Low Carbon Urban Transitions: A Melbourne case study

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ABSTRACT: Global cities are now engaging in a range of initiatives and strategic efforts to effect a low carbon transition in response to climate change. There is currently limited research that compares internationally how different cities are responding to the challenge or whether the intention to transition to a low carbon city can be realised in different urban contexts. In response, an ESRC funded international comparative urban research network has been set up involving researchers from the UK, Australia, China, India, South Africa and the US. The network, over four years, is focusing on research and policy issues involved in comparing and researching the broader dynamics and implications of low carbon urban transitions. As partners in this network, our research is contributing to this comparative network and focuses on low carbon urban transitions in the Australian context.

In this paper, we present findings from a review of low carbon initiatives in Australia with a particular focus on Melbourne, Victoria exploring the policy context in which these initiatives and responses have emerged, the typical approaches adopted and the implications for urban change and governance. We examine the roles of, and relationships between, different levels of government, climate change alliances, community/environmental organisations and other actors, and outline a 'schema' for assessing the progress of urban low carbon transitions. We identify some significant short comings and policy disconnects which we argue are limiting progress towards a low carbon future in Victoria.

Introduction

Since the Rio Earth Summit in 1992 and the United Nations Framework Convention on Climate Change agreement, there has been a proliferation of responses to climate change driven by a wide range of actors from the transnational to the local level. Cities have become key sites of action with city municipal actors and non-government and community based organisations now playing a significant role in carbon reduction initiatives across the world. The adoption of municipal level climate reduction policies is in large part a response to, and indeed an attempt to put pressure on, weak or non-existent climate change policies at a national level (Rutland and Aylett 2008). During the early 1990s, action at the municipal level focused around mitigation initiatives and reducing emissions through regulation, planning, transportation, energy provision and waste collection (Bulkeley et al 2012a). While initially involving several hundred cities, now thousands of cities are actively pursuing carbon reduction strategies as part of their governing process. Bulkeley and others (2010; 2011, 2012a; and Betsill and Bulkeley 2007) have documented the roles and actions of cities in climate change governance over recent decades and highlight the importance of transnational networks and programs including ICLEI's Cities for Climate Protection (CCP) Program and more recently the C40 Cities Climate Leadership Group and the Clinton Climate Initiative, the US Mayors Climate Protection Agreement, and the European Covenant of Mayors, as a significant feature of 'the changing climate governance landscape' (Bulkeley et al 2012:546). While local level mitigation efforts in Australia emerged during the 1990s and 2000s, it was not until the late 2000s that a national response to climate change was enacted. Since the emergence of the national Carbon Pollution Reduction Scheme there has been a shift in focus at lower levels of government towards adaptation planning, reducing vulnerabilities and building resilience to climate change. The recent bushfires in Victoria and floods in Queensland have highlighted the importance of planned adaptation initiatives. Despite the distinct policy focus on adaptation at the Victorian state level, local governments and place-based organisations and coalitions continue to trial new and innovative approaches to carbon mitigation supported largely by Federal government funding. While there are emerging divisions and a lack of clarity between roles and responsibilities across government, there is clear acknowledgment that both mitigation and adaptation initiatives are complementary and necessary in responding to climate change (DCCEE 2010).

Within the climate change policy settings in Australia and Victoria, we focus our attention in this paper on the notion of 'low carbon urban transitioning' as a set of actions and policy responses across a range of governing scales and reflect on the implications for strategic urban policy making. International research suggests that "a transition to a 'low carbon' future implies a large-scale reorganization in the way societies produce and use energy" and "cities are critical in this transition because they concentrate social and economic activities that produce climate change related emissions" (Bulkeley et al 2011:1). Transitioning therefore implies significant transformations in the way we design, plan, and construct the infrastructure and urban form that shapes our everyday lives and our capacities to adapt to and mitigate against the impacts of climate change. If we are to see a transition on a large scale this will necessitate a co-ordinated and integrated approach to policy and governance and an alignment of goals across land-use, transport and energy infrastructure planning, and in the design and retrofit of buildings and precincts. Low carbon initiatives across the world have been described as a 'patchwork mosaic' (Bulkeley 2012) and questions remain around the extent to which local scale responses have the capacity to drive the types of systemic changes required. To date there is limited in-depth comparative analysis of urban responses to climate change or research that explores whether the strategic intent of low carbon transitions can be realised in different urban contexts.

First, we situate our research by briefly defining some key concepts including 'low carbon urban transitions', 'low carbon urbanism' and 'low carbon politics' and review some of the theoretical frameworks informing research on low carbon transitions. Second, we present an overview of the climate change policy settings shaping low carbon responses. We then examine the types of low carbon initiatives emerging in Victoria and Melbourne. We highlight the range of scales, approaches and governance dynamics involved in low carbon transitioning and discuss the emerging trends, shortcomings and disconnections in low carbon urban transitioning.

Low Carbon Urban Transitions: definitions and theories

In the Australian policy context, the role of cities and urban policy in low carbon transitioning is not always made explicit. Despite the acknowledged need for cities to reduce GHG emissions, as stated in the National Urban Policy Framework (2011), the Commonwealth plays a limited role in shaping urban policies and strategies. This is the domain of State governments who are responsible for developing strategic plans and regulatory frameworks which guide future development. Despite a recognition that the challenges presented by climate change clearly implicate cities and how we transform energy and infrastructure systems, urban form and buildings our analysis later highlights the disconnections between urban policies and those focused on climate change. To help explore the explicit role of cities and city actors in transitioning, a recently edited book titled 'Cities and Low Carbon Transitions' (Bulkeley et al. 2011), draws contributions from the field of urban studies and technological transitions to help develop some conceptual frameworks and empirical research on how we might understand urban transitions and the multiple scales and actors involved. It is argued that the 'sustainable city' agenda of the 1990s has been replaced with a climate change agenda and the the emergence of a new 'low carbon urban politics' (Bulkeley, Hodson and Marvin, 2012b). This new urban politics involves multi-level (national, regional, local) strategies and actors who are placing climate change firmly within the realm of city strategy and urban policy. The climate change agenda implicates all levels of government, however to date the multitude of urban responses at the local scale, while perhaps contributing to a form of 'low carbon urbanism' are characteristically 'ad hoc',

> …"in most cases, rather than leading to the development of new forms of urban planning, or to systemic efforts to transform urban systems, what is emerging as a result of these efforts is a patchwork mosaic of low carbon urbanisms – each different in their character, politics and possibilities" (Bulkeley et al 2012a).

Along with a multi-level governance (MLG) approach another useful framework to inform understandings of 'transitioning' is the Multi-Level Perspective (MLP). Geels and others have developed the MLP as a framework for analyzing changes in socio-technical systems and includes three scales: (macro) landscape pressures, institutions and norms; (meso) socio-technical regimes which structure the way particular systems operate; and (micro) niche experiments and innovation (Geels 2004; Elzen et al 2004; Geels and Schot 2007 and Smith et al 2010). Landscape pressures, such as political cultures, economic growth, macroeconomic trends, land use, utility infrastructures exert pressures on socio-technical regimes and "create a broader context of opportunities and constraints within which actors and coalitions of actors operate" (Hodson and Marvin, 2010: 479, 479).

> "Regimes are sees as socio-technical in that technologies and technological functions co-evolve with social functions and social interests where technological development is seen to be shaped and potentially shaped by a broad constituency of not only technologists and engineers but also policy makers, business interests, NGOs, consumers and so on where the interrelationships of these interests through regulations, policy priorities, consumption patterns, investment decisions, amongst other things, hold together to stabilise socio-technical regimes and their existing trajectories (Geels and Schot 2007 in Hodson and Marvin 2010:479).

The niche level is where experiments and innovations occur and this typically involve small networks of actors developing and learning about new technologies and processes of innovation. Innovations at the niche scale can work upwards to effect change at the regime and landscape level and vice versa. While the MLP is considered a useful approach for understanding the ways in which urban infrastructure networks may be transformed in response to climate change (Bulkeley et al 2011:3), it is criticized for inadequately accounting for the role of cities or how as a framework it contributes to understanding 'urban socio-technical transitions' (Hodson and Marvin 2010:480). It is argued that within the landscape-regime-niche hierarchy there is a need to better understand the dynamic relationship between innovative activities within cities and wider national and societal transitions and further, that cities cannot be perceived as simply 'receiving' transition initiatives but that they can have a role in purposively shaping and innovating transitions (Hodson and Marvin 2010:480). Hodson and Marvin highlight the importance of analyzing the mediating roles of 'intermediary organisations and contexts' in understanding urban transitions and the need to examine the politics of whose priorities are dominant and what the implications are for urban transitions (Hodson and Marvin 2012:422). "The creation of intermediaries is necessary to constitute a space outside of the obduracy of both existing urban governance regimes and existing socio-technical regimes" (Hodson 2008: 482). This

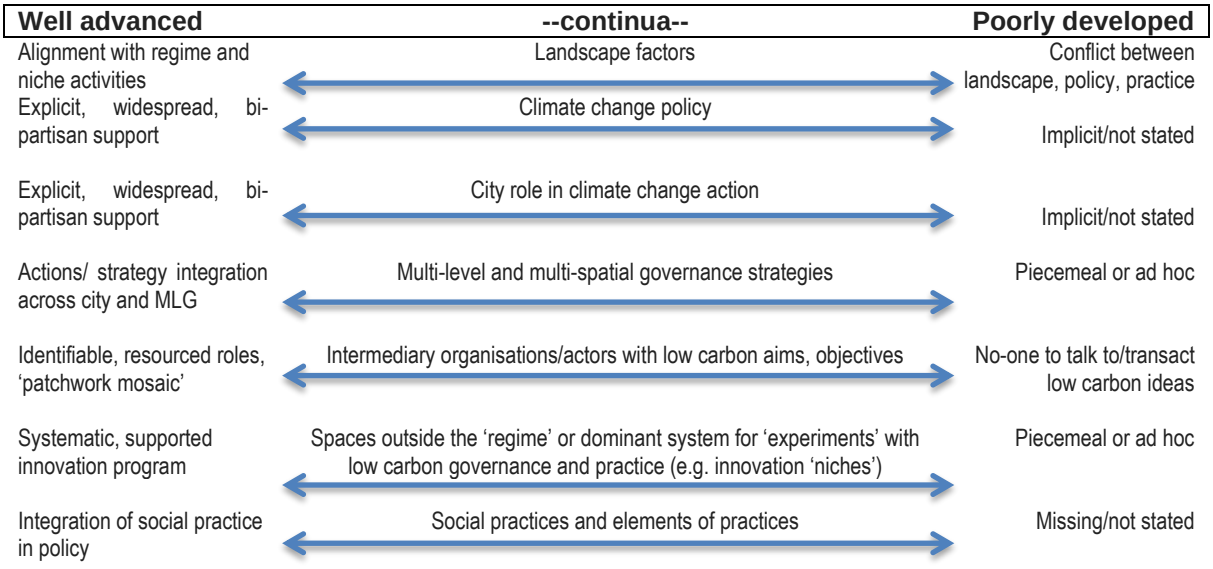
approach to understanding low carbon urban transitions provides a useful framework for examining current initiatives and their potential role in transforming urban regimes. It is concerned with the extent to which, in different contexts, the various actors and coalitions involved are actually working towards a 'genuine, radical transition' or just continuing to reproduce the status quo (ib id, 2012:437). Hodson and Marvin argue that researchers need to focus on the 'where' of transitions approaches to better understand the various urban contexts which shape and mediate transitions and importantly identify to what extent socio-technical systems and their transition can be governed and configured at the urban scale (Hodson and Marvin 2010:485).

Approach in this paper

What emerges from these frameworks (MLG and MLP) is a conceptualization of cities as complex arrangements of socio-technical systems which are comprised of and co-produced by social and technical elements (Bulkeley et al 2011). These elements include technology and materials; technical systems; political and legal institutions; processes of design; and social practices. This challenges the often siloed policy and governing arrangements which separates energy supply from demand and urban form from transport and buildings. While we may be seeing an array of 'niche' scale experiments and innovations targeting some of these elements, we are interested in this paper on the extent to which these may be contributing to systemic transitions. These transitions would necessitate multi-level and co-ordinated governance around a shared vision for a low carbon future. We would expect to see then the emergence of an integrated policy response at the scale of the city involving a metropolitan-wide, long-term strategy, a strong regulatory framework and a set of actions that aim to systematically transform all socio-technical elements comprising the city. In broad terms an integrated urban policy response would be attempting to better link the 'disconnected logics of development' (Hodson and Marvin (2010:312).

We propose the schema in Figure 1 as a starting point for considering the progress of urban low carbon transitions. As we argue below, this vision of a well advanced 'climate friendly' urban policy framework presents a significant challenge to policy and governance arrangements as they exist in Victoria and Australia.

Figure 1. Schema: Seven continua in assessing the progress of urban low carbon transitions.

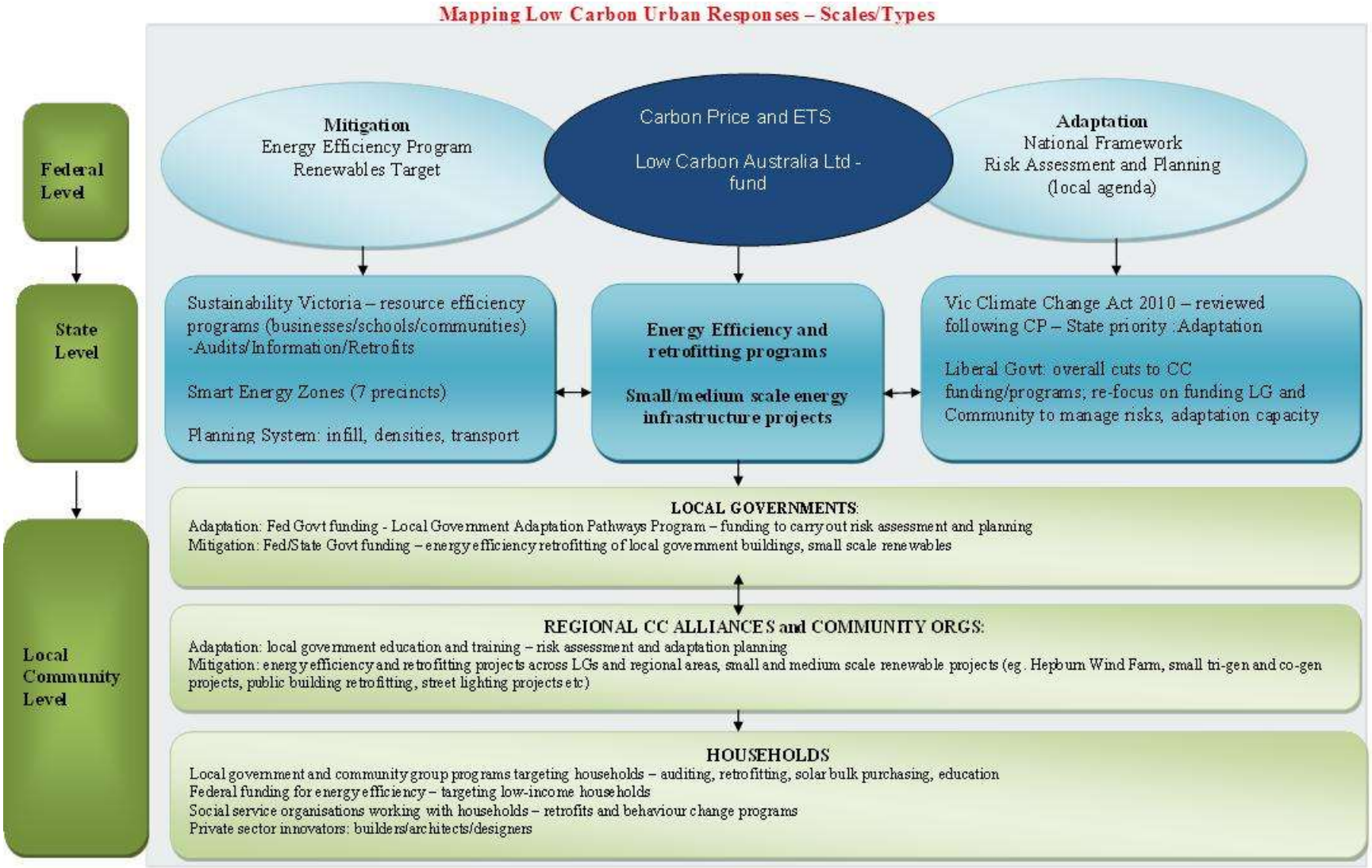


Multi-level governance in low carbon urban transitioning – the Australian and Victorian context

The policy settings

In Figure 2, we have attempted to map the major climate change policies and actions across multiple scales from the national through to the local/community scale which forms the policy setting for low carbon initiatives in Victoria.

Figure 2. Mapping Climate Change Policy



Under the previous Labor Government's[1] climate change policy framework the overall aim was to reduce the national carbon footprint by 5% below 2000 levels by 2020 through three main avenues: mitigation, adaptation and international engagement, as set out in *Securing a Clean Energy Future (DCCEE 2011)*. The key *mitigation* measures outlined included establishing a price on carbon and developing an emissions trading scheme (ETS), improving the energy efficiency of businesses and households, achieving renewable energy targets (RET) and improving on data for greenhouse gas emissions. *Adaptation* measures focused on developing a national adaptation framework, reforms and information and research. The third pillar focused on *international engagement* which involved participating in United Nations Climate Change forums and developing international partnerships.

The adoption of a carbon price has been on the policy agenda since around 2005 and a scheme was introduced in 2012. It has been highly controversial and lacking in bi-partisan support. Under the new Liberal-National Coalition Government it is likely to be abolished. While the carbon price only applies to the top 500 carbon polluters in the country there has been intense political debate over its impact on the wider community particularly businesses and low income households given recent energy price rises in Australia. To compensate for the impact of the carbon price the Labor government funded a range of initiatives including energy efficiency measures through *Low Carbon Australia Limited* (which was formerly the Australian Carbon Trust from 2001). Alongside the package of energy efficiency measures, the Government established a renewable energy target aiming to ensure that 20 percent of electricity was from renewable energy by 2020. The RET includes both large and small scale renewable energy investors. The uptake of small scale renewables has been significant with approximately 1 million households installing solar photo-voltaics and more than 794,345 solar hot water and air source heat pump systems (DCCEE 2013). Another significant national level initiative is mandatory disclosure (ie. point of sale disclosure of a buildings energy, greenhouse and water performance) which was put forward as part of the National Strategy for Energy Efficiency (2009). While residential mandatory disclosure never eventuated it does apply to commercial buildings.

The Victorian policy settings

> *"Following the review of the Climate Change Act 2010 the government will continue to support measures consistent with the appropriate role of state governments in climate change policy, focusing on management of and adaptation to climate risks that help increase the ability of individuals, businesses and communities to maximise opportunities arising from the national carbon price."* (Victorian Department of Sustainability and Environment, http://www.dse.vic.gov.au/conservation-and-environment/climate-change)

The climate change policy divide between the previous Federal Labor government and the Victorian Liberal state government has characterised the political context for low carbon transitioning in Victoria over recent years. According to critics, the introduction of the carbon price, while important, effectively distorted the whole structure and created a sort of 'abatement leakage' at state, local and community scales (Pears (2013). Under this scheme voluntary abatement action by households and businesses did not contribute to additional reduction of Australia's greenhouse gas emissions beyond those delivered under the CPRS (VCMA 2009). While this has not stopped local level actors wanting to reduce their carbon emissions it has had impacts on policies and programs delivered through the state government. Since the Liberal-National Coalition came to power in Victoria in 2010, climate change policy has focused on adaptation with the State seeing mitigation as firmly the responsibility of the Federal government. With the new Coalition government there is now an alignment politically between Federal and state governments resulting in both levels virtually stepping away from any serious attempt at reducing greenhouse gas emissions.

After a review of the Victorian Climate Change Act in 2010, the GHG emissions reduction target for the state was repealed and subsequently all reference to 'low carbon' or carbon mitigation has been removed from policy discourse. The state bureaucracy and policy settings have been a moving feast over recent years with a number of rounds of departmental restructuring and reviews. The Environmental Policy and Climate Change division previously within the Department of Sustainability

[1] Since the time of writing there has been a change of Federal Government. The new Liberal-National Coalition Government is in the process of changing climate change policy settings, including replacing the price on carbon with a 'direct action' policy, the details of which are yet to be fully understood.

and Environment (now Department of Environment and Primary Industries) has been disbanded and is now called Environmental Policy which includes a Climate Adaptation Policy team who were responsible for writing the Victorian Climate Adaptation Plan (2013). The state governments funding program, the Sustainability Accord, which has supported local governments and community groups in delivering mitigation projects and other sustainability initiatives is now almost singularly focused on funding only adaptation initiatives. Alongside Adaptation, resource efficiency remains a concern for government which includes energy efficiency (EE). EE no longer sits within the environment portfolio however, and is now in the Department of Business and Innovation which indicates that the business case is driving EE not climate change. Sustainability Victoria (SV), which is the state governments program delivery agency for environmental initiatives, focuses some of its initiatives on energy efficiency retrofitting targeting commercial building and households through information provision, rebates and incentives to non-premium commercial buildings, households and schools. SV generally acts as a co-ordinating and funding body with intermediary organisations actually delivering on programs. For example the Resource Smart AuSSI Vic 5Star Sustainability certification for schools is delivered by CERES an environmental education organisation or programs targeting low income households are delivered by social services organisations such as The Brotherhood of St Laurence and Kildonan Uniting Care.

Victoria is unique amongst other Australian states in having introduced another tier of regional governance albeit voluntary to address climate change. Victoria has ten regional climate change alliances, involving 70 of a total 79 councils, each unique in arrangement and function, but significant in driving regional level co-ordination and innovation across the state. The Alliances were initiated by the Regional Partnerships Program as part of the Victorian Greenhouse Strategy released by the state Labor government in 2002. These regional alliances vary in their arrangements and ambitions however they are largely comprised of a council based membership with aims to work in partnership within their regions to improve energy efficiency and the take up of renewable energy as well as work with their communities to become more resilient to climate change (SECCCA 2012). After a review in 2006 the partnerships program was considered a success at building regional alliances and continued to be funded by the Labor state government allowing alliances to focus their efforts on developing greenhouse abatement measures to address their specific needs; building the capacity of local governments, engaging the community and the private sector in greenhouse abatement and partnering with government in the delivery of state and commonwealth greenhouse programs and improve the integration and targeting of government services and programs (SECCCA 2012). These alliances are emerging as important intermediaries in low carbon transitioning in Victoria particularly in driving regional strategy processes, applying for grants and co-ordinating the implementation of initiatives. They are also acting as lobbyists and advocates for improved data gathering to assist in future planning and assessments and have a role in building knowledge and technical capacities across their member councils and partner organisations. Despite this important governance role, they do not have any formal place within the governing hierarchy and are dependent on local member fees and grants for their continuing work.

Analysing Low Carbon Urban Initiatives in Victoria

This section draws on a desktop review undertaken in 2013 of low carbon policies, strategies and initiatives in Australia and in particular Victoria. The review involved an internet search using the terms ‘low carbon’, ‘carbon reduction’, ‘mitigation’, ‘climate change and urban’ and targeted particular government and organisational websites. We gathered over 60 entries, some relating to multiple initiatives. We did not list each local government in Victoria (of which there are 79) but we did include the climate change alliances which incorporate 70 councils. Including all local government initiatives would expand the list significantly. The intention was not to build a comprehensive list but to gather a wide range of data in order to understand the typical responses and approaches adopted by different organisations and levels of government with a particular interest in the socio-technical and spatial dimensions of those initiatives. This resulted in four categories that we would argue fall within the realm of city strategy and urban policy, these include energy infrastructure, urban form and transport, buildings and households (people). We have not attempted to provide percentage breakdowns of initiatives according to each category as this would require further development of the database. This analysis is intended as a mapping exercise with further research planned to explore in more depth governing dynamics and approaches across initiatives.

In Figure 3, we map the policy priorities and the range of actions/initiatives at each level of government according to the four categories. While the national level is significant in driving action around climate and energy policy broadly, the majority of initiatives emerge at the local/regional and community scales where the responsibility for delivery and implementation clearly lies. The regional alliances play a key co-ordinating role in working with councils in low carbon strategy development, energy efficiency projects (buildings) and community engagement (people). This top down/bottom up multi-level governance dynamic is driving climate change responses with the state acting in a facilitating role focusing on adaptation. This highlights a significant policy gap in climate change governance focused on city strategy and policies governing urban form and transport, as this is the domain of the state government. In the absence of a clear vision and long-term plan for metropolitan growth, initiatives at the local government scale are constrained particularly around driving broad-scale urban policies shaping urban form, densities, design and transport infrastructure. During the time of writing the State government released a draft metropolitan strategy 'PlanMelbourne' which acknowledges that urban form and transport are important in reducing greenhouse gas emissions and reducing energy consumption (DTPLI 2013). While the strategy aims to direct future growth towards established areas and create a '20 minute city' to reduce car trips, there remains minimal investment in public transport particularly in outer areas where there are little or no services. In terms of an urban policy that can seriously address climate change it certainly lacks teeth given that it has emerged after decisions have been made to invest billions in road infrastructure and further expand to the coal industry. The Plan does include some reference to energy efficiency under Direction 5.7 which aims to: "Reduce energy consumption and transition to clean energy" (DTPLI 2013:129). It lists a number of existing sustainable precinct initiatives (see Figure 2) as examples of local clean energy however it is unclear if future investment will be directed towards funding similar initiatives. The Plan appears to emphasise an enabling role for the State government to assist local government and the private sector to implement energy efficiency programs and measures (eg. similar to the City of Melbourne's 1200 Buildings Project) however the details behind how this will occur are unclear.

In Figure 4, we report the typical aims and approaches across low carbon initiatives, which target three main areas; energy infrastructure, buildings and people and typically use a combination of techno-efficiency measures, financial/market measures, and behaviour change through information provision and various attempts at persuasion. Energy efficiency and demand management strategies typically employ all of these measures however there is almost consistently a separation between buildings and the people using them. Buildings are assessed according to computer models measuring thermal performance, heating and cooling systems and appliances resulting in technical and product based solutions to improve efficiencies. When people are considered at all, they are encouraged to change their behaviours by taking up a set of actions. These approaches are common across many local and community-driven low carbon initiatives. We argue this indicates a lack of integration of policy and of institutional learning about how systemic change may occur.

In considering the extent to which any of these initiatives may represent a shift in urban socio-technical regimes we can make some observations. Victoria has a number of significant niche scale initiatives that are transforming energy use in their particular contexts, for example, the Hepburn Wind Farm initiative which is the first community-owned wind farm in Australia, and generates enough power to service 2,300 households. As a community driven initiative with some funding from the previous state government, it emerged in response to a lack of leadership from both State and local governments (ABC News July 27, 2008). We would also argue that some of the regional climate change alliances are also significant in building regional scale capacity and strategies, which are seeking to challenge existing energy provision regimes, involve multi-pronged strategies in collaboration with a range of actors (eg. NAGA, CVGA, SECCCA). The Moreland Energy Foundation (MEFL) is another example of an organisation supported by a local government that is driving innovation in community engagement through multi-cultural initiatives and experimenting and trialling approaches to shift energy use in households and other sectors. The extent to which these place-based and regional scale initiatives can or will drive broad scale urban regime change remains to be seen however, in could be argued that they do represent innovative 'niche' scale responses which explicitly aim to challenge constraints including planning regulations and energy provision. As intermediaries in low carbon transitioning, they have proven to be significant in the Victorian context, in driving action and innovation, building local coalitions, developing skills and capacities of member organisations and securing on-going funding to continue their projects and innovations. That said, they are constrained by the funding grants and policy parameters that support their work.

Figure 3. Multi-level governance and spatial dimensions of low carbon urban initiatives

Governance and Spatial Scale	**CC and Energy**	**Urban Form and Transport**	**Buildings**	**Households and People**
National	Carbon price and ETS *(NB. Coalition to abolish)* Renewable target (RET) and funding Energy Efficiency funding grants	National Urban Policy Framework Infrastructure funding	Rating Schemes Mandatory Disclosure Energy Efficiency of commercial buildings Insulation scheme	Energy efficiency funding to local and community level groups and businesses Rebates and incentives
State	Adaptation framework Managing risk Fossil fuels over renewables	Limited planning regs and policy Roads over public transport	Energy efficiency commercial and residential buildings	Limited community engagement programs
Regional	Regional Strategies and Collaborations Mitigation and adaptation measures Street lighting	Public transport advocates Planning reform advocates	Energy efficiency of council owned buildings, businesses and residential	Community engagement and information Household behaviour change Audit/Retrofit schemes
Local	Adaptation planning Energy efficiency Community leadership	Implements state level planning policy Local/precinct design Local transport planning (cycle/walkability etc)	Council buildings energy efficiency retrofitting Small scale renewable initiatives and precinct dev	Training and workshops Energy Efficiency Auditing Retrofits Education Information
Community groups and other (eg. advocates, consultancies, social service orgs)	Range of expertise and agendas Social welfare agenda – low income households Consultancies – services to orgs and councils (ie. carbon accounting, strategies etc	Place-based strategies PT Advocates Activists Campaigns	Innovative designs and experiments	Auditing Retrofits Education Information Renewables – wind, solar initiatives

Figure 4. Low Carbon Initiatives by 'Target'

Target	Aims	Approaches/Mechanisms
Energy Infrastructure	Increase renewable energy (solar PVs, wind, co-generation)	Project finance/grants Rebates/feed-in-tariffs Investment in technologies Community owned energy Wind farms Co-generation projects
Buildings	Improve energy efficiency and thermal performance of council and community facilities Improve energy efficiency and thermal performance of new build and commercial blds	Star rating – building regs. Financial incentives Grants Information and training
People	Demand management – peak load etc Energy efficiency for low income households Encourage people to live more sustainably (eg. buy more efficient appliances, use less energy, use car less etc)	Community based training and workshops – take up actions Information provision Financial incentives (ie rebates) Household auditing and minor retrofitting (eg. light globe replacement schemes)

Discussion

In considering the question of whether we are witnessing broad-scale urban (regime) transformations we have identified some significant shortcomings around governance and leadership as well as policy disconnects which we argue are limiting progress towards a low carbon future in Victoria.

Returning to our seven continua outlined in Figure 1, the following shortcomings are apparent:

1. Landscape factors are poorly aligned to low carbon agendas; *climate change policy* is contested, and there is no explicit *city role in climate change action,* amounting to a lack of systematic transitioning and governance. In particular we refer the lack of political leadership and co-ordinating policy at the state government scale and to some extent the national scale in driving more systematic urban retrofitting and urban/transport planning.

2. Multi-level and multi-spatial governance strategies are generally lacking, associated with disconnected and conflicting policy settings. For example, energy efficiency agendas at local and state levels conflict with state energy policy which supports the continued growth in the fossil fuel industry, and; sustainable transport policies at local level conflict with continued focus on private transport-led road construction. Across buildings and urban policy there is a disconnection between piecemeal energy efficiency strategies; regulations targeting buildings; urban development policy and planning; and transport policy.

3. Identifiable, resourced roles, and a 'patchwork mosaic' (Bulkeley et al, 2012a) of intermediary organisations/actors with low carbon aims and objectives is largely missing outside local government alliances. Likewise, innovation 'niches' for 'experiments' with low carbon governance and practice are *ad hoc*.

4. Social practices and elements of practices are generally missing in the shadows of policy cast by the dominant hegemonies of technical efficiency, market rationales and human behaviour models. Understanding people and 'socio—technical' change does not feature in policy settings or programs. Behaviour change approaches target people typically through information, training and financial incentives with limited understanding or capacity to address the factors shaping and constraining people's everyday lives (eg. technologies, housing, urban form, transport, skills and competencies, meanings and norms).

Taking each briefly, the first concerns the lack of systematic transitioning and governance to steer broad-scale transformations and the concern that low carbon initiatives are tinkering around the edges. Landscape pressures include a lack of international consensus on climate change policy and carbon markets, and a heightened reliance upon international free-trade and liberalized markets in the face of a global downturn. These have fuelled a roll-back from action on pricing carbon and political contest. In this respect, and not-withstanding the importance of local and regional collaborations, the types of responses in Victoria could be considered piecemeal or patchwork in nature, with no clear metropolitan scale action.

The second issue refers to the lack of coordination across places and governance scales, illustrated by the current state government's plan to continue our reliance on Victoria's coal based fossil fuel industry to supply our electricity (currently provides 95% of stationary energy in Victoria) reflected in the following statement: "Victoria has one of the world's most extensive brown coal deposits and the Coalition Government is committed to maximising the opportunities to develop this resource in support of economic development, investment and job creation in the Latrobe Valley" (Premier of Victoria, 2013). The policy disconnect in carbon and the built environment is also striking. While the building code has established a 6-Star energy rating for new buildings and renovations, Victoria's policies guiding urban growth, densities and sustainable transport provision and systemic urban retrofitting are weak. While we are yet to see the final version of the new metropolitan strategy for Melbourne, the draft Plan indicates that the 'low carbon' agenda will not be significant (DTPLI 2013). With a planning system that is weak and discretionary in terms of shaping sustainability outcomes and with urban development likely to continue in low density, greenfield suburbs with little or no public transport infrastructure, there is currently no strong city strategy or urban policy for a low carbon future.

The third issue concerns the lack of low carbon intermediaries, and lack of structured spaces for experiments in low carbon responses. While there are programs such as the Victorian Energy Efficiency Target (VEET) scheme these are not linked to coherent national policy settings. The stalling of Mandatory Disclosure is an example of the *ad hoc* nature of building retrofit policy and the roll-back of structured schemes to support insulation and domestic-level PV systems and feed-in tariffs provide a foundation for intermediaries and niche experiments that resembles quick sand more than it resembles anything upon which to base a business or a long term strategy for building professions, institutions or long term low carbon goals.

The fourth issue concerns the limitations of the socio-technical divide that exists between approaches: techno-efficiency measures and a 'rational choice' approach to behaviour change. Energy efficiency focuses largely on technical solutions to reduce energy use (and the financial savings that result) and behaviour change relies upon individuals to take up 'actions'. While some efficiency gains will be achieved through technical measures, social change framed in this way, will ignore the multitude of ways that unsustainable practices and patterns of development can continue business-as-usual. For example, encouraging people in greenfield areas to reduce their car use is a waste of time if we continue to plan new suburbs with little or no alternative transport options. Likewise, reducing energy use in houses with rapidly increasing floor areas driven by the latest trends in renovations and designs is also challenging. Instead we need a broad understanding of the complex elements comprising our daily practices and target those elements not necessarily the attitudes of individuals.

Conclusion - Low Carbon Urban transition?

Rather than coherent multi-level governance, the low carbon urban transition in Victoria, Australia, is currently characterised by *ad hoc*, divergent actions. The Federal government's role in low carbon urban transition has largely manifested through renewable energy initiatives and through grants targeting energy efficiency at the local government and community scale. These national policy settings are changing however with the new Coalition government and we are yet to understand what this will mean for the role of the Federal level in low carbon transitioning. The policy landscape is such that the Victorian state government has focused its role on adaptation rather than mitigation, and in energy savings through efficiency rather than carbon reduction. Implementation, such as it is, is delivered through local government.

Multi-spatial governance is emerging in a nascent form via the local government greenhouse alliances, involving coalitions of organisations and actors from the government, business, social services, environmental and research sectors. Through the Federal energy efficiency grants funding process, organisations at local and community scales are enlisted to compete for government funding which to some extent has helped drive coalition building as this is part of the bid process. The emergence of regional climate change alliances in Victoria is, we would argue, a significant feature of this state's 'low carbon' policy and is a form of governance that is helping to drive changes at both the niche and regime scales through energy infrastructure projects, regional scale urban retrofitting and capacity building initiatives. As intermediaries they are building the capacity to create a space outside the obduracy of both existing urban governance and socio-technical regimes.

In terms of the extent to which we might consider the range of low carbon initiatives we have reviewed in Victoria as contributing to a 'genuine radical transformation' or reconfiguration in socio-technical systems and urban form, low carbon transitioning is unstable, localised and transitory. Current energy efficiency measures can be described as piecemeal and continued support for fossil fuels and urban policies that prioritise roads over public transport provide for a conflicted low carbon policy framework. This said, we recognise that socio-technical transformations occur over time and there are signs that at the local and regional scales there is a growing capacity and willingness to transform people and places. This initial analysis has opened up a number of important avenues for future research particularly around the role and significance of regional climate change alliances and similar initiatives globally and the extent to which new informal governing arrangements can transform socio-technical regimes.

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