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<input checked="" type="checkbox"/>	Master's thesis
<input type="checkbox"/>	Licentiate's thesis
<input type="checkbox"/>	Doctor's thesis

Subject	Futures Studies	Date	7.6.2019
Author(s)	Morgan Shaw	Student number	516466
		Number of pages	89 p. + appendices
Title	Governing future urban conduct through the sociotechnical imaginary of the low-carbon city: A comparative case study of carbon reduction plans from Auckland, Copenhagen, New Orleans, and Vancouver		
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Abstract

As concern over the future impacts of Climate Change has grown, cities have become key proposed sites of interventions to reduce greenhouse gas emissions. Numerous cities around the world have set goals to achieve varying levels and forms of eliminating carbon from their milieu. This study critically examines how the “low-carbon city” as a conception of a desirable future is translated into both a strategy and a set of proposed instruments for governing urban contexts in the future.

The theoretical framework of this thesis draws on Critical Futures Studies, using Jasanoff and Kim's *sociotechnical imaginaries* and Foucault's *governmentality* as linked lenses with which to scrutinize particular social and material means of intervening in the greenhouse gas emissions of cities. Two distinct logics of emissions reduction, *decarbonization* and *low-carbon practices of daily life*, are also considered for the role they play in these efforts.

This thesis took the official carbon reduction plans of Auckland, Copenhagen, New Orleans, and Vancouver as its research material, producing a comparative case study. The overall analytical approach was one of Dispositive Analysis. The data analysis methods were Directed Qualitative Content Analysis employing Dean's Analytics of Government, Comparative Analysis and Causal Layered Analysis.

The results of the study indicate that the low-carbon city is far from a homogenous sociotechnical imaginary, with the approach each case city takes to becoming low-carbon differentiated by their existing capacities and geographic situation in addition to the particular carbon reduction logic they have chosen to adopt. While some of the areas of urban fabrics and activities that the cities view as in need of transformation are similar, others are unique to individual cases. All four city governments envision specific ways of acting on urban dwellers to bring their self-conceptions in line with governmental objectives, and the different forms this takes are presented.

The goal of this study was to make the power relations that may be produced by enacting the imaginary of the low-carbon city more evident, thereby opening them up to more effective criticism. By exploring possibilities for using Dispositive Analysis to understand some of the difficult-to-perceive ways in which conceptions of desirable futures are used to govern, this project aims to expand the possibilities for ethical and reflective contributions by Futures researchers to practices of government.

Key words	low-carbon cities, carbon reduction, decarbonization, Climate Change, sociotechnical imaginaries, governmentality, dispositive analysis, Critical Futures Studies
Further information	





**UNIVERSITY
OF TURKU**

Turku School of
Economics

GOVERNING FUTURE URBAN CONDUCT THROUGH THE SOCIOTECHNICAL IMAGINARY OF THE LOW-CARBON CITY

**A comparative case study of carbon reduction plans from
Auckland, Copenhagen, New Orleans, and Vancouver**

Master's Thesis
in Futures Studies

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The originality of this thesis has been checked in accordance with the University of Turku quality assurance system using the Turnitin Originality Check service.

Table of contents

1	INTRODUCTION.....	9
1.1	Cities as Sites of Climate Intervention	9
1.2	Identifying Areas for Urban Transformation.....	11
1.3	Governing Societies of “Acting Individuals”	11
1.4	Research Questions and Structure of the Thesis.....	12
2	THEORETICAL FRAMEWORK	14
2.1	Critical Futures Studies.....	14
2.2	Sociotechnical Imaginaries	16
2.2.1	Definition and Process of Formation.....	17
2.2.2	Examples across Contexts	18
2.2.3	Imagination and Imaginaries	19
2.2.4	Relationship with Other Concepts of Desirable Futures	20
2.3	Governmentality	23
2.3.1	Government	23
2.3.2	Problematization.....	24
2.3.3	Freedom	24
2.3.4	Dispositives	25
2.4	Sociotechnical Imaginaries as Governmentality.....	28
2.5	Logics of Carbon Reduction	31
2.5.1	Decarbonization.....	32
2.5.2	Low-Carbon Practices of Daily Life	32
3	METHODOLOGY AND RESEARCH PROCESS.....	35
3.1	Research Approach.....	35
3.1.1	Multiple Case Studies.....	35
3.1.2	Dispositive Analysis as an Analytical Strategy.....	35
3.1.3	Dean’s Analytics of Government	37
3.2	Research Material	40
3.2.1	Plans as Lenses onto Imaginaries	40
3.2.2	Sampling and Selected Case Cities	40
3.3	Methods	43
3.3.1	Qualitative Content Analysis.....	43
3.3.2	Comparative Analysis.....	44
3.3.3	Causal Layered Analysis	44
3.4	Summary of the Research Process.....	45

4	RESULTS	48
4.1	Results Overview	48
4.1.1	Low Carbon Auckland	48
4.1.2	Green, Smart and Carbon Neutral Copenhagen	49
4.1.3	Resilient New Orleans	49
4.1.4	Renewable Vancouver	50
4.1.5	Comparison of Overall Approaches	51
4.2	Strategies of Carbon Reduction	51
4.2.1	Auckland	53
4.2.2	Copenhagen	54
4.2.3	New Orleans	54
4.2.4	Vancouver	55
4.3	Problematizing Aspects of Urban Life	56
4.4	Future Urban Dwellers as Governable Entities	58
4.4.1	Technologies of the Other	59
4.4.2	Technologies of the Self	59
4.4.3	Case-Specific Treatment of Urban Subjects	62
5	DISCUSSION	65
5.1	Theoretical Issues for Futures Studies	72
5.2	Methodological Considerations	73
5.3	Limitations and Lessons Learned	74
5.4	Directions for Future Research	75
5.5	Conclusion	76
	REFERENCES	78
	APPENDIX 1: PROBLEMATIZED ASPECTS OF THE CASE CITIES	90
	APPENDIX 2: URBAN SUBJECTS OF THE CASE CITIES	97

List of figures

Figure 1. Sociotechnical Imaginary Formation and Interaction with a Dispositive ...	29
Figure 2. The "Double Movement" of Dispositive Analysis (Adapted from Anderson 2003; Jager 2011).....	36
Figure 3. The Sociotechnical Imaginary of the Low-Carbon City and its Influence on Four Urban Dispositives	42

List of tables

Table 1. Initial Coding Framework.....	47
Table 2. Causal Layered Analysis of Case Cities' Carbon Reduction Plans.....	52
Table 3. Technologies of the Other (Prescriptions) Evincing by the Case Cities' Plans.....	60
Table 4. Technologies of the Self Evincing by the Case Cities' Plans.....	61
Table 5. Problematized Aspects Shared by Case Cities	90
Table 6. Problematizations Unique to Specific Case Cities	96
Table 7. Ontology and Deontology of Auckland's Urban Subjects.....	97
Table 8. Ontology, Ascetics, and Deontology of Copenhagen's Urban Subjects.....	99
Table 9. Ontology and Deontology of New Orleans' Urban Subjects.....	102
Table 10. Ontology and Deontology of Vancouver's Urban Subjects.....	104

1 INTRODUCTION

An overwhelming scientific consensus has established Climate Change as a major driver of future global change. This prognosis is based on extensive and credible evidence that the environmental transformations associated with it will produce dramatic effects on human social, economic, and political systems worldwide for decades or even centuries to come (IPCC 2014; UN-Habitat 2011). While the climate's "optimal" state with regard to human needs is highly contested, it is perhaps easier to identify particular ways in which it is becoming "sub-optimal" for various specific groups of humans, as well as for non-human living beings. Climate Change has already begun to produce discontinuities in historical time series of temperature and precipitation, strengthen the effects of extreme weather, acidify oceans, and contribute to a heightened sea-level, changes that are likely to continue and intensify over time (IPCC 2014; UN-Habitat 2011). These widespread and disconcerting impacts of Climate Change on critical human activities such as settlement and agriculture, as well as on natural ecosystems, has led to it becoming an area of significant concern for government at levels from local to global.

It is also now clear that Climate Change is predominantly anthropogenic, driven by the exponential increase in greenhouse gas emissions resulting from processes of industrialization over the last two centuries (Bonneuil & Fressoz 2016; The Royal Society 2014). In that time, scientific understanding of the ways in which both historical and present human populations have transformed their relationship with the biogeophysical carbon cycle through individual and systemic decision-making has increased the level of responsibility that can be ascribed to these actions (Jamieson 1992). As a result, the ethical implications of engaging in greenhouse gas-producing behaviors are being reconsidered by individuals and governments who wish to thoughtfully engage with their own contributions to Climate Change and attempt to diminish its associated harms.

1.1 Cities as Sites of Climate Intervention

The perception of Climate Change as a crisis that threatens the security and wellbeing of present and future people has led to a concerted search for arenas in which human action can effectively work to mitigate its possible negative consequences. Although the connections between cities and Climate Change have been a longtime element of mitigation discussions, dating back at least as far as the 1992 United Nations Conference on Environment and Development in Rio de Janeiro (see UNCED 1993), urban government has risen to new prominence as one such area over the last two decades.

There are at least four principal reasons why cities have come to be seen as important sites of climate intervention: their significant emissions footprints; the effectiveness of

transnational urban partnership networks in rapidly disseminating proposals for carbon reduction policy measures; the relative autonomy of many large cities from the dictates of state and national governments; and the desire to use Climate Change-related policies to simultaneously pursue competitive advantages in a global market for human capital and urban investment.

The outsized role of major cities in generating greenhouse gas emissions has been widely recognized. UN Habitat (2011) states that the world's cities are responsible for up to 70 percent of greenhouse gas emissions, while occupying just 2 percent of the land area of the Earth. As a result, numerous cities around the world have set achieving carbon reduction as a goal for the future, and their governments or other organizations have prepared plans that outline their intentions for doing so.

Secondly, various transnational networks of cities have been formed to work towards Climate Change mitigation as coalitions benefitting from the sharing of knowledge and policy ideas that urban areas can either implement themselves, or advocate for at larger-scale levels of governance. Organizations such as C40 Climate Leadership Group (2019), the Carbon Neutral Cities Alliance (undated), and the ICLEI-sponsored GreenClimate-Cities (ICLEI 2019) all operate internationally to further urban emissions-reduction programs. These organizations offer guidance on policy measures and assessment frameworks, facilitate communication between officials in different contexts, and solicit public commitments to reach particular objectives by urban leaders, through mechanisms such as the Global Covenant of Mayors for Climate and Energy (2019).

Thirdly, urban government, especially of large cities, often operates with a relatively high degree of independence from state and national politics (City of New Orleans 2017). As such, cities can serve as test-beds for more radical proposals and host policy experiments designed to explore the potential implications of innovative measures (Copenhagen City Council 2009). However, while cities may choose to act in the absence of national leadership on Climate Change in some cases, they may also remain constrained in certain areas in which they do not have legal jurisdiction over relevant standards and practices (City of Vancouver 2015). Fuel economy standards for automobiles and carbon taxes and emissions trading schemes, for example, tend to be established at the national level.

Finally, some authors have pointed to competition among global urban areas as a motivating factor, with climate-focused initiatives playing into cities efforts to vie for a finite pool of talented workers in the knowledge economy, as well as foreign investment in local companies, real estate, and infrastructural projects (Baker & Ruming 2015). In crafting initiatives for emissions reduction, cities have envisioned ways to use responding to Climate Change to simultaneously position themselves strategically in this arena, by emphasizing the greater "liveability" of their environments and economic success that they argue will result (Auckland Council 2014; City of Vancouver 2015; Copenhagen City Council 2009). This points to the fact that cities' carbon reduction planning often reflects

aspirations beyond emissions mitigation alone, with many other types of urban transformation being considered integral to or achievable alongside these goals.

1.2 Identifying Areas for Urban Transformation

As the proceeding discussion established, the “low-carbon city” is being envisioned as a desirable response to Climate Change in urban areas around the world, promoted by a variety of actors including city governments, national governments, and non-governmental organizations. However, views of what becoming “low-carbon” may mean for particular cities vary significantly. Tozer (2018) argues that even within the context of a shared international imaginary of low-carbon cities, reducing greenhouse gas emissions can be approached in numerous ways, shaping how cities frame their carbon reduction goals and intentions. Aspiring low-carbon cities may pursue such a designation by becoming “fossil-fuel free”, using “100% renewable energy,” achieving “carbon neutrality,” or by reducing emissions of particular kinds by a specified percentage in reference to a historical benchmark year. Each of these approaches requires different modes of accounting and a particular understanding of how to delimit the spatial boundaries and articulate the systemic elements and interconnections of the city, its population, and its surrounding environment. In addition, these myriad pathways for sociotechnical change demand context-specific strategies for building suitable material constructions and infrastructures into a more or less accommodating urban fabric. Tozer goes on to contend that this variation in “carbon problematization logics” means the path to becoming a low-carbon city cannot be a standardized roadmap for sociotechnical change relevant for all urban systems previously reliant on high-carbon practices.

Therefore, the ambition to govern a city in accordance with logics of carbon reduction does not in itself prescribe which aspects of the high-carbon city are to be transformed. The choice of how to problematize urban activities, fabrics, and populations relative to carbon reduction goals is a highly political question that extends beyond Climate Change mitigation and adaptation measures alone, to encompass the myriad views particular actors hold of what may constitute desirable forms of future urban life.

1.3 Governing Societies of “Acting Individuals”

A crucial part of analyzing of how power relations play out in the world is examining the capabilities, opportunities, and imperatives that individuals have to act. Furthermore, it is important to critically consider how they construct knowledge about these aspects as a basis for making choices. As Jäger (2011, 8) portrays it, the “[acting individual]

thinks, constructs, interacts and fabricates. As such it also faces the problem of having to prevail, i.e. to get its own way, to find its place in society.” Jäger further argues that in order to find a place for themselves, individuals must navigate a complex and constantly-expanding network of discursive relationships and arguments about how they should conduct themselves.

Individuals may choose to incorporate these discursive elements in various ways into their own self-conceptions and views of what is possible for their lives, or reject them, in some cases inventing preferred alternatives. These considerations make the question of freedom an essential concern. Dean (1999, 13) contends that contemporary conceptions of government are based in an idea of the governed as “living and thinking beings endowed with bodily and mental capacities,” free to make choices for themselves. Therefore, government works primarily by attempting to influence how this freedom will be used, while recognizing that the subjects of government may choose instead to act in ways which it may not foresee.

The growing importance of culture and consumption practices in how forms of life, individual identities, and techniques of self-management are modulated by government leads Rose (1999) to argue that this mode of conceiving of power should be recognized as a newly salient one, which he dubs “ethico-politics.” As Rose (1999, 188) goes on to define it, ethico-politics is characterized by its concern for the “self-techniques necessary for responsible self-government and the relations between one’s obligations to oneself and one’s obligations to others.” Ethico-politics implies that with the breaking open of objective determinants of values, free actors have become obliged to make ethics a key component of how they make sense of their political activities. Thus Rose (1999, 188) argues that to be sufficiently critical of government “we would need to find ways of evaluating the new technologies and the new authorities that seek to find a way of governing us, as free individuals, through ethics.” This study will explore one avenue for taking up this challenge in the context of urban carbon reduction initiatives, examining some ways in which city governments envision future urban dwellers and their personal ethics of carbon management.

1.4 Research Questions and Structure of the Thesis

This study will investigate how the imaginary of the “low-carbon city” as a conception of a desirable future acts as both a justification and an instrument for governing urban areas in particular ways. The particular technologies chosen as instruments for intervening in the city will be scrutinized for both their technical and social attributes and influences, recognizing that they combine “objects and agencies, wrapped in a political context” (Tozer 2018). Both modes of thought about relationships between carbon and the climate

and the material logics of urbanism and their management of carbon flows influence how a city will choose to approach its carbon reduction initiatives and are key issues for political contestation.

This project aims to answer the following research questions:

- How are the material and social means through which institutions of city government intend to pursue carbon reduction in the future described as coherent strategies for their particular urban contexts?
- Which aspects of their cities are urban governments identifying as in need of transformation to further their efforts to become “low carbon”?
- How may cities’ chosen means of carbon reduction influence the ways in which future urban dwellers are conceived of as governable entities?

In order to answer these questions, this study will establish a theoretical framework interweaving multiple strands. A perspective informed by Critical Futures Studies will be used to understand how theory from the social sciences could bring new insights into the power relations inherent in planning-oriented work by futures researchers when it supports the activities of governments. It will be argued that Jasanoff and Kim’s concept of *sociotechnical imaginaries* illuminates how images of desirable futures rooted in scientific and technological developments can become instruments of governing. In order to distinguish sociotechnical imaginaries from other concepts currently used in Futures studies, their relation to the concepts of *images of the future*, *visions*, and *utopias* will be examined. Furthermore, Foucault’s concept of *governmentality* provides one way to understand what government and governing are and how they can be critiqued. This approach will be examined and the supporting ideas of *problematization*, *freedom*, and *dispositives* introduced. Finally, the theoretical concepts of *decarbonization* and *low-carbon practices of daily life* will be used to provide context for the application of sociotechnical imaginaries as governmentality to the specific issue of governing cities in response to Climate Change.

Guided by this theoretical framework, multiple case studies of urban carbon reduction plans were conducted. Auckland, Copenhagen, New Orleans, and Vancouver were the four international cities whose plans were analyzed. Directed Qualitative Content Analysis of the plan documents employed Dean’s Analytics of Government as a theoretical starting point from which to produce a coding framework that was subsequently elaborated inductively. The content analysis was furthered by comparative analysis and Causal Layered Analysis.

The results of the study are presented in four sections: an overview of the general characteristics of the four case cities and their particular carbon reduction approach, followed by a presentation of the data most relevant to each of the project's three research questions.

In the discussion, the key findings of the study are examined and reflected upon. Theoretical and methodological issues, limitations, and opportunities for further research are considered.

2 THEORETICAL FRAMEWORK

This project will draw on a number of related theoretical constructs in order to examine how a critical approach to Futures Studies could benefit from incorporating two existing concepts in the social sciences: Jasanoff and Kim's *sociotechnical imaginaries* and Foucault's *governmentality*. Neither concept is yet widely used in Futures Studies, although the relevance of each for Futures Studies has been discussed in isolated cases (Ahlqvist & Rhisiart 2015; Levenda 2019). It will be argued here that both are highly applicable to important aspects of Futures research. This project will aim to define and contextualize these ideas relative to the existing concept base of the discipline in order to further their utility in this domain.

Governmentality and sociotechnical imaginaries have previously been linked in a preliminary way by Kuchler (2017), who argues for further work to articulate their interrelationship. Building upon Kuchler's argument that sociotechnical imaginaries can be seen as a specific form of governmentality, this project will work to clarify some of the implications of this assertion by examining ways in which the particular sociotechnical imaginary of the low-carbon city instrumentalizes a desirable imagined future to orient techniques of urban government.

2.1 Critical Futures Studies

Futures are inherently political. A renewed emphasis on the political dimensions involved in considering possible futures requires creating tools with which to challenge taken-for-granted views of what may be possible and preferable for particular societies and the individuals and groups of which they are composed. The primary intention of Critical Futures Studies is to investigate "the scope and constraints within public culture for imagining and debating different potential futures" (Goode & Godhe 2017, 109). Inayatullah (2007) identifies Critical Futures Studies as one of four dimensions of futures research, alongside predictive, interpretive, and anticipatory action learning branches of Futures

Studies. Inayatullah (2007, 10) argues that the goal of Critical Futures Studies is to “disturb power relations through making problematic our categories and evoking other...scenarios of the future.” Therefore, Critical Futures Studies aims to open up a broader field of possibility by breaking open familiar, ingrained, and taken-for-granted views of futures.

The increasing use of foresight as a practical tool for decision-making in business and policy contexts has developed a strand of futures thinking that turns it primarily to technocratic ends and utilitarian concerns. In many cases, this has produced a narrowing of perspectives on what futures may be considered desirable and limited the degree to which dominant forms of political and economic organization can be effectively contested. It also means that the making of the future is accomplished in these arenas in large part through “mundane socio-technical practices,” whose political content may be relatively easy to ignore or require dedicated work to decipher (Ahlqvist & Rhisiart 2015, 97).

Critical Futures Studies can be used as a means to critique what Goode and Godhe (2017) refer to as the “Future Industries,” i.e. those institutions that often have the leading role in establishing agendas for action, defining the horizons of what is achievable and desirable, and articulating which problems should be solved in order to reach preferred futures. These actors undoubtedly exert substantial influence over how societies think, discuss, and perform possible futures, but their power to do so need not go unquestioned. Technocratic prescriptions based solely on expert knowledge often do not recognize all possible modes of political agency due to a narrow focus on what is “realistic” (Goode & Godhe 2017). This produces an unnecessarily anemic public sphere in which promising avenues of exploration and debate are prematurely foreclosed.

An alternative is undertaking work to strengthen the tradition of thinking within Futures Studies that is concerned with achieving more just futures. Ahlqvist and Rhisiart (2015) argue that since its inception, Futures Studies has incorporated an “emancipatory” thread of thought aimed at “revealing some meta-level knowledge about the human condition in order to change the behaviour of human beings and societal entities toward a more sustainable direction” (Ahlqvist & Rhisiart 2015, 95). This requires that a multiplicity of rationalities about what is good for humans beings and societies are recognized and given a fair hearing as credible discourses, enabling discussions of what means may be required to reach desired futures. The intent is to escape what Blaser (2013) refers to as the “realm of reasonable politics,” a space deliberately constructed to keep debate within well-defined boundaries that tend to prop up the status quo and marginalize proposals for more transformative actions.

Critically examining the ways in which human beings can meaningfully exercise agency is central to this aim. Goode and Godhe (2017) argue that these types of agency come in various forms, which should be considered inclusively. However, human agency is also always partial and contingent, and should not be based in what the aforementioned

authors see as flawed Western, masculinist, and rationalist discourses of the potential for human beings to become the undisputed “masters” of our future circumstances.

Criticism can be used to make more explicit uses of power in the context of government that may otherwise be taken-for-granted. Techniques of well-considered criticism seek to circumvent the hazard of allowing the functions of government to become simply a set of “compulsive and mechanical reaction[s] to external and abstract stimulus” that are largely seen as the product of forces beyond a government’s control (Ahlqvist & Rhisiart 2015, 93). In rigorously examining the language, practices, and techniques of government, it becomes more obvious that the existing “ways we know ourselves and are asked to know ourselves” are only one of many possibilities for doing so (Dean 1999, 36). By bringing to light the current forms of thought that animate government, these can more easily become objects of resistance and contestation keeping futures open to transformation and the continuous pursuit of more desirable alternatives.

If the present course of contemporary society is unsustainable, we cannot avoid creating a drastically different future, whether for good or ill. Levitas (2013, 130) contends that to develop in a positive direction, we must embrace an approach to futures thinking for which “socio-cultural ethics, wisdom, imagination and responsibility” are cornerstones.

2.2 Sociotechnical Imaginaries

The stated intention of Jasanoff and Kim in formulating their concept of *sociotechnical imaginaries* was to build a framework that “pulls together the normativity of the imagination with the materiality of networks” (Jasanoff 2015a, 19). As an analytical concept, sociotechnical imaginaries aim to examine more thoroughly and completely the many avenues by which anticipatory images of science and technology become integrated into “the assemblages of materiality, meaning, and morality that constitute robust forms of social life” (Jasanoff 2015, 4). Thus, sociotechnical imaginaries are fundamentally concerned with power relations. Jasanoff (2015, 22) contends that sociotechnical imaginaries “tackle head-on, and more symmetrically, the complex topographies of power and morality as they intersect with the forces of science and technology.” This is especially important given that imaginaries have a strong normative dimension and encode a particular understanding of how life ought to be lived.

Analyzing sociotechnical imaginaries can facilitate at least four types of inquiry: they help explain differences in the “divergence of sociotechnical outcomes across political regimes” (Jasanoff 2015, 21); they point to change in sociotechnical systems over time, and the interplay of conceptions of the past and the future in different societies that is a component of these processes; they illuminate the workings of co-production of “space

and social order” by the movement of ideas and practices through time and across divisions of space; and they offer insight into the relationships between "collective formations and individual identity” (Jasanoff 2015, 23).

2.2.1 *Definition and Process of Formation*

Jasanoff and Kim define sociotechnical imaginaries as “collectively held, institutionally stabilized, and publicly performed visions of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology” (Jasanoff 2015, 4). This is an evolution of the definition originally offered in an earlier work by these authors (see Jasanoff & Kim 2009).

Though it must be collectively held, a particular sociotechnical imaginary is not necessarily hegemonic within a society. Multiple imaginaries can coexist simultaneously. Different actors work to advance their preferred imaginaries over others, in order to try to attract the lion’s share of the finite pool of resources available for materializing them.

Sociotechnical imaginaries almost always remain broad and heterogenous enough that they can be instantiated through more than one sociotechnical pathway (i.e. through different sets of practices, means, instruments, and equipment). The inherent logic of the imaginary does not determine which of the possible pathways will be chosen in a certain context. Instead, this choice is a political matter that must be negotiated with regard to the social and material conditions already existing there, alongside aspirations for change in the future.

Jasanoff (2015b) outlines a four-stage process by which sociotechnical imaginaries are formed. Sociotechnical imaginaries emerge from their origin in the imagination of a particular individual, as they formulate an imagined future in which science and technology can restructure the existing social order in a desirable way. This imagined future may then become progressively more embedded into cultures, institutions, and the material order while facing various forces of resistance. If it is viewed as successful in creating desirable changes, the fully formed sociotechnical imaginary may be further extended across time and space through adaptation to new contexts. This occurs through processes of translation between spatial scales, the imaginary’s persistence over time, and its ability to win acceptance for novel configurations of sociotechnical systems by overcoming the limitations of conventional understandings of what is possible and desirable. These four stages are depicted in Figure 1 on page 29.

Sociotechnical imaginaries can be “stabilized” by various types of powerful institutions. While Jasanoff and Kim (2009) originally framed sociotechnical imaginaries as instruments of nation-states, they have subsequently suggested that any sufficiently influential organization can potentially articulate and work to establish a sociotechnical

imaginary, including companies, non-profit organizations, social movements, and agencies at various levels of government at scales from local to global.

Although sociotechnical imaginaries are defined in reference to science and technology, this does not require that they are in favor of their more ubiquitous application to the social realm. They can be equally influential as imaginaries of technological rejection, as described in Felt's (2015) account of the ways in which Austrian political leaders' stance against nuclear power and GMOs was powered by an imaginary of a "free and natural" Austria. In this formulation, Austria was seen as surrounded by neighbors taking worrisome risks with problematic technologies, and this sociotechnical imaginary of autonomy and purity was advanced as a basis for opposing similar efforts.

2.2.2 *Examples across Contexts*

The concept of sociotechnical imaginaries originates with Jasanoff and Kim's (2009) discussion of two distinct imaginaries of the development of nuclear power that arose in South Korea and the United States. Since then, the concept has been further explored by numerous authors who have investigated how imaginaries have emerged and been put to use in different domains, scales of governance, and national contexts.

Following Jasanoff and Kim's (2009) discussion of sociotechnical imaginaries of nuclear power, much of the subsequent work on these constructs has been concentrated on their role in energy systems. Sociotechnical imaginaries of cellulosic bioenergy (Kuchler 2014), shale gas (Kuchler 2017), smart grids (Ballo 2015; Engels & Münch 2015), and offshore wind power (Korsnes 2016) have all been objects of analysis in the literature. The application of the concept is not limited to this domain, however. Other authors have used it to analyze: food systems, including 3D printed food (Lupton 2017) and genetically modified "golden rice" (Smith 2015); issues of health security (Lakoff 2015); and information technology as a tool for human development (Bowman 2015).

In addition, while Jasanoff and Kim (2009) and numerous authors continuing their work have focused on the role of imaginaries at the level of the nation-state (Ballo 2015; Bowman 2015; Engels & Münch 2015; Felt 2015; Korsnes 2016), others have examined other scales at which imaginaries may have observable effects. Sociotechnical imaginaries have been examined at the levels of cities (Tozer, Laura & Klenk 2018), sub-national regions (Levenda et al. 2018), super-national regions (Kuchler 2017), and the entire globe (Kuchler 2014; Lakoff 2015; Lupton 2017). In addition, the role of corporations in propagating sociotechnical imaginaries has also been discussed (Smith 2015).

2.2.3 *Imagination and Imaginaries*

In modern societies, imagination is a celebrated creative capacity that allows individuals to mentally traverse the frontier of everyday experience in order to make or do the extraordinary, thereby uncovering previously unrecognized potential for novelty and opportunities for transformation. Jasanoff and Kim (2015) argue that as such, imagination is "a crucial reservoir of power and action."

In the social sciences, thinking about the role of imagination has undergone a shift from conceiving of "imagination as fantasy" to "imagination as organized work and practices," which involves a turn from a largely subjective towards an intersubjective understanding of the term (Jasanoff & Kim 2015). Appadurai (1990) contributes to this view with the assertion that "imagination has become an organized field of social practices, a form of work (both in the sense of labor and of culturally organized practice) and a form of negotiation between sites of agency ("individuals") and globally defined fields of possibility." An intersubjective view of imagination, often discussed broadly under the heading of "collective imagination," can thereby become an avenue for considering the ways in which shared conceptions of futures become organizing principles coordinating or making intelligible the collaborative work being done by many actors across societies, as they seek to accomplish desired forms of political, social, and/or technological change.

The concept of sociotechnical imaginaries is built upon a foundation provided by prior approaches that can be broadly understood as dealing with different forms of collective imagination. These include Taylor's (2004) "social imaginaries" of modernity, work by Anderson (1991) on the origins of nationalism, Said's (1978) "imaginative geographies" of orientalism, and Appadurai's (1996; 1990) writings on globalization. Jasanoff (2015) argues that these prior works exhibit a critical lacuna, tending to overlook the crucial role played by the material and knowledge practices of science and technology in shaping contemporary societies. Thus, while sociotechnical imaginaries research builds upon this earlier work, it also attempts to reconcile it with an important new dimension given greater emphasis in Jasanoff and Kim's conception.

Strauss (2006) highlights the lack of consideration heretofore accorded by social sciences such as anthropology to the psychological dimensions of imaginaries, despite the fact that their understanding of imagination originates in psychology and borrows from its terminology. While societies are made up of individuals bound together by shared social practices, discourses, and symbols, this is not to suggest that these elements automatically possess the same meaning on a personal level for all of the members of a particular social group. Strauss contends that we must remain mindful of the complexity of the linkages between individual psychology and public culture, identifying at least three interacting components which should be taken into account: individuals' inner lives, the translation of these inner lives into public behaviors observable by other members of their

society, and widely available public cultural objects such as laws, rituals, and products of the mass media.

Strauss (2006) further argues that in the process of investigating imaginaries, it is crucial to avoid the reification of societies as entities capable of imagination, which is a capacity only individual people are capable of exercising. The goal of research into imaginaries should be “not to think of societies as imagining anything, but to theorize how peoples in societies imagine” (Strauss 2006, 326). This means exploring how social and power dynamics affect the use of individual imagination to construct shared conceptions and gather support for collective undertakings.

2.2.4 *Relationship with Other Concepts of Desirable Futures*

This project will seek to distinguish sociotechnical imaginaries from several other concepts that are already commonly-used within Futures Studies to describe desirable futures. These include *images of the future*, *utopias*, and *visions*. The relationship between these concepts is depicted graphically in Figure 1 on page 29.

Images of the Future

Bell and Mau (1971) offer “image of the future” as a concept with a key role to play in explaining processes of social change over time. Bell and Mau base their articulation of images of the future in the prior work of Fred Polak, for whom they contend images of the future represent syntheses of the ideas and ideals of a particular culture that provide clues as to the “vigor and potentialities of the society of tomorrow” which can be examined in the present. Bell and Mau’s intentionally unrestrictive definition of an image of the future is “an expectation about the state of things to come at some future time,” best understood as a set of alternative possibilities. Ahlqvist & Rhisiart (2015, 97) argue that images of the future are central to Futures research, since it is “most fruitfully conceptualized as analysis of present images of the futures.” These authors stress that when discussing present views onto alternative futures, it is crucial not to lose sight of which actors hold these images and the situated vantage point they occupy while doing so.

Edwards (2008) argues that the images of the future individuals hold are shaped both by their own imagination and multi-layered processes of social mediation. Dreams, hopes, and expectations embody the confluence of personal ideas and feelings with the complexities of the social world. As these two domains come together, they are negotiated through intermediary elements such as “collective myth, science, culture, social institutions, and the mass media” (Edwards 2008, 175). In order for these mediators to operate in the

liminal space between the individual and social, they "develop technologies, craft messages, implement strategies and build infrastructures" that exert considerable influence on how we conceive of the preferability of specific futures (Edwards 2008, 177).

Edwards (2008, 176), too, points to Polak's (1973) *The Image of the Future*, arguing that Polak identifies a number of other powerful mediating devices, including "legends, myths, theologies, histories and political and economic reifications" that have served throughout human history to guide us in thinking about our collective aspirations. However, Edwards is careful to indicate that these constructs can at times be deceptive and limiting as well as inspirational. The positive aspect of social mediation is the role it plays in allowing future images to be co-created, producing shared conceptions used to pursue futures that are broadly desirable, rather than just individually beneficial. More negative, however, is the power social organizations and institutions exercise over how we conceive of our preferred futures, dominating the conversation about what we can hope to achieve together and selectively excluding viable alternatives that do not align with their interests. As such, the mediating role of these actors is an especially important target of critical scrutiny and requires suitable tools to unpack the multiple interacting levels act on which processes of mediation play out.

Sociotechnical imaginaries can be seen as a more specific construct that arguably falls under the broad umbrella of "images of the future." However, their characteristics are much more specific, and not all images of the future should be seen as sociotechnical imaginaries.

Utopias

Utopia will be understood here to mean an alternative ideal state of social organization, based upon a desirable imagined future, which is ultimately unrealizable due to the ideologically uncompromising nature of its underlying premises. Given the long history of utopian thought in Western societies, the concept of utopia has morphed over time, taking on and transforming under multifarious meanings. Utopia has variously designated "a literary genre, a constitution for a perfectly restructured polity, a state of mind, [and] the religious or scientific foundations of a universal republic" (Manuel & Manuel 1979, 4).

Utopias can become collectively held, thereby potentially exhibiting significant cultural influence within a particular society. Manuel and Manuel (1979, 7) argue for this as an essential characteristic of utopian thought, requiring the "ideal condition [to] have some measure of generality, if not universality, or it becomes merely a narcissistic yearning." The most compelling and influential utopias have at their core a recognizable and thoughtful critique of a society at a particular moment in history, while still transcending it by illuminating a previously unarticulated alternative form of potentiality. This

potentiality must be conceivable enough to stimulate actual consideration, rather than simply amusing with its bizarre novelty. (Manuel & Manuel 1979.)

However, utopias seldom find institutional support in their pure form, due to incompatibilities with the messy complexities of real social and political systems. As a result, they never become a suitable vector for marshaling the resources to become fully embedded in concrete material implementations at more than micro-scales or for extremely brief periods of time.

Visions

Revolutionary sociotechnical changes are proposed and advocated for through dynamic processes in which groups that have envisioned a particular potential transformation work to make it both imaginable and plausible to others. The proponents of these imagined futures, whom Hilgartner (2015) refers to as "sociotechnical vanguards", work to advance their particular "vanguard vision." By engaging effectively with other actors who have different agendas, attempting to forge links with existing institutional capabilities and goals, and seeking to influence the aspirations and imaginaries of larger-scale collective entities (e.g. cities, regions, or nations), sociotechnical vanguards persuasively outline the contours of a preferred future dramatically different from what has come before.

Vanguard visions should be distinguished from sociotechnical imaginaries, as the latter requires that the underlying desirable future being proposed becomes the commonly held ambition of a much larger and more immutable group. However, it is possible for an emerging vanguard vision to interact in influential ways with more established imaginaries. With sustained and widespread reinforcement, vanguard visions may even become the basis of new alternative imaginaries.

For the purposes of this study, visions will be understood as desirable imagined futures that originate within institutions and have institutional but not necessarily widespread public support. As with its use in the definition of sociotechnical imaginaries, the term institutions is broadly interpreted here, encompassing not only governing institutions but also influential institutions of civil society and corporations. Visions are often offered in the form of plans or other public proposals, which the institutions attempting to advance them can use to lobby for various types of material and immaterial support on their behalf. It is possible for visions to develop into sociotechnical imaginaries if collective acceptance surpasses a threshold allowing the material embedding of the imaginary to reach a significant scale and level of pervasiveness. A vision that is viewed as sufficiently credible by a population may lead to the development of expectations surrounding it.

2.3 Governmentality

Foucault (1991, 102) employs the term *governmentality* to encompass the diverse ways in which we can “constitute, define, organize and instrumentalize” the practices by which individuals choose to engage with each other, as well as those by which they relate to themselves.

Governmentality emerges from Michel Foucault’s historical examination of *raison d’etat* (reason of state) beginning in the sixteenth century (Foucault et al. 2007). Foucault traces the development of governmentality along three axes: the administrative state became “governmentalized” as institutions centralized around government agencies; new instrumental knowledge emerged to facilitate the exercise of power based on the rationalities of political economy, resulting in particular procedures, analyses, calculations, and tactics; and power effects diffused across the whole “social body,” as populations rather than territories became the object of government through “apparatuses of security.” Without entirely replacing them, government has become pre-eminent over other ways in which power has been exercised in the past, such as sovereignty or discipline. (Darier 1999.)

In the following section, four key concepts of governmentality research will be introduced: *government*, *problematization*, *freedom*, and *dispositives*.

2.3.1 Government

Foucault defines “government” relatively simply as the “conduct of conduct” (Burchell, Gordon, & Miller 1991, 2). Dean (1999, 11) expands upon this concise formulation to offer a view of government as “any more or less calculated and rational activity, undertaken by a multiplicity of authorities and agencies, employing a variety of techniques and forms of knowledge, that seeks to shape conduct by working through the desires, aspirations, interests and beliefs of various actors, for definite but shifting ends and with a diverse set of relatively unpredictable consequences, effects, and outcomes.”

Dean (1999, 12) contends that in analyzing government, we need to find ways of making connections between governmental objectives and “the space of bodies, lives, selves and persons.” This requires asking questions about the various forms of thought that become practical means by which government acts upon and makes use of the “choices, desires, aspirations, needs, wants and lifestyles” of those it governs (Dean 1999, 12).

2.3.2 *Problematization*

Government problematizes objects to be governed with reference to specific goals. These goals are pursued using forms of knowledge and inquiry that make their objects discernible and knowable in particular ways. Furthermore, the status, capacities, desires and agencies of political subjects are imagined and orchestrated to make them governable. Within liberal forms of government, this often reflects an intention to encourage “self-government,” in which subjects internalize and identify with the aims of government to such a degree that they begin to undertake the work of directing their own conduct toward its desired ends. (Dowling, McGuirk, & Bulkeley 2018.)

Dean (1999, 27) suggests that government can best be analyzed by focusing on the points where some aspect of its ability to “conduct conduct” is called into question and thereby becomes identified as a problem in need of renewed consideration. At these inflection points, space is created for the basic question of government to be asked anew: “In light of the problem that has been identified, how should we govern now and in the future?” Dean argues that this process of problematization should be recognized as the product of particular institutions or organizations situated within specific spatial and temporal circumstances. Certain regimes of practices of government and their associated techniques, discourses, analytical tools, means of creating and recognizing knowledge, forms of expertise, and evaluative frameworks all contribute to the form problematizations take in a given context. Furthermore, an important element of problematization is its basis in “modes of evaluation of success or failure” that signal when a particular problem has been successfully resolved (Dean 1999, 210).

2.3.3 *Freedom*

The ability of subjects to freely undertaken actions that have effects on both themselves and others is the principal issue of ethics. Those who are capable of making choices and taking actions are answerable for the resulting outcomes, making it necessary for them to regulate their own actions to avoid undesirable impacts on themselves or others. The formation of a particular ethics creates a framework for determining how actions should be evaluated with reference to moral goals, as well as which actions will be considered by an individual to be within the scope of their “moral practice”.

This evaluation often takes place within the context of a problematization of a particular type of conduct, in which a way of acting is called into question and thoughtfully reexamined in light of prior experience, present circumstances, and possible future consequences. For Foucault, thought is both a use of freedom and what allows this freedom to be turned to moral ends (Rabinow 1997). Through problematizing certain forms of

conduct, the complex of relationships between the subject and their own self-conception, other members of their communities and societies, and the wider world of which they are a part can be reformed.

Dean (1999, 11) argues that in this light government should be seen as an “intensely moral activity.” Morality can be understood here as an effort to render oneself accountable for both the positive and negative consequences of exercising agency. Governmental policies, regulation, and norms make particular types of claims about what aspects of conduct will be considered “good, virtuous, appropriate, responsible” uses of individual and collective capacities.

Closely bound up with this issue is the question of freedom, to which government gives definition by delimiting the field of potential actions that will be considered acceptable within its domain. Freedom in the context of liberal democracies is therefore not a natural state, but a political technology through which government works to achieve its desired ends (Rose 1999). Liberal governments employ forms of rationality that assist them to “define the nature, source, effects and possible utility of these capacities of acting and thinking” (Dean 1999, 15). This does not prevent the governed from acting in unanticipated, contrary, or even hostile ways, but it does create a social boundary the transgression of which has repercussions, thereby giving structure to the myriad possibilities for action by encouraging some and enjoining others.

2.3.4 *Dispositives*

Dispositives are “first and foremost a tool to think about power in the perpetually dynamic social field” (Bussolini 2010, 90). Foucault uses the dispositive concept as a way to examine important differences in the power relations in a society across different historical eras, while taking into account that many of the same underlying discourses, practices, and objects can be observed in each period. Foucault (1984, 82) argues that studying dispositives leads “less toward a ‘theory’ of power than toward an ‘analytics’ of power: that is, toward a definition of the specific domain formed by relations of power, and toward a determination of the instruments that will make possible its analysis.” Foucault’s approach is therefore primarily concerned with establishing tools for recognizing how ongoing shifts in an ever-evolving network of power relations and forms of resistance lead to the establishment of intelligible configurations, oriented toward specific strategic ends, at particular times and in particular places.

Foucault (1979) contends that dispositives encompass the “entire knowledge apparatus with which a goal is achieved.” Rather than remain limited to addressing knowledge in its spoken and written forms, dispositives also make use of the ways in which knowledge “‘lives’ and ‘acts’ in the actions of people and in the objects they produce based on

knowledge” (Foucault 1979). Although each of these elements can be powerful on their own, dispositives build their larger societal influence by establishing a network of relations between these elements that allows them to act in concert towards a strategic end. At the same time, these relations lead the elements to mutually re-shape and reinforce each other in ever-evolving ways.

Varied dispositives can simultaneously exist within a society, sometimes interpenetrating each other by incorporating some of the same elements into different relationships. Jäger (2011, 28) argues that “a certain concrete discursive practice is, as a rule, of significance to several dispositives.” The relations within this network of dispositives constitutes the overall dispositive of a whole society.

The principal function of a dispositive is to respond to an “urgent need” (urgence) at a particular historical point in time (Foucault et al. 1980, 195). The recognition of an emerging form of urgency casts doubt on the prevailing dispositive, calling into question its elements and interconnections and creating space for new more suitable configurations to be formed in response (Deleuze 1991). However, the changes occurring in a particular society as a new dispositive is established do not generally reflect dramatic discontinuities in the basic elements making up that society (Bussolini 2010). These elements are instead rearranged, reconstituted, or repositioned relative to one another. Furthermore, Bussolini (2010, 90) argues that “one dispositive does not neatly and simply substitute for another,” with fading and strengthening dispositives instead interacting in multifarious ways.

Andersen (2003) summarizes the dispositive concept by stating that it consists of an apparatus of elements linked together to further a particular strategy. Bussolini (2010, 86) calls attention to the fact that in translating Foucault’s *The History of Sexuality* into English, Robert Hurley chose to use the word ‘deployment’ for the original French term *dispositif*, which aptly evokes both the strategic and technical dimensions of the concept. Foucault (Foucault et al. 1980, 194-195) explains that in this context, an apparatus refers to a “a thoroughly heterogenous ensemble consisting of discourses, institutions, architectural forms, regulatory decisions, laws, administrative measures, scientific statements, philosophical, moral and philanthropic propositions,” thereby potentially encompassing a diverse set of material and intangible components.

The apparatuses of dispositives weave together three elements, each of which reflects a different mode of power/knowledge (Jäger 2011). Through discourses, knowledge becomes a basis for speech acts that “systematically form the objects of which they speak” (Foucault 1994, 74). Social practices translate knowledge into particular types of actions that can carry recognizable social meanings. Materializations make knowledge manifest in tangible objects with which people interact. While “what is said” through discursive statements is the object of discourse analysis, “what is not said” (i.e. social practices and materialities) is viewed as equally important when analyzing dispositives.

Foucault primarily used the consideration of dispositives as a mode of historical analysis. This does not mean, however, that the dispositive concept is exclusively useful in understanding the past. Deleuze (1991) characterizes dispositives as conceptual tools capable of illuminating not only what we have been and what we are no longer, but also that which we are in the process of becoming. Dispositives describe our state of being in a way that can also be used to discern future possibilities, including opportunities for resistance and new potential subjectivities (Bussolini 2010, 102).

2.4 Sociotechnical Imaginaries as Governmentality

While sociotechnical imaginaries can be a useful analytical concept for describing constructs of collective understanding of the future and illuminating their corresponding governmental rationalities, they are relatively abstract. Jasanoff and Kim do not establish particular means of analyzing what practices and technologies of power they give rise to in the pursuit of the images of desirable futures they provide an envelope to contain.

Kuchler (2017) describes sociotechnical imaginaries as “interpretive envelopes” that can provide a means of examining how the “power to imagine futures” is exercised at the intersection of political structures and society at large for the purpose of creating or reinforcing particular pathways of sociotechnical change. They can assist in organizing strategies and technologies of power by providing a projection of a desirable future within which these elements are situated, and toward which the efforts of various actors may be aligned.

Kuchler astutely argues that while the concept of sociotechnical imaginaries as described by Jasanoff and Kim provides insight into how they can be identified, it is less capable of articulating how they emerge, by what means they become widely adopted and influential, and how they are translated into particular practices by the actors seeking to instantiate them. Kuchler contends that by seeing sociotechnical imaginaries as a specific form of governmentality, the analytical tools developed in governmentality research can be applied to an examination of how sociotechnical imaginaries are used as a means to articulate and operate upon a governable domain. This makes it possible to illuminate the “micro-politics” of how power is exercised through them more rigorously and in greater detail.

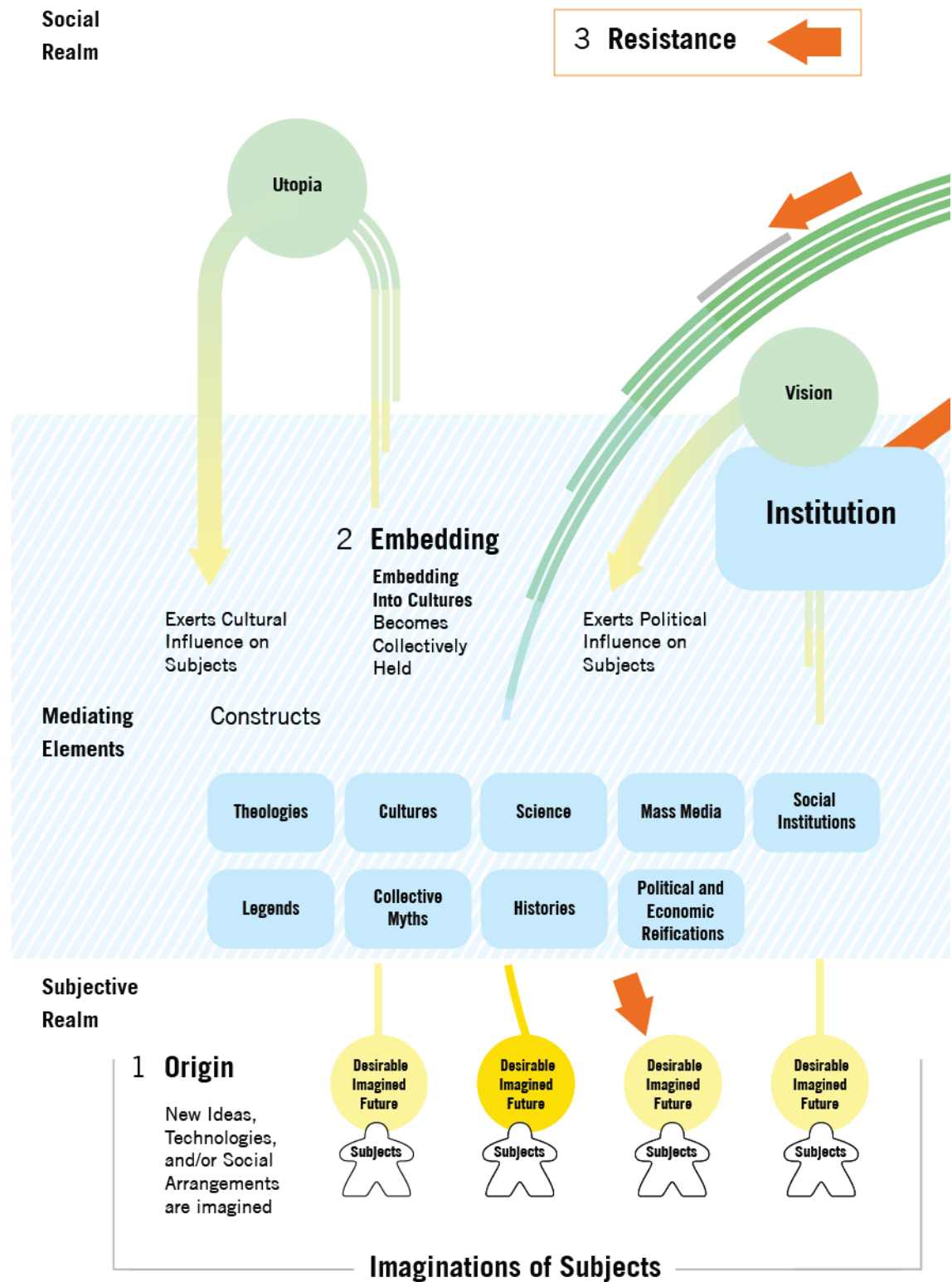
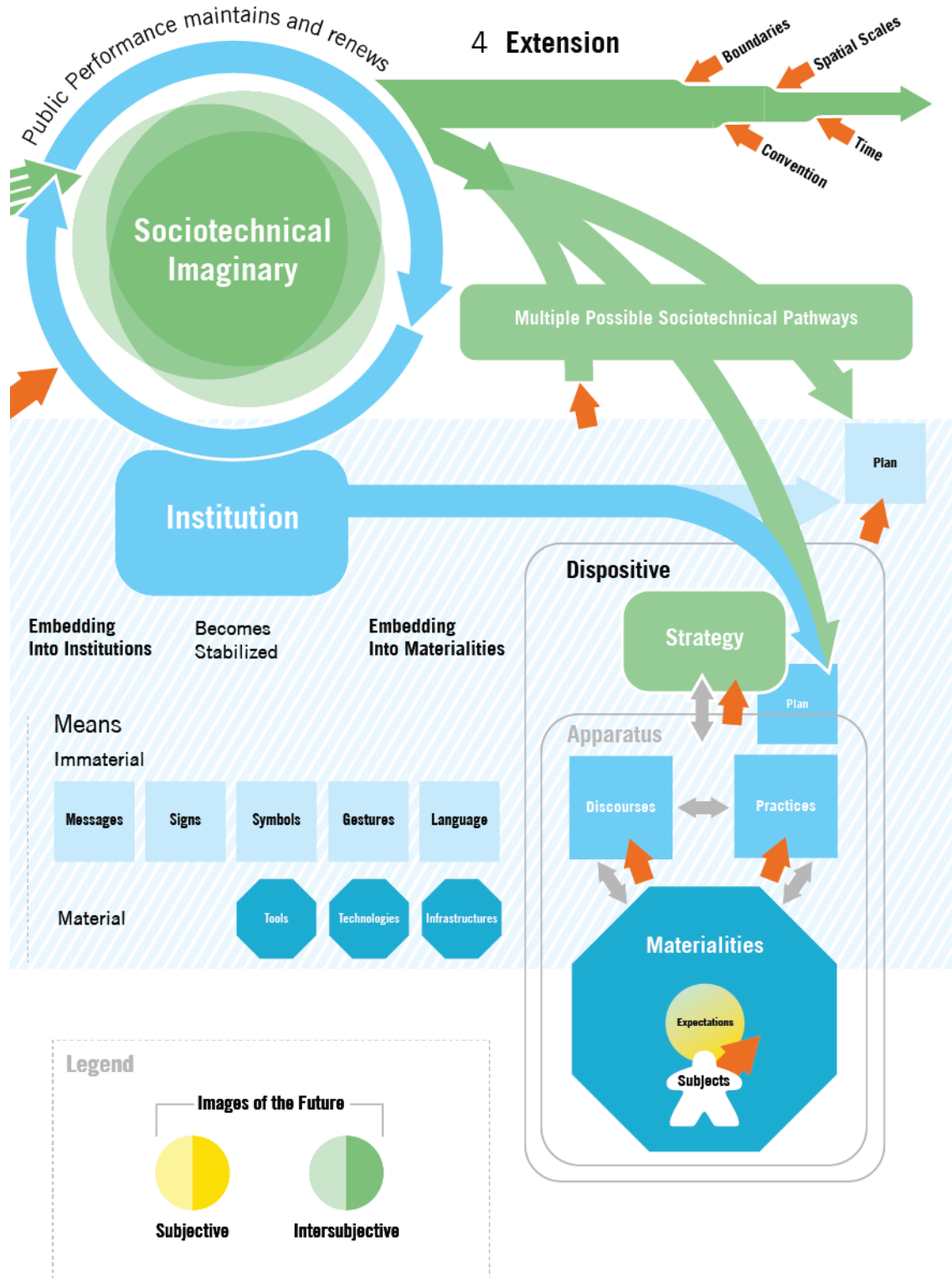


Figure 1. Sociotechnical Imaginary Formation and Interaction with a Dispositive



2.5 Logics of Carbon Reduction

Having indicated that this study will examine how the sociotechnical imaginary of the low-carbon city may inform ways of governing future cities' greenhouse gas emissions, one further theoretical strand is required. As discussed above (see Section 2.3), political economy has become a principal rationality through which government is carried out. Therefore, establishing an understanding of how carbon reduction measures are seen through the lens of political economy is an essential prerequisite for this investigation.

Two distinct but related concepts have been central to situating possible Climate Change responses within this framework: decarbonization and low carbon forms of daily life (Paterson 2016). The decarbonization of the economy is an idea intended to inform policy measures at the systemic level, while the pursuit of behavioral changes through imagining forms of daily life which could become "low-carbon" is predicated on the adoption of novel social practices and technologies by individuals. Both decarbonization and an aspiration to lead low carbon lives have contributed to planning strategies designed to enable transitions to low-carbon, or eventually even zero-carbon, societies (Shove & Walker 2010). These proposed transitions have frequently been based in new modes of governing involving changing relationships at the nexus of cities, regions, companies, and NGOs in order to redirect investment, alter patterns of urban development, propose novel sociotechnical trajectories, create mechanisms needed for functioning carbon markets and trading programs, and facilitate technology transfer of successful low-carbon innovations to new contexts (Paterson 2016).

Thus far, both decarbonization and the adoption of low-carbon practices have been moderately successful in limiting the growth of greenhouse gas emissions rates, but face major challenges in achieving more dramatic sociotechnical change (Paterson 2016). They have been constrained by the limitations of what Wapner (2016) dubs "Climate, Inc." Climate, Inc. can be seen as a form of de-politicization privileging an economic perspective on what kinds of climate "solutions" are most desirable, emphasizing those that are minimally disruptive to existing forms of economic organization and their incumbent beneficiaries. Efforts to build support for the elimination of carbon comes up against the historical fact of fossil fuels' prominence in industrial societies and the formidable vested interests it has created. By giving birth to powerful companies that have consolidated considerable political influence and accumulated immense financial resources, this system has created a set of actors who will almost certainly continue to deploy their assets to maintaining an advantageous position relative to fresh contenders for their dominant status.

While decarbonization and low-carbon practices often co-occur in the conversation surrounding emissions-reduction as a governmental objective, it is worth distinguishing

the different arenas of action in which they operate and the types of agency that they seek to influence.

2.5.1 *Decarbonization*

Decarbonization can be understood narrowly as the substitution of low or zero-emissions means of producing energy and goods for those that are emissions-intensive. It is also possible, however, to envision its broader potential to dramatically reconfigure the landscape of current high-carbon societies by undertaking a more thorough transformation of their underlying sociotechnical and economic systems. As such, decarbonization is best viewed as a macro-level concept operating on the level of large-scale collective efforts requiring significant financial resources and the coordination of a broad coalition of stakeholders. Since governments are often the actors most capable of marshalling these assets, decarbonization is frequently pursued through policy initiatives.

Decarbonization began to gain currency in policy debates in the early years of the twenty-first century. At the time it was a significant shift away from previous discourses that had focused exclusively on Climate Change as a problem of emissions regulation (Paterson 2016). The focus of the 1992 UN Framework Convention on Climate Change, as well as that of the Kyoto Protocol, was on greenhouse gases as an undesirable output of industrial economies which should be limited to certain “safe” levels in order to prevent harmful effects. Relatively little attention was paid on the global level at that point to questions about how the inner workings of these economies were linked to emissions, such as the ubiquitous use of fossil fuels as primary engines supporting economic growth and accumulation strategies. The shift in the discussion that brought decarbonization to greater prominence directed attention to the carbon intensiveness of sociotechnical systems, problematizing an “economic metabolism” reliant on high-carbon practices and technologies. Thus, the aspiration to remove carbon from sociotechnical systems became a focal issue, suggesting the need for a more systemic approach to reconsidering greenhouse gases as a byproduct of industrial capitalism.

2.5.2 *Low-Carbon Practices of Daily Life*

Imagining low-carbon practices of daily life, by contrast, places special emphasis on the greenhouse gas-producing practices of individuals. Thus, its principal utility is in framing operations at the micro-level of particular political subjects. The goal is to create ways to render emissions more visible and countable, in order to encourage changes in ingrained and habitual behaviors whose links with carbon may have become increasingly

“invisible” over time as individuals engage in them repeatedly and come to see them as taken for granted parts of life in their social milieu. Alternatively, it is possible that this link may never have been convincingly made at all in the past, opening up a possibility for making connections between certain kinds of consumption (e.g. eating large quantities of meat) and associated emissions for the first time.

Individualized Carbon Governmentalities

Paterson (2016) identifies two registers in which this daily management of emissions producing activities is discussed. The first is through “individualized carbon governmentalities” such as carbon dieting, carbon footprinting, the purchasing of carbon offsets, or membership in a Carbon Reduction Action Group (Paterson 2016, 21-22). The aim of these types of initiatives is to act upon one’s personal relationship with carbon, for which one may increasingly be held, or hold oneself, accountable. A by-product of this approach can be seen in Bulkeley’s (2016) observation that as a result of the focus on individual practices the management of carbon “gets everywhere,” becoming an unavoidable ambient concern of contemporary life. Bulkeley contends that even the smallest practices associated with carbon must continually be called into question on an ongoing basis under such a radically individualized regime, resulting in the logic of carbon minimization becoming a pervasive aspect of individuals’ considerations of how to act ethically.

One aspect of carbon reduction planning processes that has limited the scope of imagination about possibilities for future societies is the tendency to abstract urban dwellers into objectified representations using generic models of psychology and economic decision-making (Paterson 2016). The urban dwellers who inhabit and move through cities could be understood as individuals actively engaged in the continual remaking of their lives and behavior through a complex reciprocal relationship between their understanding of themselves and their conceptualization of their social setting. Instead, their involvement in imagined low-carbon futures is often accounted for solely through a technocratic rendering of their conduct as something to be more or less successfully managed at the population level.

Constructing a Persuasive Urban Fabric

The second register of managing carbon-generating conduct recognizes the potential for practices of government to establish desirable, repeatable patterns within the larger urban fabric to perform quieter but no-less effective work on much larger-scale arrangements of people and things. These approaches include choices about zoning and associated

densities of settlement, energy efficiency standards, the design of transport networks, and the proximity of food production and energy generation systems to urban centers, all of which have major effects on emissions levels.

However preferable these types of patterns may be in the abstract, however, the gap between a new vision and current realities may make the transition appear insurmountable to urban dwellers accustomed to particular ways of life, leading them to view it as an unwelcome threat even if they would not otherwise reject its normative premises. The degree to which carbon intensive components are locked-in to established sociotechnical systems can give rise to an intense and visceral sense of loss in the face of change (Pater-son 2016). Members of high-carbon societies may cling to material objects such as automobiles that have come to be invested with significant personal and cultural meaning. This is particularly difficult when elements of these sociotechnical systems are enmeshed with individual's core identity constructs, which when challenged may produce extreme intense negative psychological reactions, increasing resistance.

Approaches that seek to encourage low-carbon forms of daily life can be supported by reshaping urban infrastructures to allow for reduced energy use in facilitating mobility, by buildings, in food systems, etc. In doing so, these materialities begin to exercise a pervasive influence of their own on the choices of urban dwellers. However, this study will maintain that this type of sociotechnical change is also an important political issue whose contestation should be encouraged, especially where it purports to simultaneously offer solutions to other social problems or further additional governmental aims. Within these debates, it is crucial to recognize, as Winner (1980) maintains, that "artifacts have politics." Technologies are manifestations and instruments of particular agendas, not merely the inevitable outcome of supposedly unbiased assessments of their technical efficiency.

3 METHODOLOGY AND RESEARCH PROCESS

3.1 Research Approach

3.1.1 *Multiple Case Studies*

This project will use the study of multiple cases of proposed urban government toward carbon reduction as its overall research approach. The general objective of a case study is to examine a case in detail, in order to produce as complete an understanding of it as possible (Punch 1998). While case studies attempt to preserve the wholeness and integrity of what is being looked at, defining a more limited set of research questions is necessary in order to establish boundaries for the research and achieve a suitable level of focus on the issues of greatest interest to the researcher (Silverman 2010).

Of the three types of case studies identified by Stake (2000), this study will be a *collective case study*, in which a number of cases will be investigated in search of insight about a more general phenomenon (i.e. the sociotechnical imaginary of the “low-carbon” city at work in a particular set of urban contexts). Taking a comparative approach to this set of cases has the advantage that the analysis of similarities and differences between a phenomena across several settings directly addresses the question of the generalizability of the qualitative data which is gathered about each case individually (Peräkylä 2004).

3.1.2 *Dispositive Analysis as an Analytical Strategy*

The research approaches most suitable for analyzing sociotechnical imaginaries are those that can shed light on the relationships they are used to construct between social and material structures and the agencies of particular actors (The Sociotechnical Imaginaries Project 2018). Braun (2014) has explicitly connected plans to employ the government of cities toward climate-focused objectives with the idea of a reconfigured urban dispositive. In light of this consideration, Dispositive Analysis is the analytical approach that was chosen to guide this study.

While Dispositive Analysis can be used in rigorous ways to generate insights from empirical material, no clear procedure has been articulated for doing so, leading Andersen (2003) to contend that it is more appropriate to designate it an “analytical strategy” as opposed to a “method”. Therefore, while Dispositive Analysis can provide direction for a study such as this, it is necessary to employ other research methods within the framework it establishes.

The object of dispositive analysis is, as Jäger (2011, 3) proffers, to “explore the respective concrete context of knowledge/power and to subject it to critique.” To do so, the analyst should examine each of three forms in which knowledge becomes meaningful and powerful in the world: speech, action, and materializations. As discussed above (see Section 2.3.4) a dispositive is the formation within which these three knowledge aspects become linked together to serve a defined purpose (Jäger 2011, 32). Andersen (2003) cautions that dispositive analysis should employ a “double movement” in questioning the relationship between the apparatus and the strategy of the dispositive, examining both how the strategic intention of those assembling the apparatus guides them toward the inclusion of particular elements, and how the assembled elements may in turn exert influence on the strategy, potentially altering or transforming the initial intention it reflects over time.

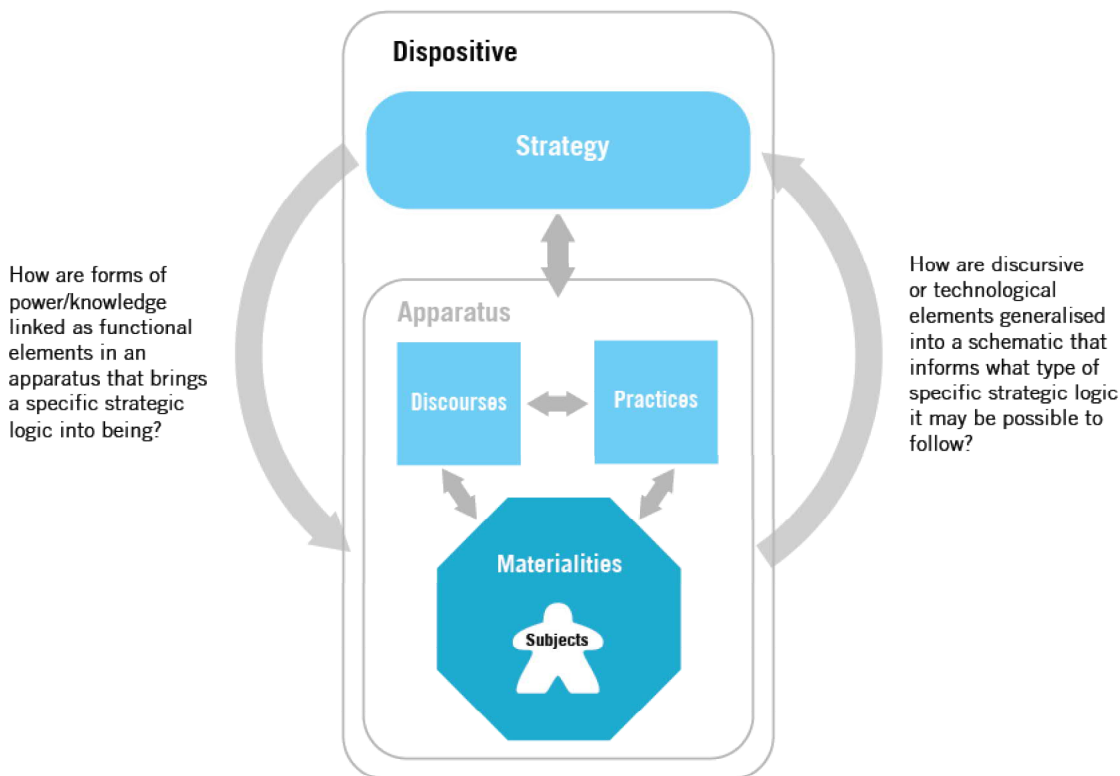


Figure 2. The "Double Movement" of Dispositive Analysis (Adapted from Anderson 2003; Jäger 2011)

3.1.3 *Dean's Analytics of Government*

Dean's (1999) *Analytics of Government* will be employed in this study as a means to articulate and examine the different aspects of the urban dispositive taking shape in proposals for instantiating the low-carbon city. In order to analyze government, Dean (1999, 11) argues that it is necessary to critically examine a number of its dimensions: the qualitative and quantitative processes of calculation and sensemaking it employs; the type of authority or agency through which it is being exercised; what types of knowledge are considered adequate for informing action and how this knowledge is produced; the social practices and technological infrastructure that act as means of materializing intentions; how the subjects of government are conceptualized by governing institutions; what government is attended to achieve; what type of results will indicate success; and what other implications may unexpectedly arise.

These considerations are viewed by Dean (2010) as falling within four aspects of government initially discussed by Foucault in his work on the "ethical government of the self": *teleology* (why we govern or are governed), *ontology* (what is being governed), *ascetics* (how we are governed), and *deontology* (who we are when we are governed in such a manner).

Ontology

The Ontology of government focuses on what things are actually being governed or acted upon. This makes it an expansive category that can potentially encompass anything or anyone within the city. For the purposes of this study, three main elements are of particular concern: the global climate, urban environments, and urban dwellers.

Ascetics

Together with the deontological aspect, the ascetics of government make up what Dean (1999) refers to as a "regime of practices". The ascetics of government focuses on how government is carried out through social practices and material interventions. It has three important sub-categories: ways of seeing and perceiving; ways of thinking and questioning; and ways of intervening and directing.

Ways of seeing and perceiving are the means of creating "fields of visibility" in which we can recognize and describe phenomena which are otherwise imperceptible. Instruments such as an "architectural drawing, a management flow chart, a map, a pie chart, a set of graphs and tables... all make it possible to 'picture' who and what is to be governed (Dean 1999, 30). Implicit in the use of these tools are choices about how to represent

particular issues as problems, as well as depict desired resolutions, and they become a selective framing of the ends of government.

Ways of thinking and questioning are the specific rationalities of government, the identification of which answers the question “How does thought seek to render particular issues, domains and problems governable?” (Dean 1999, 31). Ways of thinking and questioning reflect determinations of what knowledge is seen as credible, what data are reliable, whose expertise is called upon, and what strategies are seen as likely to succeed in attaining desired outcomes.

Ways of intervening and directing are the specific actions taken by governments to create change based on the knowledge established by the techniques of the two preceding categories.

Deontology

The deontology of government concerns its “characteristic ways of forming subjects, selves, persons, actors, or agents” (Dean 1999, 23). It therefore asks who both governing and governed subjects become when they are involved in the acts of government. Dean (1999, 33) cautions, however, that subjects are not shaped by government in a deterministic way. Instead, governments seek to “elicit, promote, facilitate, foster and attribute various capacities, qualities and statuses to particular agents” (Dean 1999, 33). The aim of these efforts is for governed subjects to begin to self-identify with the various kinds of roles government articulates and choose to frame their own experience in its preferred terms. The formation of desired subjects occurs principally through the application of and interplay between *Technologies of the Other* and *Technologies of the Self*.

Technologies of the Other

Technologies of Power are used to act on the conduct of individuals as objects by enabling means of dominating and controlling them. In outlining his Analytics of Government, Dean (1999) refers to Technologies of Power as “Technologies of the Other” to clarify that while both Technologies of the Other and Technologies of the Self are means of exercising power, they work through different types of agency. Technologies of the Other are more or less explicit and forceful means of compelling subjects to undertake desired actions.

Technologies of the Self

In contrast to technologies of power, *Technologies of the Self* structure avenues by which individuals can, on their own or in concert with others' assistance, undertake *for themselves* the transformation of their bodies, minds, or behavior, in order to achieve a desired "state of happiness, purity, wisdom, perfection, or immortality" (Foucault 1997, 225). In a basic sense, technologies of the self are the means by which we determine who we wish to be, and then act upon ourselves to make achieving this aim more possible.

Foucault (1997, 225) states that governmentality can be understood as the nexus of Technologies of Power and Technologies of the Self, or the site where the intentional external influence of government and our internalized aspirations for ourselves come together to determine our political conduct. Self-examination clarifies and recommits the individual to the course of conduct they have determined they wish to pursue, or their ethics. This understanding of ethics does not prescribe "being virtuous", but instead "conducting oneself" more consistently in line with one's personally determined ethical framework. This framework is built up through techniques of askēsis, a progressively more disciplined and accomplished self-mastery achieved through practices that intensify subjectivity by facilitating the translation of an individual's own "truth" (i.e. deeply-held personal knowledge they have formulated about the world) into well-considered principles of action (Foucault 1997, 239). Dean (1999) argues that making such a distinction between ethics (practices of the self) and politics (practices of government) is necessary to highlight Technologies of the Self as one of the principal tools by which particular forms of government can be resisted and challenged by individuals as they consider them in relation to their own ethical criteria.

Teleology

The teleology of government is concerned with *why* we govern or are governed. To govern is to "believe that government is not only necessary but possible" (Dean 1999, 33). Thus, an underlying assumption of government is that the capabilities needed to translate intentions into desired outcomes, at least to some degree, exist. "Every theory or programme of government presupposes an end of this kind - a type of person, community, organization, society or even world which is to be achieved." (Dean 1999, 33) The teleological dimension of government encapsulates the hope that governing can make things better in some specific way. The analysis of this *telos* allows us to interrogate what this "better" means and whom it is intended to benefit.

3.2 Research Material

3.2.1 *Plans as Lenses onto Imaginaries*

Plans are a key source of potential insight into the power relations involved in the embedding of sociotechnical imaginaries into materialities. Jasanoff and Kim (2015) suggest that plans are often a conduit for conveying the “intentionality” of sociotechnical imaginaries with reference to particular goals and the proposed means of reaching them.

Baxstrom (2011) argues that before a plan becomes a part of public discourse, it exists as an “image” of its potential outcomes within the institution formulating it. For Baxstrom, the creation of this image may have more impact than the actual translation of what it aspires to do into reality. Therefore, Baxstrom argues that as instruments of governance, plans do not only succeed through the delivery of their discursive payload into concrete instantiation. The potential contained within them as “perceptible virtual objects” precedes their further development as discourses and embedding in institutions and practices through their association with a larger shared imaginary.

While specific plans may refer to and contextualize imaginaries, they do not subsume them or exhaust their broader potentials, and it is the imaginary, not the plan, that is the principal vector of government. This project will understand plans as translation mechanisms that articulate a particular pathway by which a sociotechnical imaginary can be instantiated in a particular urban context, thereby attempting to reconfigure the prevailing dispositive.

From the perspective of dispositive analysis, plans are important entry points because plans are attempts to influence both the strategy and the apparatus of a dispositive at the same time. While articulating a particular set of strategic goals, plans also establish or continue discourses, elaborate practices, and describe desired material conditions, thus touching on each of the elements of a dispositive’s apparatus as well.

Thus, in analyzing a sociotechnical imaginary through plan documents, the plans become lenses through which to examine the larger complex of social and material relationships that they are attempts to organize, while simultaneously allowing the researcher to gain a new, if partial, perspective on the larger sociotechnical imaginary itself.

3.2.2 *Sampling and Selected Case Cities*

This project will draw on official urban decarbonization documents for its primary research material. The cities whose carbon neutrality plans have been selected for analysis are all members of the C40 Cities Climate Leadership Group, an international partnership

organization of cities "committed to implementing meaningful and sustainable climate-related actions locally that will help address climate change globally" (C40 Cities Climate Leadership Group 2012). Furthermore, they all belong to a specific membership category, "Innovator Cities," which have been identified as taking groundbreaking approaches to climate-focused action. According to C40, to qualify for this category, an Innovator City must "be internationally recognized for barrier-breaking climate work, a leader in the field of environmental sustainability, and a regionally recognized 'anchor city' for the relevant metropolitan area" (C40 Cities Climate Leadership Group 2012).

The specific case cities being examined here were selected through purposive, theoretically defined sampling. It was logistically necessary to select cities that have a publicly-available carbon reduction plan published in English. Furthermore, the sample was limited to cities in nations practicing a liberal form of democratic government, in order to make a narrower like-for-like comparison of governmental strategies and practices possible (this excluded from consideration, for instance, the city of Zhenjiang in China). Finally, the collection of particular cities being discussed were chosen in order to maximize their geographic dispersion across the largest number of countries and continents while at the same time keeping their overall number to a manageable level. The four cities that will be examined are Auckland, Copenhagen, New Orleans, and Vancouver. Thus, four different countries are represented.

Furthermore, each of these cities has also adopted a different time horizon for their plan and chosen a different decarbonization logic to guide their approach to emissions-reduction. The Auckland Council's (2014) target is to achieve a 40 percent reduction in GHGs by 2040 while pursuing "energy resilience". The City of Copenhagen is aiming to become "carbon neutral" by 2025 (2009). The City of New Orleans (2017) has proposed reducing emissions 50 percent by 2030, with a particular focus on simultaneous adaptation initiatives. The City of Vancouver (2015) has made deriving its energy from 100 percent renewable sources by 2050 a focal point of its plan.

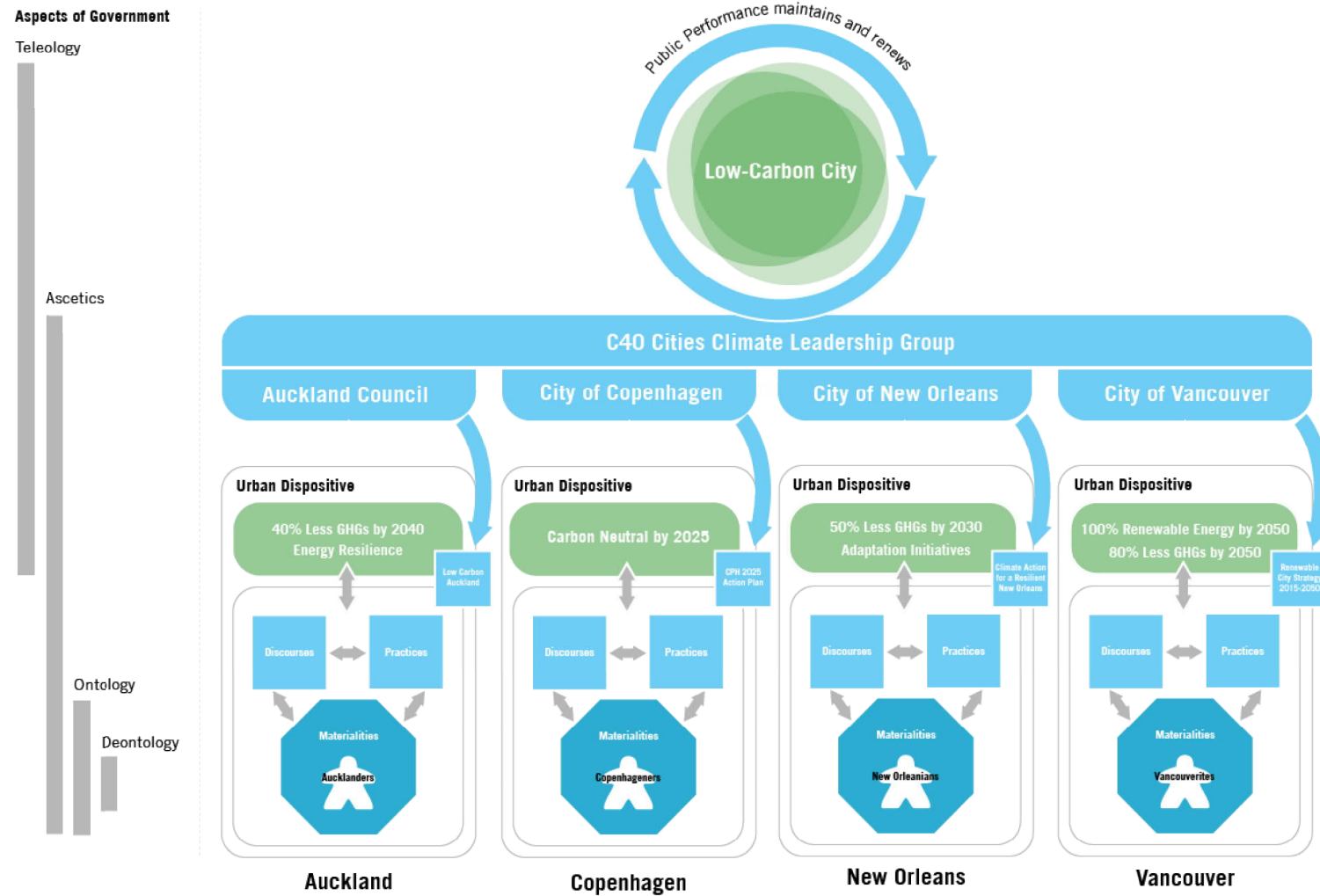


Figure 3. The Sociotechnical Imaginary of the Low-Carbon City and its Influence on Four Urban Dispositives

3.3 Methods

3.3.1 *Qualitative Content Analysis*

Qualitative Content Analysis (QCA) is a method for intensively scrutinizing text data, in order to systematically sort it into a concise and well-defined set of categories that group together terms with related meanings (Weber 1990). These meanings can either be explicit within the text or inferred by the researcher. As such QCA requires subjective interpretation in the creation and application of the codes used for classifying the text, and in the subsequent identification of emergent themes or patterns within the research material.

Seven classic steps are used in all forms of QCA: defining research questions to guide the work; selecting an appropriate sample of material; formulating the codes that will be used to categorize the data; designing a coding process (and if necessary, working to standardize understanding of the codes and specific coding practices among multiple members of a research team); coding the material; assessing the trustworthiness of the findings; and finally, seeking to identify meaningful themes and patterns within the results (Kaid 1989). Trustworthiness is primarily achieved by establishing a strong coding scheme characterized by systematic, logical, and scientific strategies of data analysis (Folger, Hewes, & Poole 1984).

Of the three QCA approaches described by Hsieh and Shannon (2005), *directed content analysis* is most suitable for this project. In directed content analysis, prior theory is the basis of the initial coding scheme, and the goal of the analysis is to validate, refine or extend this theory in some way. The codes adopted at the outset of the analytical process are based on key theoretical concepts, for which operational definitions are established using relevant literature in order to achieve greater clarity and consistency in the classification of the data drawn from a text (Potter & Levine-Donnerstein 1999). These initial codes are gradually refined as the coding is carried out, with new ones introduced as necessary.

A principal strength of a directed approach to QCA is that an existing theoretical framework can be critiqued and strengthened. At the same time, such a focused reading of the material brings with it the possibility of significant bias toward confirmatory evidence, and a tendency to overlook contextual aspects of the subject that might provide a richer understanding of the phenomenon under study. (Hsieh & Shannon 2005.)

3.3.2 *Comparative Analysis*

The urban decarbonization plans chosen for analysis were selected to facilitate comparison in two dimensions: across different national contexts and between different possible carbon reduction pathways. The goal of this comparative approach is to unearth those aspects of the “low-carbon city” that are consistent across contexts, thereby forming the core of the imaginary, while also not taking for granted the universality of qualities which may in fact be highly contingent, arising instead from the unique geographical and sociocultural situation of specific cities. Even within a set of cities of roughly similar size within Western liberal democracies, there is substantial variation in these characteristics worthy of more fine-grained and conscientious attention.

3.3.3 *Causal Layered Analysis*

Causal Layered Analysis (CLA) is a method for articulating alternative futures, with a focus on exploring them as vertical, multi-layered structures. CLA can be used to interpret and organize data into four structural layers: litany, system, worldview, and myth/metaphor.

The litany describes events, issues, trends, and problems, often expressed quantitatively as a set of disconnected and incoherent phenomena. Without further examination, the litany can engender feelings of helplessness in the face of an overwhelming context, apathy about one’s ability to productively influence the situation, or lead to calls for actors or institutions that are seen as more powerful or in control to take action.

At the system level, the phenomena of the litany are connected through technical or academic reasoning to produce an explanatory framework designed to unearth underlying social, cultural, and economic causes of the perceived problems, and identify the actors responsible for creating or sustaining them.

Analysis at the third level, worldview, seeks out actor-invariant structures within the particular society, culture, or language under examination, to understand the different discourses that constitute the issue of interest, which are likely varied and may even be in competition. A horizontal look at these different discourses can illuminate discrete alternative rationalities for why the system is as it is. Inayatullah (2004, 12) proposes multiple points of entry for analysis at this level. The differing interests of various categories of stakeholders, deeply-held ideologies, civilizational worldviews, and epistemic typologies for how knowledge is produced and rendered credible to others in society are all potentially productive avenues.

Finally, myth or metaphor is the level at which language becomes less descriptive and more evocative, reflecting deep, emotional, and/or unconscious understandings driving the worldview. Expression of these ideas can become poetic and even visual.

CLA requires the practitioner to move both up and down between different levels of organization, and side to side within them, iteratively examining the interpretation of each layer in reference to what has been unearthed in the others. While the deeper levels of worldview and myth/metaphor are arguably those most often neglected by other methods of futures research, that does not accord them a privileged status in the process of CLA. Simultaneous analysis at all four levels is crucial to enriching the process and producing new insights, and scenarios can be built upon the analysis performed at any of the individual levels. (Inayatullah 1998, 821.)

At the same time, Inayatullah (2004, 16) identifies some changes that occur in the types of issues being considered as the analyst moves down the layers. The time perspective broadens as the present concerns of the litany give way to longer-term historical patterns and, at the deepest level, to “primordial” questions of identity. The complexity of pursuing change also increases, with proposed solutions becoming less simple and focused, and the actions to be taken less immediately clear.

3.4 Summary of the Research Process

The four documents examined in the course of this study were: Auckland Council’s (2014) *Low Carbon Auckland: Auckland's Energy Resilience and Low Carbon Action Plan / Toitū te whenua, toitū te tangata* (73 pages); City of Copenhagen’s (2009) *CPH 2025 Action Plan: A Green, Smart and Carbon Neutral City* (63 pages); City of New Orleans’ (2017) *Climate Action for a Resilient New Orleans* (73 pages); and City of Vancouver’s (2015) *Renewable City Strategy 2015-2050* (62 pages). Thus, a total of 271 pages of material was analyzed.

The texts of the selected urban decarbonization plans were the subject of Directed Qualitative Content Analysis using a theoretically-derived coding framework reflecting the four aspects of Dean’s (1999) *Analytics of Government*. This approach was adapted from that outlined by Marttila (2013). The initial coding framework is summarized in Table 1. Nvivo 12 software was used to organize the coding process. As topics were identified in the course of the analysis, additional inductive codes and themes emerged as ways of describing the elements of each plan, as well as becoming points of comparison across the different cases being studied. Ultimately, 349 distinct codes were used to organize the analysis process.

All four plans were read through completely before coding began. The order in which the plans were coded was arbitrary, since it was not possible to determine the key

differentiating aspects in advance of the analysis process. Vancouver's plan was coded first, followed immediately by Auckland's. After these two plans were fully coded, the codes used up to that point were scrutinized, and an attempt was made to standardize them for consistency and to facilitate comparison. The revised coding framework was then applied to the plans from Copenhagen and New Orleans.

A unique challenge of working with Auckland's plan is that the frequent use of untranslated Maori terms and phrases required the use of a Maori-English dictionary for clarification. Fortunately, a high-quality reference work was freely available online (Moorfield 2019).

The codes that were considered most relevant to this study's three main research questions were then analyzed comparatively. To deepen the results of the findings related to Question 1, Causal Layered Analysis was used to produce metaphors describing the overall approach taken in each plan document.

Table 1. Initial Coding Framework

Level 1 <i>Aspects of Government</i>	Level 2 <i>Main Themes</i>	Level 3 <i>Sub-Themes</i>
Teleology	Desired Relationship with the Climate	Mitigation
		Adaptation
	Low-Carbon Goals	Emissions Reduction
		Renewable Energy Use
	Co-Benefits of Decarbonization	
Ontology	Climate	
	City	
	Urban Subjects	
	External Factors	
Ascetics	Ways of Seeing and Perceiving	
	Ways of Thinking and Questioning	
	Ways of Intervening and Directing	
Deontology	Technologies of the Other	Prescriptions
		Proscriptions
	Technologies of the Self	

4 RESULTS

This section will begin with a short description of each of the four case cities and their carbon reduction plans. Each of the three research questions of this study will then be considered in turn.

4.1 Results Overview

4.1.1 *Low Carbon Auckland*

Low Carbon Auckland outlines a 30-year pathway for decarbonization, while specifically defining a 10-year plan that incorporates 105 specific proposed actions. The Auckland Council's goal is to achieve a 40 per cent reduction in greenhouse gas emissions by 2040 (based on 1990 levels). At the same time, they aim to derive 90 per cent of electricity from renewable sources by 2025, but with the caveat that supply remains secure. Security of energy supply is a key issue in general in Auckland's plan, which also points to the volatility of fossil fuel prices and dependence on imports as key reasons for reducing the use fossil fuels generally. "Energy resilience" is a key secondary goal articulated several times throughout the plan and is connected with a larger discourse of self-sufficiency that comes across in the related emphasis on developing a circular economy and increasing local food production.

The "Taking Action" section Auckland's decarbonization plan describes initiatives divided into five areas: transport; energy; the built environment and green infrastructure; waste; and forestry, agriculture and natural carbon assets. This makes it one of the broadest plans among these four cases in the different areas of urban life and the urban fabric that it addresses.

One of the most unique aspects of Auckland's plan is the prominence it gives to its Maori residents as an indigenous population with their own language, cultural heritage, traditional practices, and attitudes toward the natural environment. The main headings within the report are in both English and Maori. Maori terms are also used untranslated in several places to refer to particular concepts. Perhaps most importantly, the Maori term *kaitiakitanga*, or guardianship, is adopted as a guiding principle of the plan and is a prominent discursive element within it.

4.1.2 *Green, Smart and Carbon Neutral Copenhagen*

The City of Copenhagen's main goal is to achieve carbon neutrality by 2025, meaning that the net emissions produced within the city limits would be zero. The plan acknowledges that adopting this target year, the most proximate of the four cases, means removing fossil fuels from the energy mix entirely is highly unlikely, especially when it comes to the transport sector. As a result, they intend to use an offsetting logic to make up for residual emissions in this area by exporting renewable energy generated within the city to other parts of the country.

Copenhagen's plan focuses on energy production, energy consumption, green mobility, and initiatives that affect the city administration itself as an employer, owner and operator of buildings, and user of vehicles.

Copenhagen is unique among the four cases in the emphasis it places on financial analysis of the costs of the planned initiatives, and on identifying where funding will come from. An entire section of the city's plan is devoted to a detailed breakdown of these issues. The City of Copenhagen's overall goal is for these measures to have no negative effect on the private economy of Copenhageners, and to be of financial benefit to them if and where possible.

4.1.3 *Resilient New Orleans*

The City of New Orleans is aiming to achieve a 50 percent reduction in greenhouse gas emissions by 2030. At the same time, some of the unique geographical concerns of the city, such as its location on the storm-prone Gulf Coast and the fact that the city is below sea level, mean adaptation and resilience measures are much more prominent in their plan than in those of the other case cities. Lying below sea level means that all water used in the city must be pumped and therefore incurs an energy cost, making the water-energy nexus of special concern. In addition, planning for extreme weather events and disaster recovery is given particular attention.

New Orleans currently obtains around 70 percent of its electricity from nuclear power, which the city argues is low-carbon. New Orleans' arguments for the continued use of nuclear energy for the foreseeable future is interesting in that the role of nuclear power is contested in decarbonization thinking (see Hawken 2017, 18) However, potential objections may be mitigated somewhat by the fact that New Orleans already has existing nuclear capacity and is not at this time proposing to build new nuclear generation facilities. However, the view that nuclear power is low-carbon is unique to this plan among the cities examined in this study, and the three other cases make no mention of a role for nuclear energy in their strategies.

New Orleans' plan is divided into sections dealing with energy, transport, waste, and creating a "culture of awareness and action." An additional section details the methodology of the city's greenhouse gas emissions inventory, providing additional insight into how they intend to measure and account for carbon and which urban emissions sources are included in their numbers. A key aspect of this is their choice to use a geographically-bounded inventory accounting only for carbon-generating activities that take place within Orleans Parish, rather than a consumption-based inventory which might include additional elements such as the traffic through New Orleans' extensive network of port facilities.

4.1.4 *Renewable Vancouver*

The City of Vancouver's principal goal is to meet their energy needs from 100 percent renewable sources by 2050. As a result, major discourses addressed by the Renewable City Strategy are what "renewable" means, and why renewable energy sources should be preferred over fossil fuels. Although a primary reason for advocating for renewable energy is that it has a reduced emissions footprint, this is not the only logic behind the shift. The complex interplay of renewable energy sources and zero- or low-emissions energy sources, categories which do not entirely overlap, leads to the secondary goal of reducing emissions 80% percent from 2007 levels being clearly stated, so that the shift to renewables remains framed in this light.

A key advantage that Vancouver possesses in pursuing an ambitious decarbonization goal is its existing supply of renewable electricity from large-scale hydroelectric dams beyond the city's boundaries. This means the city can pursue rather "worry-free" electrification and encounters more substantial challenges only in sourcing renewable fuels for transportation and building heating needs. At the same time, this also means that energy generation decisions are made by the provincial utility, BC Hydro, and not by the city government itself.

Therefore, the Renewable City Strategy focuses almost exclusively on the transportation and building sectors as sites of intervention for reducing carbon emissions. According to the plan document, these two sectors accounted for 90% of the city's greenhouse gas emissions in 2014 (City of Vancouver 2015, 5).

4.1.5 *Comparison of Overall Approaches*

The overall approach each case city takes to eliminating emissions varies in large part by the specific carbon reduction strategy chosen. The case cities' plans emphasize different sectors and are more or less comprehensive in their scope. In large part, this may be connected to where different cities feel they have direct control and where only opportunities for influence. Vancouver has the narrowest focus, limited to the transport and building sectors, in large part because they argue decisions about energy generation and waste management are largely taken at the provincial level. While their avowed lack of agency in these other matters could be critiqued, it follows a particular logic that is consistent throughout their plan, which focuses instead on those areas in which it feels its management can be the most effective. Auckland touches on the most different sectors, including areas such as food production, forestry, and support for biodiversity that are not taken up by the other case cities.

The choice of a time horizon for goal-setting appears to play an important role in differentiating the cities' approaches. By opting for the most ambitious time frame (2025), Copenhagen seems to be well served by choosing carbon neutrality as a goal, since it is the most flexible pathway. This allows the city to allow for continued use of fossil fuels in transport to some degree, as long as suitable offsets remain available. As the City of Copenhagen acknowledges, however, these offsets will likely not exist forever since initiatives at the national level are moving Denmark as a whole in a similar direction. Carbon neutrality will therefore be a moving target, with their strategy evolving over time. Vancouver's goal of 100 percent renewable energy is more difficult to achieve, since it is a more absolute requirement. It is therefore not surprising that their time horizon extends to 2050, in order for them to have time to develop solutions in especially difficult areas such as renewable fuels for heavy vehicles.

4.2 **Strategies of Carbon Reduction**

Causal Layered Analysis was used to dig deeper into the layers of each of the four plan documents, moving beyond the litany of planned carbon reduction measures to unearth the underlying systems, worldviews, and metaphor giving structure and coherence to each city's overall approach. The goal was to understand how the specific carbon reduction measures outlined in the plans come together to form a coherent strategy informed by the characteristics and potentials the urban governments attribute to their cities, and the image of them they wish to cultivate. The results of this analysis are displayed in Table 1.

Table 2. Causal Layered Analysis of Case Cities' Carbon Reduction Plans

	<i>Auckland</i>	<i>Copenhagen</i>	<i>New Orleans</i>	<i>Vancouver</i>
<i>Litany</i>	Eliminating need for imported energy Building a compact, high-quality urban fabric Growing green infrastructure Encouraging local food production Zero waste	Offsetting transport emissions by exporting clean renewable energy City of Cyclists No negative financial impact on Copenhageners	Land subsidence, storms, coastal loss Water-energy nexus Racial and economic inequities Existing nuclear energy generation capacity	Existing electricity supply completely derived from hydropower Eliminating fossil fuels in transport and heating Attracting "green capital" and "the very best minds" "Complete communities"
<i>System</i>	Energy resilience and security of supply Low-carbon export economy Circular economy/innovative resource management	Carbon neutrality Budgeting and financial analysis Holistic showcase of integrated green "lighthouse" projects, pilots, and demonstrations	Multiple lines of defense Pre-disaster planning for post-disaster recovery Strategic partnerships Culture of awareness and action	100% renewable energy "Worry-free" electrification Innovation hub City of Communities Advocacy for objectives governed at the provincial and federal levels
<i>Worldview</i>	Climate Change as the impetus to transform its "fossil-fuel dependent, high energy-using, high waste society" Green Growth Self-sufficiency Kaitiakitanga (Guardianship)	Climate Change as an opportunity to become a beacon of sustainable living to the world Green Growth Balancing the books	Climate Change as a clear and present danger and existential threat Resilience mindset Always in a state of change	Climate Change as a potential source of "devastating social and economic upheaval" Some things can be controlled, others only influenced Build it and they will come
<i>Metaphor</i>	City within a Forest	Shining City on a Hill	Shapeshifting City	Magnet City

4.2.1 *Auckland*

At the litany level, Auckland's plan can be seen to offer initiatives crossing aspects of urban life from energy systems to green infrastructure, and local food production to the elimination of all "waste" as it is currently understood.

Many of these proposed efforts can be seen as linked to the creation of systems of energy security and self-sufficiency, discourses which are very prominent in this plan. Movement away from fossil-fuels is framed as largely intended to escape the price volatility and lack of a guaranteed, predictable supply that comes with them. In addition, Auckland has the goal of establishing a low-carbon economy with the potential to export novel sustainability solutions. Tied in with their Zero Waste goal is the development of a circular economy characterized by innovative resource management and a view of waste as a source of as-yet-untapped value.

The desire to create a low-carbon export economy evinces a worldview within which "green growth" is a frequently mentioned objective. Economic growth remains an imperative for the Auckland Council despite their intention to pursue it what they view more sustainable ways. The intention to create an eco-economy that fosters growth by exporting innovative new solutions to environmental problems is a part of this agenda. Auckland's plan portrays Climate Change as an impetus to transform many aspects of a "fossil-fuel dependent, high energy-using, high waste society" (Auckland Council 2014) (Auckland Council 2014). In doing so, it is argued that Auckland can become more self-sufficient in its energy, food, and other resource systems, making its connections to global networks opportunities rather than tenuous lifelines. The Maori idea of *kaitiakitanga* (guardianship) is adopted to encourage thinking in terms of the stewardship of resources, natural environments, and cultural heritage.

Of the four city metaphors presented here, the guiding image of Auckland transforming itself into a "City within a Forest" is the only one directly suggested within the city's own plan. This metaphor recurs frequently throughout Low Carbon Auckland, especially in the context of restorative tree planting and the expansion of ecological corridors identified as valuable for both human activities and biodiversity. In addition, it captures the sense of Auckland as a self-sufficient island in a sea of green, whose connections to the world beyond are intentional and profitable rather than sources of unwelcome dependency.

4.2.2 *Copenhagen*

Copenhagen's litany involves a proposal to offset continued emissions from transport by exporting green energy, predominantly from wind turbines, to areas outside of the city. Improvements to cycling infrastructure are budgeted for one of the highest levels of investment of any of the plan's initiatives, aiming to build on and expand Copenhagen's identity as a "city of cyclists." In addition, the idea that the carbon reduction program described in Copenhagen's plan will not have a net negative financial impact on Copenhageners is repeatedly referenced as an important goal.

Therefore, the underlying system is one emphasizing budgeting and financial analysis, and the careful accounting of both money and carbon. The plan also emphasizes that new pilots and demonstration projects the city intends to produce and encourage in collaboration with businesses and knowledge institutions will not be one-off schemes, but a holistic and integrated set of interventions aimed at showcasing sustainable measures as a system that can meet all of the functional needs of the city.

Copenhagen's worldview is thus one that views Climate Change as an opportunity to become a beacon of sustainable living to the world. This is intended to bring not only prestige and reputation, but to provide economic benefits, including "green growth." Overall, Copenhagen is adopting a worldview in which they achieve their goals by successfully "balancing their books" in the twin ledgers recording greenhouse gas emissions and financial resources.

Copenhagen's aim to be an exemplar for other cities can be described through the metaphor of becoming a "shining city on a hill," held up and set apart as an inspiring image of the liveability and economic benefits that derive from broadly implementing sustainable technologies and practices.

4.2.3 *New Orleans*

New Orleans exists in a challenging physical context, due to its coastal location and the fact that it lies below sea level. Its litany includes the land subsidence, storms, and coastal loss it is already experiencing as a result of Climate Change. The energy cost of water is a crucial consideration, as are longstanding racial and economic inequities that the city hopes can be alleviated by some of the plan's initiatives. Existing nuclear energy generation capacity provides around 70% of New Orleans' power, which the city argues is low-carbon and will continue to make use of in the future.

At the system level, a significant part of New Orleans approach is devoted to establishing “multiple lines of defense” to protect it from potential disasters. At the same time, pre-disaster planning for post-disaster recovery is intended allow for damage to be minimal and rebuilding swift. At the same time, New Orleans argues that many of its citizens are unaware of the city’s vulnerabilities, as well as failing to make a connection between their individual behavior and its collective consequences. To address this, the city aims to create a “culture of awareness and action.” A key component of their strategy is the numerous strategic partnerships they have established with various non-profit organizations and government agencies.

Integral to New Orleans’s worldview is seeing Climate Change as an existential threat that endangers the future existence of the city, and whose impacts can already be felt in the present. At the same time, New Orleans is discussed as a city that has always been in a state of change throughout its centuries of history, and the need to continue and strengthen this resilience-oriented mindset is emphasized throughout the plan.

This idea of New Orleans as in a constant state of physical and social transformation suggests the metaphor of it as a “Shapeshifting City” that survives by holding on to its intangible capital while embracing its inherent mutability.

4.2.4 *Vancouver*

The litany described by Vancouver’s plan is one of attracting “green capital” and “the very best minds” to a city of “complete communities”. Vancouver’s focus on renewable energy means it is most concerned with eliminating fossil fuels as an energy source, which is most challenging in heating buildings and the transport sector. Their existing hydro-power capacity, however, is able to meet their other needs in a renewable way and gives Vancouver a significant head-start towards their goal of 100% renewable energy.

The systemic consequence of this clean electricity is that Vancouver sees electrification as “worry-free.” Vancouver also aims to draw on the talented workers it hopes to attract to become an innovation hub producing novel sustainability solutions. At the same time, Vancouver’s plan emphasizes the city government’s identification of particular areas in which it does not effectively control policy measures, requiring that the city become an advocate for preferred approaches at the provincial and federal levels.

At the worldview level, Vancouver argues that Climate Change is worth addressing because of its potential to create “devastating social and economic upheaval”. Vancouver appears to be pursuing a strategy that might be dubbed “build it and they will come,” suggesting carbon emissions will be reduced when urban subjects come to embrace the new opportunities and adapt themselves to the constraints of reshaped urban fabrics and infrastructure and reconfigured sociotechnical systems. An interesting element of

Vancouver's plan is how explicitly it identifies those areas which the city effectively controls, and those which it can only influence as an advocate for particular approaches. Significant aspects of Vancouver's sociotechnical systems are directed through institutions beyond the immediate control of the city government, and are instead managed at the regional, provincial, and federal levels.

"Magnet City" is the metaphor chosen to reflect Vancouver's strategy of creating the infrastructure to attract and repel suitable elements, working at a distance through powerful but invisible forces of influence.

4.3 Problematizing Aspects of Urban Life

As discussed above, a primary technique of government is identifying "problems" to be addressed by government programs and initiatives. Problematizations often use specific indicators to discuss phenomena, in part because problematizing requires a usable measure of success or failure, i.e. a broadly acceptable means of determining whether the problem has been "solved".

The problematizations articulated by the four case studies are varied, but can be broadly understood as falling into three main categories: problems of Climate Change and its specific impacts; problematically "high-carbon" aspects of urban life, infrastructure, and the urban fabric; and associated social, cultural, and political problems that influence how the first two categories can be effectively solved, and whose resolutions would provide significant co-benefits in addition to decarbonization itself. These problematizations are presented more fully in Appendix 1.

A number of problematizations are shared by all of the case cities, including the use of fossil fuels, the reliance of transport systems on the use of private automobiles, the difficulty in creating public awareness and buy-in for carbon reduction efforts, and the effects Climate Change is having or may have in the future on both built and natural environments.

At the same time, these common matters of concern are not necessarily problematized in identical ways. Fossil fuels, for example, are seen as a problem in all four case cities but for different secondary reasons in addition to their status as a major source of greenhouse gas emissions. For Auckland, the principal concern is that fossil fuels have to be imported and are subject to price volatility and variation in supply, making them less secure than locally-produced energy. For Copenhagen, the elimination of fossil fuels in transport is seen as a goal that cannot be achieved by 2025, necessitating the use of offsets to reach carbon neutrality. For New Orleans, the emissions from the use of private vehicles is of principal concern, in addition to the small percentage of coal used for electricity

generation. Finally, for Vancouver, fossil fuels should be disqualified because they are non-renewable.

Some of the problematizations are shared, but with implications extended by certain of the case cities in particular directions. The problematization of private car use is common to the plans from Auckland and New Orleans, and both see it as potentially creating inequitable outcomes for different categories of urban dwellers. For Auckland, these come in the form of road crash and injury rates disproportionately affecting poorer and minority groups. New Orleans, however, links it to the problem of accessing employment opportunities via public transport, arguing that car ownership is also connected in important ways with economic opportunity, which disincentives for private vehicle use need to take into account if they are to be implemented fairly.

A spectrum could be described that places the four case cities on a continuum from New Orleans, the city that see Climate Change as a dire and immediate threat, to Copenhagen, which primarily views Climate Change as an opportunity for green growth and a positive international reputation, with Auckland and Vancouver somewhere in between. Each of the cases positions themselves relative to these two concerns somewhat differently, something that is apparent in the different guiding metaphors that resulted from the process of Causal Layered Analysis summarized in the preceding section. Auckland, Vancouver, and especially New Orleans problematize Climate Change through its adverse impacts on their own contexts in the form of extreme weather events and other less dramatic but still impactful changes in long-term climatic patterns. Copenhagen primarily views Climate Change as a matter of global concern that simultaneously offers an opportunity to establish itself as a world leader in urban sustainability through pioneering a system of interconnected carbon reduction interventions.

Closely connected with this point is the way in which each city instrumentalizes the idea of security. For Auckland, security is desired in the form energy resilience and self-sufficiency in the face of potential disruptions to supplies of food and goods from international sources. New Orleans conceives of security through concrete plans for responding to the pervasive threat of disastrous storms and flooding, including defensive strategies for managing the presence of water in the urban landscape and mapping of evacuation routes.

Where the problematizations of the case cities as expressed through their plans diverge most seriously is in issues that go beyond carbon reduction understood narrowly to touch on other desired transformations of urban contexts seen as linked with or benefitting from carbon reduction initiatives. While the “liveability” of these cities is a recurring concern, other areas are of greater importance in particular cases.

Some problematizations are unique to a specific context, potentially illuminating something important about the approach to governing being taken, as well as the geographical, political, social, and cultural conditions prevailing there. Auckland points to

the importance of avoiding short-term decision-making that compromises long-term objectives, the need to address the decline in native biodiversity, and the scarcity of food-stuffs and medicinal plants important for Maori cultural practices. Copenhagen makes an extensive assessment of the financial aspects of the plan, identifying where necessary funds will come from and attempting to ensure that carbon reduction measures will not be a financial burden for Copenhageners. New Orleans is uniquely focused on the role of water management, given the unique challenges they face both in obtaining drinking water and controlling the flow of water across the urban landscape during and after storms and flood events. Vancouver identifies the integration of carbon reduction measures into the provision of city services as a particular problem they wish to solve.

4.4 Future Urban Dwellers as Governable Entities

The evidence for how urban governments will conceive of future urban dwellers as governable entities can be seen mainly in their ontology and deontology. Data in these areas responds to the basic questions of whose conduct these governments feel they can act upon, as well who they want these subjects to become and in which ways they would like them to envision themselves in the future.

The types of urban subjects that are enumerated in these plans are broadly similar, but not all of the same categories are present in every plan and they can take decidedly different forms. Broadly speaking, the city administration and its employees, different types of organizations, communities and neighborhoods, and urban dwellers all appear to be considered appropriate subjects of government. In addition, the governments of surrounding municipalities, as well as states or provinces, regions, and nations are all institutions which at least some of these case cities seek to influence, whether or not they can act upon them directly. The urban subjects each case city references are detailed in Appendix 2.

All four cases make use of both the reshaping of urban environments and low-carbon practices of daily life as modes of thinking about carbon reduction, though the balance between the two may be different in different contexts. Vancouver in particular leans heavily in the direction of changes to energy and transport systems and the urban fabric, arguing that they will induce behavior changes through anticipated responses to a reconfigured material order. Auckland is perhaps the case that goes farthest in the direction of creating change through changed practices, prescribing direct efforts to change behaviors across numerous aspects of daily life.

Explicit proscriptions offered by these plans are relatively few and narrowly defined, such as eliminating fossil fuels or discouraging the use of private vehicles in transport. Prescriptions, however, are more numerous and have broader scope, covering many different aspects of urban life.

4.4.1 *Technologies of the Other*

The Technologies of the Other suggested by these plans are generally focused on key areas that appear in some form across all four cases: influencing the routine behaviors of urban dwellers, particularly in their use of transport and energy; showcasing successful pilots and demonstration projects as exemplars to be emulated; establishing education programs; building support for carbon reduction through engagement with stakeholders; stimulating low-carbon economic activities and increasing employment; encouraging and facilitating collaboration between different actors; reforming the practices and renewing the material objects used by the city government itself; building an environment that is attractive to talented and knowledgeable workers; and increasing use of renewable energy technologies through efforts to make them more widely available. The forms these Technologies of the Other take in each case are summarized in Table 3, and more fully elaborated in Appendix 2.

4.4.2 *Technologies of the Self*

Although the specific form they take differs to some degree, the Technologies of the Self that are evinced in these four plans fall into five main areas. If these plans are successfully implemented, urban subjects will be expected to: actively manage their routine emissions-producing behaviors; find a sense of purpose in carbon reduction and maintain their motivation to contribute to it over time; become vectors of knowledge transmission and persuasion to others; contribute to the economy; and work directly to restore natural environments through voluntary work. The Technologies of the Self implicit in each case's plan are summarized in Table 4, and more fully elaborated in Appendix 2.

Table 3. Technologies of the Other (Prescriptions) Drawn from the Case Cities' Plans

	<i>Auckland</i>	<i>Copenhagen</i>	<i>New Orleans</i>	<i>Vancouver</i>
<i>Influencing the Routine Behavior of Urban Dwellers</i>	Transportation behavior change through Personalized Journey Planning	Achieving energy savings in companies Alternative fuels for cars City of Cyclists Opportunities to try car sharing/electric vehicles	Reducing emissions from hospitality activities Incentive programs and awareness campaigns to encourage residents to bike, walk, and use public transport	Accelerating energy efficiency and conservation measures
<i>Building Support for Carbon Reduction through Engagement with Stakeholders</i>	Community-led conversations about a liveable low-carbon future with a focus on practical solutions	Engagement and understanding from Copenhageners of the goal of carbon neutrality	Building a culture of awareness and action Review commissioned ratepayer-funded energy resilience study with stakeholders	Leading and guiding the wider public and business communities Engaging with and consulting the public
<i>Stimulating Low-Carbon Economic Activities and Increasing Employment</i>	Creating a low-carbon export economy	Generating employment and green growth with new technologies, services, and competences	Job creation and workforce skills development	
<i>Showcasing Pilots and Demonstration Projects</i>	“Brightspots” as exemplars of innovative thinking and action	Integrated showcase of “lighthouse” projects		
<i>Reforming and Renewing Practices of and Things Used by City Government</i>		City employees inspired to “climate-friendly conduct”	Energy efficient operation of city buildings and facilities Broad leadership commitment to wellbeing	
<i>Establishing Education Programs</i>	School-based initiatives		Citizen science climate data repoting platform	
<i>Increasing Availability and Use of Renewable Energy Technologies</i>		Solar energy adoption		Making renewable technologies available and implementable
<i>Attracting Talented and Knowledgeable Workers</i>		Maintaining an attractive knowledge environment		
<i>Encouraging and Facilitating Collaboration Between Different Actors</i>		Collaboration between authorities, universities, businesses, and citizens		

Table 4. Technologies of the Self Drawn from the Case Cities' Plans

	<i>Auckland</i>	<i>Copenhagen</i>	<i>New Orleans</i>	<i>Vancouver</i>
<i>Actively Manage Routine Emissions-Producing Behaviors</i>	Responsible parties who “take ownership” of their daily carbon-generating decisions Travelers who make sustainable transport journey choices Active waste managers	Individuals who take a “long look” at habitual transport, waste, and energy behaviors Travelers who avoid thinking of themselves as users of one specific transport mode Users who monitor and learn from building energy consumption	Individuals who establish connections between daily habits and collective contributions to Climate Change	Travelers who make “rational” transport journey choices
<i>Find a Sense of Purpose in Carbon Reduction and Maintain Motivation over Time</i>	Adherents to a “shared sense of understanding and purpose” willing to “play their part”	Those with “courage and a will to succeed” through the “long, hard haul together”	Those who adopt a “culture of awareness and action”	Agents for and investors in the Renewable City
<i>Contribute to the Economy</i>	Collaborators toward “green growth” Local food cultivators at home and in communal gardens	Purchasers of shares in wind turbines		Energy prosumers
<i>Become a Vector of Knowledge Transmission and Persuasion to Others</i>	Individuals who take satisfaction in sharing what they have learned about sustainability		Individuals who are involved in “educating each other about our opportunities and risks”	
<i>Volunteer to Restore Natural Environments</i>	Tree planters		Tree planters	

4.4.3 *Case-Specific Treatment of Urban Subjects*

Despite broad similarities, a few specific points should be made about each of the case cities' approaches to their urban subjects.

Auckland

The Auckland Council itself is a proposed object of government to increase its responsibility and accountability for its own building assets. It does not control relevant programs such as New Zealand's emissions trading scheme, which is organized at the national level.

Urban dwellers are categorized in part by ethnicity as well as whether they are property owners, but the main qualities ascribed to them are dependence on private vehicles and vulnerability to fluctuating oil prices. The role Maori as an indigenous people deserving particular consideration is frequently mentioned, and their contributions to the planning process are noted.

Copenhagen

The City of Copenhagen owns approximately 6% of the total floorage in Copenhagen (around 2.2 m sqm), and the city administration's 45,000 employees make it one of the largest employers in Denmark (Copenhagen City Council 2009, 51). Copenhagen's plan therefore makes governing the city government itself a priority and suggests that city vehicles and buildings will be at the forefront of testing and implementing new "smart city" technologies.

Of the organizations mentioned in its plan, Copenhagen is particularly interested in supporting "those businesses willing to take part all the way to achieving carbon neutrality for Copenhagen in 2025 and beyond" (Copenhagen City Council 2009, 13). The plan focuses on creating the conditions for such businesses to succeed in creating novel sustainability solutions.

Copenhagen is unusual in its specific identification of a generic household, which it describes as "a couple with one child and one car living in a flat" (Copenhagen City Council 2009, 56). Several times throughout the plan, this representation of a typical set of urban dwellers is used as a benchmark to show that the plan will not have negative effects on the finances of Copenhageners.

Cyclists are a category of urban subject that receives special attention in Copenhagen's plan, as the city argues that the "many cyclists in Copenhagen are a major reason that the

city's CO₂ emissions are relatively low compared with other cities," with 35% of all journeys to places of work or study taken by bicycle (Copenhagen City Council 2009, 44). At the same time, the plan argues that urban dwellers should avoid thinking of themselves as users of one specific mode of transport, so that they will remain open to choosing the most suitable transport option for any particular trip.

New Orleans

Across many areas of the plan, from solar energy adoption and energy affordability to accessibility of jobs and the health effects of poor air quality, New Orleans' approach consistently highlights issues of racial and economic inequity. The plan outlines concerns about the specific needs and interests of more vulnerable populations, including children, the elderly, and those dealing with low-income, poverty, and homelessness.

New Orleans is unusual among these case cities in describing efforts to govern tourists. However, this is less surprising when the number of annual visitors (10 million) is compared against the resident population (around 395,000).

A key element of New Orleans' approach is their assertion that many New Orleanians lack awareness of "unique challenges and opportunities our community has with regard to climate adaptation and resilience" and of the connection between their individual daily behaviors and collective impacts. New Orleans is also unique in their mention of arts and culture organizations as among those with whom they wish to collaborate in creating greater awareness.

Vancouver

The *Renewable City* plan describes Vancouver's urban dwellers as "citizens of our local and global communities," characterizing them as ethnically and linguistically diverse, adaptable, visionary, and will a strong desire to be involved in carbon reduction initiatives. However, Vancouver's plan makes very few mentions of urban dwellers at the level of individuals. An exception to this is in the way it deals with transportation choices, which is the only area in which the behavior of urban dwellers is discussed on a more human scale. At the same time, Vancouver identifies the widest array of different kinds of organizations they would like to involve in carbon reduction efforts. Labor unions and faith groups, for instance, are two categories not mentioned by the other case cities.

Vancouver cites governments at several other levels as those on which it would like to have influence in encouraging complementary carbon reduction initiatives. These include

the governments of other municipalities, the provincial government of British Columbia, and the federal government of Canada.

While there is passing mention of Coast Salish First Nations as indigenous peoples with whom the city government is concerned, there is no further elaboration of their involvement in realizing Vancouver's plan.

Given Vancouver's emphasis on renewable energy, a major proscription is the continued use of fossil fuels in any form. The plan suggests that the city will attempt to make renewable energy technologies more widely available and implementable while also supporting energy efficiency and conservation measures (which can be seen as technologies of the other). Connected with these two points is a related technology of the self which would involve urban dwellers becoming energy prosumers who more consciously and actively manage their relationship with energy generation and distribution.

5 DISCUSSION

The plans analyzed in this study have been prepared by cities designated as “innovators” by C40 Cities. Closely examining them, however, leads to the conclusion that they largely work to preserve the status quo as far as possible, seeking to make Climate Change minimally disruptive to prevailing forms of political and economic organization and urban life. Climate Change is primarily problematized here through the ways in which its direct physical impacts unsettle urban security and stability, not as an issue of social justice either within or beyond the boundaries of these cities.

The choice to make becoming “low-carbon” a principal goal establishes a clearly-bounded scope for action while still allowing cities to benefit from the international recognition they receive. Rather than giving rise to a radical realignment of political, social, and economic priorities, for these cities Climate Change largely seems to present an opportunity to profit from innovative technological solutions which the private sector is expected to develop and future urban dwellers are expected to adopt as they come to recognize their obvious benefits.

Following this logic, businesses should be innovators, while urban dwellers should mainly be cooperative. None of the plans anticipate or envision significant resistance from their inhabitants. However, a brief mention of illegal waste dumping as an area of concern by New Orleans suggests that not all urban activity proceeds according to the regulations and directives of city government. More explicitly exploring these alternate forms of conduct and how the plans’ measures might be skirted or ignored might yield a different perspective on forms of agency that are not currently being recognized.

The prominence of economic considerations and the discourse around an aspiration to “green growth” suggests that these plans are still operating largely in the realm of “Climate, Inc.” (see Section 2.5 above). The focus on encouraging private sector efforts to develop carbon reduction solutions largely cedes agency for shaping the trajectory of sustainable development to companies. Responses to Climate Change are seen as ways to benefit the economy by producing new products and services for export and increasing employment, rather than the economy being reinvented as a tool for more effectively responding to Climate Change in ways that recognize that greenhouse gases can no longer be considered irrelevant externalities.

Since Futures Studies is frequently used to contribute to governmental efforts to reduce carbon, appropriate tools are needed for futures research to exercise well-considered criticism of whether these sustainability initiatives will be effective environmental initiatives, as well as how well they reflect other “emancipatory” values of the discipline.

From a methodological perspective, it is worth considering how foresight processes were used to develop the case cities’ carbon reduction plans, though the evidence for this is somewhat limited on the basis of the plan documents alone. If any of the case cities

used the consideration of multiple scenarios to develop their strategic plans, this is not evident in the final form they take. Roadmapping logics are the principal form of futures thinking that can be clearly seen, as all of the case cities define goals, pathways, and intermediate milestones.

While roadmapping makes the intended process for achieving certain desired outcomes more legible, it requires other methods to determine what these outcomes should be. The Auckland Council (2014, 9) states that it employed a “visionary” approach to generate “‘big picture’, future thinking and an understanding of the scale of change required...[which] has enabled a ‘what is possible’ approach rather than ‘what is likely’”. Their description suggests that this involved a form of backcasting. At the same time, Auckland’s use of independent technical analysis to create an “evidence-based” roadmap incorporating “global best practice,” risk analysis, and cost-benefit analysis appears to have substantially shaped their understanding of “what is possible” (Auckland Council 2014, 9) making its approach less of a departure from that taken by the other cases than might otherwise be assumed. The other cases’ plans were less transparent about how goals and pathways were established.

A challenge of critiquing plans for more sustainable futures is recognizing that sustainability is not a monolithic or homogenous alternative to unsustainable practices, which are themselves characterized by myriad types of undesirable consequences and effects playing out in many different areas. It is crucially important to recognize that each of the four dimensions of sustainability, i.e. environmental, economic, social, and cultural sustainability (United Nations International Secretariat C & RMIT University 2019), may be pursued in different ways which can potentially come into conflict, or benefit one of the dimensions at the expense of others.

In considering carbon reduction and other sustainability programs holistically and contextually, we should remain mindful that the means matter. By developing the tools and approaches needed to assess responses to Climate Change in light of values that include equity, justice, and transparency in addition to environmental consciousness, we will be better able to make choices that ensure the long-term sustainability of cities and societies across all four aspects simultaneously. Dispositive Analysis in general and Dean’s Analytics of Government in particular show potential to be further developed into this type of instrument.

Strategies of Carbon Reduction

A danger of focusing on cities as primary domains of carbon reduction is that by limiting themselves to governing what occurs within the city itself for pragmatic reasons, cities will shape themselves into ethical enclosures that work to purify their own environments

while setting themselves apart from or ignoring their many connections to larger systems. Auckland's narrative of self-sufficiency and Copenhagen's pursuit of carbon neutrality are perhaps the most clearly evident versions of this approach among the four case cities studied here, but all four exhibit some version of this logic. Turning inward to such a degree means that these cities may largely ignore greater opportunities to be agents of change beyond their limits.

This inward turn may stem from the use of geographically-bounded greenhouse gas emissions inventories, which account only for emissions originating within well-defined spatial boundaries. This choice is one key example in which the *how* of governing weighs heavily in relation to the *what* of responding to Climate Change as a global challenge, constraining the level of ambition cities exhibit in dealing with issues such as port traffic, commuters, tourists, and the environmental footprint of material consumption as a separate issue from the waste it generates. Emissions from aviation receive no mention at all. The use of consumption-based greenhouse gas inventories would account for more of these cities' connections to the wider world but would require a different form of accounting that problematizes additional forms of unsustainable resource use. This would likely prove more troubling to incumbent interests than efforts to promote active transport, energy efficiency, and new practices of waste management. Incremental improvements will likely result from these initiatives, but the question of whether they go anywhere near far enough to be effective Climate Change counter-measures needs to remain an open and frequently revisited one.

In the programs and practices of urban government studied here, an individual-centered approach to carbon management is brought together with concerns about larger-scale logics, uniting two different perspectives on carbon's role in preferable forms of life within future cities. Decarbonization and low-carbon lifestyles are both widely recognized forms of emissions-reduction that can conceivably complement each other in the way they encourage systemic transformations toward greater urban sustainability. However, this complementarity is not a foregone conclusion. Recent research has suggested that an emphasis on using low-carbon practices to "nudge" everyday behavior can crowd out public support for measures such as carbon taxes, which are likely to be more effective tools for reducing the carbon output of the largest emitters (Hagmann, Ho, & Loewenstein 2019).

Therefore, it is important to ask whether involving urban dwellers in carbon reduction measures creates a culture of shared commitment to combating Climate Change, or counterproductively engenders a feeling that more expansive measures more intrusive to corporate interests may be unnecessary. A focus on what can be accomplished at the urban scale may lead to a greater emphasis on behavior change, but cities should remain cognizant that this is not where the greatest impact in diminishing emissions can be achieved. The limited control cities have over carbon taxation and other larger-scale political

instruments does not mean that they have no agency in this arena, something Vancouver recognizes in articulating its desire to be an advocate for change in policies at the provincial and national levels. What is largely absent from the plan documents examined in this study are more detailed arguments about what means and tactics might make such advocacy resonate for decision-makers.

Thinking about the interplay of decarbonization and low-carbon practices of daily life should attempt wherever possible to illuminate the complex, context-specific interplay of imaginaries, new materialities, social practices, and forms of economic life that each concept represents, while leaving room for their frontiers to continue to be thoughtfully expanded through a constructive dialogue with emerging alternatives.

Problematizations

An extremely important problematization that only the Auckland Council (2014, 9) takes up explicitly is that carbon reduction measures often exhibit a trade-off between long- and short-term benefits, which must be evaluated carefully to prevent “locking in high-carbon growth or infrastructure, creating obsolete assets or limiting future options.” This gets to the question of whether legacy infrastructure is an existing asset or a concretization of thinking that anchors sociotechnical systems to outdated logics. In addition, it challenges whether cities and the climate are better served by urban governments taking up measures and goals that will give them momentum-building “quick wins,” or whether they should invest for the long-term even if they do not see immediate benefits or have to give up potential economies of scale.

Careful consideration should be given to whether a shorter time horizon is an adequate measure of a plan’s level of carbon reduction ambition. Copenhagen’s choice of an aggressive time horizon for significant carbon reduction has brought it international attention, but also likely led to the formation of a carbon neutral strategy that pushes a more fundamental reconsideration of issues such as transport fuels further down the line. If faster “progress” toward carbon reduction in the short term leads to the increasing optimization of half-measures, it may undermine more substantive and longer-lasting change.

Existing high-carbon dispositives may be seen as problematic, but in many ways they are also associated with conceptions of freedom deeply embedded in contemporary societies, such as the freedom to make consumption choices based on one’s own preferences from among those offered by markets, and the freedom to choose when and how to be mobile. The City of Vancouver (2015, 41) argues that it does not want its plan to describe a future where “freedoms are given up at the expense of environmental benefit, but one where people make sustainable choices because they are the most rational, comfortable, convenient, safe, and enjoyable.” This is a view that is common to all four plans examined

here. Vancouver's statement implies that there is a singular rationality of sustainable decision-making, founded on a particular view of what constitutes reasonable and efficient resource use, that should inform the carbon ethics of future urban dwellers. Neither freedom nor sustainability, however, are subject to one particular logic, and effectively addressing the challenges Climate Change presents will involve considering multiple rationalities about what freedoms should be valued in today's democracies, as well as what understandings of sustainability offer the best routes to the long-term flourishing of human beings, dependent as this is on its relationship with a natural world that is being severely damaged and degraded.

Urban Subjects

A number of important questions should be asked about the way in which the carbon reduction plans examined in this study consider the people who will inhabit these cities in the future. As discussed above (see Section 2.5.2), a key danger in carbon reduction planning is abstracting urban dwellers into generic representations whose behavior will follow predictable, "rational" patterns. Doing so fails to recognize the way in which groups of urban dwellers in a particular city may be different from each other in their vulnerability to Climate Change impacts, pollution, and systemic forces beyond their control, as well as in their economic circumstances, cultures, perceived modes of agency, and views of what futures may be preferable.

In taking a critical view of these plans, at least this basic set of questions should be asked about how urban dwellers are represented and discussed (though this list should in no way be considered exhaustive):

- Are urban dwellers seen as a differentiated or homogenous population?
- Are urban dwellers talked about as individuals, or only as members of aggregate groups or populations?
- How are indigenous peoples referred to?
- Is the conduct of populations temporarily inhabiting or passing through the city dealt with?
- Will city employees have particular responsibility for conducting themselves in ways that support these plans?

While the answers to these questions cannot be considered comprehensive or conclusive based on the examination of the plan documents alone, some points can be made about them, especially through comparison between the approaches taken by the four case cities.

Differentiation or Homogeneity

Especially in the plans produced by Auckland and New Orleans, urban dwellers are not viewed uniformly, but are discussed as having particular needs and opportunities based on their economic situation, health condition, vulnerability to environmental factors such as air quality and extreme weather events, and race. Vancouver's consideration of diversity is more narrowly focused but does touch on the need to maintain the affordability of housing at different income levels.

This can be contrasted with Copenhagen, whose plan describes a generic two adult, one child, apartment-dwelling household as typical. This is surprising in part because there is a brief mention of the fact that social housing makes up around 20 percent of the city's building stock, suggesting there is at least some disparity in economic circumstances meriting consideration. In Copenhagen's plan, what differences are described between urban dwellers are largely based on the different modes of transport they currently rely on, i.e. whether they primarily consider themselves to be driver, cyclists, or users of public transport.

Individuals or Aggregate Populations

Vancouver's plan makes very few mentions of urban dwellers at the level of individuals. An exception to this is in the way it deals with transportation choices, which is the only area in which the behavior of urban dwellers is discussed on a more human scale.

Auckland's plan discusses future Aucklanders on the whole more abstractly than present ones, which is perhaps unsurprising. Examples of carbon reduction activities by present Aucklanders, however, are presented as a set of case studies providing examples of desirable forms of conduct and include interviews with and descriptions of actual individuals in different roles.

Indigenous Peoples

Despite passing mention of several indigenous First Nations groups as a population of concern to the city, no details about how they will be affected by or contribute to the plan are offered by Vancouver's plan.

By contrast, Auckland's plan makes explicit mention of Maori concerns and describes how they will be integrated into planning processes. Furthermore, there is evidence for

the adoption of some Maori cultural principles more broadly throughout the plan (e.g. in the emphasis on guardianship)

Temporary Inhabitants

A question of interest in considering these case cities is whether the populations that move through the city or inhabit it on a temporary basis are considered governable. Vancouver's plan mentions that 400,000 commuters and students move through the city on a daily basis but does not explain whether any of the measures or initiatives they propose are tailored to the carbon-generating practices of this group.

Copenhagen suggests that it will explore how cruise ships docking there can be supplied with electricity from onshore renewables, reducing their emissions as well as local air pollution. At the same time, they identify international discourses of Copenhagen as an attractive travel destination, but do not mention whether tourists will be expected to participate in or contribute to their proposed programs in the transport and energy sectors.

By contrast, the fact that visitors to New Orleans represent a population many times the size of its resident population receives specific consideration and it is clear the behavior of tourists will be encouraged in particular directions, in part through the actions of those businesses offering accommodation, hospitality services, and events.

Responsibility of City Employees

The description of strategies for acting on the conduct of city employees across the four cases suggests that they may be one of the most intensively governed categories of subjects if these plans are implemented as proposed. City employees are the main group for whom training rather than education in "appropriate climate conduct" is prescribed, and discourses of accountability such as that offered by Copenhagen suggest acting in a climate-oriented way will be a component of reviewing employees' performance in some roles.

Urban Dwellers as Thinking, Ethical Individuals

Fundamentally, discussion of these questions points to the need to consider urban dwellers as thinking and acting individuals, who will take diverse standpoints on how to formulate their own ethics of carbon conduct. In order for carbon reduction planning to be fair and equitable, it needs to recognize meaningful differences in how both Climate

Change and carbon reduction initiatives will affect specific urban dwellers in light of their unique vulnerabilities, capacities, and aspirations.

In addition, a key element of a governmentality approach is examining the interplay between Technologies of the Other and Technology of the Self. The space between a government's articulation of its desired forms of subjectivity and the ethical work of individuals on their own conduct is where some of the issues most in need of criticism can be found. All four case cities articulate norms for appropriate carbon conduct and suggest desired behavior changes for various categories of urban subjects. There are differences, however, in how the plans address the processes through which this change will be brought about.

For New Orleans, a principal goal is to create a "culture of awareness and action" among its citizens by employing a wide spectrum of participatory means including a role for arts and culture initiatives and a platform for citizen science, strategies largely ignored by the other case cities. By contrast, Copenhagen intends to engage in "long-term attitude training," which suggests a more prescriptive, behaviorist method of influencing the activities of its urban subjects. While a detailed examination of this distinction is beyond the scope of this study, it is a meaningful one for the question of what agency is accorded to urban subjects, and could be further clarified through continued study of the differences in how education, awareness, and training programs are actually carried out in these two contexts.

A limitation of this research approach for understanding the carbon-reducing Technologies of the Self that may prevail in the case cities in the future is that these can only be understood as described by the selected plans, which are from the perspective of the governing body and not the governed subjects. Therefore, these Technologies of the Self have to be understood as those intended or recommended for future urban dwellers, not those which they might propose for themselves. Other methods and research material would be needed to elicit urban dwellers' perspectives on how they intend to manage their own emissions-producing activities relative to their cities' goals.

5.1 Theoretical Issues for Futures Studies

In the course of conducting this study, two important theoretical issues for Futures Studies were raised. The first is that Sociotechnical Imaginaries can be understood as a more specific category of Image of the Future with utility for examining desirable futures arising through developments in science and technology. The second is that while Images of the Future encompass both subjective and intersubjective views of possible futures, these two categories have distinct properties and cannot be conflated without obscuring

important questions about the role of social mediation as a bridge between them, within which power relations play out in meaningful ways.

Sociotechnical imaginaries can be understood as a particular type of intersubjective Image of the Future. It is not the only type of desirable future image, but remains distinct from utopias and visions, two constructs with which it was compared above. The use of this concept within Futures Studies adds to the discipline's vocabulary for describing the ways in which desirable conceptions of the future are used to influence cultures, societies, and power relations.

A danger of the “intersubjective turn” in the study of imagination is that it may have a tendency to conflate the mentalist notion of imagination with imagination as a social practice, thereby eliding or obscuring the acts of negotiation and power dynamics at work in the translation between an individual's imaginings and the larger imaginaries that collect and attempt to reconcile the imaginings of many people. This is problematic in that the interaction of individuals' psychology and public culture is complex and multi-dimensional (see Section 0 above). Thus, the idea of “collective imagination” risks ascribing capacities to the social body that properly belong to its constituent subjects, obscuring the myriad modes of interplay between personal subjective imaginings and the products of culture and society.

This study is predicated on the idea that the broad category of images of desirable futures needs to be understood as encompassing both subjective imagined futures and various types of collective constructs, including sociotechnical imaginaries, but as distinct categories. Only by doing so can futures researchers be sufficiently critical of the power relations inherent in how conceptions of preferable futures move between the subjective and social realms. This is especially crucial in the context of government, where preferable futures can easily become means of domination, no matter how laudable their underlying goals may be.

5.2 Methodological Considerations

Dispositive analysis has the advantage over using discourse analysis alone of focusing attention on social practices and materialities in addition to discursive statements. This acknowledges other important forms of power that might otherwise go unconsidered if attention was paid to “what is said” alone. At the same time, the attempt made here to understand a set of “anticipated” or “emerging” dispositives is somewhat different from the original application of the dispositive concept to analyses of historical circumstances, in which factual description of what has already occurred can be established. This analysis is constrained by the fact that the primary evidence of emerging low-carbon dispositives available so far is the statements of intent encapsulated by the plan documents examined.

This means that the study was limited to what the case cities *say* about the practices and materialities they claim they are working to bring about.

A more complete understanding of the various low-carbon dispositives will therefore only become possible when the processes of implementing the plans has progressed further and the “facts on the ground” can provide additional information about any slippages between intent and reality that have occurred. Thus, the findings presented here represent only what a low-carbon dispositive *may* look like in the future.

5.3 Limitations and Lessons Learned

As with any research, this study has a number of limitations resulting from deliberate choices about its scope and methodology as well as the resources available for conducting it. These include limitations of the sample of case cities selected for analysis, limitations of the carbon reduction plans as research material, and limitations of the research process as actually carried out.

Limitations of the Sample

These particular cases were explicitly identified as atypical exemplars by C40 through their designation of them as “innovator cities”. As a result, the findings discussed above may be generalizable as far as the remainder of C40’s Innovator Cities but will not necessarily be more broadly evident in other urban areas. Further work would be needed to determine if holding these cities up as models of climate action leads to their example being emulated elsewhere.

Although many of the issues the plans examined in the course of this research discuss are likely to be faced by the majority of cities globally, the relatively small size of these four cities means that these plans may not have considered all of the issues of concern for much larger urban contexts, which may have more complex administrative systems, larger spatial extents, different population densities, or other qualities which differentiate them from the cities examined in this study.

Finally, although the documents used for this research were the most recent complete plans available from the city governments concerned, some of them are now several years old. Copenhagen’s plan in particular was written ten years ago, and more up-to-date information may give a different perspective on how their approach has evolved in the intervening years.

Limitations of the Research Material

Although the research material selected for each case study was the most recent complete plan document available concerned explicitly with carbon reduction, this by no means exhausts the available material which might have informed this study's research questions. The plans examined here are all linked to other strategic plans at various scales and focused on various aspects of their cities. Examining other plans referenced in these decarbonization documents would almost certainly yield further information about how they will be carried out.

In some cases, these cities have established timelines for regularly reviewing and updating their plan documents, which means updated versions or supplements are now available. In addition, some Climate Change-related aspects, such as more detailed accounts of intended adaptation strategies, are omitted from these specific plans because they are dealt with by another more narrowly-focused plan on those subjects.

Limitations of the Research Process

In the data collection process, the first two cases examined (Vancouver and Auckland) were initially coded primarily at the level of the four aspects of the Analytics of Government alone. This proved to be too high a level of organization to provide usable insights, requiring that all of the coded material for these cases be reviewed again to establish a more useful number of sub-categories. For the second two cases, the more detailed coding hierarchy was used from the outset.

The difficulty in standardizing a large number of codes across several cases means it is likely that there is some inconsistency in how the codes were applied as well as aggregated into larger categories, hindering an ideal comparison across the four cases.

5.4 Directions for Future Research

There are numerous aspects of the interplay of low-carbon urban imaginaries and techniques of city government that merit further research. The first step in extending these findings could be interviews with city officials from the four case cities to confirm the findings presented here and discuss how the implementation process has proceeded in the years since the plans were first written. In addition, details about specific carbon reduction measures could come from a study of linked strategic plans concerned with or focused on other aspects of the future of cities but touching on relevant material for carbon reduction or adaptation efforts.

Furthermore, it may be illuminating to examine how the “low-carbon city” imaginary formed and has been disseminated, possibly by looking at the role of C40 Cities and similar organizations in more detail, and certainly by examining a larger sample of different urban contexts. Possible sources of consistency and variation in the initiatives the plans describe, such as policy mobility between city governments, would be interesting to consider further (see, for example, McCann 2011). While these questions were beyond the scope of this study, they are undoubtedly worth examining as questions of power and influence over carbon reduction efforts.

Additionally, it would be fruitful to examine whether consumption-based emissions inventories could be made viable alternatives to the geographically bounded approaches used by these case cities.

Finally, participatory work with urban dwellers from the case cities to discuss their assessment of the deontology implicit in the plans would start to get beyond the trap of viewing these individuals as abstractions. Are the roles and responsibilities described ones with which they identify? Are they willing to conduct themselves in the ways prescribed, or do these recommendations provoke resistance and suggestions for alternatives? Would they be willing to do more than what is being asked of them by these plans, and do they have additional capabilities that could serve carbon reduction measures? Discussions of the potential agency of future urban dwellers may be informed by the findings presented here but should also continue to be renewed and expanded as new details about the emerging low-carbon dispositive come to light.

5.5 Conclusion

Climate Change is a matter of urgency that has called into question the prevailing high-carbon dispositive of contemporary societies. By “shaking loose” the apparatus that has supported a strategy of improving living standards through economic growth, intensive resource use and an ever-expanding environmental footprint, concerns about Climate Change in general as well as its context-specific impacts have opened the way to potential future reconfigurations of power relations.

The sociotechnical imaginary of the low-carbon city has become one guide to how power relations may be reformed at the urban level and a new, more sustainable dispositive constructed for cities. This imaginary is multifaceted, and this study has demonstrated that urban governments may interpret this desirable conception of the future in a number of different ways. The specific aspects of urban areas and urban life that city governments choose to problematize, the means of decarbonization they propose to implement, and the way they intend to act on urban dwellers both directly and through influencing the ways

in which they see themselves, their roles, and their responsibilities are all uses of power which this research set out to make more transparent.

This study has demonstrated that the low-carbon city envisioned by Auckland, Copenhagen, New Orleans, and Vancouver is one in which current growth-oriented and entrepreneurial economic logics, the pursuit of a relatively narrow conception of security, and forms of political and social organization that enshrine the ability to move and consume as important freedoms would extend into the future. This suggests that the emerging low-carbon dispositives planned for these urban contexts will reconfigure their existing discourses, practices, and materialities only to a limited degree, representing incremental progress toward meeting the larger challenge of Climate Change.

This is somewhat unsurprising, given that the previously unprecedented scope, complexity, and slow-onset nature of Climate Change have made both means of addressing it through government and the desired ends actors hope to achieve in doing so (i.e. what would constitute “winning” this protracted struggle) very difficult to define. Developing an approach to governing urban life in the age of Climate Change requires continued work toward a stance that embraces imagination as an instrument for meaningfully engaging with all urban subjects, so that a longer time perspective and more expansive conceptions of the possible can become a part of policy conversations in this arena.

REFERENCES

- Ahlqvist, Toni – Rhisiart, Martin (2015) Emerging pathways for critical futures research: Changing contexts and impacts of social theory. *Futures* Vol. 71, 91-104. DOI: 10.1016/j.futures.2015.07.012.
- Andersen, N. Å. (2003) *Discursive analytical strategies: Understanding Foucault, Koselleck, Laclau, Luhmann*. The Policy Press, Bristol.
- Anderson, B. (1991) *Imagined communities: Reflections on the origin and spread of nationalism* (revised ed.) Verso, London and New York.
- Appadurai, A. (1996) *Modernity at large: Cultural dimensions of globalization*. University of Minnesota Press, Minneapolis.
- Appadurai, Arjun (1990) Disjuncture and Difference in the Global Cultural Economy. *Public Culture* Vol. 2 (2), 1-24. DOI: //doi.org/10.1215/08992363-2-2-1.
- Auckland Council (2014) *Low Carbon Auckland: Auckland's Energy Resilience and Low Carbon Action Plan / Toitū te whenua, toitū te tangata*. Auckland, New Zealand. Retrieved from <<https://www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-plans-strategies/topic-based-plans-strategies/environmental-plans-strategies/docslowcarboncopy/low-carbon-strategic-action-plan-full.pdf>>, 12 June 2018.
- Baker, Tom – Ruming, Kristian (2015) Making ‘Global Sydney’: Spatial Imaginaries, Worlding and Strategic Plans. *International Journal of Urban and Regional Research* Vol. 39 (1), 62-78. DOI: 10.1111/1468-2427.12183.

- Ballo, I. F. (2015) Imagining energy futures: Sociotechnical imaginaries of the future Smart Grid in Norway. *Energy Research and Social Science* Vol. 9, 9-20. DOI: 10.1016/j.erss.2015.08.015.
- Baxstrom, Richard (2011) Even governmentality begins as an image: Institutional planning in Kuala Lumpur. *Focaal - European Journal of Anthropology* Vol. 61, 61-72.
- Bell, W. – Mau, J. A. (1971) Images of the future: Theory and research strategies. In: *The sociology of the future: Theory, cases, and annotated bibliography*, ed. by W. Bell – J. A. Mau, 6-44. Russell Sage Foundation, New York.
- Blaser, M. (2013) Notes towards a political ontology of 'environmental' conflicts. In: *Contested ecologies: Dialogues in the South on nature and knowledge*, ed. by L. Green, 13-27. HSRC Press, Cape Town.
- Bonneuil, C., & Fressoz, J. (2016) Chapter 1: Welcome to the anthropocene. In: *The shock of the anthropocene: The earth, history, and us*, ed. by C. Bonneuil – J. Fressoz, 3-18. Verso, Brooklyn, NY.
- Bowman, W. (2015) Imagining a modern Rwanda: Sociotechnological imaginaries, information technology, and the postgenocide state. In: *Dreamscapes of modernity : Sociotechnical imaginaries and the fabrication of power*, ed. by S. Jasanoff – S. Kim, 79-102. University of Chicago Press, Chicago, IL.
- Braun, B. P. (2014) A new urban dispositif? Governing life in an age of climate change. *Environment and Planning D: Society and Space* Vol. 32 (1), 49-64. DOI: 10.1068/d4313.

Burchell, G. – Gordon, C. – Miller, P. (eds.) (1991) *The Foucault effect: Studies in governmentality. With two lectures by and an interview with Michel Foucault*. Harvester Wheatsheaf, London.

Bussolini, J. (2010) What is a dispositive? *Foucault Studies* Vol. 10, 85-107. DOI: 10.22439/fs.v0i10.3120.

C40 Cities Climate Leadership Group (2012) C40 announces new guidelines for membership categories. Retrieved from <https://c40-production-images.s3.amazonaws.com/press_releases/images/25_C40_20Guidelines_20F1-NAL_2011.14.12.original.pdf?1388095701>, 26 June 2018.

C40 Cities Climate Leadership Group (2019) About. Retrieved from <<https://www.c40.org/about>>, 26 June 2018

Bulkeley, Harriet (2016) *Can we govern the climate?* [Video] Retrieved from <<https://www.youtube.com/watch?v=KATUvvZ8fiw>>, 26 June 2018.

Carbon Neutral Cities Alliance (undated) About. Retrieved from <<https://carbonneutralcities.org/about/>>, 15 May 2019.

City of New Orleans (2017) *Climate action for a resilient New Orleans*. New Orleans, LA.

City of Vancouver (2015) *Renewable city strategy 2015-2050*. Vancouver, BC.

Copenhagen City Council (2009) *CPH 2025 action plan: A green, smart and carbon neutral city*. City of Copenhagen, Copenhagen.

- Darier, E. (1999) Foucault and the environment: An introduction. In: *Discourses of the environment*, ed. by E. Darier, 1-33. Blackwell, Oxford.
- Dean, M. (1999) *Governmentality: Power and rule in modern society*. Sage, London.
- Dean, M. (2010) *Governmentality: Power and rule in modern society* (2nd ed.) Sage, Los Angeles.
- Deleuze, G. (1991) What is a dispositif? In: *Michel Foucault, philosopher: Essays translated from the French and German*, ed. by T. J. Armstrong, 159-168. Routledge, New York.
- Dowling, R. – McGuirk, P. – Bulkeley, H. (2018) Governing carbon conduct and subjects: Insights from Australian cities. In: *Rethinking urban transitions: Politics in the low carbon city*, ed. by A. Luque-Ayala – S. Marvin – H. Bulkeley, 185-202. Routledge, London.
- Edwards, Mark G. (2008) "Every today was a tomorrow": An integral method for indexing the social mediation of preferred futures. *Futures* Vol. 40 (2), 173-189. DOI: 10.1016/j.futures.2007.11.014.
- Engels, Franziska – Münch, Anna V. (2015) The micro smart grid as a materialised imaginary within the German energy transition. *Energy Research & Social Science* Vol. 9, 35-42. DOI: 10.1016/j.erss.2015.08.024.
- Felt, U. (2015) Keeping technologies out: Sociotechnical imaginaries and the formation of Austria's technopolitical identity. In: *Dreamscapes of modernity : Sociotechnical imaginaries and the fabrication of power*. ed. by S. Jasanoff – S. Kim, 103-125. University of Chicago Press, Chicago, IL.

- Folger, J. P. – Hewes, D. E. – Poole, M. S. (1984) Coding social interaction. In: *Progress in communication sciences*, ed. by B. Dervin – M. J. Voigt, 115-161. Ablex, Norwood, NJ.
- Foucault, M. (1979) *Discipline and punish: The birth of the prison*. Vintage, New York.
- Foucault, M. (1984) *The history of sexuality, vol. 1: An introduction*. Penguin Books, Harmondsworth.
- Foucault, M. (1994) *The order of things: An archaeology of the human sciences*. Vintage Books, New York.
- Foucault, M. – Rabinow P. (ed.) (1997) *Ethics: Subjectivity and truth. the essential works of Michel Foucault, 1954-1984, vol. 1*, trans. by Robert Hurley and others. Allen Lane/Penguin Press, London.
- Foucault, M. – Gordon, C. – Marshall, L. – Mephram, J. – Soper, K. (1980) *Power/knowledge: Selected interviews and other writings 1972-1977*. Pantheon Books, New York.
- Foucault, M. – Senellart, M. – Ewald, F. – Fontana, A. – Davidson, A. I. – Burchell, G. (2007) *Security, territory, population: Lectures at the Collège de France, 1977-1978*. Palgrave Macmillan, Basingstoke.
- Global Covenant of Mayors for Climate and Energy (2019) About Us. Retrieved from <https://www.globalcovenantofmayors.org/about/>, 15 May 2019.
- Goode, Luke – Godhe, Michael (2017) Beyond Capitalist Realism - Why we need Critical Future Studies. *Culture Unbound* Vol. 9 (1), 108-129. DOI: 10.3384/cu.2000.1525.1790615#sthash.7bZEHXNK.dpuf.

- Hagmann, David – Ho, Emily H. – Loewenstein, George (2019) Nudging out support for a carbon tax. *Nature Climate Change* Vol. 9, 484-489.
- Hawken, P. (ed.) (2017) *Drawdown: The most comprehensive plan ever proposed to reverse global warming*. Penguin Books, New York.
- Hilgartner, S. (2015) Capturing the imaginary: Vanguards, visions and the synthetic biology revolution. In: *Science and democracy: Making knowledge and making power in the biosciences and beyond*, ed. by R. Hagendijk – C. Miller – S. Hilgartner, 36-50. Routledge, London.
- Hsieh, Hsiu-Fang – Shannon, Sarah E. (2005) Three approaches to qualitative content analysis. *Qualitative Health Research* Vol. 15 (9), 1277-1288.
- ICLEI (2019) GreenClimateCities Program. Retrieved from <<https://iclei.org/en/Green-Climaticities.html>>, 26 June 2018.
- Inayatullah, Sohail (1998) Causal layered analysis: Poststructuralism as method. *Futures* Vol. 30 (8), 815-829.
- Inayatullah, S. (2004) Causal layered analysis: Theory, historical context, and case studies. In: *The Causal Layered Analysis reader*, ed. by S. Inayatullah, 8-49. Tamkang University Press, Taipei.
- Inayatullah, S. (2007) *Questioning the future: Methods and tools for organizational and societal transformation*. Tamkang University Press, Tamsui.
- IPCC (2014) *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth*

Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge.

Jäger, S. (2011) Discourse and knowledge: Theoretical and methodological aspects of a critical Discourse and Dispositive Analysis. In: *Methods of Critical Discourse Analysis*, ed. by R. Wodak – M. Meyer, 32-59. SAGE Publications, Ltd, Thousand Oaks, CA.

Jamieson, Dale (1992) Ethics, Public Policy, and Global Warming. *Science, Technology & Human Values* Vol. 17 (2), 139-153. DOI: 10.1177/016224399201700201.

Jasanoff, S. (2015a) Future imperfect: Science, technology, and the imaginations of modernity. In: *Dreamscapes of modernity: Sociotechnical imaginaries and the fabrication of power*, ed. by S. Jasanoff – Sang-Hyun Kim, 1-33. University of Chicago Press, Chicago, IL.

Jasanoff, S. (2015b) Imagined and invented worlds. In: *Dreamscapes of modernity: Sociotechnical imaginaries and the fabrication of power*, ed. by S. Jasanoff – S. Kim, 321-341. University of Chicago Press, Chicago.

Jasanoff, Sheila – Kim, Sang-Hyun (2009) Containing the Atom: Sociotechnical Imaginaries and Nuclear Power in the United States and South Korea. *Minerva* Vol. 47 (2), 119-146. DOI: 10.1007/s11024-009-9124-4.

Jasanoff, S. – Kim, S. (2015) *Dreamscapes of modernity: Sociotechnical imaginaries and the fabrication of power*. University of Chicago Press, Chicago, IL.

Kaid, L. L. (1989) Content analysis. In: *Measurement of communication behavior*, ed. by P. Emmert – L. L. Barker, 197-217. Longman, New York.

- Korsnes, Marius (2016) Ambition and ambiguity: Expectations and imaginaries developing offshore wind in China. *Technological Forecasting and Social Change* Vol. 107, 50-58. DOI: 10.1016/j.techfore.2016.03.030.
- Kuchler, Magdalena (2014) Sweet dreams (are made of cellulose): Sociotechnical imaginaries of second-generation bioenergy in the global debate. *Ecological Economics* Vol. 107 (C), 431-437. DOI: 10.1016/j.ecolecon.2014.09.014.
- Kuchler, Magdalena (2017) Post-conventional energy futures: Rendering Europe's shale gas resources governable. *Energy Research & Social Science* Vol. 31, 32-40. DOI: 10.1016/j.erss.2017.05.028.
- Lakoff, A. (2015) Global health security and the pathogenic imaginary. In: *Dreamscapes of modernity: Sociotechnical imaginaries and the fabrication of power*, ed. by S. Jasanoff – S. Kim, 300-320. University of Chicago Press, Chicago, IL.
- Levenda, Anthony M. (2019) Regional sociotechnical imaginaries and the governance of energy innovations. *Futures* Vol. 109, 181-191. DOI: 10.1016/j.futures.2018.03.001.
- Levenda, Anthony M. – Richter, Jennifer – Miller, Thaddeus – Fisher, Erik (2018) Regional sociotechnical imaginaries and the governance of energy innovations. *Futures* Vol. 109, 181-191. DOI: 10.1016/j.futures.2018.03.001.
- Levitas, R. (2013) *Utopia as method: The imaginary reconstitution of society*. Palgrave, London.

- Lupton, Deborah (2017) 'Download to delicious': Promissory themes and sociotechnical imaginaries in coverage of 3D printed food in online news sources. *Futures* Vol. 93, 44-53. DOI: 10.1016/j.futures.2017.08.001.
- Manuel, F. E. – Manuel, F. P. (1979) *Utopian thought in the Western world*. Belknap Press of Harvard University Press, Cambridge, MA.
- Marttila, T. (2013) Whither Governmentality research? A case study of the governmentalization of the entrepreneur in the French epistemological tradition. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research* Vol. 14 (3). DOI: 10.17169/fqs-14.3.1877.
- McCann, Eugene (2011) Urban policy mobilities and global circuits of knowledge: Toward a research agenda. *Annals of the Association of American Geographers* Vol. 101 (1), 107-130.
- Moorfield, J. C. (2019) Te Aka Māori-English, English-Māori Dictionary. Retrieved from <<https://maoridictionary.co.nz/>>, 1 February 2019.
- Paterson, M. (2016) The sociological imagination of climate futures. In: *Reimagining Climate Change*, 14-28. Routledge, Abingdon, UK.
- Peräkylä, A. (2004) Reliability and validity in research based upon transcripts. In: *Qualitative research: Theory, method and practice* (2nd ed.) ed. by D. Silverman, 282-303. Sage, London.
- Polak, F. L. (1973) *The image of the future*. Elsevier, Amsterdam.
- Potter, W. J. – Levine-Donnerstein, D. (1999) Rethinking validity and reliability in content analysis. *Journal of Applied Communication Research* Vol. 27, 258-284.

- Punch, K. (1998) *Introduction to social research: Quantitative and qualitative approaches*. Sage, London.
- Rabinow, P. (1997) Introduction: The history of systems of thought. In: *Ethics: Subjectivity and truth. The essential works of Michel Foucault, 1954-1984, vol. 1*, ed. by P. Rabinow. Allen Lane/Penguin Press, London.
- Rose, N. (1999) *Powers of freedom: Reframing political thought*. Cambridge University Press, Cambridge.
- Said, E. W. (1978) Imaginative geography and its representations: Orientalizing the oriental. In: *Orientalism*, 49-73. Routledge & Kegan Paul, London.
- Shove, E. – Walker, G. (2010) Governing transitions in the sustainability of everyday life. *Research Policy* Vol. 39 (4), 471-476.
- Silverman, D. (2010) *Doing qualitative research* (3rd ed.) Sage, London.
- Smith, E. (2015) Corporate imaginaries of biotechnology and global governance: Syngenta, golden rice, and corporate social responsibility. In: *Dreamscapes of modernity: Sociotechnical imaginaries and the fabrication of power*, ed. by S. Jasanoff – S. Kim, 254-276. University of Chicago Press, Chicago, IL.
- The Sociotechnical Imaginaries Project (2018) Retrieved from <<http://sts.hks.harvard.edu/research/platforms/imaginaries/>>, 26 June 2018.
- Stake, R. (2000) Case studies. In: *Handbook of qualitative research* (2nd ed) ed. by N. Denzin – Y. Lincoln, 435-454. Sage, Thousand Oaks, CA.
- Strauss, Claudia (2006) The Imaginary. *Anthropological Theory* Vol. 6 (3), 322-344.

Taylor, C. (2004) *Modern social imaginaries*. Duke University Press, Durham.

The Royal Society (2014) Climate change: evidence and causes. Retrieved from
<<https://royalsociety.org/topics-policy/projects/climate-change-evidence-causes/>>,
retrieved 1 May 2019.

Tozer, L. (2018) What is ‘carbon neutral’?: Planning urban deep decarbonization in
North America. In: *Rethinking urban transitions: Politics in the low carbon city*,
89-107. DOI: 10.4324/9781315164779.

Tozer, Laura – Klenk, Nicole (2018) Discourses of carbon neutrality and imaginaries of
urban futures. *Energy Research & Social Science* Vol. 35, 174-181. DOI:
10.1016/j.erss.2017.10.017.

UNCED (1993). Agenda 21: The final text of agreements negotiated by governments at
the United Nations Conference on Environment and Development (UNCED), 3-14
June 1992, Rio de Janeiro, Brazil. Paper presented at the *United Nations Confer-
ence on Environment and Development (UNCED), Rio De Janeiro, Brazil*, Re-
trieved from <[https://sustainabledevelopment.un.org/content/docu-
ments/Agenda21.pdf](https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf)>, 1 May 2019.

UN-Habitat (2011) *Cities and Climate Change: Global Report on Human Settlements
2011*. UN-Habitat. Retrieved from <[https://unhabitat.org/books/cities-and-climate-
change-global-report-on-human-settlements-2011/](https://unhabitat.org/books/cities-and-climate-change-global-report-on-human-settlements-2011/)>, 26 June 2018.

Wapner, P. (2016) Introduction: Reimagining climate change. In: *Reimagining Climate
Change*, ed. by P. Wapner – H. Elver, 1-13. Routledge: Abingdon, UK.

Weber, R. P. (1990) Basic content analysis. Sage, Beverley Hills, CA.

Winner, L. (1980) Do artifacts have politics? In: *The social shaping of technology*, ed. by D. A. MacKenzie – J. Wajcman, 26-38. Open University Press, London.

APPENDIX 1: PROBLEMATIZED ASPECTS OF THE CASE CITIES

Table 5. Problematized Aspects Shared by Case Cities

	Auckland	Copenhagen	New Orleans	Vancouver
Climate Impacts				
Impacts of Climate Change	<ul style="list-style-type: none"> • Sea level rise • Storm surges and flooding 	Climate changes are real and are already taking place	<ul style="list-style-type: none"> • "If global temperature rises unchecked, New Orleans will not see another 300 years" • "climate change is not a future scenario, but a current reality" • Extreme heat • Sea level rise • Storm and surge exposure • Subsidence of urban land • Coastal loss greater than anywhere else in the US, at a rate that is one of the fastest in the world 	<ul style="list-style-type: none"> • Potential cause of "devastating social and economic upheaval worldwide" • Sea level rise • More frequent and more severe heat waves • Increased frequency and severity of storms • Increased winter rainfall • Summer droughts • Less snow

	Auckland	Copenhagen	New Orleans	Vancouver
Carbon Reduction				
Fossil Fuels	<ul style="list-style-type: none"> • Volatile prices and unpredictable supply • Dependence on imports • Adverse health and environmental effects 	<p>Vehicles in 2025 will continue to be largely powered by petrol and diesel, causing substantial CO₂ emissions and local air pollution</p>	<ul style="list-style-type: none"> • Majority of transport emissions, which accounts for 44% of GHG emissions come from personal vehicles • Small percentage of coal in the electricity generation mix 	<p>Using renewable energy will:</p> <ul style="list-style-type: none"> • Reduce GHG emissions • Improve air quality • Result in direct health benefits • Lead to healthier lifestyles • Enhance natural habitats and reduce habitat loss • Reduce pollution risk from fuel leaks and spills • Prepare for extreme weather events • Reduce effects on agricultural production
Energy Use	<ul style="list-style-type: none"> • High energy-using society • Rising energy prices • More affluent lifestyles and growing economy are cancelling out energy efficiency improvements 	<ul style="list-style-type: none"> • Worldwide demand for energy is projected to increase by 33% by 2025 • Energy prices for consumers are expected to rise up to 2025 due to increased price pressure on fossil fuels and national and international climate policy measures • Difference between estimated and actual energy use should be accounted for 	<ul style="list-style-type: none"> • Rising energy prices 	

	Auckland	Copenhagen	New Orleans	Vancouver
Carbon Reduction				
Waste	<ul style="list-style-type: none"> • High waste society that ignores the "true cost" of resources, materials and waste management 	<ul style="list-style-type: none"> • Plastic in the waste stream causes GHG emissions when incinerated 	<ul style="list-style-type: none"> • Emissions from transport of waste • Emissions from landfills • E-waste 	
Resource Consumption	<ul style="list-style-type: none"> • Resource scarcity (including peak oil) 	<ul style="list-style-type: none"> • Price increases for resources and raw materials 		
Population growth	<ul style="list-style-type: none"> • 1 million additional people within the next 30 years 	<ul style="list-style-type: none"> • Population of Copenhagen is expected to increase by nearly 110,000 by 2025 • More people create more congestion, GHG emissions, and noise 		

	Auckland	Copenhagen	New Orleans	Vancouver
Related Socio-cultural, Economic, and Political Concerns				
Affordability	Of energy and transport		Home energy burden and its racial and economic inequities	<ul style="list-style-type: none"> • Cost of housing is high • Important to assure affordable housing for all income levels to retain residents, attract talent, and maintain diversity
Liveability		Less Noise Cleaner Air Better Dwellings Green Mobility Safe Inspiring, buzzing, creative, and interesting Multifarious (mix of old and new buildings)		
Health effects of poor air quality	New Zealand has the world's second highest rate of child asthma		Respiratory illnesses and allergy problems disproportionately affect vulnerable populations	

	Auckland	Copenhagen	New Orleans	Vancouver
Related Socio-cultural, Economic, and Political Concerns				
Building quality	<ul style="list-style-type: none">Homes are damp, cold draughty, difficult and expensive to heat and increase respiratory ailments in the old and the young33% of New Zealand homes below WHO standardsBuildings do not take advantage of Auckland’s warm temperate climate, making up for this with inefficient use of technology			
Reliance on private vehicles for transport	<ul style="list-style-type: none">Physical inactivity costsInequitable outcomes in terms of health and injury rates by level of deprivation and ethnicity		Reliance on cars and practice of driving alone: <ul style="list-style-type: none">increases traffic congestionreduces community interactionlessens pedestrian traffic to local businesses	
Transport Infrastructure			Cycling and public transport conditions need improvements to be more attractive mobility options	
Coastal and Marine environments	In need of protection and restoration for their ability to protect from storm surges and sequester carbon		Loss of coastal wetlands cannot be entirely avoided	

	Auckland	Copenhagen	New Orleans	Vancouver
Related Socio-cultural, Economic, and Political Concerns				
Urban fabric	Dispersed, low-density urban form is inefficient, resource hungry and fossil fuel dependent	6.8 m sqm of new city will need to be built to accommodate population and job growth		
Social and Economic Inequities	Racial and economic disparities in car accidents and injuries		Various forms of racial and economic inequity in: <ul style="list-style-type: none"> • Access to rooftop solar installation and job development programs • Access to jobs without car ownership • Transit system service • Health effects of poor air quality 	
Split Incentives for Energy Efficiency Measures (Owner-Tenant Paradox)		Neither owners nor tenants have and incentive to energy retrofit their homes, because temporary owners/tenants will not be present to see benefits before the investment has been repaid	Allowances encourage property owners to make energy efficiency improvements that reduce utility bills for their tenants	
Tourism and Hospitality	Auckland as a potential future tourism hub	Environmental improvements have attracted the attention of international lifestyle magazines and made Copenhagen an attractive travel destination	Currently hosts 10 million visitors per year, with significant effect on energy use, waste, and emissions	

Table 6. Problematizations Unique to Specific Case Cities

Unique Problematizations	Auckland	Copenhagen	New Orleans	Vancouver
	<p>Tradeoffs between long- and short-term benefits:</p> <ul style="list-style-type: none"> • Short-term decisions and investments need to support rather than inhibit a better future • Guarding against ‘locking-in’ high carbon growth or infrastructure, creating obsolete assets or limiting future options 	<p>Costs of the plan:</p> <ul style="list-style-type: none"> • Transition to carbon neutrality should not increase expenses for Copenhageners • An entire chapter of the plan is devoted to financing and economic implications 	<p>Water-energy nexus</p> <ul style="list-style-type: none"> • Because the land the city is built on is below sea-level, all water moving into and out of the city must be pumped and therefore incurs an energy cost 	<p>Service planning by the City government</p> <p>The City will adopt a comprehensive approach to the consideration of climate change as part of its service planning</p>
	<p>Lack of natural resources for Maori cultural practices</p>		<p>Accessibility of jobs by transit:</p> <ul style="list-style-type: none"> • The average New Orleanian with a car can reach 89% of jobs in the region within 30 minutes • The same New Orleanian depending on transit can only reach 44% of those jobs within a full hour 	
	<p>Biodiversity:</p> <ul style="list-style-type: none"> • Native biodiversity in decline • Habitats fragmented 			

APPENDIX 2: URBAN SUBJECTS OF THE CASE CITIES

Table 7. Ontology and Deontology of Auckland's Urban Subjects

Auckland			
<i>Aspect</i>	<i>Theme</i>	<i>Sub-Theme</i>	<i>Examples</i>
Ontology	Urban Subjects	Auckland Council government	Responsibility and accountability for its own building assets
		Other governments	National government
		Organizations	Organizations Communities
		Urban dwellers – General public	Categorized in part by levels of deprivation and by ethnicity (e.g. Pacific children), as well as whether they are property owners
			Qualities of residents: <ul style="list-style-type: none"> • Vulnerable to oil prices • Dependent on private vehicles
		Urban dwellers – Indigenous peoples	Māori

Auckland			
<i>Aspect</i>	<i>Theme</i>	<i>Sub-Theme</i>	<i>Examples</i>
Deontology	Technologies of the Other – Prescriptions	Transportation behavior change	Through personalized journey planning
		Using off-peak electricity	Through education and incentives
		School-based initiatives	Educating students about sustainable behaviors and encouraging them to be agents of disseminating information and behaviors (e.g. to their parents)
		Showcasing “Brightspots”	As exemplars of innovative thinking and action
		Community-led conversations about a liveable low-carbon future	With a focus on practical solutions
	Technologies of the Other – Proscriptions	Travel using private vehicles	
	Technologies of the Self	Travelers who make particular types of transportation journey choices	“sustainable travel options as the first and perhaps even habitual choice”
		Responsible parties who “take ownership” of their daily carbon-generating decisions	
		Informed energy consumers	Efficient use of energy in the home
		Active waste managers	Through recycling, home composting, and vermiculture
		Collaborators toward Green Growth	Esp. for businesses and in industry
		Adherents to a “shared sense of understanding and purpose” willing to “play their part”	
		Knowledgeable vectors of persuasion	Who take satisfaction from sharing what they have learned about sustainability
		Local food cultivators	At home and in communal gardens
		Agents of environmental remediation	Tree planters

Table 8. Ontology, Ascetics, and Deontology of Copenhagen's Urban Subjects

Copenhagen			
Aspect	Theme	Sub-Theme	Examples
Ontology	Urban Subjects	City of Copenhagen government	As an owner and operator of buildings and vehicles
		City Employees	45,000 employees
		Companies owned, wholly or in part, by the City of Copenhagen	Copenhagen Energy Nordhavn Energy Partners
		Suppliers to the City	Through environmental and climate requirements, large procurement volume, and terms of private leases
		Transport Authorities	Movia Copenhagen Metro DSB S-trains
		Other governments	National government
		Businesses – Business Community in General	Invited to develop and test new technologies and solutions
		Businesses – Construction Sector	
		Businesses – Developers	Through a “catalogue of inspiration”, recommendations and agreements
		Knowledge Institutions	Universities City Lab Other educational institutions
		Scientists	“curious scientists”
		Organizations	Green organizations
		Urban dwellers – Copenhageners	
		Cyclists	
Copenhagen			
Aspect	Theme	Sub-Theme	Examples
Ascetics	Ways of Thinking and Questioning	Typical household	A couple with one child living in a flat, who own one car and bicycles

Copenhagen			
<i>Aspect</i>	<i>Theme</i>	<i>Sub-Theme</i>	<i>Examples</i>
Deontology	Technologies of the Other – Prescriptions	Generating employment and green growth with new technology, services, and competencies	Spearheaded by businesses and universities
		Achieving energy savings in companies through the Green Business Network	Easily accessible tools for climate action and energy consultancy tailor-made to each business.”
		Maintaining an attractive knowledge environment	Attracting and retaining research and businesses Open digital infrastructure and platform for new and innovative solutions
		Engagement and understanding by Copenhageners of the goal of carbon neutrality	Accepting that the city will be a construction site as new infrastructure is put in place Motivating Copenhageners to opt for green solutions in urban development, transport, consumption, and education
		Collaboration between authorities, universities, businesses, and citizens	“Businesses, citizens and scientists will be offering new suggestions and solutions. Copenhagen is ready to listen and collaborate.”
		Solar energy adoption	Promoting the growth of solar energy by collaborating with Copenhageners and businesses
		City employees inspired to “climate-friendly conduct”	Communication, education, behavioral campaigns to create a “culture where the climate and environment are in focus on a daily basis” Training in “appropriate climate conduct” in procurement, transport and energy efficient operation and consumption
		Alternative fuels for cars	Large majority of cars should use electrical, hydrogen, biofuels, or hybrid power sources

	City of Cyclists	“Copenhagen is already a city of cyclists...new initiatives are necessary to encourage even more to use their bikes.”
	Transport alternatives	Information on and an opportunity to try electric cars and car clubs
Technologies of the Other – Proscriptions	Burning plastic waste	
	Increasing overall expenses for Copenhageners	
Technologies of the Self	“Courage and a will to succeed” through the “long, hard haul together”	
	Taking a “long look” at habitual transport, waste, and energy behaviors	<ul style="list-style-type: none"> • Bike and public transport as preferred means of transport • Separation of plastic and organic residues from the waste stream • Investing in energy retrofitting of homes • Efficient use of heating systems
	Avoiding thinking of oneself as a user of one specific transport mode	“Besides, road users must stop thinking about themselves as motorists, cyclists or people using public transport – everyone is all of these things but at different times.”
	Monitoring and learning from energy consumption in buildings	
	Purchasing shares in wind turbines	

Table 9. Ontology and Deontology of New Orleans' Urban Subjects

New Orleans			
<i>Aspect</i>	<i>Theme</i>	<i>Sub-Theme</i>	<i>Examples</i>
Ontology	Urban Subjects	City of New Orleans government	<ul style="list-style-type: none"> • Office of Resilience and Sustainability leading partner departments • Sewerage and Water Board • Convention and Visitors Bureau
		City employees	<ul style="list-style-type: none"> • Facility Managers • Management and Staff
		Other governments	
		Entergy New Orleans	City-regulated investor-owned utility with a service territory that mirrors the city boundaries
		Businesses	<ul style="list-style-type: none"> • Building industries • Energy companies • Hospitality Providers: conference and event facilities, hotels • Housing Sector: building, renovation, sale, and lease of housing • Real Estate Developers • Waste Management Companies
		Knowledge Institutions	<ul style="list-style-type: none"> • Local community colleges
		Organizations	<ul style="list-style-type: none"> • Non-Profits • Arts and Culture Organizations • Community Organizations • Professional Associations
		Urban dwellers – New Orleanians	<ul style="list-style-type: none"> • Many do not connect daily habits and collective contribution to Climate Change • Lack awareness of “unique challenges and opportunities our community has with regard to climate adaptation and resilience”
		Visitors	<ul style="list-style-type: none"> • More than 10 million visitors annually • Drawn by conferences, business, world-famous festivals and special events, local culture, and cuisine
		Vulnerable Populations	<ul style="list-style-type: none"> • Children, the elderly, those experiencing low-income, poverty and homelessness

New Orleans			
<i>Aspect</i>	<i>Theme</i>	<i>Sub-Theme</i>	<i>Examples</i>
Deontology	Technologies of the Other – Prescriptions	Energy efficient operations of City buildings and facilities	Facility managers will be trained in energy management and energy-efficient operations of buildings and facilities will be a performance requirement of those positions.
		Broad leadership commitment to wellbeing	“regulation and energy procurement decisions... makes clear the City’s commitment to our future.”
		Reducing emissions from hospitality activities	Save energy, reduce waste, and reduce emissions behind the scenes at conferences, hotels, and events to cut costs and improve visitor experiences
		Job creation and workforce skills development	Through technical assistance and education alongside community colleges and professional associations
		Building a culture of awareness and climate action	Increase awareness and action among residents, businesses and visitors
		Review commissioned ratepayer-funded energy resilience study with stakeholders	For shared understanding, informed dialogue, and decision-making
		Incentive programs and awareness campaigns to encourage residents to bike, walk, and use public transport	<ul style="list-style-type: none"> • Transit Pass incentives • Free Ride Days • Employers who provide subsidized parking must also offer cash allowance
		Citizen science climate conditions reporting platform	iSeeChange platform
	Technologies of the Other – Proscriptions	End use of coal-fired power	
	Technologies of the Self	Agents of environmental remediation	Volunteer tree planters
		“Educating each other about our risks and opportunities”	
		Establish connection between daily habits and collective contribution to Climate Change	

Table 10. Ontology and Deontology of Vancouver's Urban Subjects

Vancouver			
<i>Aspect</i>	<i>Theme</i>	<i>Sub-Theme</i>	<i>Examples</i>
Ontology	Urban Subjects	City of Vancouver government	City's own operations
		Other governments	<ul style="list-style-type: none"> • Surrounding Municipalities • Provincial government of British Columbia • Federal government of Canada • Public Agencies
		Organizations	<ul style="list-style-type: none"> • Business Community • Academia • Non-Profit Organizations • Schools • Labor Unions • Neighborhoods • Faith Groups • Utilities
		Urban Dwellers – Vancouverites	<ul style="list-style-type: none"> • “Citizens of our local and global communities” • Adaptable • Visionary • Desirous of involvement • Ethnically and linguistically diverse
		Urban Dwellers – Indigenous Peoples	Coast Salish First Nations, living in unceded traditional territories

Vancouver			
<i>Aspect</i>	<i>Theme</i>	<i>Sub-Theme</i>	<i>Examples</i>
Deontology	Technologies of the Other – Prescriptions	Accelerating energy efficiency and conservation measures	
		Leading and guiding the wider public and business communities	
		Making renewable technologies available and implementable	
		Engaging and consulting the public	
	Technologies of the Other – Prescriptions	Eliminating fossil fuels	
	Technologies of the Self	Travelers who make “rational” transportation journey choices	Based on travel time and reliability, cost, travel distance, and flexibility required
		Agents for and investors in the Renewable City	
		Energy prosumers	Direct engagement in energy production and conservation