1

Introduction

Eating noodles in Melbourne is common. A large, international city with nearly 5 million inhabitants, Melbourne has over 220 restaurants of Chinese or Asiatic inspiration, most of which will cook noodle-based recipes. For the great poet Boey Kim Cheng, however, eating noodles in Melbourne is no less remarkable. In his poem "La Mian in Melbourne," he sits in a restaurant in Little Bourke Street in Melbourne's Chinatown and observes the cook doing "noodle magic," slapping and pummeling the dough in the traditional La Mian style. Cheng looks, smells, tastes, and remembers his own travels across multiple cities. The landscapes of Melbourne intersect with those of his home town of Singapore, and the La Mian maker reminds him of his grandmother. In this poem, the noodles become a symbol of the unconscious memory awakened by the senses, similarly to how the "petit madeleine" with tea revealed the childhood memories of Marcel Proust in the novel *À la Recherche du Temps Perdu*.

Cheng's and Proust's experience-memories happened in different times and places. The first part of *À la Recherche du Temps Perdu*, which contains the episode of the madeleine, was published in 1913. Cheng's poem was published almost a hundred years later in 2012. The comparison between the noodles and the madeleine, between 1913 and 2012, is revealing. The noodles belong to an urbanized world, one in which most of the inhabitants of the world live in highly dense urban areas, in which capital and job opportunities accumulate. The madeleine belongs to the countryside of Proust's childhood and his imagined village, Combray. Nevertheless, both authors evoke the tight node between food, taste, smell, ambience, family, and feeling at home. They both describe the landscapes that surround them as part of their biography and memory, on the one hand, and as part of the material world they inhabit, on the other hand. Both Melbourne and Combray are landscapes of dwelling in which Cheng and Proust experience, remember, and live.

There is another difference. Proust's madeleine opens up a pastoral landscape of gardens, flowers, pavilions, little houses, paths, and churches. Cheng's experience

is, however, flanked by blocks, music, and the passage of bodies and cars in a hectic landscape of city life. Cheng's poems bring together the public and the private, the past and the future in a single moment to realize the affective sensations that underlie routines. He makes extraordinary an ordinary moment waiting for the La Mian noodles to be ready, because Cheng's experience-memory landscapes are full of energy; he looks at the "neon calligraphy, its quavering script mirrored on the warm sheen of the Noodle King" and listens to "the murmur of traffic." When he reclines over the noodle bowl, he finds himself "enveloped in steam." Energy thus becomes part of Cheng's experience-memories because they incorporate lighting, thermal comfort, cooking, mobility, and even the possibility to take a selfie to send to grandma in place of any noodle rituals already lost.

Cheng portrays an urban energy landscape. In an urban energy landscape different forms of energy (light, heat, mobility, and communications) envelop city life. Those urban energy landscapes reflect the infrastructure legacies of urban history as markers of collective memories, as Gandy (2011) explained. Simultaneously, those urban energy landscapes also reflect the material dynamics that shape those experience-memories. In line with Bennet's (2010) argument about vibrant matter, urban infrastructure landscapes are shaped by multiple forms of distributive agency whereby vibrant materialities can also bring about change. Energy-related artifacts (the cookstove, the electricity cable and the meter, the solar panel, and the TV) are indispensable parts of the urban energy landscape to the point that such a landscape cannot be understood without them. Noodles cannot be enjoyed without appreciating the complex infrastructures that make a restaurant possible, from the neon light to the boiling water. The specific objects that integrate the urban energy landscape might be different in Melbourne and Singapore. Each city might have integrated energy infrastructures differently, depending upon its history. Nevertheless, global visions of cities are haunted by images full of energy because we struggle to conceive of cities without lights, without kitchens, without mobile phones, without elevators, without various forms of electronic metering and calculating, or without mobile vehicles.

Although energy has become part of the city life, our dependence upon energy systems threatens humanity and the world. The last report of the Intergovernmental Panel on Climate Change in 2014 concluded that humans are influencing and altering the climate system, and that higher levels of disruption increase the risk of severe, pervasive, and irreversible effects, including droughts and heatwaves, hurricanes, changes in precipitation patterns including extreme events and flooding, sea-level rise, decline of agricultural yields, mass migration, and the disappearance of forests, corals, and wildlife. This portrayal is of a world unlike the one we live in. The distribution of effects is also unequal. The worst effects will affect those who are most vulnerable (Hallegatte, Bangalore et al. 2015). Concerns with

social justice, responsibility and equity are central to radical demands for low-carbon transformations.

Climate change is a manifestation of humanity's existential crisis. Head (2016) speaks of an impending sense of catastrophe that requires examining both the foundations of humans' capacity to influence the surroundings and how that capacity is embedded within material relationships. The sort of cosmic terror that climate change generates can be addressed directly, starting with our turning attention to the instability of the world as constitutive of the material relationships we inhabit (Last 2013). Confronting the global existential crisis requires using the horror underneath the threat of extinction to mount a re-examination of the meaning and purpose of human life and the changes that will make the future possible (Kallis and March 2015). The transformation called for is of such magnitude that it requires a fundamental examination of the infrastructures of life, the material objects that sustain us. Instead of "the environment," the Dutch speak of "de leefomgeving," the environment in which life happens. Making sense of existence requires situating it somewhere, Being-in-the-World, as Heidegger's core concept is expressed in the English-speaking world.

My proposal in this book is to examine the possibility for radical transformations that emerge within urban energy landscapes. This intent implies recognizing first how energy-related infrastructures shape everyday life in specific locations. In particular, I am interested in how energy-related infrastructures are integrated in diverse and heterogeneous modes of being urban in urban energy landscapes. From this perspective, fundamental transformations of socio-material relationships begin with an assessment of how experience-memory events, such as eating noodles in Little Bourke Street, shape multiple possibilities to deliver urban futures.

1.1 Three Propositions about Urban Energy Landscapes

This book belongs within a growing body of literature that understands energy challenges as indissolubly linked to their geography and spatial dynamics (Calvert 2016, Bouzarovski, Pasqualetti et al. 2017, Bridge, Barr et al. 2018, Solomon and Calvert 2018). Urbanization, in particular, is closely interrelated with systems that produce energy and with how it is used and consumed, as is recognized in policy debates (Johansson, Patwardhan et al. 2012). Scholars of climate change governance have drawn attention to the city as a central site in which carbon is governed (Bulkeley 2013, Hughes, Chu et al. 2017). The accumulation of empirical evidence of action on the ground and new institutional models of change have shifted perceptions toward an increasing optimism in terms of transforming unsustainable energy configurations through progressive urban interventions (Hoffmann 2011,

Roorda, Wittmayer et al. 2014, Frantzeskaki, Castán Broto et al. 2017, Frantzeskaki, Hölscher et al. 2018). Recently, scholars have started talking about "the second generation" of studies of urban low-carbon transitions, acknowledging the rapid growth of the field (Luque-Ayala, Marvin et al. 2018).

I engaged with the notion of urban energy landscape, seeking a means to shift my own attention from salient innovations to the actual forms of urban change occurring around energy systems in different cities. My initial concern was to examine urban change because of situated practices of city making. The idea of energy landscapes started from an engagement with urban political ecology perspectives on energy that emphasize, in particular, how specific ecologies and technologies are implicated in the urban politics of energy (Heynen 2014, Lawhon, Ernstson et al. 2014, Rice 2014, Holifield and Schuelke 2015, Silver 2015). Therefore, my inquiry into urban energy landscapes started from three propositions:

First Proposition: Urban Energy Must Be Understood from Within a Postcolonial Perspective

The idea of deploying a postcolonial understanding of the urban landscape might be uncontroversial in urban studies, but it is not widely recognized in energy studies (but see recent examples: Baptista 2018, Bridge 2018, de Souza, Bosco et al. 2018). Many of the concerns articulated in postcolonial readings of the urban landscape resonate with long-standing concerns within social studies of energy and energy technology. Such a perspective emphasizes that urbanization and infrastructure development processes take place within conflicting historical conditions (Bishop, Phillips et al. 2013). In recognizing such patterns of historicity, the challenge is not to understand the mechanics of transitions from colonial to postcolonial rule but rather to understand the conditions of possibility that emerge within a global history of colonialism away from singular models of capitalism development (Ong 2011). One key aspect, for example, is to recognize how technologies and knowledge are tied to such colonial history in terms of their relationships to particular technocratic enterprises (Bishop, Phillips et al. 2013). Decolonizing the knowledge that underpins energy policy and implementation is one of the key areas in which social scientists can make a difference to energy studies (Bridge 2018). Like other postcolonial scholars (Bishop, Phillips et al. 2013), I have found the work of Martin Heidegger useful in exploring forms of urbanism that emerge from situated urban histories. Urban energy landscapes reveal the centrality of energy relationships to those urban histories.

The implications of the postcolonial perspective relate to the specific treatment of infrastructure politics and how everyday struggles appear intertwined with particular technological projects of urban control. Urban infrastructure studies have been dominated by theory that responds to the empirical observations and needs of cities in the West. Hughes' (1993) classic work studying the history of

electrification in Chicago, London, and Berlin is one superb example. However, global assessments of urbanization patterns increasingly suggest that our understandings generated in the global north could be irrelevant at best and damaging at worst in urban contexts in the global south, which are distinctly different (Nagendra, Bai et al. 2018). Uneven patterns of access to energy are constituted at the intersection between global and situated energy politics (Luque-Ayala and Silver 2016). In a postcolonial context, universalist models of infrastructure provision become exposed as fragmented, incomplete fantasies (Coutard 2008).

If we decentralize the object of knowledge and focus on unfamiliar cities – that is, cities that have rarely been considered in infrastructure studies – new understandings of energy infrastructures emerge. For example, a number of studies on urban infrastructure in African cities have revealed the coexistence of diverse and heterogeneous models of energy delivery (Jaglin 2014, Baptista 2015, Monstadt and Schramm 2017). Decolonizing aspirations must be matched with feasible alternatives. In urban energy landscapes, the emphasis is on energy politics as they emerge within complex urban histories. In this context, progressive social and material transformations for a low-carbon transition require engaging with multiple processes and visions that coexist without establishing the dominance of one of those visions, the type of disposition that Pieterse (2008) labeled "radical incrementalism." Seeking a radical transition through incrementalism might appear paradoxical but might be the only alternative in the context of heterogeneous and diverse urban energy landscapes.

Second Proposition: The Politics of Urban Energy Are Constituted in Relational Spaces

Studying the spatial aspects of the politics of energy first requires examining the concept of space. Following the implications from the first proposition, the recognition of heterogeneous, coexisting configurations of urban energy links to a strong sense of space as actively produced through multiple processes of connectivity, proximity, and differentiation. This observation resonates with geographical critiques of the classical notion of Euclidean space as a fixed, pre-existing category. Instead, space is thought of as a dynamic process constituted through social dynamics (e.g., Massey 1994, Harvey 1996, Thrift 1996, Crang and Thrift 2000, Amin 2002, Massey 2005). In a recent special issue, I have argued for the need to place notions of relational space at the center of energy studies (Castán Broto and Baker 2018). Doreen Massey explained that the notion of relational space implies, first, that space is constituted through interactions; second, that space constitutes a sphere of possibilities in which multiple historical trajectories are deployed simultaneously; and third, that space is continually being made, and therefore, always unfinished (Massey 2005). These three assertions apply particularly to urban energy landscapes.

Relational approaches to space have implications for rethinking energy politics (Bridge, Bouzarovski et al. 2013, Calvert 2016). However, there is considerable ambiguity about the meaning embedded in relational conceptualizations of energy geographies. In urban areas, relational approaches have often been linked to conceptualizations of cities as inserted in global multi-dimensional flows (Sigler 2013). Clearly, urban energy landscapes can be shaped by multiple flows of resources and technologies, but flows alone do not constitute the energy spaces that generate the experience-memories that characterize our social landscape. These flows do not only relate to intercity or interregional connections, but also to the maintenance of flows in unstable configurations that depend upon a number of day-to-day interactions and situated practices of infrastructure use (Rutherford 2011, Rutherford and Coutard 2014). In energy studies, relational approaches have examined how inequality and vulnerability are generated through the integration of energy flows within specific household practices (Buzar 2007, Harrison and Popke 2011, Bouzarovski and Petrova 2015). The notion of landscape engages with the configurations of urban energy that emerge from the active maintenance of urban flows alongside situated practices of energy use, which we can understand in the urban case as energy choreographies. Landscape is a deeply textured assemblage of human activity and objects, "not the surface on which dwelling takes place, but dwelling itself" (Knowles 2012, p. 512). The notion of urban energy landscapes recognizes that in such landscapes, energy infrastructures are indispensable to sustain urban life.

Third Proposition: Urban Energy Landscapes Reveal the Situated Nature of Low-carbon Transitions

The engagement with urban energy landscapes matters, because they direct attention to alternative notions of urban transformations and the types of agency that can foster them. Social science analyses of transition have shown the importance of examining the complex dynamics of change in low-carbon transitions. One implication has been the questioning of a linear conceptualization of change. An alternative perspective conceives of socio-technical systems as organized in regimes that might undergo reconfiguration following the occasional irruption of disruptive innovations (e.g., Geels 2002, Geels and Schot 2007, Verbong and Geels 2007, Verbong and Geels 2010). Moreover, low-carbon transitions need to be examined from the perspective of power and governance, because claims to make a transition must be actively assembled through purposive acts of governing and the constitution of appropriate means of calculation (Bulkeley, Castán Broto et al. 2014). Overall, there are multiple pathways whereby transitions can occur (Rydin, Turcu et al. 2013). However, these analyses pose a strategic intent at the core of energy and low-carbon transitions. Plan, control, manage, deliver, implement, and accomplish are the verbs that animate the empirical cases studied in most

scholarship examining low-carbon transitions (and some more recent critiques are included in Luque-Ayala, Marvin et al. 2018)

Postcolonial approaches to infrastructure challenge the nature of strategic urban-development projects. Clearly, urban life is threatened by efforts to subsume everyday activities and materialities under one single narrative of capitalist development (Ruddick 2015). Equally, there is a need to be suspicious of efforts to establish the parameters for a low-carbon transition that simply responds to those narratives. Moreover, urban areas are already changing. Despite the overwhelming effects of forms of capitalist urbanization, urban areas over the global north and south are replete with examples that demonstrate the "inexplicable capacity of the most resource-challenged areas to hang together" (Simone and Pieterse 2017, p. 185). External projects of radical change may change cities, but only alongside existing dynamics of urbanization.

Urban energy landscapes belong to unbounded cities in which life is constantly being created. Hence, sustainability transformations in urban energy landscapes are transformations of diverse and situated modes of being. It is imperative to think about low-carbon transitions as radical transformations that will change the fundamental nature of being. Because of the embeddedness of energy infrastructure in urban life, such existential change depends upon understanding the metaphysics of infrastructure. That is, we need to understand how socio-material relationships around infrastructure shape the nature of being. In practice, this understanding requires engaging with change as it occurs. However, change is occurring all the time, in the daily tasks that configure urban energy landscapes. The idea of urban energy landscapes is a conceptual device to engage with the already-occurring urban transitions whose protagonists inhabit cities-in-the-making.

1.2 Heterogeneous Urban Energy Landscapes

Urban energy landscapes display the spatial patterns of urban energy systems that are visible in the built environment. Traditionally, landscape has been thought of as the territorial expression of socio-ecological relationships – in this case, how urban dwellers manage and use energy and how energy uses relate to resource and ecosystem exploitation. Urban energy landscapes relate to the spatial organization of multiple energy services depending upon how people use energy (e.g., for lighting, thermal comfort, communications, and cooking[1]) and how energy services are provided (whether for the generation of electricity, gas provision or the direct use of fuels for heat or mechanical power). Even when using similar technologies, the experience will be completely different in each city, from Melbourne to Singapore. Urban energy landscapes reflect the specificity of urban energy systems and the heterogeneous spatial arrangements that emerge within particular places.

In relation to energy, landscape has been described as a conceptual means to emphasize the co-constructed nature of socio-technical systems (Bridge et al. 2013). The notion of energy landscape invokes cultural aspects of energy, for example, by pointing at the different meanings and ideas that influence how energy is thought of and used, and at the different material arrangements that make such use possible. Many of the factors that shape current energy systems, from electricity networks to the type of houses in which people live, have emerged over time as part of a historical process through which different features of energy systems become embedded in our societies and economies. Energy landscapes, resulting from the interaction between humans and nature in a particular location over a specific period, have a central historical dimension.

One of the objectives of this book is showcasing both differences and how they become visible in the built environment. The most obvious implication of this argument is that there is no one single model for delivering urban energy. The diversification of infrastructure configurations is one of the central transformations visible in contemporary infrastructures (Coutard and Rutherford 2015). Infrastructures can be thought of as assembled in heterogeneous configurations (Lawhon, Nilsson et al. 2018) within radical contingent contexts (Graham and McFarlane 2014, Silver 2014). Nevertheless, people make sense of the infrastructure landscapes they inhabit and navigate different intersections between infrastructure and social life (Simone 2010, Simone 2013). We may think that contemporary urban life requires inventiveness and improvisation, but most times we just get on with it and constitute the spaces that we inhabit. The assumption that the urban energy landscapes that people inhabit correspond to specific models of urban infrastructure development overestimates the extent to which the city can be strategically planned (cf. Watson 2013). Instead, there is an enormous sense of reassurance in the idea that whatever strategic project of modernization is imposed in a city, its inhabitants will find the means to appropriate and transform urban space by inhabiting and navigating urban landscapes (Nair 2005, Knowles and Harper 2009, Simone 2010).

Therefore, the focus of the empirical analysis in this book relates to the need to represent a diversity of urban energy landscapes, on the one hand, and the need to situate visual observations of those landscapes within a historical and spatial moment, on the other hand. The focus on cities does not pretend to reify them as bounded, single, homogeneous entities (for a critique, see: Angelo and Wachsmuth 2015) but rather as a figure of the collective imagination that enables the development of an urban project over time. The cities studied are Maputo (Mozambique), Bangalore (also known as Bengaluru) (India), Hong Kong (PRC), and Concepción (Chile) (Figure 1.1). Each city was selected because it represents a radically different energy landscape.

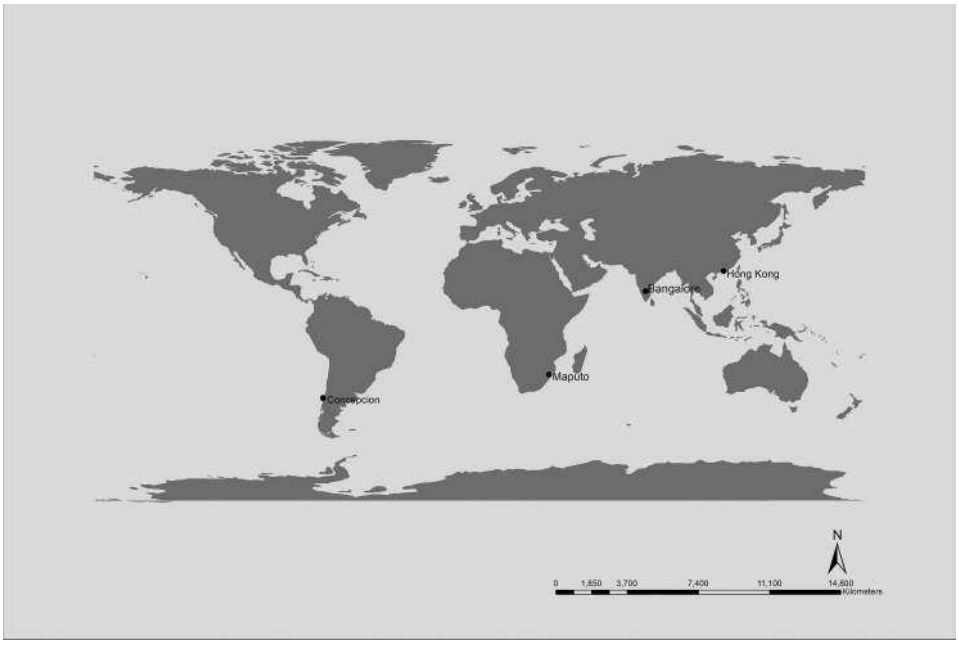

Figure 1.1 Case study cities.
Elaborated by Hita Unnikrishnan.

Regarding the systems of energy provision, Hong Kong is a city with a completely networked energy system, in terms of both the provision of electricity and fuels. Concepción represents a city that depends upon a national system of networked provision of electricity, but traditional fuels (particularly fuelwood) constitute an important part of the energy landscape. Bangalore represents the type of city in which networked models of energy provision have always been incomplete, in terms of both the provision of electricity and fuels. Maputo, having the lowest rates of energy access, represents a city in which until very recently only a partial electricity network operated. The majority of the households in Maputo depend upon charcoal to satisfy the bulk of their energy demand.

The cities also have very different energy requirements. In Bangalore and Concepción, the industrial sectors drive energy demand. In Bangalore, key dynamics include the growing energy needs of the ICT and offshoring industry alongside the lifestyle demands of new professionals working in those industries. In Concepción, heavy industries drive energy demand and environmental justice conflicts. In Hong Kong, demand is driven by disincentives to improve efficiency in the built environment. In Maputo, any concerns about the low-carbon transition require confronting the enormous energy access challenge; being "under the

umbrella" of the network is not a guarantee of energy access. People are still dependent on charcoal for the bulk of their energy needs.

Each case has been situated within a particular energy history, reflecting upon the coevolution of resource flows, technologies, and choreographies of urban life. The storylines developed for each case study build upon individual accounts of the urban energy systems, trying to map the different strategic projects that shape urban energy landscapes.[2] In addition, each case study uses the walking of transects as a means to engage with inhabited energy landscapes. Here, I draw inspiration from the work of Caroline Knowles, whose account of the urban landscapes of Hong Kong (Knowles and Harper 2009) initially inspired me to seek an alternative approach to study urban infrastructure. Knowles has shown the potential of methods based on the idea of walking-with as a means to discover the urban landscapes of urban dwellers, particularly those thought of as migrants, whose comings and goings shape those landscapes (Knowles 2011). More recently, Knowles has also shown the potential of walking as a method of independent research to characterize the city "from the ground" and "while in motion" (Knowles 2017). In my case, faced with the impossibility of truly inhabiting any of those four urban energy landscapes, walking is a means to engage with what is, for me, a routine task and thus engage directly with the urban landscape without reifying the city as a measurable entity. Walking and using hand-drawn maps of the city, I have sought to develop a portrait of urban energy landscapes as a bundle of relationships, that is, as connective tissue sustaining energy-dependent urban life.

1.3 Structure of the Argument

The argument is developed in three parts. Part I is called "Understanding Urban Energy Landscapes" because it focuses on the development of the concept through an engagement with the three propositions explained above. By engaging with the first proposition, Chapter 2 situates the idea of urban energy landscapes within current debates on the politics of urban infrastructure and, specifically, the type of politics that shapes energy transitions. Chapter 2 reveals some of the assumptions that permeate the thinking of the book. First, urban energy landscapes redirect attention away from the search for disruptive innovations, situating radical change instead within mundane practices of infrastructure-making. Second, the chapter introduces the ideas of energy flows, energy choreographies, and energy governance that constitute the analytical framework for the empirical analysis of case studies.

Chapter 3 advances a relational perspective on urban energy landscapes and expands the concerns of the second proposition presented above. In doing so, Chapter 3 proposes a definition of urban energy landscapes as "connective tissue."