The new normative: synergistic scenario planning for carbon-neutral cities and regions

DOI:
10.1080/00343404.2020.1813881

Document Version
Accepted author manuscript

Link to publication record in Manchester Research Explorer

Citation for published version (APA):
https://doi.org/10.1080/00343404.2020.1813881

Published in:
Regional Studies

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# The New Normative: Synergistic Scenario Planning for Carbon-Neutral Cities and Regions

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<th>Regional Studies</th>
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<td>Manuscript Type:</td>
<td>Special Issue Paper</td>
</tr>
<tr>
<td>JEL codes:</td>
<td>Z18 - Public Policy &lt; Y1 - Data: Tables and Charts &lt; Y - Miscellaneous Categories, R5 - Regional Government Analysis &lt; R - Urban, Rural, Regional, Real Estate, and Transportation Economics, Q54 - Climate; Natural Disasters and Their Management; Global Warming &lt; Q5 - Environmental Economics &lt; Q - Agricultural and Natural Resource Economics; Environmental and Ecological Economics, Q01 - Sustainable Development &lt; Q0 - General &lt; Q - Agricultural and Natural Resource Economics; Environmental and Ecological Economics</td>
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<td>Keywords:</td>
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### Synergistic scenario planning: a combined framework

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<th>TARGETS / BOUNDARY OBJECTS</th>
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<th>MODE-II EVOLUTIONARY (emergent complexity)</th>
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### SCENARIO PLANNING PROCESSES

| Systems (relational thinking) | ‘Known knowns’: material functional systems | ‘Unknown knowns’: incentives, enterprise | ‘Unknown unknowns’ with cognitive complexity |
| Scenarios (divergent thinking) | Tangible trends, projections, forecasts | Evolutionary trends / scenarios | Co-evolutionary transformation |
| Synergies (emergent thinking) | Functional problem solving | Innovation & problem insight | Societal co-creation & co-design |
| Strategies (convergent thinking) | Specific actions / responses | Entrepreneurial strategy & road-mapping | Transformation via collective intelligence |
### Greater Manchester case: ‘synergistic scenario planning’ analysis

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<tr>
<td><strong>Low Carbon targets:</strong> annual emissions / multi-year budget / base year change</td>
<td>e.g. CO2 direct emissions in tonnes</td>
<td>CO2 as indicator of change &amp; development</td>
<td>Carbon neutral as civic responsibility, ethical stewardship</td>
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<td><strong>Low carbon economy:</strong> ‘green growth’ / ‘circular economy’ / eco-business</td>
<td>CO2 / GVA indicators, total or sectoral</td>
<td>CO2 reduction as market opportunities, supply chain innovations</td>
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<td><strong>Low carbon society:</strong> ‘sustainable consumption’ / ‘clean inclusive growth’</td>
<td>CO2 / person, household,</td>
<td>CO2 / pp for social incentives, peer pressure, performance benchmarks</td>
<td>Carbon neutral as social &amp; civic transformation</td>
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<tr>
<td><strong>Low carbon city:</strong> livable cities / accessible neighborhoods</td>
<td>CO2 / community, town or other settlement</td>
<td>CO2 / community for benchmarks, peer learning etc</td>
<td>Carbon neutral as livable &amp; healthy urban future</td>
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### PROCESSES

| Systems | GM data: 2.75 million persons: £56 bn GVA: 10.3 mt CO2 per year (2019) | ‘CO2 economy’ / energy efficiency & low carbon transition in firms, sectors, markets | Innovation on cognitive side, e.g. Carbon Literacy, pledges, extended CSR |
| Scenarios | ‘SCATTER’ model scenarios: BAU / policy push / 1.5° outcome | Some economic modelling, but lacking sector level scenarios. | Transformation scenarios are implicit in political discourses |
| Synergies | Current opportunities in ‘devolution’ | Incentives in efficiency, market opportunity, business model innovation | Alternative ventures, e.g. ‘Transition Towns’, ‘Incredible Edible’, ‘Beyond Carbon’ etc. |
| Strategies | 5-year strategies, technically correct but vulnerable to ‘unforeseens’ | Sector strategies dependent on firm / stakeholder / national government support | Emerging models for ‘accelerator’ or ‘Collaboratorium’ (work in progress) |
The New Normative: Synergistic Scenario Planning for Carbon-Neutral Cities and Regions

ABSTRACT

Carbon-neutral targets are a ‘new normative’ for cities and regions around the world. Such targets call for rapid system transformations, far beyond the previous scope of urban-regional planning. In response we propose a framework of theory and practice, in three parts: ‘trading zone’ concepts for collaborative planning; ‘scenario backcasting’ for longer horizons; and ‘synergistic thinking’ for systems transformation. We demonstrate this with the case study of Greater Manchester and its many phases of carbon-neutral policy. The results suggest the ‘new normative’ for cities and regions, can be greatly facilitated by ‘synergistic scenario planning’, in theory and practice.

KEYWORDS

Backcasting; trading zone; boundary object; net-zero; carbon-neutral; collective intelligence; Greater Manchester

Note: all tables and figures are sourced by the authors.
1. INTRODUCTION

“Transformative changes in transportation networks, energy systems, commercial centers, neighborhoods and even governance practices are essential to meeting the challenge of cutting greenhouse gas emissions at least 80% by 2050” (Carbon Neutral Cities Alliance 2016). The imperative of cutting carbon emissions to ‘net-zero’ or ‘neutrality’ in just one generation, calls for a rapid expansion in the scope of urban and regional planning. System level socio-technical transformations are needed in the energy, transport, industry and buildings sectors, which go far beyond the normal spatial or economic planning remit. The transformation imperative constitutes the ‘new normative’ for urban-regional planning – but as yet the implications are unclear and contested.

The carbon neutral goal (also termed ‘net-zero’) is defined by the Carbon Neutral Cities Alliance (hereafter ‘CNCA’), as a city or region where the net greenhouse gas emissions ‘associated’ with that territory, are zero or less (Praskin and Cleveland 2019). In technical terms this can be achieved, either by changing the energy mix (supply or demand) within the boundary, generating excess renewable energy (‘energy positive’); or by purchase or management of carbon offsets elsewhere. The concept links to the Greenhouse Gas Reporting Protocol (2016), which includes Scope 1 emissions (within the boundary), Scope 2 emissions from consumption of electricity generated outside the boundary, and Scope 3 emissions ‘embedded’ in the import / export balance of goods and services. In engineering terms the way forward seems quite feasible: decarbonize fuel sources and power generation on the supply side, increase efficiency on the demand side, while managing land-use, waste and other greenhouse gas sources. But in reality each system and subsystem is complex and conflicted, a multi-level array of social, technical, economic and political challenges and uncertainties. The different carbon neutrality options and emissions ‘scopes’, with typical agendas for implications for urban-regional planning stakeholders, are summed up in Table 1.

<<INSERT: Table 1>>

The implication is that the targets of the CNCA, C40, Covenant of Mayors and similar groups may be aspirational but problematic, lacking clear definitions and responsibilities (Bansard et al.2017). Apparently simple de-carbonization programs have to engage with large complex infrastructures, entangled with macro-economic forces, real estate markets, sector supply chains, professional
institutions, and lifestyle patterns. Meanwhile the ‘ghost at the table’, the ‘Scope 3’ indirect emissions from international trade, is a reality check on the direct carbon neutrality. For instance, the UK exported most of its former heavy industry, so its Scope 1-2 emissions show rapid improvement, but while its Scope 3 account shows rapid growth in imports with higher carbon intensities (Defra 2019).

Moreover, it seems that policy is often ambiguous or confused, between a linear approach to ‘problem solving’, and a more complex socio-technical systems transformation. At the global level, the targets for emissions projections and budgets, call for extremely challenging rates of change, estimated by some at 15% emissions reductions per year (Anderson 2015). At the local level, many cities around the UK and EU are (as of 2019) declaring ‘climate emergencies’, where aspirations are strong, but local powers and resources are weak. Most carbon studies focus on the technical aspects of energy and carbon, and tend to assume that policy levers can be pulled, or that coordination can be achieved. Some look more systematically at the policy challenge, for instance the Association for Conservation of Energy (Guertler and Rosenow 2016), but, as yet, few address the scale of transformation needed.

DEBATES IN THE FIELD

Current theoretical perspectives help to situate the ‘new normative’ within wider debates on environmental governance, urban-regional innovation, and system transitions. Carbon-neutral policies can be viewed from an institutional critique (Castan Broto & Bulkeley 2013), along with the nuances of ‘softer’ spaces of ambiguity and dissonance (Allmendinger & Haughton 2010; Bäcklund et al. 2018; Mäntysalo et al. 2015). Exploring the cognitive dynamics of urban-regional policy and planning, are the concepts of institutional ambiguity (Hajer 2009), organizational change and learning (Argyris and Schön 1996), and strategic planning as extended co-production (Albrechts 2012). Strategic or higher order learning prepares (or even emancipates) stakeholders for future-oriented action (Neuvonen & Ache 2017; Quist et al. 2011) and mobilization around strategic frames (Healey 2009).

Meanwhile, concepts of complexity, emergence and collective learning are taking shape in urban and regional analysis (Komninos 2015: Uyarra & Flanagan 2010). From the evolutionary approach to path-dependencies and spillovers, co-evolutionary thinking now explores ‘path-inter-dependencies’ and ‘transversalities’ (Cooke, 2012). Urban-regional innovation policy can then look beyond top-down programs towards ‘platforms for industrial interaction’, across the ecosystem of firms, agencies, universities, civil society and public bodies (Asheim 2018). The ‘experimental city’ of living
labs and embedded innovation (Evans et al. 2015), also highlights the nature of transitions in hyper complex systems (Hodson et al. 2017).

Parallel thinking also comes up for energy and carbon issues, contrasting a linear problem-solving approach, to evolutionary innovation, to a conscious systems transformation (Grubb et al. 2015). However even simple carbon targets may conceal a jungle of organizational conflicts (Lippert 2012): and there may be a widening gap between the nuances of urban-regional planning theory (Watson 2008; Alexander 2020), and the urgency of the climate crisis (cf. Phdungsilp 2011). The rapid emergence of Extinction Rebellion in 2019 is a stark reminder of the potential tipping points in global systems, and catastrophic implications for many cities and regions (Fischer et al. 2018).

AIMS, SCOPE AND METHODS

In that context, this paper aims firstly to contribute on the theoretical-methodological side, with a framework which can help both practitioners and academics to respond to the ‘new normative’. Secondly, the paper aims to illustrate this approach with a single case study, which demonstrates in some depth the application on the ground of such ideas. Thus, our theoretical-methodological contribution aims to explore new conflicts and possible opportunities, spaces between the ‘new normative’ and the reality of urban-regional policy. Our practical contribution aims to help cities and regions to achieve carbon neutral targets, by means of a rational and transparent approach to system transformation: Synergistic Scenario Planning (hereafter ‘SSP’).

The case material has been gathered through a long series of collaborative research-policy projects in and around the case (see policy references in the next section). Documentary evidence from stakeholder dialogue and workshops was used for methodological development, in three main phases. Firstly, with the Sustainable City Region program (1993-2000) developed an urban metabolism / integrated policy model was developed (Ravetz 2000). More detailed regional resource modelling and supply / value chain analysis then followed (Ravetz 2006 & 2010). The third phase (2010-2020) explored the cognitive side of policy learning and innovation, socio-technical transition, urban-regional foresight and collective intelligence (Ravetz and Miles 2016; Ravetz 2020). The components of the SSP ‘synergistic scenario planning’ framework have been developed over some time by each co-author, and the combination is presented here for the first time.

With that in mind, the paper is set out in five-six parts. Following this introduction is a brief review of ‘debates and tensions’ in the literature around the New Normative challenge. A third section is a
reality check, with, we outline the case study of Greater Manchester (GM) and its many phases of climate / carbon policy. The central section then sets out the SSPSection three proposes an analytical framework in three main parts: ‘longer’ horizons of scenario planning, ‘deeper / wider’ trading zone concepts, and ‘further’ systems transformation. The fifth section appliesThen we apply the framework back to the case study, for insight on both problems to date, and on opportunities looking forward. Finally, we highlight some implications for theory and practice on urban-regional futures, to help on the journey towards the ‘new normative’.

2. CARBON-NEUTRAL PLANNING – A LANDSCAPE OF TENSIONS

Here we sketch some topical debates and tensions in the field, as context to the SSP framework detailed in the next section. In summary, the SSP framework contains three key dimensions: futurity by use of scenario planning, alignment of wider communities of interest, and transformation or structural socio-technical change. This conceptual 3D space then locates around it, three key debates and conceptual tensions, as pictured in Figure 1: ‘institutional tension’, ‘experimental tension’, and ‘systemic tension’.

<<Insert Figure 1>>

INSTITUTIONAL TENSION? TERRITORIAL PLANNING VERSUS SYSTEMIC

The perennial tension of spatial / territorial planning versus non-territorial political economy, comes to a carbon neutral head – should the unit of analysis and governance be cities and regions, or global supply chains and corporations? Many critique idealized models of strategic planning that bypass institutional / political realities; and this is highlighted by carbon neutral goals, which shift from rigid statutory frameworks with outdated zoning tools, towards networked ‘soft’ space governance (Steele & Ruming 2012; van den Broeck 2013; Mäntysalo et al. 2019a; Searle 2017.)

As Newman has noted, existing forms of strategic planning are “not just a convenient contrast to the ideal form... but the origin and residue of previous institutional designs that generate constraints and forms of path dependence” (Newman 2008, p. 1374). Where carbon neutral policy calls for both – a regulatory and legalistic spatial planning, alongside an entrepreneurial approach to supply chains and technology – the coexistence of such parallel systems raises many ambiguities (Castan Broto & Bulkeley 2013). The barriers to institutional change are then a major concern, even more so with
headline carbon targets which force the issue, and highlight gaps and mis-matches all around
(Granqvist & Mäntysalo 2020). While ‘soft space’ approaches raise both opportunities and
ambiguities (Allmendinger & Haughton 2010; Bäcklund et al. 2018; Mäntysalo et al. 2015), new
concepts of collaborative ‘co-governance’ with hybrid organizations may be more relevant to the

EXPERIMENTAL TENSION? BETWEEN INNOVATION AND VESTED INTERESTS

A second kind of tension arises between the goals of transition / transformation, and the realities of
incumbent institutions. Luque-Ayala et al (2018) suggest that traditional forms of urban-regional
policy are not (yet) capable of the structural changes implied by carbon neutrality. With the focus
on networked infrastructure (energy, transport, construction supply chains etc), transitions in large
and complex systems call for new forms of governance, with new forms of engagement of multiple
stakeholders, through ‘triple helix’ or similar models of engagement (Bulkeley et al 2013: Etzkowitz
and Leydesdorff 2000).

This opens up a wider agenda, one of complexity, emergence and collective learning in urban and
regional analysis (Komninos 2015: Uyarra & Flanagan 2010). Looking beyond evolutionary thinking
on path-dependencies and spillovers, co-evolutionary thinking now explores ‘path-inter-
dependencies’ and ‘transversalities’ (Cooke 2012), with ‘platforms for industrial interaction’, bridging
across public-private-civic-academic ecosystems (Asheim 2018). As for starting points, one is urban
experimentation, as an enabler of institutional collaborations across the public-private-civic divide,
for the many economic, political and social changes involved (Luque-Ayala et al 2018). The
‘experimental city’ of small-scale Living Labs and embedded innovations, also highlights the
granularity of change and transition in large complex systems (Evans et al.2015: Hodson et al.2017).
It also renews interest in learning for organizational change, now applied to strategic planning as ‘
extended co-production’ (Argyris and Schön 1996: Albrechts 2012). Strategic or higher order
learning can prepare and empower stakeholders for future-oriented action (Neuvenen & Ache 2017;
Quist et al.2011), and mobilization around strategic frames (Healey 2009). However on the ground
many tensions arise, where such experimental / learning zones are seen as risky or vulnerable to
special interests, and raising structural questions on the ‘transformative capacity’ of cities and
regions (Wolfram 2016).

SYSTEMIC TENSION: TRANSITION PLANNING VERSUS CRISIS MANAGEMENT?
A third tension is on the mismatch between longer-term transition planning, and short-term crisis management (in this case, 'climate emergency'). Transition theory and practice has also spawned a new approach to 'system innovation', not only in niche technologies or business models, but in the wider system 'architecture' (OECD, 2015; Schot and Steinmueller, 2018). In reality this is the beginning of a dialogue, which for carbon neutral policy includes many stakeholders: finance, infrastructure, regulators, construction, labour, households, digital providers and public services, to name a few (Ravetz 2020; Weber and Truffer 2017; Borrás and Edler, 2020). And while such engagement can look good on paper, the reality is often one of disconnected policy, market hurdles and split incentives, such as in housing retrofit (next section) (Webber et al 2015; Guertler et al 2016). A structural response would aim to enhance the 'collective anticipatory intelligence' via urban-regional foresight, but this faces a typical reality of under-resourced and dis-empowered local government (Ravetz and Miles 2016).

Parallel thinking also comes up for the energy sector itself, in a scheme similar to SSP, which contrasts a linear problem-solving approach, to evolutionary innovation, to strategic systems transformation (Grubb et al.2015). But again, even the most simple carbon targets conceal a jungle of organizational conflicts (Lippert 2012): again the gap grows between the nuances of planning theory (Watson 2008; Alexander 2020), and the urgency of the climate crisis (Cf. Phdungsilp 2011). The rapid emergence of Extinction Rebellion in 2019 is a stark reminder of the possible tipping points in global systems, with unquantifiable risks of catastrophic impacts on many cities and regions (Fischer et al. 2018).

Overall, a picture emerges of tensions in theory and in practice; between different transformation agendas, different future horizons, and different policy frames and institutions. Such tensions on the ground are demonstrated by the 'Long road to low-carbon’ case study which follows.

### 3. A LONG ROAD TO LOW-CARBON: THE CASE OF GREATER MANCHESTER

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Greater Manchester (hereafter, ‘GM’) is the UK’s second city-region after London, a hub of investment and innovation, and a global destination for young people, culture and sport. It is also a sink of unemployment and deprivation, poor housing and low productivity, costing around £5 billion per year in net public expenditure. GM also considers itself a showcase for urban renewal and regeneration, devolution and public-private partnerships, and its climate / carbon targets are framed in that context. Several phases of strategic spatial planning have emerged in GM, in parallel with climate / carbon policy (Hodson et al. 2018). This shows scenario planning in both ‘explicit’ forms (dedicated scenario modelling and deliberation on alternative futures): and more typically, ‘implicit’ forms where scenario thinking is part of a wider policy process.

CARBON AS AN ENVIRONMENTAL AGENDA

Climate change and carbon awareness in GM emerged in 1992, and practical action took shape following the 1997 Kyoto protocols, with evidence from the TCPA Sustainable City-Region project (Ravetz 2000). The UK then took the lead as the first nation with a mandatory carbon budget, in the Climate Change Act 2008 and the Low Carbon Transition Plan (DECC, 2009). In parallel, the (then) Regional Development Agencies each produced a climate strategy to meet the new national target for 80% carbon reductions, with support from the ‘Regional Economy-Environment Input-Output’ scenario model (Ravetz 2010). Meanwhile the Manchester Independent Economic Review set up a city-region version of the global Stern Report, the GM ‘Mini-Stern’ (McKillop et al. 2007). With scenario modelling for the urban-regional economy and energy system, this report provided a long-lasting ‘boundary object’ (as in the next section), or a common reference point between different sectors.

However, progress was not straightforward: in 2008 a public referendum was held on a proposed Congestion Charge and public transport plan for the whole inner urban area, which aimed to contribute to the carbon targets (Sherriff 2010). The scenario modelling showed a clear carbon benefit of 10-15 percent of all local transport emissions. However, the proposals were framed by the opposition as an attack on civil liberties and low-income motorists, and after a heated campaign, the proposals were rejected by a large majority. With growing uncertainty on the GM low carbon strategy in the face of public and media scepticism, the 2008 financial crisis coincided, followed in 2010 by a new coalition government, committed to cutting ‘red-tape’ and ‘rolling back’ the public sector. The general effect was to keep carbon targets on the policy agenda, but to sideline most of the any practical actions, so that for instance, both regional innovation clusters and the national Code for Sustainable Homes were each abolished, with little to replace them.
Meanwhile, the newly established GM Combined Authority (GMCA) set up an Environment Commission, later renamed the GM Low Carbon Hub, with a multi-sector partnership (www.ontheplatform.org.uk). The GM Climate Change Strategy (GMCA 2012) then aimed at a short term carbon reduction of 48% (1990-2020). With a range of scenarios, the Strategy acknowledged that the ‘easy wins’ since 1990 had been made already, including the national shift from coal to gas for power generation, improvements in vehicle technology, and export of heavy industry to the developing world.

CARBON AS AN ECONOMIC AGENDA

Meanwhile, the moves towards city-region devolution were gathering pace. Regional Development Agencies were replaced by a patchwork of Local Enterprise Partnerships: the ‘Northern Powerhouse’ was in many ways a re-branded inter-regional strategy, and critiqued by some as a ‘Northern Poorhouse’ (Moran 2016). Shortly after the national experiment in devolution was set up in GM in 2014, known as ‘Devo-Manc’, with enhanced powers including housing, transport, skills and infrastructure (Haughton et al. 2016). In parallel, the GM Spatial Framework was launched in 2016, with three scenarios / options for growth, from 152000 to 336000 new dwellings over 20 years; in parallel was a modest target of 60% carbon reduction (1990-2035), but with few specific actions (Deas 2014).

One headline policy was the national Green Deal, promoted as the ‘world leader’ for energy retrofit in housing, but on the ground a near total failure, GM being the only UK city which enrolled more than a few households (Webber et al. 2018). Currently the UK lacks any programs beyond the most basic (at the time of writing), for energy efficiency in housing or commercial buildings, or the fuel poverty which still afflicts 15% of GM households.

As for ‘explicit’ scenario planning and foresight, various methods were tried with mixed results. An interactive ‘sustainable eco-region’ model was tested with stakeholders (Ravetz 2010). The DECC ‘Pathways’ program put up an interactive online energy model for users to explore, with stakeholder workshops to debate the settings and implications (http://2050-calculator-tool.decc.gov.uk/#/guide). Another strand came via the UK Foresight on Future of Cities; in GM this used advanced foresight methods (including a forerunner of ‘synergistic scenario planning’), to inform energy, transport and housing strategies; but at the time it seemed that exploration of the ‘future’ was over-shadowed by the ‘Devo-Manc’ agenda of the ‘present’ (Ravetz & Miles 2016).

CARBON AS ‘CLIMATE EMERGENCY’

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Against a turbulent context, the incoming GM Mayor set up a Green Summit 2018 which put new carbon targets at the centre of a new five-year Environment Plan (GMCA 2019). The calculations were based on the energy /emissions model SCATTER (‘Setting City and Area Targets and Trajectories for Emission Reduction’), with detailed energy / carbon scenarios and priorities for action, backed up by sectoral studies such as ‘retrofit regeneration’ (UKGBC, 2017). The key graph at the top left (a) of Figure 2 shows that carbon neutrality is possible under Scenario 4, but this is far more ambitious than current UK targets, being “on the boundaries of the application of current technologies ... with unprecedented transformational change and extraordinary national financial investment” (Kuriakose et al.2018).

The carbon budgeting method translates global commitments and national multi-year budgets, into tangible goals for the city-region (Anderson & Bows 2011). The recommendations are for GM to make its ‘fair’ contribution, with immediate and drastic action for emissions reduction at 15% per year (and for aviation, to stabilize emissions by 2030 and then reduce to zero by 2075). However, the detailed action plans show many leaps of optimism, for instance a proposed ‘retrofit accelerator’ innovation hub, or ‘national fiscal policies to be identified’. There is an over-arching sense of near-possible aspiration, which fits with the GM self-image of fearless bold innovation and creative action: the technical carbon targets are pieces in a larger game or discourse, or as we explore below, boundary objects in a wider ‘trading zone’, where different actors can exchange knowledge, ideas and actions.

3. 4 A synergistic scenario planning FRAMEWORK for THE “NEW NORMATIVE”

The evolution of the GM climate / carbon strategies show how the transformations of buildings, transport, industry, land-use, energy and waste systems cross between sectors, challenge policy structures and change the power relations between stakeholders. It seems evident that new theoretical-methodological frameworks and practical tools are needed, (a) to understand the implications of the ‘new normative’ transformations, and (b) to apply this understanding in practice.

The analytical framework we propose addresses three key challenges: how to link future goals with present day actions, how to bring stakeholders into alignment, and how to look beyond problem-fixing towards system transformation. The first is about the ‘longer’ horizons of scenario planning which we link particularly to the backcasting approach. The second concerns the ‘deeper / wider’ inter-connections between knowledge and value between different groups, and the alignment or coordination between them, drawing on the insights of boundary objects and trading zones. The
third challenge concerns the ‘further’ agenda of system transformation, which we tackle with the synergistic approach. Interestingly, a current handbook on carbon neutral cities follows quite similar principles: i.e. innovation culture, ecological ‘abundance’, social ‘sharing’, and future-oriented adaptive governance (Praskin and Cleveland 2019). In this section, we first introduce these three components, and then combine them into an integrated framework, with visual mapping methods shown in Figure 24, and analytical fields in Table 2.

**Scenario planning and backcasting**

The simplicity of carbon targets and the possible complexity of responses, suggests the use of ‘scenario planning with backcasting’. Such methods emerged in the 1970s for sustainability transitions such as food, energy, water and climate change (Quist 2007). Backcasting scenarios are formed by defining normative criteria for desirable futures (e.g. sustainable level of carbon emissions), and then building a feasible, rational pathway towards them (Börjeson et al.2006). In other words, backcasting (a) assumes a normative frame to the future, in addition to the descriptive, and (b) explores the human intentions and collective goal-setting to achieve the goals (Dreborg 1996).

Carbon neutrality targets are an interesting case for scenario planning: the more ambitious the target, the larger the ‘aspiration-reality gap’ that can undermine their credibility as practical policy tools. In this context the overall purpose of normative backcasting scenarios is to expand the scope of future options, and thus find ways around gaps and barriers to systems change (Höjer & Mattson 2000; Börjeson et al.2006; Zegras & Rayle 2012).

Scenario planning in practice often utilizes the medium of narratives or stories (see Mäntysalo & Grišakov 2017), which can be effective ways of sharing ‘rich’ information in a simplified format. Hence storytelling has trading zone characteristics (Harris 2016; Mäntysalo et al. 2019b). In scenario work, it may provide a narrative thread for interconnecting the boundary objects related to the carbon target. Some examples from GM (next section) have resonance as stories, even where technical evidence may be lacking, for instance ‘Transition Towns’ or ‘Incredible Edible’, (Figure 32 centre right d), using an ‘implicit’ scenario approach, which describes positive visions in contrast to ‘business as usual’ dystopias.

Backcasting scenario methods have been applied in urban-regional planning in various ways, from generalized ‘visioning’ to specific policy development (e.g. Phdungsilp 2011; Viguié et al.2014). Most
urban-regional plans are developed with a narrow range of demographic, traffic and economic forecasts and scenarios based on technical modelling (Chakraborty et al. 2011; Myers & Kitsuse 2000), leaving the transformative agenda to fuzzy aspirations such as ‘sustainable’, ‘smart’, or ‘livable’. Some cities and regions have followed the integrated foresight approach, where scenario studies are integrated to capacity building and road-mapping / strategy development (Ravetz and Miles 2016; Phaal et al. 2007). Figure 24 (a) shows a functional-technical version of back-casting, while on the top right (b) there is a synergistic version with a wider and deeper scope.

Boundary objects and trading zones

The concept of ‘boundary object’ was coined by Star and Griesemer (1989), to explain the boundary-crossing capacities of coordinated action in local contexts, involving multiple actors from different “social worlds”. A simple carbon target can be considered a boundary object of a sort, but one with weak connections to the agencies and interests of its stakeholders; whereas an elaborated carbon strategy, which connects visions to actions, could be much stronger (e.g. carbon policy with specifics on urban greenspace and public transport). This suggests the role of multiple interconnected boundary objects, in a cognitive chain where the carbon object is connected to other more tangible or ‘material’ objects, for which the stakeholders may be aligned and mobilized.

Such chains may then grow into locally or regionally grounded trading zones between many stakeholders, in which boundary objects evolve and emerge (Galison 1997; 2010). The concept of ‘trading zone’ refers to hybrid platforms where information and services are “traded” between different actors, with different problem framings or value systems, but where there is scope for alignment, by trading in boundary objects enabled by the thinness of interpretation rather than the thickness of consensus” (Galison, 2010, p. 36). Boundary objects and trading zones, and their implications for social learning and policy innovation have also been examined in the planning context (e.g. Fuller 2006; Balducci & Mäntysalo 2013; Mäntysalo & Jarenko 2014), including recent studies on strategic spatial planning (Balducci 2017; Mäntysalo et al. 2019a; 2019b). Figure 24 centre left (c) shows a typical ‘nexus’ of climate policy syndromes, gaps, barriers or conflicts between the values and objectives of different domains. Meanwhile at centre right (d) are some typical synergies, agendas, narratives or discourses, linking between multiple domains of value and rationality.
**Synergistic thinking, methods and tools**

'Synergistic' methods and tools then bring together the 'longer' scenario perspective and the 'deeper / wider' community of trading zones and value domains, to look 'further', beyond functional problem fixing towards system transformation (Ravetz 2015 and 2020). With a combination of visual thinking (Figure 24) and analytic matrices (Table 2), the method helps to map complex problems and explore forward pathways.

A typical ‘functional’ scenario planning process is shown on the upper left (a) of Figure 24: the carbon scenario modelling outputs show a range of options from ‘business as usual’ to ‘aspirational’. Intermediate options can be debated as a balance of risk, innovation, policy effort and financial cost. For example the IPCC reports and UNFCC protocols provide the aspiration of a “1.5 degree world”, with a clear target for a “2 degree world”, which contrasts to current trend projections for a “3-4 degree world” (Tyndall Centre 2018).

A more realistic picture shows on the upper right (b) of Figure 24: here the baseline axis includes for complex realities, and future scenarios are more about system-wide transformation, involving many stakeholders with many domains of value, summed up with the flexible menu known as ‘STEEPC’ (social, technological, economic, ecological, political, cultural) (Loveridge 2008). As in the centre right (d), for system transformation the many actors will need to coordinate and collaborate, via supply chains, markets, finance, regulations, skills, procurements and so on, within and between the various trading zones. In each there is a process of collaborative value chain development, which rests on collective (‘co-’) learning and thinking, co-creation or co-production; i.e. the components of an overall collective intelligence for carbon policy, or a ‘collective carbon intelligence’. Such intelligence can then work in different ‘modes’ of systems complexity (Ravetz 2015 & 2020):

- **‘Mode-I’** or ‘linear’ complexity: functional energy / carbon systems, which can be framed as bounded problem-solving with ‘known knowns’.
- **‘Mode-II’** or ‘evolutionary’ complexity, for adaptive / optimizing energy / carbon markets or enterprises, framed as partially bounded problems of innovation or competition (Modes-I and II appear are shown together on the left sides of Figures 24 and 32).
- **‘Mode-III’** or ‘co-evolutionary’ energy / carbon systems (shown on the right of Figures 24 and 32): focused framed as collective on cognitive processes of learning, thinking, co-creating and co-production, also framed as unbounded ‘further’ system transformations.

Similar frameworks for co-evolutionary systems have emerged in various fields, such as energy / climate economics (Grubb et al.2015), organizational learning (Argyris and Schón 1996), and the
widely shared aspiration for ‘new forms of government which are adaptive, responsive, participative and deliberative’ (Revi et al. 2014).

By comparing the concept mappings for mapping of transformations from Mode-I/II to Mode-II and Mode-III, we can then explore the opportunities in the trading zones behind the single-issue carbon targets, for both value systems and for real stakeholders. On the lower left (e) of Figure 21, we see a typical set of stakeholders (‘actors’) in the energy / carbon system, with typical syndromes, gaps, barriers, split incentives, moral hazards or ‘lost in translation’, where generally the ‘new normative’ targets are difficult or impossible to achieve.

A positive alternative then emerges on the lower right (f) of Figure 21, with many potential synergies and value-chain opportunities in various trading zones. For example, a low carbon supply-chain depends on synergy between finance, designers, builders, citizens and municipalities: or a low carbon finance model can work on the synergies between eco-stewardship, public procurement and green municipal bonds. Here the extended trading zones in the centre right (d) enable stakeholders to make shared commitments or investments (economic, political, technological), for collective risks and returns. Likewise, the concept of boundary object helps to realize the potential in the trading zones with practical applications of the carbon targets: so that ‘carbon per unit of GVA’ is an environment-economic object for firms or sectors, or ‘carbon per household’ is a socio-environmental object, as in Table 2.

SYNERGISTIC PROCESS MODEL

Overall, synergistic thinking can enable collaborative learning, thinking, co-creation and co-production, in other words a kind of collective intelligence. It also helps to integrate scenario planning with the mapping of trading zones, both in practice opaque and compromised. In response, the synergistic method helps to map and manage a more systemic cycle of knowledge flows and cognitive learning, from present to future. The synergistic method provides a process model for different modes of thinking, from ‘relational to divergent, emergent and convergent’ (Ratcliffe & Krawczyk 2011). A four stage cycle then includes:

- ‘Baselines’ – problems, challenges, and the underlying systems, in the present; ('relational thinking' centred on trading zones and actor mapping);
- ‘Scenarios’ – forces of change, uncertainty, and alternatives in the future; (‘divergent thinking’, centred on the back-casting process);
- ‘Synergies’ – visions, opportunities, innovations and inter-connections, for the future; ('emergent thinking', for centred on 'further'-transformation and the collective intelligence to enable it);
‘Strategies’ – pathways and road-mapping for action, which link the future back to the present; (‘convergent thinking’ and the strategic planning and management to implement it).

Further detail on these stages and their application practical methods and tools is available as the ‘synergistic toolkit’ (Ravetz 2020).

TOWARDS A COMBINED FRAMEWORK

These three conceptual approaches (backcasting scenario planning, boundary objects and trading zones, and synergistic thinking) can then be combined into the SSP’synergistic scenario planning’ framework, summed up with a simple matrix as in Table 2:

- ‘new normative’ carbon targets, elaborated into interconnected boundary objects and trading zone platforms;
- backcasting scenario planning processes, linking future goals with present day actions;
- systems transformation: with synergistic mapping from linear (Mode-I) and evolutionary (Mode-II), to co-evolutionary (Mode-III).

The matrix analysis, in combination with visual thinking, can help to analyse a case, such as GM, with typical gaps and mis-matches between problems, targets, pathways and solutions. The matrix can also be used to compare or benchmark between cities and regions: for self-evaluation, resource libraries, synergistic dialogue, or a larger Collaboratorium (‘laboratory for collaboration’) (Ravetz 2020).

<<INSERT Table 2>>

4. APPLICATION TO THE CASE STUDY ANALYSIS

The case of GM shows how apparently simple carbon targets raise many challenges in the transformation of a major city-region. Here we explore some of the nuances and implications, using the SSPsynergistic scenario planning approach with the its matrix and visual mapping.

<<INSERT Figure 32>>
FROM SCENARIO PLANNING TO ACTION PLANNING

The carbon scenario modelling from the SCATTER program forms the key diagram in the GM Environment Strategy (GMCA 2019) shown on the upper left (a) of Figure 32. There is a typical range from the ‘aspirational’ (targets for 1.5 degrees of global warming IF replicated around the world), the ‘desirable’ (rapid policy innovation, technology rollout and social change), the ‘probable’, with slower and less ambitious change, and the ‘do nothing’ option leading towards a global four degree rise. Some key policy discourses are then interpolated from the Strategy and supporting documents, on the upper right (b) of Figure 32. Either society and the economy continues but at risk of growing climate impacts: or, global climate stability could result if others do the same, but at risk of societal impacts.

Looking more closely at the nexus of syndromes, many negative patterns in GM surfaced around the 2008 Congestion Charge episode, and continue in various forms. Some, such as ‘bonfire of regulations’ or ‘who needs experts’ are from national policy / politicians, others are more apparent in popular media, and then various combinations form with skeptical counter narratives of skepticism and cynicism.

In contrast is a mapping of a ‘con nexus’ of synergies, in Figure 2 centre right (d), with key ‘trading zones’ in the Strategy (these are interpolated and not always explicit). We can track the ‘climate emergency’ rhetoric in the technical-environment trading zone, ‘green growth’ in the environment-economy zone, ‘sustainable consumption’ in the economy-society zone, and ‘livable city’ in the urban-environment zone. Each of these in various ways combines political discourses, lifestyle trends, media narratives or policy agendas: each also represents various shades of ambiguity or dissonance. Mapping of underlying layers may reveal deeper assumptions or archetypes, such as ‘trust in policy-makers’ or ‘culture of expertise’ which are often contested in public life (Inayatullah 2018). The implication of such multi-layer mapping is that successful climate / carbon policy will work in key trading zones, aiming to shift negative syndromes towards positive synergies, as identified in the right hand column of Table 3.

<<insert Table 3>>>

SECTOR EXAMPLES

The housing energy retrofit agenda is very topical in GM, with its stock of older less efficient dwellings (Ravetz 2008b & 2020). This is a challenge which appears technically simple and cost-effective, but where syndromes and side-effects of every kind seem to block progress (Shrubsole et al.2015). The stakeholder / actor mapping, on the lower left (e) of Figure 2, shows many gaps,
myopias, perverse incentives, ‘moral hazards’, ‘landlord traps’ and other barriers around the table (Ravetz 2020).

Learning from the failure of the national Green Deal program, (section 2), GM is developing a new policy model for a ‘retrofit accelerator’ (at the time of writing). So, on the lower right (f) of Figure 32 is a preliminary alternative mapping of the same actors, now co-creating collaborative ‘synergies’ and value-chains, with various pathways to mobilize them. The policy model looks for synergies between procurement and sector innovation, finance and home ownership, poverty alleviation and area regeneration, warm homes and public health benefits, retrofit and skills training, and so on (UKGBC 2017). Some synergies and pathways are focused on finance or technology, some more social and lifestyle-related, and others are more ethical and cultural. Each of these and more are currently debated in an ongoing GM program of forums, ‘listening events’, breakfasts, citizens’ assemblies and online consultations, and then assembled into policies and road-maps.

On the social and cultural side, Carbon Literacy is an award-winning program, born in GM and now working internationally, providing training in basic climate change knowledge and skills, and capacity building for organizations and institutions (https://carbonliteracy.com/). This tends to work in the baseline systems area of the matrix, to create a Mode-I type systems understanding, and also in the Mode-III synergy area, where it enables creative interactions between a wider circle of stakeholders. The program emerged from a previous venture of 2005-2009, ‘Manchester is My Planet’, which asked organizations and individuals to make a ‘pledge’ to reduce their emissions. In technical terms this project achieved a small cut (around 0.2%) of total GM emissions, but arguably it paved the way for further waves of cultural and psychological change.

On the sectoral supply chain agenda, green public procurement is in principle a good place to start a low carbon innovation ecosystem and supply chain transformation. However, the current reality in the UK is one of scarce funds and skills, low tolerance of risk, and fragmentation of local government and public services (Georghiou et al.2014). The boundary objects / targets on the right of the matrix help to identify the potential role and scope, not just as procurement of low carbon products which may be higher cost and risk, but as strategic leadership of a fast growing economic sector, in collaboration with other public bodies, and with social co-learning across the innovation eco-system.

Green or low carbon finance is a complex and often controversial agenda in the UK: the Green Investment Bank was reduced and sold off, and capital controls on local authorities restrict the scope of long term green finance (ING Bank 2015). However, in GM there are interesting developments under the heading of Natural Capital (ecosystems and their services), and the current Investment Plan aims to bring together wider sets of stakeholders, with ‘deeper’ layers of value, to collaborate on ‘further’ synergistic social-eco-business models, all in the zone of Mode-III thinking (Eftec et al.2019). Work is now in progress on specific low carbon policies as part of the national Transforming Cities Fund and Brownfield Fund.
Process analysis

Overall, some key challenges and potentials of synergistic scenario planning for a carbon neutral GM, are summed in the matrix at Table 3. The ‘carbon targets’ here are framed as boundary objects linking different sectors and domains: economy-environment, socio-economic, eco-technical, and so on. The ‘process’ views the scenario planning methods in their context of the four-stage process model presented above, i.e. ‘systems, scenarios, synergies and strategies’. The table columns then show different levels of system complexity, from the Mode-I ‘functional’ and Mode-II evolutionary/innovative, to a Mode-III co-evolutionary transformation. The experience in GM shows how policy typically puts up material carbon targets, supported by energy-emissions modelling in the background (functional Mode-I type thinking); and to achieve the targets relies on markets, innovations and incentives for other actors beyond its direct control (Mode-II thinking). However, making such incentives work in reality calls for mutual learning (‘co-learning’) and collaboration between a wider community, which then calls for new forms of ‘associative and deliberative’ governance (Mode-III thinking). There are also ongoing tensions with a ‘wider’ range of actors who argue for ‘deeper’ economic or political transformation. The synergistic process model also provides another perspective on current gaps in GM and any further potentials:

- **Systems / baselines** (‘relational thinking’): despite a multi-year program of evidence building there is no overall inventory and little wider understanding of the city-region carbon metabolism, of the physical, economic or social city-region. The Carbon Literacy program above has spread basic skills and awareness, but this needs to multiply up into every sector at every level.

- **Scenarios** (‘divergent thinking’): there is some explicit scenario planning in the previous and current GM climate / carbon strategies: and various ‘implicit’ scenario methods in the background to many policies, which rely on some ambiguity which might gain from being more explicit. However, from policy-maker dialogue, it seems that such implicit ambiguity can be easier to manage, in contrast to explicit scenarios which leave less room for manoeuvre: here the previous insights on ambiguities help to explain the viable scope and limits of scenario planning (Mäntysalo and Grišakov 2017).

- **Synergies** (with ‘emergent thinking’): GM is fertile ground for the co-creation of synergies and innovations. However, there is critique of an inner circle of ‘usual suspects’ working in a neoliberal framework, lacking an open ‘trading zone platform’ which could involve wider communities (Hendrick 2014). The GM experience shows how different levels of debate are often confused between practical action, strategic planning or system transformation. But And to accelerate the transformation up to 15% carbon reduction per year (‘aggressive’ change in the words of the CNCA), the synergy formation process is even more critical, and the spaces / resources / skills to enable it are more urgent.

- **Strategies / pathways** (with ‘convergent thinking’): in principle the road-mapping of actions (short, medium and long term), in the face of STEEP uncertainties, should follow logically from
the synergy formation, and mobilize action from all stakeholders concerned. In practice nothing is simple: the public sector is under-funded and over-stretched, the business sector focused on survival or growth, and the academic sector is often disconnected from local needs. However, with its large and creative stakeholder community, GM continues to work on a range of carbon neutral pathways. The policy agenda includes (at the time of writing) low carbon supply chain initiatives, energy up-skilling, micro-generation and carbon finance: public sector eco-stewardship and natural capital finance, with next generation smart transport and waste systems. Meanwhile, civil society is designing countless experiments, social innovations, living laboratories, Fab-labs, Carbon Coops, and similar spaces for collective learning, thinking, co-creation and co-production.

6. DISCUSSION: CHALLENGES & WAYS FORWARD

Cities and regions around the world are planning their pathways towards climate neutrality – the ‘new normative’. But the chances of success are small if we lack the most effective methods and tools, and the theory behind them. In this paper, ‘synergistic scenario planning’ is proposed, both to understand the challenge of systems transformation, and to facilitate practical pathways towards it. This final section sketches (a) the implications and transferability of the GM case study, and (b) the relation to broader planning debates. It then points to (c) beyond the state of the art, and (d) implications for urban-regional planning practice.

Practical implications and transferability

The GM case shows by experience the three key challenges for synergistic scenario planning: how to link future goals with present actions, how to bring stakeholders into alignment, and how to look towards system transformation. The last 25 years have seen much learning with many versions of climate policy, scenario methods, and experiments in stakeholder alignment and capacity building. The goals of system transformation are often contentious, but arguably there is more awareness of the challenge now, than in previous decades.

For transferability, the GM experience is in many ways typical of a post-industrial secondary city-region. However, in contrast to others, GM sees ongoing experiments in devolution of powers (while the UK remains one of the most centralized of all developed nations). The urban infrastructure of energy and transport is largely privatized, in terms set by national government, and so requires special efforts for alignment and synergy at the city-region level. The growth agenda of GDP, population and urban expansion, seen in many countries, in GM is quite constrained. Meanwhile there is a culture of active innovation in GM which is not easy to replicate, perhaps all
the more reason for GM to lead the way, with its many experiments in deliberative democracy, action learning sets, citizens’ assemblies and crowd-sourced forums.

Broader planning debates

For our first challenge of ‘futurity’ between longer and shorter horizons, strategic urban-regional planning has often been slow to adopt the principles and practices of scenario planning (Chakraborty et al. 2011). Basic economic or population scenarios are often used for “vision documents” that serve multiple jurisdictions, and then the ‘central estimate’ is applied for technical land-use or economic policies; but such documents are often opaque and disconnected from the main policy process (Myers & Kitsuse, 2000). In response, the scenario backcasting approach aims to be more explicit and transparent, in both technical modelling and participative envisioning. Here the urban-regional scenarios are contested zones of vision, aspiration, imaginaries and discourses, ripe for deliberation and negotiation – and so the scenarios themselves perform as boundary objects in every sense (Robinson 1988). Climate / carbon scenarios are particularly topical, combining simple headline targets with the complexities of responses.

For the second challenge of ‘alignment’, the concepts of trading zones and boundary objects help with mapping a complex territory, to identify potential synergies between different actors (Mäntysalo et al. 2019b). Some of the most crucial trading zones lie between future scenarios, physical maps/plans, and wider stakeholder engagement, but such links are often missing in practice (Petrov et al. 2011, 245), and this calls for skills and methods to enable such links (Freestone 2012). And for the wider urban-regional community, the principles of ‘collaborative co-production’ can be more explicit and effective by SSPsynergistic scenario planning (Healey 2009: Albrechts 2012).

Thirdly, for the challenge of ‘system transformation’, SSPsynergistic scenario planning provides practical methods and tools. It addresses the perceived gaps and common shortcomings, in exploring multiple futures, engaging diverse stakeholders, and in linking scenarios to practical strategic planning (Bartholomew, 2007; Bartholomew & Ewing, 2008; Zegras et al., 2004; Chakraborty & McMillan, 2015; Zapata, 2015).

For the ‘institutional tensions’ in section 2, of spatial versus economic planning, the mapping of trading zones may help to resolve and move forward. The ‘experimental tensions’ may be addressed through the mapping of actors / stakeholders and their value chain opportunities: and for the ‘systemic tensions’ of transition versus crisis management, the mapping of co-evolutionary change helps to see the overlaps and differences.

Beyond state of the art?

The ‘new normative’, along with many other policy/societal aspirations, points towards ‘beyond state of the art’ in planning for urban-regional futures. This urban-regional as a unit of governance is...
under pressure from all sides: the political economy of (carbon-related) infrastructure is increasingly
globalized, while many displaced communities are seeking a new kind of local identity and
empowerment (Goodhart 2017). More workplaces and social networks are global, while the
physical impacts of climate change are stubbornly local. All this calls for a new generation of
planning theory and practice, to rationalize and enable and mobilize, with longer time horizons,
*longer* communities, deeper values, and further levels of transformation. The *SSP-synergistic scenario planning described* here is one contribution, alongside other emerging initiatives, such as,
integrated bio-regional participative planning (Robinson et al.2012); stakeholder value-chain
deliberation forums (Mulgan 2016); and ‘urban living labs’ for grassroots innovation (Evans et
al.2017). All this suggests an update of the current communicative paradigm of planning theory,
which could more effectively responding to the implications of the new normative, with newly
emerging and the potential for co-evolutionary ‘Mode III’ forms of governance for to manage system transformation.

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**Implications for urban-regional planning**

This paper has proposed new conceptual tools for both theory and practice of planning, to enable
the system transformation of cities / regions and build the capacity of all stakeholders involved. This
paper proposes the SSP concepts and tools for carbon-neutral planning: meanwhile

Meanwhile the mainstream continues in very different situations around the world, calling for
comparative research on the international context of carbon-neutral cities and regions. Many of the
CNCA members (Melbourne, London, Stockholm etc.), it seems, are affluent well-organized
metropolitan areas, resting on a post-colonial legacy, and highly dependent on global trade,
technology and finance. Vancouver for one prides itself on its Zero Emission Building Plan, electric
vehicles and reforestation of its hinterland, all building on abundant hydroelectric power resources.
However just over its city boundary are other municipalities in the wider metropolis, which are (at
the time of writing) set on a trajectory of intensive fossil-fuel mobility and globalized consumption
(Robinson et al.2012).

Meanwhile, there is a sense of urgency and looming catastrophe. Many cities and regions set off on
a ‘climate emergency’ with high aspirations and simple carbon targets, then find themselves
entangled in energy economics, infrastructure renewal, real estate markets, fossil-fuel lobbies,
supply chain inertia and, not least, public resistance. There is an urgent need for a new generation of
‘future-proof’ urban-regional planning to respond, for which the SSP aims to contribute. This paper
takes a first step on that journey, with a mapping of the challenges, review of a major case study,
outline of the Synergistic Scenario Planning approach, with implications for this case study and
others. We hope this will stimulate further developments in theory and practice for the ‘New
Normative’.
There is an urgent need for a new generation of ‘future-proof’ urban-regional planning to respond with initiatives such as synergistic scenario planning. This paper has aimed to make a modest contribution, reviewing work in progress in the GM city-region, with a new theoretical-methodological approach and toolkit for wider application.
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**Carbon neutrality & urban-regional planning agendas**

(Source: authors, based on CNCA 2016 & Greenhouse Gas Protocol 2016)

<table>
<thead>
<tr>
<th>INSTITUTIONAL AGENDAS</th>
<th>PUBLIC SECTOR POLICY &amp; PLANNING</th>
<th>PRIVATE SECTOR / PARTNERSHIP</th>
<th>WIDER PUBLIC &amp; CIVIC SOCIETY</th>
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<tr>
<td><strong>Carbon neutrality (a):</strong> via positive (exported) renewable energy</td>
<td>Local energy resource planning</td>
<td>Incentives &amp; standards for energy firms</td>
<td>Bio-regional resource stewardship</td>
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<td><strong>Carbon neutrality (b):</strong> via carbon offsets / sequestration / other</td>
<td>Local land-use management &amp; finance for offsets</td>
<td>Incentives &amp; standards for energy firms &amp; carbon markets</td>
<td>Integrated landscape stewardship</td>
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<td><strong>EMISSIONS SCOPE</strong></td>
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<td><strong>SCOPE 1:</strong> on-site direct emissions</td>
<td>Building regulation &amp; transport planning</td>
<td>Building standards &amp; transport technology</td>
<td>Integrated urban form &amp; infrastructure</td>
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<td><strong>SCOPE 2:</strong> indirect emissions via off-site electricity generation</td>
<td>Energy system local regulation</td>
<td>Energy system quotas &amp; incentives</td>
<td>Energy system stewardship</td>
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<td><strong>SCOPE 3:</strong> indirect emissions via traded products &amp; services</td>
<td>Supply chain incentives &amp; standards</td>
<td>Public procurement, innovation incentives</td>
<td>Supply chain &amp; value chain stewardship</td>
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Synergistic scenario planning: framework & tensions
Mapping the 3 key axes of the SSP framework, with 3 key tensions in theory & practice

TRANSFORMATION AXIS
Synergistic co-evolution

'Experimental tension':
innovation VS embedded institutions

'Systemic tension':
deep transition planning VS crisis management

ALIGNMENT AXIS:
Stakeholder capacity

'Institutional tension':
territorial VS systemic planning

FUTURITY AXIS:
Scenario planning

260x260mm (300 x 300 DPI)
SYNERGISTIC SCENARIO PLANNING: OVERVIEW

General visual mapping for the transformation from 'functional scenario planning' to 'synergistic scenario planning'

(a) FUNCTIONAL SCENARIO PLANNING (Mode-I&II)

- 'the future' is framed as a 'boxed' version of the present
- Functional feedback & back-casting loops
- Baseline: 'known knowns'
- Short term 'action plan'
- Medium term 'strategic plan'
- Dystopian scenario

(b) SYNERGISTIC SCENARIO PLANNING (Mode-III)

- 'The future' is an 'unboxed' co-evolution from the present
- Synergistic pathways & road-mapping loops
- Baseline: 'unknown unknowns'
- Short term 'action plan'
- Medium term 'strategic plan'
- Potential transformations of complex systems

(c) TRADING ZONES: NEXUS

- Mapping typical climate policy syndromes, barriers, gaps etc.
- e.g. Climate denial:
- 5 stages of grief:
- 'not my problem'

(d) TRADING ZONES: CONNEXUS

- Potential climate policy synergies, agendas, narratives, discourses:
- Mapping links between domains of value & rationality
- e.g. Green growth:
- Low-carbon business:
- Low-impact lifestyle:
- Smart housing:
- Healthy cities:

(e) ACTOR MAPPING: SYNDROMES

- Typical climate policy syndromes of power, wealth, knowledge
- Media sceptics
- Vested interests
- Knowledge
- Finance
- Infrastructure
- Fossil fuel lock-in
- Hidden subsidies
- Materi-alist culture

(f) ACTOR MAPPING: SYNERGIES

- Potential climate policy synergies & value-chain opportunities
- Active regeneration
- Social enterprise models
- Integrated value chain
- Distributed systems
- Social stewardship
- Natural capital
- Public equity

SYNERGISTIC SCENARIO PLANNING: OVERVIEW

259x259mm (300 x 300 DPI)
SYNERGISTIC SCENARIO PLANNING: GREATER MANCHESTER CASE

Visualization of synergistic scenario planning in GM: Tynwald Centre 2018: Ravetz & Miles 2016

(a) FUNCTIONAL SCENARIO PLANNING (Mode-1&II)
Carbon target scenarios from SCATTER model (GMCA 2019)
- BAU projection: 4 degrees
- Technical / policy innovation
- Aspiration: 1.5 degrees

(b) SYNERGISTIC SCENARIO PLANNING (Mode-III)
Carbon scenarios & deeper socio-political implications & discourses
- Society & economy continues - BUT at risk of severe climate impacts
- Dynamic balance of aspiration & practicality
- Global climate stability - IF others do the same - BUT risk of severe societal impacts

(c) TRADING ZONES: ‘NEXUS’
GM climate policy (2019): syndromes, barriers, conflicts etc.
- ‘elite & out of touch’
- ‘dismantle’
- ‘technology to the rescue’
- ‘shop till we drop’
- (skeptic/cynic agenda)
- ‘confused by regulations’

(d) TRADING ZONES: ‘CONNEXUS’
GM climate policy (2019): agendas, narratives, discourses, imaginaries
- ‘original modern’
- ‘transition towns’
- ‘sustainable consumption’
- (techno-economic agenda)
- ‘climate emergency’
- ‘green growth’
- ‘incredible lifestyle’
- ‘shop till we drop’

(e) ‘RETROFIT’ ACTOR MAPPING: SYNDROMES
GM retrofit programs (2014-15): typical gaps, barriers, conflicts
- Piecemeal design
- High finance costs
- Fragmentation
- Infrastructure
- Top-down & trusted
- Skills gaps & insecurity
- Information & knowledge
- Public service
- Government
- Community
- Private

(f) ‘RETROFIT’ ACTOR MAPPING: SYNERGIES
GM retrofit forward agenda (2019): value-chain opportunities
- Building health
- Mentor role
- Positive media
- Social collateral
- Eco-procurement
- Trusted intermediary
- Community
- Public
- Private
- Housing
- Infrastructure
- Finance & devt
- Community builders
- Re-socialize utilities
- Performance / skills incentive
- Proxy markets in savings

SYNERGISTIC SCENARIO PLANNING: GREATER MANCHESTER CASE

259x259mm (300 x 300 DPI)