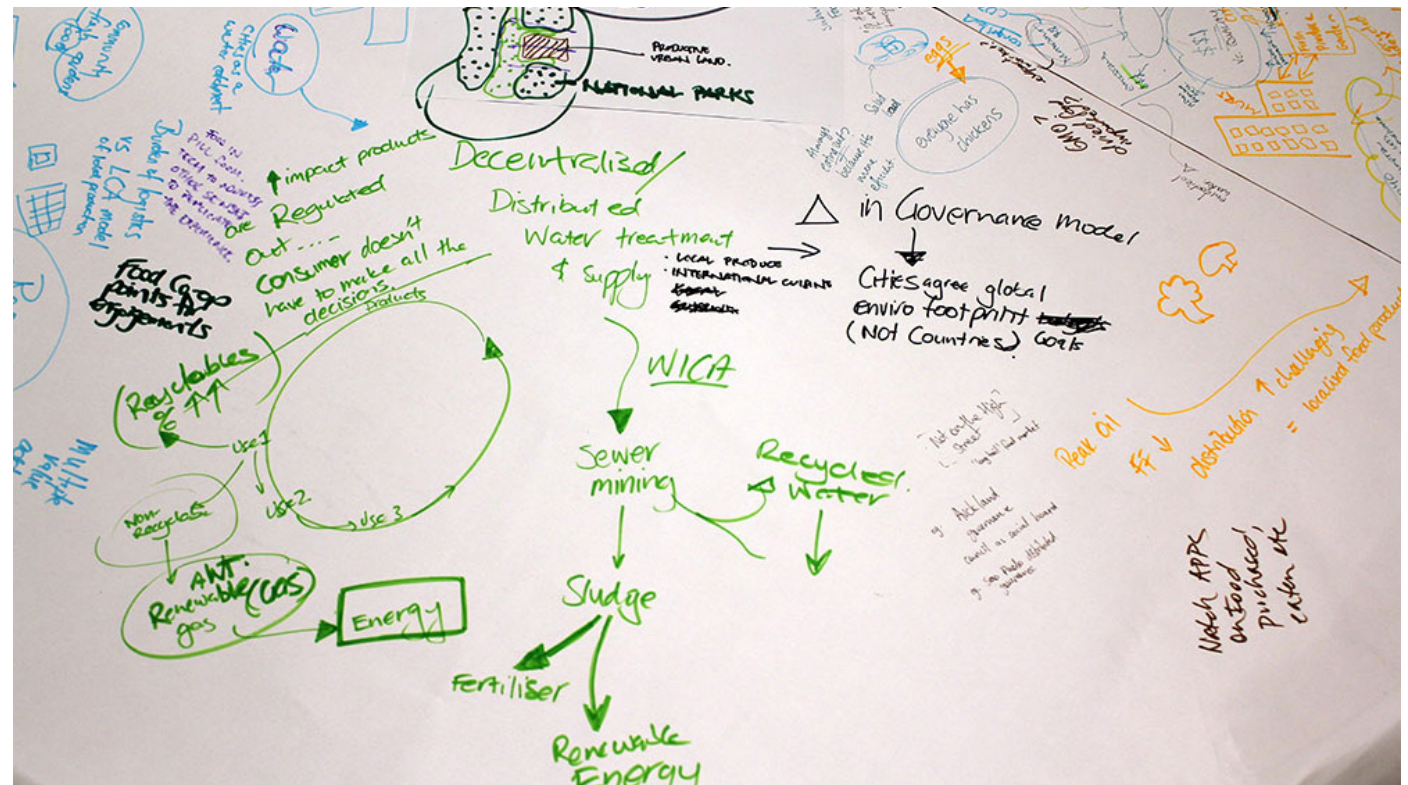

Image from Visions & Pathways Sydney workshop, 2014.

4. International examples of urban transition initiatives

This section describes and critically reviews five innovative international urban transition projects. Additional information on these projects is available on the internet and in publications; here we summarise their overall approach and, where applicable, the use of transition theory.

Retrofit 2050: 'Re-engineering the City 2020–2050' (October 2010 – March 2014)

Project overview

Purpose: The Retrofit 2050 project aims to 'deliver a step change in current knowledge and capacity for urban sustainability' and identify ways to increase the scale and effectiveness of retrofitting.[10] The project is focused on UK city-regions. Retrofitting is defined as the process of re-engineering existing cities to enable societal responses to climate change and resource constraints.

Time horizon: The project examines urban transitions up to the year 2050: in line with 'three horizons' thinking, and linked to the UK's 2050 carbon reduction targets (Eames et al. 2013).

Focal issue: Retrofitting cities; the new challenge for urbanism is 'to develop the knowledge and capacity for public agencies, the private sector and multiple users in city-regions systematically to re-engineer their built environments and urban infrastructure' (Eames et al. 2013, p. 513).

Theoretical framework: Complex systems, socio-technical transitions, and transition management

This project views a city as a 'complex adaptive system' and draws on critiques of traditional planning processes. Urban retrofitting is approached as system of innovation challenge, with emphasis on:

• multi-scalar transitions: e.g. building, neighbourhood, community and city scale;

• integrative perspectives on longer-term systems innovation, which are multi-sectoral and multi-level; the concept of socio-technical regime is adapted to identify focal urban retrofit 'regimes', e.g. housing, urban infrastructure and land-use regimes (Eames et al. 2013);

• identifying sustaining and disruptive retrofit technologies;

• understanding retrofit as a 'co-evolutionary' and 'socio-technical' change process.

Transition theory is drawn on as a way of conceptualising a more systemic approach, in contrast with building scale or more piecemeal approaches. They draw on 'transition management' frameworks, and theorisation of the performative roles of visions and expectations (outlined in Section 2).

The project also reviews and adapts transition theory. They argue that some aspects of the built environment have not been adequately considered in the generic transitions literature, e.g. the spatial complexity of cities, larger 'sunk' costs, and associated strong inertia (Dixon et al. 2013).

Retrofit 2050 banner: http://www.retrofit2050.org.uk/

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8. Quotes from the project website: http://www.retrofit2050.org.uk/. The project is focused on two regions, Greater Manchester and Cardiff City-Region, as well as exploring other cities in the UK and elsewhere through workshops.

Methodology

- Expert workshops to develop three 'generic' 2050 visions (Figure 3 below locates the visions in relation to core variables, e.g. the degree of change to land use/urban form);

- Concurrent 'foresight' activities focused on identifying potential disruptive and sustaining technologies in three domains (energy, water and waste): national urban retrofit roadmaps – which were also a workshop input, expert reviews, and an online survey; and

- Exploring and evaluating the potential implementation of the 2050 visions in two case study city-regions (Cardiff/South East Wales, Greater Manchester) using: quantitative modelling to assess environmental and energy-performance at a holistic level, participatory-deliberative approaches, and production of more detailed roadmaps. Three scales: building scale (energy modelling); neighbourhoods; and regional scale (e.g. via low carbon region models).

The front-end of the project is expert-centric (e.g. roadmaps, survey, generic visions), followed by greater stakeholder inclusion when examining specific city-regions (Manchester and Cardiff). The project leaders emphasise that their aim in is not to develop a finalised vision of the future (i.e. to act as an 'immovable utopia'); the approach is more pluralistic (Dixon et al. 2013).
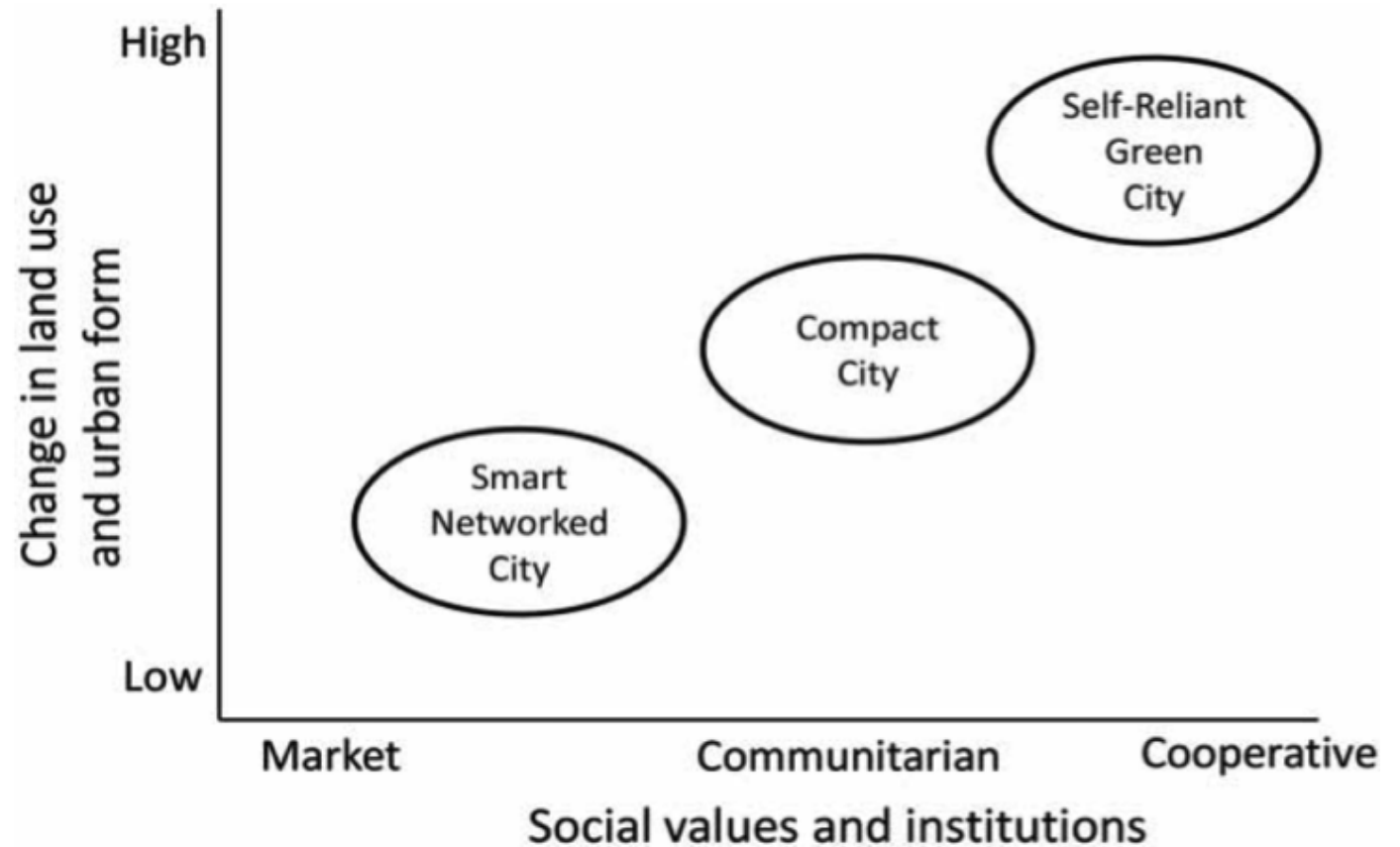

Figure 3: Core generic Retrofit 2050 city visions (Eames et al. 2013)

The European Union-funded 'MUSIC' project (Mitigation in Urban areas: Solutions for Innovative Cities) and development of 'Urban Transition Labs' (2010 – 2014)

Project overview

Purpose: The 'MUSIC' project aims to reduce carbon dioxide emissions in five cities by 50 per cent by 2030. It is a collaborative project between five cities (Aberdeen, Montreuil, Gent, Ludwigsburg and Rotterdam) – e.g. via local government partners – and two research institutes in Northwest Europe.

The MUSIC project is using and testing transition management tools within an urban context. A new type of 'transition arena' – termed an Urban Transition Lab (UTL) – is also being trialled. These labs are inspired by the 'living lab' concept and aim to help enable social innovation. In practice, a UTL involves developing new networks and associated institutional sites to help to catalyse innovation through pilot projects and by mobilising stakeholders (Nevens et al. 2013). The transition model is designed to enable social learning and empowerment (Nevens et al. 2013).

Time horizon: 2010–2030

Focal issue: Climate change mitigation via local urban innovation/action.

Theoretical framework: transition management

The 'MUSIC' project is adapting transition management processes, which includes the following mutually reinforcing steps (see Figure 4 below): analysing the system, envisioning, analysis of future pathways, experiments (connected to societal challenge and longer term vision), and assessment and monitoring. It draws on complex systems theory and models of reflexive governance.
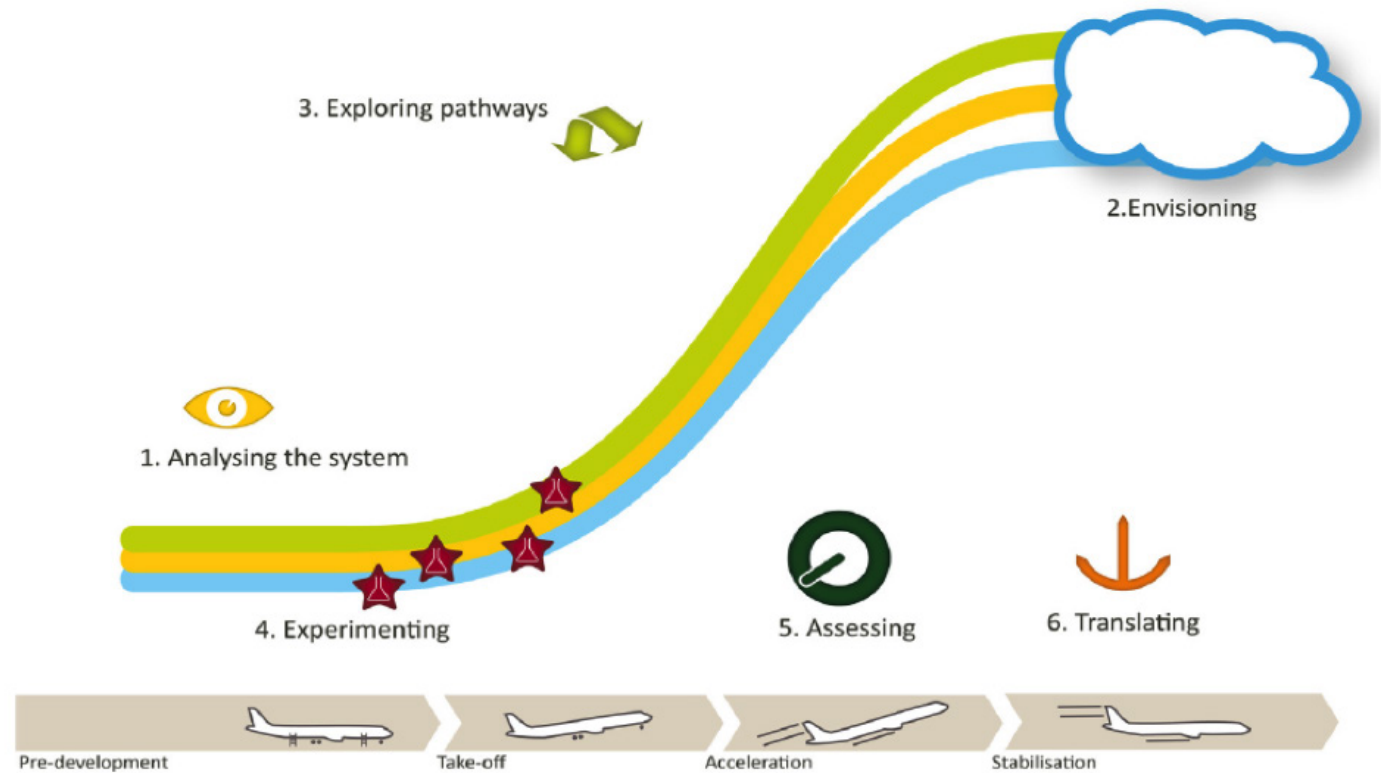

Figure 4 – Transition processes to sustainable development (Nevens et al. 2013)

Methodology

An 'Urban Transition Management Manual' was developed by the Dutch Research Institute For Transitions (DRIFT), which specialises in transition management (TM). The TM process is adapted for the urban context. The process includes the following forward-looking activities:

- Visioning to develop a common vision and shared language. This vision includes a storyline and images of the future and is based on collectively agreed sustainability principles (Frantzeskaki et al. 2011).

- Backcasting workshops to identify 'strategies that go beyond "business-as-usual" solutions and are not constrained by vested interests and stakes' (Frantzeskaki et al. 2011).

Initially the process has highly selective participation – within a small 'transition arena' comprised of so-called visionary 'frontrunners' – which is later expanded upon to involve more diverse actors.

Below are two representative visions and images from participating cities. Initiatives in Rotterdam, Netherlands are focused on densification strategies; among other issues, Aberdeen in Scotland is envisioning economic transitions away from oil and gas towards a diversified economy:

Figure 6 – Rotterdam vision, entitled: 'densification + greenification = sustainable city'

Figure 5 – Image from Aberdeen city vision (the participating city in Scotland)

SPREAD Sustainable Lifestyles 2050 Project (January 2011-December 2012)

Project overview

Purpose: The aim of the project was to engage societal stakeholders from business, research, policy and civil society in the development of a vision for sustainable lifestyles in 2050 and to produce a roadmap for strategic action for policy makers to enable sustainable lifestyles in Europe.

The objectives of the project were:

* to explore the conditions for, and complexities of, shifting current lifestyles by reviewing the existing knowledge base and learning from existing promising cases; and.

* to establish a communication platform for stakeholders to share and transfer knowledge on sustainable lifestyles in the fields of sustainable living, mobility and consumption, and on sustainable societies at national, EU and international levels.

The SPREAD project focused on four key lifestyle impact areas of: living (the built environment and homes), moving (individual mobility, transport); consuming (food, household and leisure consumer products), and health and society (health, wellbeing, ageing, and equity). The research had a dual focus on: 1) individual motivators, influencers and triggers; and 2) the systems, infrastructure boundaries and enabling environments that drive the way Europeans choose to live their lives.

Time horizon: 2050

Focal issue: The negative impacts of current consumption and production practices; how these lifestyles could be influenced, and the contexts and systems that influence lifestyle choices.

Theoretical frameworks

The project sought to quantify a 'sustainable lifestyle', which was defined as a material footprint of 8000 kg/annum, based on research by the Wuppertal Institute for Climate, Environment and Energy (Lettenmeier 2012). This figure also draws upon the 'planetary boundaries' framework which interprets earth system science to quantify plausible 'tipping points' (or thresholds) in the global earth system, which are presented as fixed environment boundaries on development (Rockström et al. 2009). 'Social boundaries' were identified focused on human development, based on research by UNDP and UN Population Division and minimum requirements for socially sustainable development. There is implication that multi-level perspective on system innovation, but this is not clear. Other frameworks are not specified.

Table 4: Environmental and social boundaries adopted in the project

Environmental boundaries

Earth-system process	Current value	Boundary value
Climate change Atmospheric carbon dioxide concentration (ppm by volume)	387	350
Biodiversity loss Extinction rate (number of species per million per year)	>100	10
Biochemical Anthropogenic nitrogen removed from the atmosphere (millions of tonnes per year)	121	35
Land use Land surface converted to cropland (percent)	11,7	15
Fresh water Global human consumption of water (km³/yr)	2600	4000
Ozone layer Stratospheric ozone concentration (Dobson units)	283	276

Social boundaries

Human development	Current Value	Goal 2050
Human Developed Index (measure of life expectancy, literacy, education and standards of living)	0,63	0,77
Years of education in less developed countries (average years)	6	8
Life expectancy (global average)	70	>75
GINI coefficient (Measure of the inequality: a value 0 expressing total equality and a value 1 maximal inequality.)	0,7	0,55
Global population (billion)	7	8,9

Methodology

Background research was carried out on critical lifestyle impacts and the barriers/drivers impeding and encouraging more sustainable lifestyles. The findings were then consolidated to create a shared vision for 2050, four scenarios to explore extreme prototypical futures supporting sustainable lifestyles, and pathways to overcome challenges and realise opportunities.

The following vision was co-created by consortium members and contributors to the social platform: 'In 2050 we want to be living healthy, happy and meaningful lives which are within the boundaries of our planet. Whether this life will be in dense communities or close to nature; with a strong emphasis on community or highly competitive structures; with technological solutions to reduce our resource consumption or social innovations to share and consume less...'

The creation of alternative sustainable lifestyle futures was completed in six phases:

- Defining the framework (based on two critical uncertainties) for the creation of the scenario quadrants, based on background research and findings of the SPREAD Delphi survey.

- Defining four prototypical scenarios based on the two critical uncertainties.

- Exploring pathways to sustainable living in each plausible scenarios using backcasting.

- Qualifying and quantifying the scenarios and pathways based on a second Delphi survey.

- Finalising the scenario stories and visualisations.

- Identification of additional drivers for each scenario (i.e. key gate keepers and triggers).

Post Car(d) Urbanism project (2012–)

Project overview

Purpose: 'Post-Car(d) Urbanism' is a project exploring the future of mobility and transport in Swedish cities. It is based at the Royal Institute of Technology in Stockholm and funded by the Swedish research council FORMAS, and is trialling online scenario planning systems.[9] The project is the first time large-scale 'crowd-sourcing' platforms have been used in Sweden to explore future policy issues.

The core study aims to:

- integrate approaches from strategic planning, urban design, simulation and creative arts;

- use creative arts to visualise future post-automobile environments for the general public, making 'post cards from the future' to encourage public discussion and debate;

- bridge gaps between the scientific fields of urban morphology, transport research, planning theory, urban economy and urban sociology;

- explore plausible pathways towards 'car-independence' and formulate policy and design objectives that will support proactive transitions towards a positive car-free future;

- add to the international body of research on sustainability and climate change and further develop ongoing research on urban sustainability and walkability.

Time horizon: Discussing factors and scenarios influencing automobile usage over next 50 years.

Focal issue(s): Urban mobility and sustainability

Theoretical framework

The project is using general qualitative scenario-building processes, quantitative urban modelling methods, and 'design fiction' methods; additional theoretical frameworks are not specified.

Methodology

The project leaders summarise their approach as follows. The project:

uses crowdsourcing, scenario planning, and urban modelling to visualize several possible outcomes for urban mobility. The scenarios generated from you and others on this website will be tested, refined and then integrated into a set of quantitative urban transport models for further testing. These will in turn be used to create artists' impressions of specific Swedish cities in each scenario. Finally, these 'postcards from the future' will be used to create a public dialogue about the most desirable futures for the country, and the policy options necessary to achieve them.

The project has four inter-related stages: scenario planning; land-use transport analysis via urban modelling; creative scenario communication; and translating outputs into recommendations. The scenario-planning component comprises social gaming approaches with crowd-sourcing to create collaborative scenarios for the future of Swedish cities (see http://www.postcardurbanism.net/).

9. The project description, online scenario planning system, and project blog can be found at: www.postcardurbanism.net

Futurescape City Tours (2012 – 2013)

Project overview

Purpose: Six different American cities are hosting an engagement process – called the 'Futurescape City Tours' (FCT) – that aim to build the capacity of 'participants to appreciate their role in the trade-offs, path dependencies, and choices which shape technologies and their urban landscape'.[10] During each 'city walking tour' the participants photograph places where they see the past persisting, signs of the present, and emerging futures, along with video and journaling activities. These impressions, particularly the images, are used as a means to stimulate dialogue in later sessions. The images also serve as the basis for a public exhibition to gain feedback from the wider community.

Time horizon: Not stated. In contrast to the earlier example projects, FCT considers how 'the past and the present are good indications of what tomorrow will bring'. The project consequently focuses more on sensing emerging technological changes within urban landscapes.

Focal issue: technology and the urban environment, with a focus on emerging nanotechnologies.[11]

Theoretical framework

The project is grounded in a critical Science and Technology Studies (STS) perspective, emphasising:

- citizen-led agendas: addressing power relations between citizens and scientific experts;

- material deliberation: using anthropological understandings of images as representations of culture, and theorisation of how photography can provide a voice to silenced groups;

- integration of science and technology stakeholder expertise: addressing representativeness, while also enabling stakeholders and relevant experts to deepen conversations;

- capacity-building: enabling citizens to better shape socio-technical change.

Methodology/activities

The methods are based on 'citizen-driven agendas, the importance of place and materiality, the relevance of multiple timescapes, and the use of photography as a tool for deliberation'. During FCT a citizen group meets for three sessions. All elements are determined by participants' interests (e.g. sites visited on the walking tour; and which stakeholders or experts participate in the dialogue). Figure 7 below shows an image from a Futurescape City Tours public exhibition.

Figure 7: Material presented at a Futurescape City Tours public exhibition[14]

10. The project is led by the Center for Nanotechnology in Society at Arizona State University; see: http://cns.asu.edu/fc
11. Also see the Nanotechnology in City Environments (NICE) database that they've developed: http://nice.asu.edu/home
12. Image from: http://www.flickr.com/photos/cns_asu/8281402051/

These five example projects are further outlined and compared in
Table 5 below:

Table 5: Summary of approaches used in each project – with respect to the identified key process considerations

Considerations	Retrofit 2050 project	Urban Transition Labs ('MUSIC' project)	SPREAD Sustainable Lifestyles 2050 project	Post-Car(d) Urbanism	Futurescape City Tours
'Guiding vision' OR adopt a pluralistic approach?	Envisages a range of possible urban transitions, because 'the future is uncertain and that sustainability is an inherently contested and irreducibly political concept' (Dixon et al. 2013). Aims to create a 'space of communication' - not a final vision/ immovable utopia. Makes explicit competing framings.	Co-creation of a shared vision in the 'transition arena': this core group is then expected to spread their vision through wider networks. The single vision is expected to play strong guiding and mobilising functions. Possible 'pathways' are then identified by backcasting.	A single vision was co-created by consortium members and contributors to social platform. Four scenarios were subsequently developed based on two critical uncertainties.	Single vision of the future (of 'car-independence', a 'positive car free future'); also exploring scenarios for the future of Swedish cities related to this vision.	Multiple impressions and fragments of visions are collected during the project. No attempt is made to form a consensus vision.
Recognises and/ or addresses expectation dynamics?	Argues there is a need to 'overcome the constraints of '"consensual" performative techniques', by using additional methods to identify possible disruptive innovations. Circulating views were fed via literature review into workshops.	Recognises that social and cognitive factors can often prevent creative envisioning; little more. Processes used: ensure 'genuine frontrunners' (i.e. visionaries) and diverse people are involved in visioning.	Unclear.	Unclear.	Aims to help enable the 'imaginative leaps' (their term) that are inherently involved and demanded when considering the future of a city.
The role of power and politics?	Aims to make explicit major societal choices but no discussion of politics and power shaping these choices, and the subsequent events.	Considers power dynamics and empowerment – aims to create a 'protected' niche. Argues more research is needed on political agency, and agency dynamics in urban transition processes.	This aspect is not addressed.	This aspect is not addressed.	Explicit focus on power relations (the unequal power dynamic between citizens and scientific experts). Aims to empower citizens.

Table 5 Continued: Summary of approaches used in each project – with respect to the identified key process considerations

What change model and who participates?	Framed as 'multi-sectoral, multi-level problems' that require new forms of cooperation across the usual institutional boundaries. No discussion of dilemmas (e.g. incumbents vs. challengers)	Multiple-level participation: each urban transition lab 'brings together innovative 'regime' actors and frontrunners from 'niche' contexts' (Nevens et al. 2013).	Create scenarios through a 'social platform', by setting up a people's forum and an online community, aiming to host an ongoing dialogue that is open to the public.	Participation in online scenario-building is open; participation in the subsequent project phases has not been described.	Participation of publics, experts and stakeholders – but adopts an explicit 'citizen-led' approach.
Degree of focus on normative or cultural change?	Changes in value and institutions considered in visioning process; no involvement of NGOs etc.	No substantive discussion. Just states that 'transition' also involves changes in culture.	High; the project aims to identify and experiment with alternative lifestyles.	Little, but the project does aim to generate dialogue about desirable futures.	Normative focus on urban sustainability and deliberative democracy.

These projects are representative of the increasing focus on cities and the use of future-oriented techniques to catalyse change. However, there are significant differences too. For example, Retrofit 2050 emphasises the contested nature of sustainability and its multiple subjective meanings in urban contexts – consequently exploring alternative futures – whereas the Urban Transition Labs develop a core shared vision within the 'Lab' itself, which is then promoted to others.

Researchers from DRIFT have noted the difficulty of establishing a vivid, shared vision and tendencies for dialogue to focus on 'topical' issues, i.e. current issues, rather than futures-oriented perspectives (Nevens & Roorda 2012). Both aspects speak to key challenges often faced in such processes.

Less attention has been placed on other key challenges. In particular, the role of politics and power, and change models and participation dimensions are touched on but rarely explicitly addressed.

5. Discussion and implications for future directions of the Vision and Pathways project

This 'foreground' paper has presented a scan of recent trends in futures inquiry and advances in underpinning theory, and outlined five similar projects occurring in Europe and the United States. Some key findings can be specified regarding the use of visioning and backcasting processes for creating low-carbon futures and enabling resilient urban futures. These are addressed in turn below.

The findings of this scan support many as the methodological choices in the Visions and Pathways 2040 project. In particular, reviewed trends and advances in theory have re-emphasised:

- the potential to draw on and shape the presence of future expectations and visions in relevant networks (e.g. in built environment and other professional networks);

- the importance of designing processes for mutual learning between stakeholders;

- the added value of combining multiple methods in a broader 'foresight process' (e.g. see 'strategic foresight' frameworks: Hines & Bishop 2006; Voros 2003);

- the need for targeted interventions that help to enable 'time shifting' (Ryan 2013; 2008), i.e. moving thinking beyond the usual short-term future focus or the present time;

- issues associated with technocratic efforts to define a final 'blueprint' for the future, such as regarding rigidity and control in the context of rapid change and uncertainty.

Additionally, the review clearly demonstrates that visioning and scenario analysis cannot be reduced to developing and applying technical tools (e.g. precinct modelling software); they are necessarily social processes. These social processes unfold, both within a visioning or scenario process and when the outputs are interpreted and used by others (Ramírez & Selin 2014). In this respect SoE theory is particularly important. It points out that these exercises are embedded in a pre-existing 'sea of expectations' (van Lente 2012), which shapes these exercises and how their outputs are received, and influences their efficacy. This has implications for efforts in weaken carbon 'lock-in' by disrupting business-as-usual expectations via visioning and scenario exercises.

This paper also points to opportunities for using scenario and other techniques in additional ways in urban and organisational planning to help enable resilient urban futures. These include:

- developing or adapting existing future context scenarios (e.g. national scenarios regarding the future of Australia) which are used to help build 'vision resilience'. The scenarios could be used in workshops to clarify the core of a vision (e.g. the central uncompromisable parts) and to explore potential necessary adaptations for different plausible future contexts;

- anticipating potential system shocks – e.g. via 'wildcard' identification and assessments – in order to broaden transition pathways so that they also build system resilience;

- the use of structured scenario exercises to build 'adaptive capacity': these exercises can help to identify resilience-building policies and develop institutional flexibility.

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